RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	**Applied Mathematics – III (BEAE 301T)**	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	The objective of this course is to familiarize the prospective engineers with techniques in different transforms and calculus of variation and numerical computation.
2	It aims to equip the students with standard concepts and tools at an intermediate to advanced level.
3	It will serve them well towards tackling more advanced level of mathematics & applications that they would find useful in their disciplines.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Students will be able to understand Laplace Transform and should be able to solve differential equations.
CO2	Expand the function in periodic form using Fourier series and understand the relationship between z transform and the Fourier transform for discrete time signals.
CO3	Apply concept of complex variable for solving integration and engineering problem.
CO4	Formulate and solve linear partial differential equations in the field of Industrial Organization and Engineering.
CO5	Use of the MATRIX theory to solve differential equations using Eigen values and Eigen vectors.

SYLLABUS

Contents	No of hours
Unit I **LAPLACE TRANSFORM: (8 Hrs)** Definition, Properties (statement only), Evaluation of integrals by Laplace Transform, Inverse Laplace Transform (Partial fraction method) and its Properties, Convolution theorem (statement only), Laplace Transform of Periodic Functions (statement only), Unit Step Function and Unit Impulse Function (statement only), Applications of Laplace Transform to solve ordinary Differential Equations, Integral Equations & Integro-differential Equations.	8
Unit II **FOURIER SERIES & FOURIER TRANSFORM: (6 Hrs)** Periodic functions and their Fourier Expansions, Even and Odd functions, change of interval, Half Range Expansions. Fourier Transform: Definition and Properties (excluding FFT), Fourier Integral Theorem, Applications of Fourier Transform to Solve Integral Equation.	6
Unit III **FUNCTIONS OF COMPLEX VARIABLE: (8 Hrs)** Analytic function, Cauchy- Riemann Conditions, Harmonic Functions (excluding orthogonal system), Milne- Thomson Method, Cauchy Integral Theorem & Integral Formula (Statement only), Taylor's & Laurent's series (Statement only), Zeros and Singularities of Analytic function, Residue Theorem (Statement only).	8
Unit IV **PARTIAL DIFFERENTIAL EQUATIONS: (8 Hrs)** Partial Differential Equations of First Order First Degree i.e. Lagrange's form, Linear Homogeneous Equations of higher order with constant coefficients. Method of separations of	8

variables, Simple Applications of Laplace Transform to solve Partial Differential Equations (One dimensional only).	
Unit V **MATRICES: (6 Hrs)** Linear dependence of vectors, Eigen values and Eigen vectors, Reduction to Diagonal form, Singular value decomposition, Sylvester's theorem [without proof], Largest eigen value and corresponding eigen vector by iteration method.	6

Total: 36 Hours

References:

Text Books Recommended:

1. Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication
2. Advanced Engineering Mathematics by Erwin Kreysizig, 8th Edition, Wiley India
3. Applied Mathematics for Engineers & Physicist by L.R. Pipes and Harville,
4. Calculus of variation by Forrey.

Reference Books Recommended:

1. A Text Book of applied Mathematics, Volume II , by P.N. Wartikar & J.N. Wartikar, Poona Vidyarthi Griha Prakashan
2. Introductory methods of Numerical Analysis, by S.S. Sastry, PHI
3. Mathematics for Engineers by Chandrika Prasad
4. A text book of Engineering Mathematics by N. P. Bali & M. Goyal, Laxmi Publication.

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Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Aero-Thermodynamics (BEAE 302T)	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	Understand the laws of thermodynamics and determine thermodynamic properties, gas laws.
2	Apply knowledge of pure substances, mixtures, usage of steam tables and Mollier chart, psychrometric charts.
3	Understanding of steam properties, air standard cycles and applications of various components like compressor, turbine etc.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Memorize and understand basics of thermodynamics along with basic of zeroth law.
CO2	Understand and apply basics of thermodynamics along with basic laws of thermodynamics.
CO3	Understand the limitations of first law of thermodynamics and different forms of second law of thermodynamics.
CO4	Understand and apply the basics of Properties of Steam.
CO5	About the basics of Air Standard Cycles. Understanding the applications of Nozzle, diffuser, compressor and turbine.

SYLLABUS

Contents	No of hours
Unit I : Introduction to Thermodynamics Basic concepts of Thermodynamics, Closed & Open Systems, Forms of energy, Properties of system, State & Equilibrium, Processes & Cycles, Temperature & Zeroth Law of Thermodynamics. Introduction to First Law of Thermodynamics (Law of Conservation of Energy), Heat & Work, Mechanical forms of work, Non-Mechanical forms work (Electrical, Magnetic etc.) The Ideal Gas equation of state, Difference between Gas & Vapor, Compressibility factor, Internal energy & specific heats of gases, Universal Gas Constant.	7
Unit II : First Law of Thermodynamics Closed Systems (Control mass system), Work done, Change in internal energy, Heat transferred during various thermodynamic processes, P-V diagrams. Open systems (Control volume systems), Thermodynamic analysis of control volumes, Conservation of energy principle, Flow work & enthalpy.	10
Unit III : Second Law of Thermodynamics Introduction (Law of degradation of energy), Thermal energy reservoirs, Kelvin-Plank & Clausius statements, Heat engines, Refrigerator & Heat pump, Perpetual motion machines, Reversible & Irreversible processes, Carnot cycle, Thermodynamic temperature scale. Entropy: - The Clausius inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed & Steady flow open systems. Second law analysis of engineering systems: - Availability, Reversible work, Irreversibility, Temperature-entropy diagram.	10
Unit IV : Properties of Steam Critical state, Sensible heat, Latent heat, Super heat, Wet steam, Dryness fraction, Internal energy of steam, External work done during evaporation, T-S diagram, Mollier chart, Work & Heat transfer during various thermodynamics processes with steam as working fluid. Determination of dryness fraction using various calorimeters.	8

Unit V : Air Standard Cycles Otto cycle, Diesel cycle, Stirling & Ericsson cycle, Brayton cycle, Vapour cycles :- Simple & Modified Rankine cycle with reheat & regeneration. Applications to i) Nozzles & Diffusers ii) Turbine & Compressors iii) Throttle Valves. (Simple systems like charging & discharging of tanks).	10

Total: 45 Hours

References:

Text Books Recommended:

1. Engineering Thermodynamics by P. K. Nag, Tata Mc-Graw Hill Publication
2. Thermodynamics by C. P. Arora, Tata Mc-Graw Hill Publication
3. Fundamentals of engineering Thermodynamics by R. K. Rajput

Reference Books Recommended:

1. Thermodynamics An engineering approach by Yunus Cengal, M.A.Boles
2. Fundamentals of classical by Gorden J. V. Wylen, Sonntag

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Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	Aero-Thermodynamics (BEAE 302P)	0	0	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	To provide an understanding about the steam turbines
CO2	To provide an understanding about the construction and working of internal combustion engines.
CO3	To provide an understanding about the working and types of compressors
CO4	To provide an understanding about the steam turbines
CO5	To be able to understand and evaluate the performance of Rotary air Compressor and Reciprocating air Compressor

Sr. No.	List of Practical's
01	Study of steam turbines
02	Study of internal combustion engines.
03	Study of various types of compressors.
04	Performance and evaluation of Rotary air Compressor.
05	Performance and evaluation of Reciprocating air Compressor.
06	Visit to thermal power plant .(Case study to be prepared by students).

References:

1. Thermodynamics An engineering approach by Yunus Cengal, M.A.Boles
2. Thermodynamics by C. P. Arora, Tata Mc-Graw Hill Publication
3. Fundamentals of classical by Gorden J. V. Wylen, Sonntag
4. Engineering Thermodynamics by P. K. Nag, Tata Mc-Graw Hill Publication
5. Fundamentals of engineering Thermodynamics by R. K. Rajput
6. Lab Manual

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Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Fluid Mechanics and Machinery (BEAE 303T)	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	This course is designed to develop an understanding of the behavior of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as the mechanical engineers has to deal with fluids in various applications.
2	This course will also develop analytical abilities related to fluid flow. It is expected that students will gain conceptual understanding of fluids and their properties and will be able to apply the analytical tools to solve different types of problems related to fluid & fluid flow.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Remember the basic fluid properties, Newton's law of viscosity and its application & detailed idea about different pressure measuring device(like manometer, bourdon's gauge)
CO2	Get basic idea about flow visualization techniques, Euler's equation of motion & Bernoulli`s equation & it's application
CO3	Able to get a clear idea about the types of flow depending on the Reynolds' number, Significance of Reynolds' and Mach number in the fluid flow, Phenomena for separation of flow and after the completion of this unit student will be able to find lift and drag force on an immersed body.
CO4	Able to understand Classify the hydraulic machines (such as turbines & pumps) understand about the working principle, Constructional features, Performance Characteristics , Governing & Selection criteria for- Impulse Turbines
CO5	Able to evaluate the hydraulic machines (such as turbines & pumps) understand about the working principle, Constructional features, Performance Characteristics , Governing & Selection criteria for Reaction Turbines, Get the basic ideas regarding the classification of pumps, Applications of pumps.

SYLLABUS

Contents	No of hours
Unit I: Introduction to Fluid Mechanics Properties of fluids, Newton`s law of viscosity and its applications, Pascal`s law, Basic equation of fluid statics, Fluid pressure & its measurement (Manometers & Bourdon`s pressure gauge), Pressure variations in compressible & Definition of Fluids :-the science of fluid mechanics, fluid properties, capilliarity, surface tension, compressibility, units and dimensions, Normal and Shear stresses in fluid flows, measurement of fluid velocity, Pascal's law, types of forces on a fluid system, measurement of pressure, use of manometers and gauges, numerical problems. Hydraulic devices, forces on partially and fully submerged bodies, including that on curved surfaces, numerical problems, buoyancy, stability of floating bodies, centre of gravity and meta centric heights, Incompressible fluids.	9
Unit II: Kinematics of Fluid Flow Types of flow, Stream line, Path line, Streak line, Stream tube, Continuity equation, One & Two dimensional flow, Velocity & Acceleration at a point, Potential lines, Flow net, Stream function, Velocity potential, Circulation, Vortex motion. Dynamics of Fluid Flow: One dimensional method for flow analysis, Euler`s equation of motion, Derivation of Bernoulli`s equation for incompressible flow & its applications	8

Unit III : Viscous Flow Introduction to laminar and turbulent flow, Reynolds number and its significance, Mach number and its significance, Boundary layer concept, Wall shear and boundary layer thickness, Displacement thickness and Momentum thickness, Separation, Drag and Lift on immersed bodies. Flow of viscous fluids through parallel plates, Pipes, Kinetic energy correction factor.	8
Unit IV : Principles & Classification of Hydraulic Machines Impulse Turbines :- Principle, Constructional features, Installation of Pelton turbine, Velocity diagram & analysis, Working proportions, Design parameters, Performance characteristics, Governing & selection criteria.	10
Unit V : Reaction or Pressure turbine Principles of operation, Degree of reaction, Comparison over pelton turbine, Development of reaction turbines, Classification, Draft tubes, Cavitation in turbines. Francis turbine, Propeller turbine, Kaplan turbine: Types, Constructional features, Installations, Velocity diagram & analysis. Working proportions, Design parameters, Performance characteristics, Governing, Selection of hydraulic turbines, Classification & Applications: Introduction to Centrifugal, axial & mixed flow Pumps, Self-priming Pumps. Introduction to Reciprocating Piston / Plunger Pumps. Rotary Displacement Pumps: - Introduction to gear pumps, Sliding vane pumps, Screw pumps.	10

Total: 45 Hours

References:

Text Books Recommended:

1. Fluid Mechanics & Fluid Power Engineering by D.S.Kumar
2. Fluid Mechanics & hydraulic Machines by R.K.Bansal
3.Fluid Mechanics for Engineers by P.N. Chartterjee
4.Fluid Mechanics by J.F.Douglas, J.M. Gasiorek

Reference Books Recommended:

1. Fluid Mechanics by Frank M. White
2.Mechanics of Fluids by B.S.Massey
3.Fluid Mechanics by A.K.Jain
4.Fluid Mechanics with engineering applications by Daugherty & Franizini

RTM Nagpur University
Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	Fluid Mechanics and Machinery (BEAE 303P)	0	0	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	The objective of this lab is to teach students, the knowledge of various flow meters and the concept of fluid mechanics.
CO2	This lab helps to gain knowledge on working of centrifugal pumps, positive displacement pumps,hydraulic turbines.
CO3	Students will compare the performance of various machines at different operating points.

Sr. No.	List of Practical's
List of Experiments in Fluid Mechanics and Machinery:	
01	To verify Bernoulli's Theorem
02	To determine the critical velocity of flow by Reynolds's apparatus.
03	Performance characteristics of Pelton Turbine
04	Performance characteristics of Francis Turbine
05	Performance characteristics of Kaplan Turbine
06	To study the Centrifugal Pump
07	To study the Axial Flow Pump
08	To study the Reciprocating Pump

References:

1. Fluid Mechanics by Frank M. White
2. Fluid Mechanics & Fluid Power Engineering by D.S.Kumar
3. Lab Manual

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Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	Avionics –I (BEAE 304T)	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	Understand the fundamentals behind the principles of operation of the various types of Avionic Systems and technical terms associated with it.
2	Understand the mathematical tools required for the determination of the reliability of avionic systems and the performance of actuation systems.
3	Learn about principles Information, Modulation, Transmission, Propagation

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Understand about the principle of information's, various communication systems, problem of communicating
CO2	Understand about the Modulation: Amplitude, angle and phase modulations and examples of coding and decoding circuits.
CO3	Describe about the Transmission lines and their circuit representation, Frequency and time division multiplexing.
CO4	Understand about the Radiation: Principles and apply basic formulae.
CO5	Remember and understand about the Propagation, bandwidth requirements and Circuits : Circuits for communication transmitters and receivers, The Systems and Special Systems (Principles) : VHF, UHF, Fiber optics and Laser Technology

SYLLABUS

Contents	No of hours
Unit I: PRINCIPLES Information: Communication systems: signals, analogue, digital and coded forms, time and frequency representation, signal spectra, types of distortion Information: Nature and measure, influence of bandwidth and signal/noise ratio on channel capacity, elements of Shannon's theorem and its implications. Problems of communicating in presence of noise. ,	8
Unit II: Modulation: Amplitude, angle and phase modulations, single and vestigial sideband forms, demodulation, Super-heterodyne principle, automatic gain and frequency control, typical circuit arrangements. Pulse modulation: sampling principles, sampling criterion, quantization and quantization noise, selection of number and distribution of quantization levels, bandwidth requirements, examples of coding and decoding circuits.	9
Unit III: Transmission: Transmission lines and their circuit representation, characteristic impedance, complex propagation constant, standing wave radio, matching and impedance charts. Channel Performance: Amplitude and phase distortion, phase and group delay distortion caused by multiple effects. Noise, origin, measurements, noise figure and noise temperature effect on channel performance. Frequency and time division multiplexing.	10
Unit IV : RADIO & TELEVISION ENGINEERING Radiation : Principles: application of basic formulae for unipole and dipole, aerials, effective height, directional, properties, gain, impedance, linear arrays, traveling wave aerials, rhombicas, parasitic elements. Television Waveforms: Scanning, interlacing, horizontal and vertical resolution, bandwidth requirements. Color television, principles, chrominance and luminance signals	8

Unit V: Propagation: Principles: influence of ionosphere and troposphere reflection from earth's surface, field strength calculations, fading diversity reception. Basic definitions of photometry and colorometry, trichromatic systems. Circuits: Circuits for communication transmitters and receivers, block diagrams and examples of typical circuits, television receivers, Camera and display tubes. Systems: Description of typical point-to-point and broadcast radio systems, choice of typical parameters (e.g. operating frequency, type of modulation, transmitter power level, bandwidth). Special Systems (Principles) : VHF, UHF, Fiber optics and Laser Technology, Satellite communication and related equipment, electronic counter measures, low-level TV and Head-down displays, CR T displays ,	10

Total: 45 Hours

References:

Text Books Recommended:

1. F E Terman, Radio Engineering, McGraw Hill
2. E C Jordon, Electromagnetic Waves and Radiating System, Prentice Hall
3.B P Lathi, Communications Systems, John Wiley and Sons

Reference Books Recommended:

1.Prasad, Antenna and Propagation
2.Schwattz Bennet MWR and Stein S, Communication Systems and Techniques, McGraw Hill, NY
3.Carlson A. N., Communication Systems - An Introduction to Signals and Noise in Electrical Communication, McGraw Hill, New York, 1968.

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Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
III	Computer Programming (BEAE 305P)	0	1	2	2	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Write and compile programs using C programs.
CO2	The objective of this lab is to teach students, how to write program for swapping of two variables, sum of all digit of a five digit number and whether the year is a leap year or not.
CO3	Program to print Armstrong number, finding the factorial of a number and finding the factorial of a number, prime number & odd number or even number.
CO4	To make the students to imbibe the knowledge to write the program for palindrome, biggest number.
CO5	To demonstrate the call by value and reference method.

Tutorials	
1	Programme for swapping of two variables without using third variable
2	Programme to calculate the sum of all digit of a five digit number
3	Programme to check whether the year is a leap year or not.
4	Programme for finding the factorial of a number, prime number & odd number or even number.
5	Programme to check whether the entered string of number is paleindrome or not.
6	Programme to calculate or demonstrate call by value & call by reference

Sr. No.	List of Practical's
01	Write a programme to perform swapping of two variables without using third variable.
02	Write a programme to calculate the sum of all digit of a five digit number.
03	Write a programme to check whether the year is a leap year or not.
04	Write a programme to print Armstrong number from 1to 500.
05	A menu programme for finding the factorial of a number, prime number & odd number or even number.
06	Write a programme to check whether the entered string of number is paleindrome or not.
07	Write a programme to find the biggest number of three numbers.
08	Write a programme to calculate or demonstrate call by value & call by reference

References:

1. The C Programming Language : Dennis Ritchie & Brain Kernighan [Pearson]
2.Programming with C : K.R.Venugopal & S.R.Prasad [TMH]
3. Let Us C : Yashwant Kanetkar [BPB]
4. Lab Manual

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Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Elements of Aeronautics (BEAE-306T)	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	This course will able the student to understand the basic concepts of aerospace engineering.
2	Able to understand the technical terms associated in aviation industries.
3	This course will make the students aware and imbibe knowledge of various types of airplane engines and its working.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Understand the basic concepts of aerospace engineering, historical revolution, early airplanes, biplanes and monoplanes.
CO2	Able to understand the evolution in the field of aerodynamics, materials, structures and propulsion over the years.
CO3	Explain about the major components of an airplane and their functions, Different types of flight vehicles, classifications, flight instruments for flying, different types of air breathing and non airbreathing engines, their comparative merits demerits..
CO4	Understand the physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment.
CO5	Understand different types of fuselage structures, wing structure and will able to get the knowledge of various Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials.

SYLLABUS

Contents	No of hours
Unit I: Introduction To introduce the basic concepts of aerospace engineering early airplanes, biplanes and monoplane	7
Unit II : Development Developments in aerodynamics, materials, structures and propulsion over the years	8
Unit III : Aircraft Configurations and Power Plants Used In Airplanes Components of an airplane and their functions, Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation. Basic ideas about piston, turboprop and jet engines, Use of propeller and jets for thrust production. Comparative merits, Principles of operation of rocket, types of rockets and typical applications ,	10
Unit IV : Introduction to Principles of Flight Physical properties and structure of the atmosphere, Temperature, pressure and altitude relationships, Evolution of lift, drag and moment. Aerofoil's, Mach number, Maneuvers.	10

Unit V : Introduction to Airplane Structures ,Materials used In Airplanes General types of construction, Monocoque, semi-monocoque construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials. General types of construction, Monocoque, semi-monocoque construction, Typical wing and fuselage structure. Metallic and non-metallic materials, Use of aluminium alloy, titanium, stainless steel and composite materials,	10

Total: 45 Hours

References:

Text Books Recommended:

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

Reference Books Recommended:

1. Kermode, A.C., "Flight without Formulae", McGraw-Hill, 1997.

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Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Aerodynamics-I (BEAE 407T)**	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To impart knowledge of basics of air flow
2	To provide details regarding the flow over aerofoil and wings
3	To impart knowledge of forces and moments over an aerofoil and characteristics of lift and drag forces
4	To impart knowledge of shock waves and boundary layer problems.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Able to apply the knowledge in order to measure the lift and drag characteristics of an aerodynamic body
CO2	Able to apply the knowledge of potential flow theory in order to measure the lift and drag characteristics
CO3	Able to design and measure the lift and drag characteristics of an aerofoil
CO4	Able to determine the flow characteristics in a variable are duct and the flow across a shock wave, flow characteristics across a shock wave.
CO5	Able to solve the boundary layer problems.

SYLLABUS

Contents	No of hours
Unit I: Introduction To understand the behavior of airflow over bodies with particular emphasis on airfoil sections in the incompressible flow regimes. CHARACTERISTICS PARAMETERS FOR AIRFOIL AND WING AERODYNAMICS Characterizations of Aerodynamic Forces and Moments, Airfoil Geometry Parameters, Wing Geometry Parameters, Aerodynamic Force and Moment Coefficients, Wings of Finite Spans	6
Unit II: Two Dimensional Flows Basic flows – Source, Sink, Free and Forced vortex, uniform parallel flow. Their combinations, Pressure and velocity distributions on bodies with and without circulation in ideal and real fluid flows. Kutta Joukowski's theorem.	8
Unit III: Incompressible Flows Around Airfoils General Comments, Circulation and the Generation of Lift, General Thin- Airfoil Theory, Thin, Flat Plate Airfoil (Symmetric Airfoil),Thin, Cambered Airfoil, High-Lift Airfoil Sections, Multi element Airfoil Sections for Generating High Lift, High-Lift Military Airfoils.	11
Unit IV: Compressible Flow Thermodynamic Concepts, Adiabatic Flow in a Variable Area Stream tube, Isentropic Flow in a Variable area stream tube, Characteristic equations and Prandtl- Meyer Flow, Shock Waves. Stagnation properties, speed of sound wave. Mach number, one dimensional isentropic flow, Stagnation properties, isentropic flow through convergent - divergent nozzles. Normal shock.	6

Unit V: : Introduction To Boundary Layer Theory Concepts of laminar and turbulent boundary layer. Momentum integral equation. Approximate methods for solution of boundary later for simple cases.	7

Total: 45 Hours

References:

Text Books Recommended:

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

Reference Books Recommended:

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

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Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
III	Essence of Indian Traditional Knowledge (BEAE307T)	2	0	0	2	Grades: (O, A, B, C)			2

Sr. No.	Course Objective The objective of this course is–
1	Students will have increased ability to understand the importance and application of: Indian Knowledge system and its scientific approach, Indian philosophical tradition, Indian artistic tradition, Traditional knowledge and protection of nature.
2	The legality and its importance for the protection of Indian traditional knowledge.
3	The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system

Course Outcomes

After successful completion of this course the student will be able to:

CO1	To understand Indian Knowledge system and its scientific approach
CO2	To understand Indian philosophical tradition
CO3	To understand Indian artistic tradition
CO4	To understand Traditional knowledge and protection of nature, importance for the protection of Indian traditional knowledge.
CO5	To obtain Knowledge about the Legal Framework and TK

SYLLABUS

Contents	No of hours
Unit I: Basic Structure of Indian Traditional Knowledge Vedas, Upavedas, Vedang, Upadang, scientific approach.	6
Unit II : Ecology and Indian Traditional Knowledge Meaning, role, Case studies.	7
Unit III : Intellectual Property Rights and Indian traditional Knowledge Meaning, role in protection of Indian traditional knowledge, case studies.	7
Unit IV : Indian Philosophical traditions and Indian Artistic Traditions Nyay, Sankaya, Yog, Mimansa, Jainism, Buddhism, Sikhism, and other approaches, Chitrakala, Murtikala, Vastukala, Sangeet, Sthpatya, NrityaevamSahitya, case studies,	10
Unit V : , Legal Framework and TK The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003. ,	10

Total: 40 Hours

References:

Text Books Recommended:

1. RR Gaur, Rajeev Sangal, GP Bagaria, Human Values and Professional Ethics (Excel Books, New Delhi, 2010)

Reference Books Recommended:

1.V. Sivaramakrishanan (ed.), Cultural Heritage of India – Course material, Bharatiya Vidya Bhavan, th Mumbai, 5 Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
3. Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan
4. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984
5. Pramod Chandra, Indian Arts, Howard University Press, 1984
6. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987.

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Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	Manufacturing Process –I (BEAE 401T)	3	0	0	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	The main objective of this course is to emphasize the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used. The course is delineated particularly to understand the conventional manufacturing processes like casting, forming, joining.
2	To provide knowledge regarding the methods of joining, powder metallurgy process and plastics processing.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	The students will able to understand the basic concepts of Casting Process, types of Patterns, moulding process and various moulding machines
CO2	The students will able to understand the concepts of gating design process, various types of Melting furnaces and special casting processes.
CO3	The students will able to explain about the mechanics of forming processes, forging process, extrusion & wire drawing processes.
CO4	The students will able to illustrate the various kinds of metal joining processes, weldability of metals, defects & inspection of welding.
CO5	The students will able to demonstrate different types of powder metallurgy processes, sintered carbide cutting tools and types of composite materials and its applications, To explain different types of processing of plastics methods use for processing of plastic materials.

SYLLABUS

Contents	No of hours
Unit I: Casting Process Introduction. Pattern making: - Types, materials used, Type of Pattern, allowances, colour codes. Core making: - Types of core, Core materials & its properties. Moulding: - Types of sand moulds, moulding sand composition, moulding sand properties, moulding machines	9
Unit II: Gating design Type of gating systems, pouring time, riser design (Analytical treatment) Melting furnaces: - Types, Electric furnace, Induction furnace, Cupola - construction & operation. Cleaning, inspection & casting defects. Special casting processes such as investment casting, centrifugal casting, shell moulding, Slush casting, Die casting	10
Unit III: Mechanics of forming processes Rolling - rolling pressure & roll separation force, driving force & torque, power loss in bearing. Forging - forging forces & stresses, equipment (Hammer / Press), capacity required. Extrusion & Wire Drawing.	8

Unit IV : Joining Processes Introduction to Welding, Soldering, Brazing Processes. Types of Welding, Arc Welding & Gas Welding Processes, Joints, Electrodes, Weldability of Metals, Defects & Inspection of Welding, Welding equipments of Fixtures. Soldering, Brazing Processes	8
Unit V: Powder Metallurgy and Processing of Plastics Powder manufacturing & conditioning, Fabrication methods, Production of Sintered Structural Components. Self-lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools Composite Materials: - Classification, Different types of composite materials and its applications,Thermoplastic, Thermosetting plastics, General properties & applications of Thermosetting & Thermoplastics. Extrusion, Injection Moulding, Compression Moulding, Transfer Moulding, Blow Moulding, Calendering, Wire Drawing, Embossing	10

Total: 45 Hours

References:

Text Books Recommended:

1. Manufacturing Science by Ghosh & Mallik, Affiliate East –West Press – Pvt Ltd.
2. Manufacturing Engineering & technology 4th Edn by S. Kalpakjian & SR Schmid, Addison Wesley Longman Pvt.Ltd.
3. Production Technology 8th Edn by R.K.Jain, Khanna Publication , New Delhi

Reference Books Recommended:

1.Work Shop Technology, Vol. I - III by WAJ Chapman.
2. Manufacturing Processes by M. Begman
3. Processes & Materials of Manufacture by R. Lindberg.
4. Work Shop Technology (Volume - I & II) by Bawa
5. Work Shop Technology (Volume - I & II) by B. S. Raghuvanshi

RTM Nagpur University
Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	**Manufacturing Process Lab. (BEAE 401P)**	0	0	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	To provide an understanding about the cupola furnance working and construction, moulding techniques and casting process.
CO2	To be able to understand the pattern making, various joining processes and forming process.
CO3	To be able to understand the drawing process.
CO4	To impart knowledge in detail about the pattern making process.
CO5	To impart knowledge in detail about the process of casting and welding

Sr. No.	List of Practical's
Minimum Eight out of the following shall be performed:	
01	Study of Cupola Furnace.
02	Study of Moulding Techniques.
03	Study of Casting Process.
04	Study of Pattern Making.
05	Study of Joining Processes.
06	Study of Forming Processes.
07	Study of Drawing Processes.
08	One Job – Pattern Making.
09	One Job – Casting.
10	One Job – Welding.

References:

1. Work Shop Technology, Vol. I - III by WAJ Chapman.
2. Manufacturing Processes by M. Begman
3.Processes & Materials of Manufacture by R. Lindberg.
4.Work Shop Technology (Volume - I & II) by Bawa
5.Work Shop Technology (Volume - I & II) by B. S. Raghuvanshi

RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Aircraft Structure- I (BEAE 402T)**	3	1	0	4	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To provide an understanding the concepts of stress and strain, Shear force and Bending moment
2	To provide knowledge regarding the methods of determining the deflections of beams and Torsion of shaft
3	To impart basic knowledge about strain energy, columns and Principle stresses and strains.

Course Outcomes	
After successful completion of this course the student will be able :	
CO1	To understand the concept of simple stresses & strains, Torsion of circular shafts and Thin cylinders and spherical shells subjected to internal pressure.
CO2	To understand and analyze the Shear force & bending moment, Pure bending, deflection of beams and Shear stresses in beams concept.
CO3	To be able to understand and apply the Strain energy & impact loading and Statically indeterminate beams and frames.
CO4	To establish relations for Principal stresses & strains and analyze member's subjected to different types of stresses simultaneously. And understand the Buckling of columns.
CO5	To analyze the derivation of maximum, minimum principle stresses & maximum shear stress induced in shaft when it is subjected to bending moment, torque & axial load.

SYLLABUS	
Contents	**No of hours**
Unit I: Concept of simple stresses & strains Concept of simple stresses & strains :- Introduction, stress, strain, types of stresses, stresses & strains with uni-axial loading, stress-strain diagram for brittle & ductile material, elastic limit, Hooks law, Poisson`s ratio, bulk modulus, relation between Young`s modulus & Shear modulus. Torsion of circular shafts: - Derivation of torsion equation with the assumptions made in it. Torsion, shear stress induced in the shaft, when it is subjected to torque. Strength & rigidity criterion for design of shaft. Torque transmitted by solid & hollow circular shaft. Thin cylinders and spherical shells subjected to internal pressure	9
Unit II: Shear force & bending moment Shear force & bending moment: - Types of beams (cantilever beam, simply supported beam, overhung beam etc.) Types of loads (Concentrated & UDL), Shear force & bending moment diagrams for different types of beams subjected to different types of loads, Sign. Conventions for bending moment & shear force, shear force & bending moment diagrams for beams subjected to couple, Relation between load, shear force & bending moment. Stresses in beams: - Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections. Deflection of beams: - Derivation of differential equation of elastic curve with the assumptions made in it. Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated load, UDL, Relation between slope, deflection & radius of curvature. Macaulay`s method, area moment method to determining deflection of beams. Shear stresses in beams :- Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum & average shear stress.	11

Unit III: Strain energy & Impact loading Strain energy & impact loading: - Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads & impact loads. Strain energy under uniaxial tension and compression, bending and torsion. Castingliano`s theorem. Statically indeterminate beams and frames, Clapeyron's three moment equation method, Moment distribution method.	8
Unit IV : Principal Stresses & Strains, Buckling of Columns. Principal stresses & strains :- Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress &direct stresses in two mutually perpendicular planes, Mohr`s circle for representation of stresses. Derivation of maximum & minimum principle stresses & maximum shear stresses when the member is subjected to different types of stresses simultaneously (i.e. combined stress) Buckling of columns with various end conditions, column curves, Columns with initial curvature, with eccentric loading, South well plot, short column formulae like Rankine's Johnsons, etc. Energy method. Beam Column.	10
Unit V : Application Derivation of maximum, minimum principle stresses & maximum shear stress induced in shaft when it is subjected to bending moment, torque & axial load. Theories of failure, modes of failure, compound stresses, eccentric axial loading, variable stresses in machine parts, stress concentration & stress raisers, notch sensitivity, stress concentration factor, methods for reducing stress concentration factor, Factor of safety	7

Total: 45 Hours

References:

Text Books Recommended:

1. Strength of Material by S. Ramamurtham
2. Strength of Material by R. K. Rajput
3. Strength of Material by F. L. Singer
4. Mechanics of Material by Beer & Johnson
5. Timoshenko, S., "Strength of Materials", Vols, I and II, Princeton D.Von Nostrand Co., 1988.
6. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", McGraw Hill, 1993.

Reference Books Recommended:

1. Strength of materials by Timoshenks
2. Machine Design by Black & Adam
3. Machine Design by J. E. Shigley

RTM Nagpur University
Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	Aircraft Structures - I (BEAE 402P)	0	0	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	To demonstrate to the students about various strain measuring instruments mechanical, electrical types
CO2	To perform the tensile test, hardness test, torsion test, impact test on different metals.
CO3	To perform the deflection test, deflection of spring and Absorption Test

Sr. No.	List of Practical's
01	Study of strain measuring instruments mechanical, electrical types
02	Tension test on metals
03	Hardness test on metals.
04	Torsion test on metals
05	Impact test metals
06	Transverse test on beams including deflections
07	Notch Bar Test for toughness of metals.
08	Measurement of static strains using electrical resistance gauges
09	Verification of S.T. in beams.
10	Deflection of springs.
11	Aircraft structure material: Absorption Test, Dimension Test, Crushing strength

References:

1.Strength of Material by S. Ramamurtham
2. Strength of Material by R. K. Rajput
3.Lab Manual

RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	Aerodynamics-II (BEAE-403T)	3	0	0	3	30	70	100	3 Hours

Sr. No.	Course Objective The objective of this course is–
1	To explain advanced concepts of Aerodynamics.
2	To explain experimental set ups, measurement techniques and visualization techniques used in aerodynamics.

Course Outcomes

After successful completion of this course the student will be:

CO1	Able to explain the formation of wing tip vortex and will able to measure the lift and induced drag characteristic using momentum theory.
CO2	Able to apply the knowledge of lifting line theory in order to measure the induced drag characteristics
CO3	Able to measure the drag and moment characteristics of complete airplane using different theories.
CO4	Able to understand and estimate the lift and drag characteristics over an airfoil section at supersonic speed.
CO5	Able to explain the classification, construction and working of a wind tunnel will its application in Aerospace industry and the instrumentation part along with flow visualization techniques used in Wind tunnel.

SYLLABUS

Contents	No of hours
Unit I Description of flow past a wing - Streamline pattern, formation of tip vortices - Down wash - Induced angle of attack and induced drag - Momentum theory of wing for lift and induced drag - Schrenk's method of estimation of wing characteristics from airfoil data.	8
Unit II Representation of lifting effect of wing by vortex lines - Lifting line theory - Formulation of governing integro - Differential equation - Method of solution by Fourier series - Effect of Individual terms of the series (first 3 terms) - Effect of taper twist and sweep back - Influence of flaps on wing lift distribution.	9
Unit III Extended lifting theory - Low aspect ratio wings - Jones theory - Winglets and strakes - Flow past slender bodies of revolution - Lift, drag and moment characteristics of complete airplane. Shoc.k expansion method for flow over airfoils - small perturbation equation for compressible flow - Glauret and Geothert's rules - Ackert's supersonic airfoil theory	10
Unit IV Three dimensional thin wings in supersonic flows - Perturbation potential - Non-lifting wings - Lifting wings of simple plan form - Conical flows - Numercial integration procedures - Drag at supersonic speeds - Supersonic area rule.	8

Unit V Principles of model testing - Types of subsonic wind tunnels - Balances and measurements - Interference effects - transonic, Supersonic and hypersonic wind tunnels and characteristic features, their operation and performance - Shock tubes and shock tunnels. Free flight testing - Measurements of pressure, velocity and Mach number - Flow visualization methods of subsonic and supersonic flows.	10

Total: 45 Hours

References:

Text Books Recommended:

1.Clancy J., " Aerodynamics ", Pitman, 1986.
2.Houghton And Caruther, " Aerodynamics for engineering students ", Edward Arnold Publishers, London, 1989.
3.Anderson J.D., " Fundamental of Aerodynamics ", McGraw Hill Book Co., New York, 1985.

Reference Books Recommended:

1.Allen Pope, " Low Speed Wind Tunnel Testing ", Vol. I - John Wiley & Sons Inc., New York, 1966.
2.Allen Pope, " High Speed Wind Tunnel Testing ", Vol. II - John Wiley & Sons Inc., New York, 1966.
3.Mccornick. W., “Aerodynamics, Aeronautics and Flight Mechanics ", John Wiley, New York, 1979.

RTM Nagpur University
Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	Aerodynamics (BEAE 403P)	0	0	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	To provide an understanding about various graphs, forces over cambered and un-cambered aerofoils.
CO2	To provide an understanding about the forces over flat plate
CO3	To provide an understanding about the pressure distribution on symmetrical, unsymmetrical aerofoil, flat plate and cylindrical body.

Sr. No.	List of Practical's
Based on above syllabus minimum eight practical's to be performed	
01	To draw the graph for different velocities verses manometer deflection.
02	Analysis of forces (Lift & Drag) over aerofoil symmetrical.
03	Analysis of forces (Lift & Drag) over cambered aerofoil unsymmetrical
04	Analysis of forces (Lift & Drag) over flat plate.
05	To draw graph of pressure distribution on a symmetrical aerofoil.
06	To draw graph of pressure distribution on a unsymmetrical aerofoil.
07	To draw graph of pressure distribution on flat plate.
08	To draw graph of pressure distribution on a circular cylinder
09	To visualize the flow patterns over the surface of different model
10	To study the side force in yawing motion of an aircraft.
11	To study the boundary layer concept over the various models.

References:

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

RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Propulsion- I (BEAE-404T)**	3	1	0	4	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To familiarize with Principles of Propulsion systems
2	To introduce working principles of Compressors and turbines
3	To familiarize with the concept of Matching of compressors and turbines and Off design performance

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Will able to explain about different types of jet engine, there working principal and performance characteristics, apply basic concept of gas turbine cycle on jet engine and thrust augmentation methods
CO2	Will able to explain about different types of inlets (mainly subsonic and supersonic), internal and external flow in terms of boundary layer separation and stall condition, diffuser performance and shock swallowing by area variation
CO3	Will be able to explain about various type of combustion chamber used in gas turbine cycle, and the factor affecting to design and performance parameters of combustion chamber, they can also able to apply the fundamental knowledge on different types flaming technique used in combustion chamber
CO4	At the compilation of Unit IV students will able to explain about various types of compressor and turbine, their performance parameters, their efficiency and component characteristics, the basic operating principle of convergent and divergent nozzles, the choking condition in nozzles, the various types of CD nozzles and thrust reversal methods.
CO5	Finally at compilation of Unit V student will able to explain about basic working principal of gas turbine components like: inlet, compressor, combustion chamber, turbine and nozzle, and able to apply fundamental concept on numerical technique

SYLLABUS

Contents	No of hours
Unit I: Fundamentals of Gas Turbine Engines Illustration of working of gas turbine engine - The thrust equation - Factors affecting thrust – Effect of pressure, velocity and temperature changes of air entering compressor - Methods of thrust augmentation - Characteristics of turboprop, turbofan and turbojet - Performance characteristics.	9
Unit II: Subsonic and Supersonic Inlets for Jet Engines Internal flow and Stall in Subsonic inlets - Boundary layer separation - Major features of external flow near a subsonic inlet - Relation between minimum area ratio and eternal deceleration ratio. Inlet Diffuser performance - Supersonic inlets - Starting problem in supersonic inlets – Shock swallowing by area variation – External deceleration - Modes of inlet operation.	10
Unit III: Combustion Chambers Classification of combustion chambers - Important factors affecting combustion chamber design – Combustion process - Combustion chamber performance - effect of operating variables on performance - Flame tube cooling - Flame stabilization - Use of flame holders - Numerical problems.	8

Unit IV : Compressors , Turbines and Nozzles Description Classification, type, performance parameters – efficiency, component characteristics , Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking - Nozzle throat conditions - Nozzle efficiency - Losses in nozzles - Over expanded and under-expanded nozzles - Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces – Thrust reversal.	11
Unit V: Matching of Gas Turbine Components Inlet, compressor, combustion chamber, turbine, and nozzle. Numerical problems.	7

Total: 45 Hours

References:

Text Books Recommended:

1. V. Ganesan, “Gas-turbines” , Tata McGraw-Hill Education, 2010.
2. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. " Gas Turbine Theory ", Longman, 1989.
3. Mathur, M.L., and Sharma, R.P.,"Gas Turbine", "Jet and Rocket Propulsion", Standard Publishers and Distributors, Delhi, 1988.

Reference Books Recommended:

1.Hill, P.G & Peterson, GR. “Mechanics of Thermodynamics of Propulsion” Addison – Wesley Longman JNC, 1999.
2. Oates, G.C. “Aerothermodynamics of Aircraft Engine Components ", AIAA Education Series, New York, 1985.

RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Aircraft Flight Mechanics (BEAE-405T)**	3	0	0	3	30	70	100	3 Hours

Sr. No.	Course Objective The objective of this course is–
1	To make students familiar of ISA along with various similarity laws for models and prototypes applicable during flight conditions.
2	To make students aware of Airplane performance analysis in steady and accelerated situations.
3	To make students aware of general airplane stability and control with specific application to longitudinal stability and control.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Understand and apply the dimensional analysis, similarity laws and model laws with ISA for aircraft in various operating conditions.
CO2	Understand and analyze the general Forces and moment distribution of aircraft for different, flight conditions.
CO3	Analyze the performance of aircraft under steady straight level, Flight conditions.
CO4	Analyze the performance of aircraft during climbing, gliding, turning and other maneuvers.
CO5	Understand the establishment of aircraft stability criteria and co-relate various stability aspects with aircraft control. Analysis of longitudinal stability and control aspect due to aircraft components including fuselage-engine nacelle and control surface effectiveness.

SYLLABUS

Contents	No of hours
Unit I Introduction and background. Dimensional analysis, Buckingham Pi theorem-applications-similarity laws and models International Standard Atmosphere.	8
Unit II Forces and moments acting on a flight vehicle - Equation of motion of a rigid flight vehicle - Different types of drag - Drag polars of vehicles from low speed to high speeds - Variation of thrust, power and SFC with velocity and altitudes for air breathing engines and rockets - Power available and power required curves.	8
Unit III Performance of airplane in level flight - Maximum speed in level flight - Conditions for minimum drag and power required - Range and endurance, Climbing flight (Maximum rate of climb and steepest angle of climb,) Service and absolute ceiling.	9
Unit IV Gliding flight (minimum rate of sink and shallowest angle of glide) Turning performance (Turning rate turn radius). Bank angle and load factor, take off and landing performance - Limitations of pull up and push over.	10

Unit V Static and dynamic stability - Purpose of controls in airplanes -Inherently stable and marginal stable airplanes – Static, Longitudinal stability - Stick fixed stability - Basic equilibrium equation - Stability criterion. Effects of fuselage and nacelle - Influence of CG location - Power effects - Stick fixed neutral point - Stick free stability-Hinge moment coefficient - Stick free neutral points- Symmetric maneuvers - Stick force gradients - Stick _ force per 'g' - Aerodynamic balancing. Determination of neutral points and maneuver points from flight test.	10

References:

Text Books Recommended:

1. Perkins, C.D., and Hage, R.E., “Airplane Performance stability and Control”, John Wiley & Son:, Inc, New York, 1988.
2. J.D.Anderson, “Aircraft Performance & Design”, McGraw-Hill Education, 1999.

Reference Books Recommended:

1. Etkin, B., “Dynamics of Flight Stability and Control”, Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., “Aircraft Dynamic Stability and Re¬sponse”, Pergamon Press, Oxford, 1980.
3. Nelson, R.C. “Flight Stability and Automatic Control”, McGraw-Hill Book Co., 1998

RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		College Assessment	University Examination	Total	
IV	**Professional Ethics (BEAE-406T)**	2	0	0	0	15	35	50	2

Sr. No.	Course Objective The objective of this course is–
1	To develop human values and ethical standards.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	An understanding of business ethics, levels, myths, use and train oneself to be ethical.
CO2	Knowledge on Ethical principles, reasoning, roles & responsibilities.
CO3	An understanding of stake holder theory, Individual and corporate responsibilities towards stake holders.
CO4	Understanding on Corporate responsibilities towards Product Safety & Reliability and environment friendly approach.
CO5	Understanding between the Employee & Corporate on responsibilities on aspects of contracts, equal opportunity , Affirmative action, sexual harassment etc.,

SYLLABUS

Contents	No of hours
Unit I HUMAN VALUES: Definition of ethics-Morals values and ethics – integrity-Work ethics- Service learning-Civic virtue- Respect for others-Caring-Sharing-Honesty-Courage-Valuing time-Cooperation-Commitment- Empathy-Self-confidence-Character-Spirituality-Introduction to Yoga and meditation for professional excellence and stress management. Suggested Reading: Case study of Discovery failure	5
Unit II ENGINEERING ETHICS: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories. Suggested Reading: Study the Bhopal gas tragedy	7
Unit III SAFETY, RESPONSIBILITIES AND RIGHTS: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Suggested Reading: Chernobyl explosion, Nuclear and thermal power plant issues	7
UNIT IV LIFE SKILLS: Definition, Relevance, Types of values, changing concepts of values-aims and values of value education- basic etiquette-morals and values in life-dealing with people. Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self- restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses.	6
UNIT V EMPLOYER & CORPORATE ON RESPONSIBILITIES : Influences - Peer pressure, familial and societal expectations, media.	5

Total: 30 Hours

References:

1 Megan J. Murphy (Editor), Lorna Hecker (Editor), Ethics and Professional Issues in Couple and Family Therapy
2 Andrew Belsey (Editor), Ruth Chadwick (Editor), Ethical Issues in Journalism and the Media (Professional Ethics)
3 Warwick Fox (Editor), Ethics and the Built Environment (Professional Ethics)
4 RuchikaNath, Value Education, APH Publishing Corporation, New Delhi, 2012 5 Manoharan P.K., Education and Personality Development, APH Publishing Corporation, New Delhi, 2012

Text Books Recommended:

1 Subramanian R., Professional ethics, Oxford University press

RTM Nagpur University
Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	**Mini Project –I : {Internship/Case Study} (BEAE 407P)**	0	0	4	2	25	25	50

Course Outcomes	
After successful completion of this course the student will be able :	
CO1	To create an Industrial environment and culture within the institution.
CO2	To understand production lab, utilizing the infrastructure of the institution.
CO3	To standardize laboratories to industrial standard, thereby giving exposure to industrial housekeeping standards.
CO4	To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education.

Sr. No.	List of Practical's
The mini project-I can be organized based on the recommendations and evaluation criteria listed below.	
01	Standardization of Laboratories: This phase of the mini project can be clubbed with laboratory hours of the semester. Before the commencement of cycle of experiments for the semester, the students should be given instructions on 5S method of industrial housekeeping. Video resources available in the internet can be utilized for the purpose. After the initial summarizing, students should be grouped into batches of 5 and should be entrusted with activities of implementing or maintaining 5S standardization of the laboratory. This ensures that all experiments of the laboratory are performed as per industrial standard. To elaborate the concept of standardization let us consider a typical case of machine shop. The case can suitably be adopted for any departments as standardization concept is the same for all industry, whether it is manufacturing, service or hospitality.
02	Case study: Standardization of laboratory of Aeronautical engineering Department.
03	Phase-I of the mini project carries 30% of the total marks. The evaluation should be made as group performance in implementing the standardization and individual contribution in setting work place clean and tidy. Evaluations by way of surprise visits made by the Head of Department and Guide during laboratory hours at least twice the semester contribute to the part of total marks.

References:

Innovative ideas of commercial values should be encouraged to be continued as project for the forth coming semester.

1. Evaluation Standardization (30%), Group (15%) and Individual (15%).
2. Problem identification and solving (50%) or collaborative work (50%) or involvement in production center (50%).
3. Documentation (20%).

RTM Nagpur University
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		Exam Duration (Hrs.)
		L	T	P		College Assessment	Total	
IV	**Environmental Studies (BEAE-408T)**	2	0	0	0	Grades: (O, A, B, C)		2

Sr. No.	Course Objective The objective of this course is–
1	This course provides an integrated and interdisciplinary approach to the study of environment and solutions to environmental problems. This course will spread awareness among the student s about environmental issues and shall alert them to find solutions for sustainable development.
2	Knowledge of key factors of environment; awareness of interconnectedness of multiple factors in environmental challenges.
3	Attitude building for motivating to protect environment; contribution to analysis, innovation and entrepreneurships via development and realisation of sustainable products, systems and solutions.
4	A clear idea of the interdisciplinary nature of environment and health risk assessment

Course Outcomes

After successful completion of this course the student will be able to:

CO1	To understand relationship and interactions between organisms and the environment.
CO2	To acquire a knowledge of importance of natural resources and their sustainable uses.
CO3	To understand the delicate ecological balances in nature and role of Biodiversity.
CO4	To recognize the sources and impacts of various pollutions on human health and environment.
CO5	To, recognize and able to apply methodological approaches of the social sciences, natural sciences, and humanities

SYLLABUS

Contents	No of hours
Unit I: Introduction Definition, scope and importance; Need for public awareness -Institutions in environment, people in environment. **Natural Resources** Renewable and non-renewable and associated problems; Role of an individual in conservation of natural resources; equitable use of resources for sustainable lifestyles.	5
Unit II: Ecosystems Concept of an ecosystem - understanding ecosystems, ecosystem degradation, resource utilization, Structure and functions of an ecosystem- producers, consumers) and decomposers. Energy flow in the ecosystem - water, carbon, oxygen, nitrogen; and energy cycles, integration of cycles in nature. Ecological succession; Food chains, food webs and ecological pyramids; Ecosystem types - characteristic features, structure:, and functions of forest, grassland, desert and aquatic ecosystems	6
Unit III: Biodiversity Introduction – Biodiversity at genetic, species and ecosystem levels Bio-geographic classification of India Value of biodiversity - Consumptive use value, productive use .value, social, ethical, moral, aesthetic and optional value of biodiversity. India as a mega-diversity nation; hotspots of biodiversity Threats to bio-diversity - habitat loss, poaching of wildlife, man-wild life conflicts. Common endangered and endemic plant and animal species of India. Insitu and Exsitu conservation of biodiversity	7

Unit IV : Pollution Definition; Causes, effects and control measures of air, water, soil, marine, noise and thermal pollutions and nuclear hazards. Solid waste management - Causes, effects and control measures of urban and industrial waste. Role of individual and institutions in prevention of pollution. Disaster management Floods, Earth quacks, Cyclone and land slides	5
Unit V: Social Issues and the Environment: Unsustainable to sustainable development; Urban problems, related to energy; Water conservation, rainwater harvesting, watershed management; Problems and concerns of resettlement and rehabilitation of affected people. Environmental ethics - issues and possible solutions – Resource consumption patterns and need for equitable utilization; Equity disparity in Western and Eastern countries; Urban and rural equity issues; need for gender-equity.Preserving Resources for future generations. The rights of animals; Ethical basis of environment education and awareness; Conservation ethics and traditional value systems of India. Climate change, global warming, acid-, rain, Ozone layer depletion, nuclear accidents and holocausts. Wasteland Reclamation; Consumerism and Waste products. Environment legislations - The Environment (protection) Act; The water (Prevention and Control of Pollution) Act; The. Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislations - environment impact assessment (EIA), Citizens action sand action groups. Public awareness — Using an environmental calendar of activities, self-initiation.	7

Total: 30 Hours

GUIDELINES FOR EVALUATION OF ENVIRONMENTAL STUDIES
SUBJECT (As per Ordinance No. 2 of 2012):
At the end of the course, the student shall be evaluated for 100 marks with distribution as below:
Field note book - 25 Marks
Objective Questions - 50 Marks (50 questions, each of one mark)
Essay type question - 25 Marks
. Passing marks - 40 Marks
OR
In view of the above entire course the students in terms of batches of 20 students each may be assigned a project work encompassing People‘s Bio-diversity Register (PBR) of any Gram Panchayat as per the format of Bio-diversity Authority of India under the guidance of a teacher. The PBR should be evaluated for 100 marks.
The result shall be declared in grades as follows:
Grade O: above 75 Marks;
Grade A: 61–75 Marks;
Grade B: 51-60 Marks;
Grade C: 40-50 Marks

References:
Text Books Recommended:

1. A Text Book of Environmental Studies for Undergraduate Courses, Erach Bharucha, University Press (India) Pvt. Ltd., Hyderabad