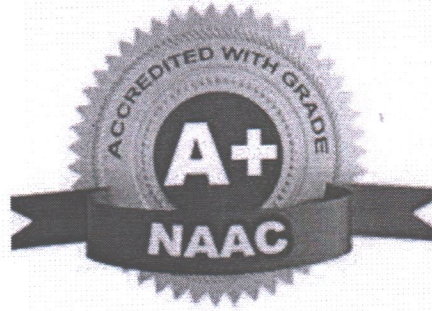


TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108



DEPARTMENT OF AERONAUTICAL ENGINEERING

Structure & Curriculum

From

Academic Year 2021-22

Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

SCHEME OF INSTRUCTION & SYLLABI

Programme: Aeronautical Engineering

Scheme of Instructions: Second Year B. Tech. in Aeronautical Engineering Semester - III

Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME				
									CT-1	CT-2	TA/CA	ESE	TOTAL
1	BSC	BAE2301	Applied Mathematics-III	3	1	-	4	4	15	15	10	60	100
2	PCC	BAE2302	Introduction to Aerospace Engineering	3	-	-	3	3	15	15	10	60	100
3	PCC	BAE2303	Fluid Mechanics and Machinery	3	-	-	3	3	15	15	10	60	100
4	PCC	BAE2304	Aero-Thermodynamics	3	-	-	3	3	15	15	10	60	100
5	PCC	BAE2305	Solid Mechanics	3	-	-	3	3	15	15	10	60	100
6	ESC	BAE2306	Meteorology and Measurement	3	-	-	3	3	15	15	10	60	100
7	PCC	BAE2307	Aero-Thermodynamics Lab	-	-	2	2	1	-	-	25	25	50
8	PCC	BAE2308	Fluid Mechanics and Machinery Lab	-	-	2	2	1	-	-	25	25	50
9	PCC	BAE2309	Solid Mechanics Lab	-	-	2	2	1	-	-	25	25	50
10	ESC	BAE2310	Meteorology and Measurement Lab	-	-	2	2	1	-	-	25	25	50
11	MCC	BAU2303	Environmental Science	2	-	-	2	Audit	-	-	#25	#25	#50
Total				20	1	8	29	23	90	90	160	460	800

L-Lecture

T-Tutorial

P-Practical

CT1- Class Test 1

TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2

** ESE- End Semester Examination (For Laboratory End Semester performance)

Course Category	HSMC (Hum., Soc. Sc, Mgmt.)	BSC (Basic Sc.)	ESC (Engg. Sc.)	PCC (Programme Core Courses)	PEC (Programme Elective Courses)	OEC (Open Elective from other discipline)	Project/ Seminar/ Industrial Training	MCC (Mandatory Courses)
Credits	--	04	04	15	--	--	--	Yes
Cumulative Sum	03	22	18	15	--	--	--	--

PROGRESSIVE TOTAL CREDITS: 35+23=58

[Signature]
Head of Department
Aeronautical Engineering
Tulsiramji Gaikwad- Patil
College Of Engineering And
Technology, Nagpur.

[Signature]
Dean Academics
Tulsiramji Gaikwad-Patil
College Of Engineering
and Technology, Nagpur

[Signature]
Vice Principal
Tulsiramji Gaikwad Patil
College Of Engineering &
Technology, Nagpur

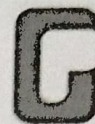
[Signature]
Principal
Tulsiramji Gaikwad Patil College Of
Engineering and Technology, Nagpur



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Wardha Road, Nagpur-441 108

NAAC Accredited (A+ Grade)



Second Year (Semester-III) B. Tech Aeronautical Engineering

BAE2301: Applied Mathematics III

Teaching Scheme		Examination Scheme	
Lectures	3 Hrs/week	CT-1	15 Marks
Tutorial	1 Hrs/week	CT-2	15 Marks
Total Credit	4	TA	10 Marks
		ESE	60 Marks
		Total	100 Marks
		Duration of ESE: 02 Hrs 30 Min.	

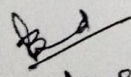
Course Outcomes (CO)

Students will be able to

1	Apply the concept of Laplace Transform for Solving differential equation
2	Analyze numerical techniques to find the roots of equations different types of equations.
3	Apply the knowledge of Fourier series and Transform for understanding periodic signals and solve integral equations.
4	Solve Partial Differential Equation using appropriate method
5	Understand Complex Variable and its application.

Course Contents

		Hours
Unit I	Laplace Transforms: Laplace transforms and its properties, Inverse Laplace Transform & its properties, Convolution Theorem, Unit Step Function, Application for Laplace Transform to solve ordinary differential equations including simultaneous Differential Equations	(9)
Unit II	NUMERICAL METHODS: Error in numerical calculations, Errors in series approximation, Rounding of errors, Solution of Algebraic and Transcendental Equation: Bisection method, False position method, Newton -Raphson method and their convergence, Solution of system of simultaneous linear equations: Gauss elimination method, Gauss Jordon method. Gauss Seidel method, Crout's method.	(10)
Unit III	Fourier Series and Fourier Transform (FT): Periodic Functions and their Fourier Expansions, Even and Odd functions, change of interval, Half Range Expansions, Fourier transform, Fourier Sine & Cosine transforms, Discrete Fourier Transform, Application of Fourier Transform to solve Integral equation	(9)
Unit IV	Partial Differential equations: Partial differential equation of first order first degree i. e. Lagrange's form. the Linear homogeneous PDE of nth order with constant coefficient, method of separation of variables. Simple Applications to solve Partial Differential Equations (Wave Equations & One-dimensional heat equation only).	(9)


Dr. B. D. Deshpande

Unit V	Functions of a Complex Variable: Function of a complex variable, Analytic functions, Cauchy-Riemann conditions, Conjugate functions, singularities, Cauchy's integral theorem and integral formula, Taylor's and Laurent's theorem, Residue theorem (without proof), contour integration	(8)
Text Books		
1	Higher Engineering Mathematics by B.S. Grewal, 40th Edition, Khanna Publication	
2	Advanced Engineering Mathematics by Erwin Kreyszig, 8th Edition, Wiley India	
3	Applied Mathematics for Engineers & Physicist by L.R. Pipes and Harville.	
Reference Books		
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 John wiley & son	


Dr. B. D. Deshpande



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Second Year (Semester-III) B.Tech. Aeronautical Engineering

BAE2302: Introduction to Aerospace Engineering

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/Week	CT-I	15 Marks
Tutorial	0 Hrs/Week	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3 Hrs		ESE	60 Marks

Course Contents

Unit I	Introduction and developments Pre Wright-Brothers era, Wright Flyer, history and evaluation of aircraft. Conventional airplane, progress in airplane design and application, Current status. Other kinds of heavier than air vehicle, helicopter, VSTOL machines, space vehicles, reusable space vehicles and space shuttle, Developments in aerodynamics, materials, structures and propulsion over the years.
Unit II	Aircraft Configurations and Aircraft Systems Components of an airplane and their functions, Different parts of airplane. Different types of flight vehicles, classifications. Conventional control, Powered control, Basic instruments for flying, Typical systems for control actuation. Aircraft Systems: Elementary studies on hydraulic, pneumatic, pressurizing air-conditioning and oxygen systems. Landing gear and control surface actuating system. Aircraft electrical systems, elementary studies of generation and on-board distribution of electricity.
Unit III	Introduction to Aerodynamics Aerofoil nomenclature; Flow over aerofoil; Lift and generation of lift by Bernoulli's principle; Lift and drag components – generation of lift and drag; lift curve, drag curve, types of drag, factors affecting lift and drag; variation of lift with angle of attack, pressure distribution over aerofoil; centre of pressure and its significance; aerodynamic centre, aspect ratio, velocity of sound, Mach number and supersonic flight effects, wing span, wing area, sweep, tapered ratio, wash out, wash in, dihedral, anhedral angle, simple problems.
Unit IV	Airplane Structures: Configuration of fuselage and wings. Evaluation of structure, progress in materials: wooden to all metal airplanes, strength to weight ratio of aircraft materials, importance of weight load factors, factors of safety in aeronautics and aerospace applications. Details of the structural layout of wing, fuselage tail planes. Cockpit and cabin configuration. Different types of materials for airplane and engine application. Materials for space vehicles. Advance composite materials.
Unit V	Introduction to Aircraft Propulsion Difference between air-breathing and non-air-breathing engines, classification of aircraft based on power plant, location and principle operation, basics of piston engine, classification of aircraft engines, Brayton cycle and its application to the gas turbine engines, performance characteristics of turbofan, turbojet, turbo prop, ramjet and scramjet engines, basics of propeller theory, classification and working of compressors, turbine and combustion chamber, types of fuel used in commercial aircraft engines, principle operation of rocket engine and type of rockets.

Text Books

1	John D. Anderson, Jr., "Introduction to Flight", Mc-Graw Hill, 3rd edition, 1995.
2	Lalit Gupta and O P Sharma, Fundamentals of Flight, Vol-I to Vol-IV, Himalayan Books, 1st edition, 2006.
3	John D. Anderson, Jr., "The Airplane - History of its Technology", AIAA Series, 1st edition, 2002.

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Reference Books	
1	G. P. Sutton, O. Biblarz, "Rocket Propulsion Elements", John Wiley & Sons, 7th edition, 2001.
2	A. C. Kermode, "Flight without Formulae", Pearson Education, 5th edition, 2004.
3	S. K. Ojha, "Flight Performance of Aircraft", AIAA Series, 1st edition, 1995.
Useful Links	
1	https://nptel.ac.in/courses/101/101/101101079/
2	https://nptel.ac.in/courses/101/105/101105059/
3	https://onlinecourses.nptel.ac.in/noc19_ae05/preview

	Course Outcomes	PO/PSO	CL	Class Sessions
BAE2302.1	Understand history of aviation and basic concepts of aerospace engineering and implement the knowledge acquired in design and development of aircrafts.	PO1, PO2, PO12, PSO1	2	9
BAE2302.2	Understand different components of aircraft, vehicle types and flight instrumentations and develop conceptual design of aircraft systems and subsystems.	PO1, PO2, PO12, PSO1	2	9
BAE2302.3	Apply the knowledge of aerodynamic forces and moments acting on airplane for understanding of different flight parameters.	PO1, PO2, PO3, PO12, PSO1	3	9
BAE2302.4	Apply the knowledge of aircraft structures and configurations in solving the problems on airplane layouts, load factor and factor of safety.	PO1, PO2, PO3, PO12, PSO1	3	9
BAE2302.5	Investigate the performance of the aircraft and rocket engines with the basic understanding of its working principles.	PO1, PO2, PO3, PO12, PSO1	4	9

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Second Year (Semester-III) B.Tech. Aeronautical Engineering

BAE2303: Fluid Mechanics and Machinery

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/Week	CT-I	15 Marks
Tutorial	0 Hrs/Week	CT-II	15 Marks
Total Credit	3	CA	10 Marks
Duration of ESE: 3 Hrs		ESE	60 Marks

Pre-Requisites: Engineering Physics

Course Contents

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 and its measurement (Manometers and Bourdon's pressure gauge), Pressure variations in compressible and incompressible fluids.
Unit II	Kinematics and Dynamics of Fluid Flow Types of flow, Stream line, Path line, Streak line, Stream tube, Continuity equation, One and Two dimensional flow, Velocity and 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 and its applications.
Unit III	Viscous flow Viscous flow on a flat plate; Boundary layer, displacement, momentum and energy thicknesses; Flow between two plates, flow in a pipe; Laminar flow vs. turbulent flow. Dimensional analysis and Buckingham pi theorem, Reynolds number; turbulence and turbulent flows; Frictional losses, losses in a pipe; Flow past cylinder, critical Reynolds numbers; Incompressible viscous flow past an airfoil, wakes, types of drags.
Unit IV	Compressible flow Mach number and its importance in compressible flows; Equation of motion for compressible flow in 1D, continuity, momentum and energy equation for compressible flow.
Unit V	Principles and Classification of Hydraulic Machines: Impulse and reaction Turbines:- Principle, Constructional features, Installation of Pelton, Kaplan and Francis turbine, Velocity diagram and analysis, Working proportions, Design parameters, Performance characteristics, Governing and selection criteria. Cavitation in turbine, draft tube design. 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 and analysis.

Text Books

1	Fluid Mechanics by Frank M. White, Mcgraw-Hill, 7th Edition, 2011.
2	Fluid Mechanics and Fluid Power Engineering by D. S. Kumar, S.K. Kataria & Sons, 9th Edition, 2015.
3	Fluid Mechanics for Engineers by P.N. Chatterjee, Macmillan Publishers India, 1st Edition, 1995.

Reference Books

1	Fluid Mechanics and hydraulic Machines by R. K. Bansal, Laxmi Publications, 9th Edition, 2018.
2	Mechanics of Fluids by B. S. Massey, PHI, 7th Edition, 2015.
3	Fluid Mechanics by A. K. Jain, Khanna Publishers, 12th Edition, 2004

Useful Links

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1	https://nptel.ac.in/courses/112/104/112104117/
2	https://nptel.ac.in/courses/112/105/112105206/
3	https://nptel.ac.in/courses/112/105/112105182/

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2303.1	Comprehend the basic principles of fluid mechanics and apply the knowledge in solving problems on fluid measurements.	PO1, PO2, PO3, PO12, PSO1	3	9	2
BAE2303.2	Analyze types and properties of the fluid flow and solve the problems on potential function, stream function and Bernoulli's principle.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2303.3	Investigate the viscous flow and solve the problems on boundary layer theory, laminar and turbulent and flow through pipes.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2303.4	Solve problems on the compressibility effect and governing equations of fluid flow.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2303.5	Estimate the performance of different fluid machineries, study their application and classification.	PO1, PO2, PO3, PO4, PO12, PSO3	4	9	2

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Second Year (Semester-III) B.Tech. Aeronautical Engineering					
BAE2304: Aero- Thermodynamics					
Teaching Scheme			Examination Scheme		
Theory	3 Hrs/Week		CT-I	15 Marks	
Tutorial	0 Hr/Week		CT-II	15 Marks	
Total Credits	3		CA	10 Marks	
Duration of ESE: 3 Hrs			ESE	60 Marks	
Course Contents					
Unit I	Fundamental Concepts and Definition Basic concepts: System boundary, surroundings, state, extensive and intensive properties, energy interactions, work and heat transfers, equilibrium, quasi-static and reversible processes, non-equilibrium and irreversible processes. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium. Zeroth law of thermodynamics, Temperature; concepts, scales, fixed points and measurements.				
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 and enthalpy.				
Unit III	Second Law of Thermodynamics Introduction (Law of degradation of energy), Thermal energy reservoirs, Kelvin-Planck and Clausius statements, Heat engines, Refrigerator and Heat pump, Perpetual motion machines, Reversible and Irreversible processes, Carnot cycle, Thermodynamic temperature scale. Entropy: The Clausius inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed and Steady flow open systems. Second law analysis of engineering systems: Availability, Reversible work, Irreversibility, Temperature-entropy diagram.				
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 and Heat transfer, Simple and Modified Rankine cycle with reheat and regeneration, Conditions for exact differentials. Maxwell relations, Clapeyron equation, Joule-Thompson coefficient and Inversion curve. Coefficient of volume expansion, Adiabatic and Isothermal compressibility.				
Unit V	Air Standard and Gas power cycles: Closed and open systems, polytrophic processes, cyclic processes, Carnot cycle, Otto cycle, Diesel cycle, Stirling and Ericsson cycle, Brayton cycle, ideal and real cycles, design point analysis. Applications to i) Nozzles and Diffusers ii) Turbine and Compressors iii) Throttle Valves. Basics of Aero Engines operations, cycles involved types of engines, application in aerospace.				
Text Books					
1	Thermodynamics: An engineering approach by Yunus Cengel, M. A. Boles, McGraw Hill Education, 9th Edition, 2019.				
2	Thermodynamics by C. P. Arora, Tata Mc-Graw Hill Publication, 1st Edition, 2004.				
3	Fundamentals of classical Thermodynamics by G. J. V. Wylen, R. E. Sonntag, C. Borgnakke, John Wiley & Sons, 4th Edition, 2014.				
Reference Books					
1	Engineering Thermodynamics by P. K. Nag, Tata Mc-Graw Hill Publication, 6th Edition, 2017.				
2	Fundamentals of engineering Thermodynamics by R. K. Rajput, Laxmi Publications, 4th Edition 2016.				
Useful Links					
1	https://nptel.ac.in/courses/112/105/112105123/				

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	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2304.1	Apply the basic concepts of thermodynamics in solving related problems.	PO1, PO2, PO3, PO12, PSO1	3	9	2
BAE2304.2	Evaluate heat transfer problems by appreciating the first law of thermodynamics and its application.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2304.3	Solve problems on Carnot cycle, Clausius inequality, availability and irreversibility by interpreting the application of second law of thermodynamics to heat engines, heat pumps and refrigerators.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2304.4	Work out problems on change of entropy through understanding of the concepts of available energy.	PO1, PO2, PO3, PO4, PO12, PSO1	4	9	2
BAE2304.5	Solve problems on operation of engines by comprehending the basics of different air standard, gas power and refrigeration cycles and concerned engines.	PO1, PO2, PO3, PO4, PO12, PSO1	3	9	2



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**Second Year (Semester-III) B.Tech. Aeronautical Engineering****BAE2305:Solid Mechanics**

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/Week	CT-I	15 Marks
Tutorial	0 Hr/Week	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3 Hrs		ESE	60 Marks

Course Contents

Unit I	Stress, Strain and Deformation of Solids: Introduction: Rigid bodies and deformable solids, Types of stresses and strains, Elastic constants and their relationships, Thermal Stresses, Analysis of the state of stress at a point, Plane stress and Plane strain conditions, Mohr's circle of stress, equilibrium equations, strain displacement relations, compatibility conditions, natural and kinematic boundary conditions, stress-strain relations, generalized Hooke's Law - Isotropy, Orthotropy, Anisotropy. Displacement and force methods of analysis. Concepts of linear and nonlinear problems. Linear elasticity solutions, problems in 2-D (rectangular and polar co-ordinates), stress function approach, St. Venant's principle.
Unit II	Shear force and bending moment: Shear force and bending moment: Types of beams (cantilever beam, simply supported beam, overhung beam etc) Types of loads (Concentrated and UDL), Shear force and bending moment diagrams for different types of beams subjected to different types of loads, Sign. Conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple, Relation between load, shear force and bending moment stresses in beams:- Pure bending, theory of simple bending with assumptions and expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections.
Unit III	Deflection of beams: Derivation of differential equation of elastic curve with the assumptions made in it. Deflection and slope of cantilever, simply supported, overhung beams subjected to concentrated load, UDL, Relation between slope, deflection and 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 and average shear stress.
Unit IV	Strain energy and impact loading: Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads and impact loads. Strain energy under uniaxial tension and compression, bending and torsion. Castiglione's theorem. Statically indeterminate beams and frames, Clapeyron's three moment equation method, Moment distribution method. Columns 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.
Unit V	Principal Stresses and Strains: Definition of principal planes and 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 and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of stresses. Derivation of maximum and minimum principle stresses and maximum shear stresses when the member is subjected to different types of stresses simultaneously (i.e. combined stress).

Text Books

1	Strength of Material by S. Ramamurtham and R. Narayanan, Dhanpat Rai Publishing Company Pvt. Ltd., 16th Edition, 2011.
2	Strength of Material by R. K. Rajput, S. Chand Publishing, 7th Edition, 2018.
3	Strength of Material by A. Singer and F. L. Singer, Longman, 4th Edition, 1990.

Reference Books

1	Strength of materials by S. Timoshenko, CBS, 3rd Edition, 2002.
2	A Textbook of Strength of Materials by R.K. Bansal, Laxmi Publications, 4th Edition, 2018.
3	Strength of Materials by S. S. Bhavikatti, Vikas Publishing House, 4th Edition, 2013.

Useful Links

1	https://nptel.ac.in/courses/112/102/112102284/
2	https://onlinecourses.nptel.ac.in/noc20_me84/preview
3	https://nptel.ac.in/courses/105/106/105106049/

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2305.1	Evaluate St. Venant's principle by assessing the basic concepts related to stress and strains.	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	4	9	2
BAE2305.2	Calculate the shear force, bending moment, stresses in a beam under given load conditions.	PO1, PO2, PO3, PO4, PO12, PSO1, PSO2	3	9	2
BAE2305.3	Analyze deflection of beams by Macaulay's and area moment methods and evaluate stresses in beams.	PO1, PO2, PO3, PO4, PO12, PSO2, PSO3	4	9	2
BAE2305.4	Investigate the buckling of column at different end conditions using Rankine's, Johnsons and Energy method.	PO1, PO2, PO3, PO4, PO12, PSO3	4	9	2
BAE2305.5	Investigate the principle stresses and strains and its effect on different structures.	PO1, PO2, PO3, PO4, PO12, PSO1, PSO3	4	9	2





Tulsiramji Gaikwad-Patil College of Engineering and Technology

Wardha Road, Nagpur-441 108

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Second Year (Semester-III) B.Tech. Aeronautical Engineering

BAE2306:Meteorology and Measurement

Teaching Scheme		Examination Scheme	
Theory	3 Hrs/Week	CT-I	15 Marks
Tutorial	0 Hr/Week	CT-II	15 Marks
Total Credits	3	CA	10 Marks
Duration of ESE: 3 Hrs		ESE	60 Marks

Course Contents

Unit I	Basics of Meteorology: Introduction to Metrology, Need, Elements, Work piece, Instruments, Persons, Environment, their effect on Precision and Accuracy, Errors, Errors in Measurements, Types, Control, Types of standards.
Unit II	Linear and Angular Measurements: Linear Measuring Instruments, Evolution, Types, Classification, Limit gauges, gauge design, terminology, procedure, concepts of interchange ability and selective assembly, Angular measuring instruments, Types, Bevel protractor clinometers angle gauges, spirit levels sine bar, Angle alignment telescope, Autocollimator, Applications.
Unit III	Advances in Meteorology: Basic concept of lasers Advantages of lasers, laser Interferometers, types, DC and AC Lasers interferometer, Applications, Straightness, Alignment. Basic concept of CMM, Types of CMM, Constructional features, Probes, Accessories, Software, Applications, Basic concepts of Machine Vision System, Element, Applications. Form Measurement: Principles and Methods of straightness, Flatness measurement, Thread measurement, gear measurement, surface finish measurement, Roundness measurement, Applications.
Unit IV	Measurement of Power, Flow and Temperature: Force, torque, power, mechanical, Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube, Temperature: bimetallic strip, thermocouples, electrical resistance thermometer, Reliability and Calibration, Readability and Reliability.
Unit V	Aircraft Instruments: Flight Instruments and Navigation Instruments, Gyroscope, Accelerometers, Air speed Indicators, TAS, EAS, Mach Meters, Altimeters, Principles and operation, Study of various types of engine instruments, Tachometers, Temperature gauges, Pressure gauges, Operation and Principles.

Text Books

1	Gupta. I.C., "Engineering Meteorology", Dhanpatrai Publications, 1st Edition, 2005.
2	Jain R.K. "Engineering Meteorology", Khanna Publishers, 20th Edition, 2017.
3	Raghavendra, N. V., Krishnamurthy, L., "Engineering Meteorology and Measurements", Oxford Academic Publication, 1st Edition, 2013.
4	Pallet, E.H.J., "Aircraft Instruments & Principles", Pearson Education, 2009.

Reference Books

1	Bewoor, N. A., Kulkarni, V., "Meteorology and Measurement", McGraw Hill Education, 1st Edition, 2017.
2	Rajput, R. K., "Mechanical Measurements and Instrumentation (Including Meteorology and Control Systems)", S.K. Kataria & Sons, 2nd Edition, 2021.
3	Williams, C. A. "Aircraft Instruments & Principles" Galgotia Publications, 1972

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Useful Links	
1	https://nptel.ac.in/courses/112/104/112104250/
2	https://nptel.ac.in/courses/112/106/112106179/
3	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-me70/

	Course Outcomes	PO/PSO	CL	Class Sessions	Lab Sessions
BAE2306.1	Illustrate the basics concepts of measurements by understanding various meteorological instruments.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.2	Summarize the principles of linear and angular measurement tools used for industrial applications.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.3	Elucidate the procedure for conducting computer aided inspection.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.4	Exhibit the different techniques of form measurement used for industrial components.	PO1, PO2, PO12, PSO3	2	9	2
BAE2306.5	Illustrate working and operating principles of various aircraft instruments.	PO1, PO2, PO12, PSO3	2	9	2

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Second Year (Semester-III) B.Tech. Aeronautical Engineering

BAE2307: Aero- Thermodynamics Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

BAE2307.1	Apply the basic concepts of thermodynamics in solving related problems.
BAE2307.2	Evaluate heat transfer problems by appreciating the first law of thermodynamics and its application.
BAE2307.3	Solve problems on Carnot cycle, Clausius inequality, availability and irreversibility by interpreting the application of second law of thermodynamics to heat engines, heat pumps and refrigerators.
BAE2307.4	Work out problems on change of entropy through understanding of the concepts of available energy.
BAE2307.5	Solve problems on operation of engines by comprehending the basics of different air standard, gas power and refrigeration cycles and concerned engines.

Sr. No.	List of Experiment	CO
1	Performing Morse test on 4-stroke petrol engine	1
2	Performance evaluation of 4-stroke petrol engine without Morse test	1
3	Performance test on single cylinder 4-stroke diesel engine	1
4	Performance test of reciprocating air compressor	2
5	Study of steam Turbine Engine	2
6	Determination of specific heat of solid	3
7	Determination of Thermal Conductivity of solid (metal rod)	3
8	Determination of Thermal Conductivity of insulating powder	4
9	Determination of Thermal Conductivity of liquid	4
10	Determination of Thermal Resistance of Composite wall	5

Text Books

1	Thermodynamics: An engineering approach by Yunus Cengel, M. A. Boles, McGraw Hill Education, 9th Edition, 2019.
2	Thermodynamics by C. P. Arora, Tata Mc-Graw Hill Publication, 1st Edition, 2004.
3	Fundamentals of classical Thermodynamics by G. J. V. Wylen, R. E. Sonntag, C. Borgnakke, John Wiley & Sons, 4th Edition, 2014.

Reference Books

1	Engineering Thermodynamics by P. K. Nag, Tata Mc-Graw Hill Publication, 6th Edition, 2017.
2	Fundamentals of engineering Thermodynamics by R. K. Rajput, Laxmi Publications, 4th Edition 2016.

Useful Links

1	https://nptel.ac.in/courses/112/105/112105123/
2	https://nptel.ac.in/courses/112/105/112105266/
3	https://nptel.ac.in/courses/112/104/112104113/

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Second Year (Semester-III) B.Tech. Aeronautical Engineering

BAE2308: Fluid Mechanics and Machinery Lab

Teaching Scheme		Examination Scheme	
Practical	2 Hrs/week	CA	25 Marks
Total Credit	1	ESE	25 Marks
		Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.	

Course Outcomes (CO)

Students will be able to

BAE2308.1	Comprehend the basic principles of fluid mechanics and apply the knowledge in solving problems on fluid measurements.	
BAE2308.2	Analyze types and properties of the fluid flow and solve the problems on potential function, stream function and Bernoulli's principle.	
BAE2308.3	Investigate the viscous flow and solve the problems on boundary layer theory, laminar and turbulent and flow through pipes.	
BAE2308.4	Solve problems on the compressibility effect and governing equations of fluid flow.	
BAE2308.5	Estimate the performance of different fluid machineries, study their application and classification.	
Sr. No.	List of Experiment	CO
1	Determination of coefficient of discharge of Venturimeter	1
2	Determination of coefficient of discharge of orifice meter	1
3	Determination of pipe flow losses	2
4	Verification of Bernoulli's theorem	2
5	Determination of meta-centric height of float vessel	3
6	Performance test on reciprocating pumps	4
7	Performance test on variable speed pump	4
8	Performance test on axial flow pump	4
9	Performance test on piston wheel turbine	5
10	Performance test on Francis turbine	5

Text Books

1	Fluid Mechanics by Frank M. White, Mcgraw-Hill, 7th Edition, 2011.
2	Fluid Mechanics and Fluid Power Engineering by D. S. Kumar, S.K. Kataria & Sons, 9th Edition, 2015.
3	Fluid Mechanics for Engineers by P.N. Chatterjee, Macmillan Publishers India, 1st Edition, 1995.

Reference Books

1	Fluid Mechanics and hydraulic Machines by R. K. Bansal, Laxmi Publications, 9th Edition, 2018.
2	Mechanics of Fluids by B. S. Massey, PHI, 7th Edition, 2015.
3	Fluid Mechanics by A. K. Jain, Khanna Publishers, 12th Edition, 2004

Useful Links

1	https://nptel.ac.in/courses/112/104/112104117/
2	https://nptel.ac.in/courses/112/105/112105206/
3	https://nptel.ac.in/courses/112/105/112105182/

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Second Year (Semester-III) B.Tech. Aeronautical Engineering

BAE2309:Solid Mechanics Lab

Teaching Scheme			Examination Scheme	
Practical	2 Hrs/week		CA	25 Marks
Total Credit	1		ESE	25 Marks
			Total	50 Marks
			Duration of ESE: 02 Hrs 00 Min.	
Course Outcomes (CO)				
Students will be able to				
BAE2309.1	Evaluate St. Venant's principle by assessing the basic concepts related to stress and strains.			
BAE2309.2	Calculate the shear force, bending moment, stresses in a beam under given load conditions			
BAE2309.3	Analyze deflection of beams by Macaulay's and area moment methods and evaluate stresses in beams.			
BAE2309.4	Investigate the buckling of column at different end conditions using Rankine's, Johnsons and Energy method.			
BAE2309.5	Investigate the principle stresses and strains and its effect on different structures.			
Sr. No.	List of Experiment			CO
1	Performing direct tension test on the given mild steel specimen			1
2	Performing torsion test on given cylindrical/ square/ rectangular specimen			1
3	Determining bending load on simply supported beam			2
4	Determining bending load on cantilever beam			2
5	Determining hardness of the given material using Brinell hardness test			3
6	Determining hardness of the given material using Rockwell hardness test			3
7	Determining stiffness constant of the spring			4
8	Evaluating compression strength of the given aluminum block			4
9	Determining impact load on the given mild steel specimen using I-Zod impact test			5
10	Determining impact load on the given mild steel specimen using Charpy impact test			5
11	Determining shear strength of the given mild steel specimen using Punch shear test			5
Text Books				
1	Strength of Material by S. Ramamurtham and R. Narayanan, Dhanpat Rai Publishing Company Pvt. Ltd., 16th Edition, 2011.			
2	Strength of Material by R. K. Rajput, S. Chand Publishing, 7th Edition, 2018.			
3	Strength of Material by A. Singer and F. L. Singer, Longman, 4th Edition, 1990.			
Reference Books				
1	Strength of materials by S. Timoshenko, CBS, 3rd Edition, 2002.			
2	A Textbook of Strength of Materials by R.K. Bansal, Laxmi Publications, 4th Edition, 2018.			
3	Strength of Materials by S. S. Bhavikatti, Vikas Publishing House, 4th Edition, 2013.			
Useful Links				
1	https://nptel.ac.in/courses/112/102/112102284/			
2	https://onlinecourses.nptel.ac.in/noc20_me84/preview			
3	https://nptel.ac.in/courses/105/106/105106049/			

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Second Year (Semester-III) B.Tech. Aeronautical Engineering				
BAE2310:Meteorology and Measurement Lab				
Teaching Scheme			Examination Scheme	
Practical	2 Hrs/week		CA	25 Marks
Total Credit	1		ESE	25 Marks
			Total	50 Marks
		Duration of ESE: 02 Hrs 00 Min.		
Course Outcomes (CO): Students will be able to				
BAE2310.1	Illustrate the basics concepts of measurements by understanding various meteorological instruments.			
BAE2310.2	Summarize principles of linear and angular measurement tools used for industrial applications.			
BAE2310.3	Elucidate the procedure for conducting computer aided inspection.			
BAE2310.4	Exhibit the different techniques of form measurement used for industrial components.			
BAE2310.5	Illustrate various measuring techniques of mechanical properties in industrial applications.			
Sr. No.	List of Experiment		CO	
1	Calibration and use of measuring instruments: Vernier caliper, micrometer, Vernier height gauge -using gauge blocks		2	
2	Calibration and use of measuring instruments: depth micrometer, bore gauge, telescopic gauge.		2, 3	
3	Measurement of linear dimensions using Comparators		3	
4	Measurement of angles using bevel protractor and sine bar		1	
5	Measurement of screw thread parameters: Screw thread Micrometers and Three wire method (floating carriage micrometer)		1	
6	Measurement of gear parameters: disc micrometers, gear tooth vernier caliper		2	
7	Measurement of features in a prismatic component using Coordinate Measuring Machine (CMM)		4	
8	Programming of CNC Coordinate Measuring Machines for repeated measurements of identical components		5	
9	Non-contact (Optical) measurement using Toolmakers microscope / Profile projector and Video measurement system		5	
10	Measurement of Surface finish in components manufactured using various processes (turning, milling, grinding, etc.,) using stylus based instruments.		3	
11	Machine tool metrology: Level tests using precision level; Testing of straightness of a machine tool guide way using Autocollimator, spindle tests.		5	
12	Measurement of force, torque and temperature		5	
Text Books				
1	Gupta. I.C., "Engineering Meteorology", Dhanpatrai Publications, 1st Edition, 2005.			
2	Jain R.K. "Engineering Meteorology", Khanna Publishers, 20th Edition, 2017.			
3	Raghavendra, N. V., Krishnamurthy, L., "Engineering Meteorology and Measurements", Oxford Academic Publication, 1st Edition, 2013.			
Reference Books				
1	Bewoor, N. A., Kulkarni, V., "Meteorology and Measurement", McGraw Hill Education, 1st Edition, 2017.			
2	Rajput, R. K., "Mechanical Measurements and Instrumentation (Including Meteorology and Control Systems)", S.K. Kataria & Sons, 2nd Edition, 2021.			
Useful Links				
1	https://nptel.ac.in/courses/112/104/112104250/			
2	https://nptel.ac.in/courses/112/106/112106179/			
3	https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-me70/			

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