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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

V Semester

Scheme & Syllabus of B.E. Programme

Aeronautical Engineering

(2024 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

GOLD

INSTITUTION'S INNOVATION COUNCIL 4-Star Rating

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

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SCHEME OF TEACHING AND EXAMINATION – B.E. – Aeronautical Engineering

(Applicable for students admitted from the Academic Year 2024-25 and onwards)

5th Semester

Aeronautical Engineering

Sl. No.	Course Code	Course Title	Course Type	TD/ PSB	Teaching Hours / Week			Examination				
					L	T	P	SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	Credits
1	BAE501	Theory of Vibrations	PCC	AE	3	0	0	**3**	**50**	**50**	**100**	**3**
2	BAE502	Composite Materials and Structures -I	IPCC	AE	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BAE503	Finite Element Methods	PCC	AE	3	2	0	**3**	**50**	**50**	**100**	**4**
4	BAEL504	Modeling and Analysis Lab	PCCL	AE	0	0	2	**3**	**50**	**50**	**100**	**1**
5	BAE525x	Professional Elective Course – I	PEC	AE	3	0	0	**3**	**50**	**50**	**100**	**3**
6	BAE536	Mini Project	PROJ	AE	0	0	2	**3**	**50**	**50**	**100**	**2**
7	BRM507	Research Methodology and IPR	AEC	AE	2	2	0	**3**	**50**	**50**	**100**	**3**
8	BCE508	Competency Enhancement Course-3	NCMC	CDCAC	0	2	0	-	**100**	-	**100**	**0**
9	BNS509	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	-	**100**	-	**100**	**0**
	BPE509	Physical Education (PE)(Sports and Athletics)		Physical Education Director								
	BYO509	Yoga		Yoga Teacher								
	BMU509	Music		Music Teacher								
									550	**350**	**900**	**20**

ASC: Applied Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Professional Elective Course – I

Course Code	Course Name	Course Code	Course Name
BAE525A	Gas Turbine Technology	BAE525D	Aircraft Systems & Instrumentation
BAE525B	Rockets & Missiles	BAE525E	Aviation Management
BAE525C	Basics of Unmanned Aerial Vehicles		

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

National Service Scheme (NSS) /Physical Education(PE)(Sports and Athletics)/Yoga/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rd Semester to the 6th semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Semester: V					
Theory of Vibration					
Course Code	:	BAE501	**Credits**	:	3
Hours/Week(L:T:P)	:	3:0:0	**CIE**	:	50Marks
Total Hours	:	40L	**SEE**	:	50Marks
Course Type	:	PCC	**SEE Duration**	:	3Hours

Prerequisites:	
Courses	• Applied Physics for ME Stream • Mathematics for ME-I&II Stream • Elements of Mechanical Engineering
Knowledge on Fundamental Concepts	Concept of vibration, SHM, Fourier series
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students	
CLO1	Understand the basic concepts of vibrations.
CLO2	Use the working principle of vibration measuring instruments
CLO3	Gaintheknowledgeofnumericalmethodsforsingle-degreefreedomSystems and Multi degree freedom.

Module-1	**08Hrs**
Introduction: Concept of vibration, Definition, Types of vibrations, S.H.M , principle of super position applied to Simple Harmonic Motions. Beats, Fourier theorem and simple problems. **Text Book:1:Ch1**	

Module-2	**08Hrs**
Undamped Free Vibrations: Single degree of freedom systems. Undamped free vibration, natural frequency of free vibration, Spring and Mass elements, effect of mass of spring, Compound Pendulum. **Damped Free Vibrations:** Single degree of freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping, critical and over damping, Logarithmic decrement**.** **Text Book:1: Ch2&3**	

Module-3	**08Hrs**
Forced Vibration: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force. Solution by Complex algebra, reciprocating and rotating unbalance, vibration isolation, transmissibility ratio due to harmonic excitation and support motion **Vibration Measuring Instruments and Whirling of Shafts:** Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problem. **TextBook:1:Ch4&5**	

Module-4	**08Hrs**
Systems with Two Degrees of Freedom: Introduction, principle modes and Normal modes of vibration, co-ordinate coupling, generalized and principal co-ordinates, Free vibration in terms of initial conditions. Geared systems. Forced Oscillations Harmonic excitation. **Applications:** Vehicle suspension, Dynamic vibration absorber and Dynamics of reciprocating Engines.	

Continuous Systems: Introduction, vibration of string, longitudinal vibration of rods, Torsional vibration of rods, Euler's equation for beams.

TextBook:1:Ch6

Module-5	**08Hrs**

Continuous Systems: Introduction, vibration of string, longitudinal vibration of rods, Torsional vibration of rods, Euler's equation for beams.

Numerical Methods for Multi-Degree Freedom Systems: Introduction, Influence coefficients, Maxwell reciprocal theorem, Dunkerley's equation. Orthogonality of principal modes, Method of matrix iteration-Method of determination of all the natural frequencies using sweeping matrix and Orthogonality principle. Holzer's method, Stodola method.

TextBook:1:Ch7

Course Outcomes: At the end of the course, the student will be able to

CO1	Apply the fundamental concepts of mechanical vibrations, including simple harmonic motion, vibration terminology, and Fourier analysis.
CO2	Analyze the free vibration response of single-degree-of-freedom (SDOF) systems under undamped and damped conditions.
CO3	Evaluate the steady-state response of SDOF systems subjected to harmonic excitation and assess vibration isolation and vibration measurement techniques for engineering applications.
CO4	Analyze the dynamic behavior of multi-degree-of-freedom (MDOF) and continuous systems by determining natural frequencies, mode shapes, and vibration responses.
CO5	Apply numerical methods and engineering principles to solve vibration problems involving multi-degree-of-freedom systems and interpret the dynamic characteristics of mechanical systems.

Text Books

1. Mechanical Vibrations, JBK Das and Dr.P L Srinivasa Murthy,Published By–Sapna Book House(P)Ltd., Bangalore 560009,Edition August 2016,ISBN:978-81-280-0371-4.
2. Mechanical Vibrations, Rao. V Dukkipati,J Srinivas,March2005,2nd PrintISBN:81-203-2593-1.

Reference Books

1. Mechanical Vibrations, S.S.Rao, Pearson Education Inc 4th Edition,2003.
2. Mechanical Vibrations, S.Graham Kelly,Tata McGraw Hill Special Indian edition,2007.
3. Theory & Practice of Mechanical vibrations,J.S.Rao&K.Gupta,NewAgeInternational Publications, New Delhi 2001.
4. Elements of Vibrations Analysis, Leonanrd Meirovitch, Tata McGrawHill Special Indian Edition, 2007.

Web links and Video Lectures(e-Resources)

1. https://archive.nptel.ac.in/courses/112/107/112107212/

CO-POMAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	1	1	-	2	1
CO2	2	2	1	-	-	-	-	-	1	1	-	2	1
CO3	3	3	1	-	-	-	-	-	1	1	-	2	1
CO4	3	2	1	-	-	-	-	-	1	1	-	2	1
CO5	3	2	1	-	-	-	-	-	1	1		2	1

Semester: V					
Composite Materials & Structures-I					
Course Code	**:**	BAE502	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40L+12P	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours
Prerequisites:					
Courses	• Mechanics of materials • Aircraft material and processing				
Knowledge on Fundamental Concepts	Concept of stress and strain of composite materials, Fatigue.				
Knowledge on Connected Tools (If any)	--				

Course Learning Objectives: This course will enable the students

CLO1	Understand the basic structures of composite materials and Structure.
CLO2	Acquire the knowledge of composites for various applications.
CLO3	Provide the design process using different failure theories.
CLO4	Impart the knowledge of types of loads on aerospace vehicles

Module-1	**08 Hrs**

Introduction: Natural and man-made composites, aerospace applications, other structural applications.

Composite Materials: Classification of composite materials reinforcements, Fibers, Particulates, polymers and polymer composites, metals and metal matrix composites, Carbon –carbon composite laminate designation, Elastics constant for orthotropic and isotropic Materials.

Text Book:1: Ch 1 & 2

Module-2	**08 Hrs**

Composite Fabrication: Composite manufacturing, Moulding process for polymer matrix composites, fabrication processes for metal matrix composites, fabrication process for ceramic matrix composites, machining, joining.

Sandwich structures: Basic design of sand which structures, Application of sandwich structures. Failure criteria of composites.

Text Book:1:Ch3

Module-3	**08 Hrs**

Design for Static Strength: Introduction Normal, shear biaxial and triaxial stresses Stress tensor, principal stress and codes /standards Maximum normal stress theory and maximum strain theory Maximum shear stress and strain theory Distortion energy theory ,Failure of brittle and ductile material Numerical.

Text Book:2: Ch1 & 2

Module-4	**08 Hrs**
Design for Impact Strength: Introduction, Impact stresses due to axial, bending and torsional loads, effect of inertia. **Fatigue Strength**: S- N diagram, low cycle fatigue and high cycle fatigue Endurance limit, modifying factors (size, surface and stress concentration effect) Goodman and Soderbergh relationship Stresses due to combined effect and cumulative fatigue damage. **Text Book: 2:Ch3&4**	
Module-5	**08 Hrs**
Stress concentration: Stress concentration factor, Determination of stress concentration factor, Methods of Reducing stress concentration Numerical problems. **Loads on Air craft:** Structural nomenclature & Types of loads Aerodynamic loads Symmetric Manoeuvre loads Load factor Velocity diagram Function of structural components. **Text Book: 2:Ch2** **Text Book: 4:Ch14**	

Practical Component of IPCC	
Sl. No.	**List of Experiments**
1	Fabrication of Composite plate using Hand layup method.
2	Fabrication of Composite plate using Vacuum infusion method.
3	Fabrication of Composite plate using Compression Molding Technique.
4	Measurement of major constituent fraction by Burnout method using Muffle furnace.
5	Carry out the tensile test of the prepared composite specimen as per the ASTM procedure.
6	Carry out three point bending test of the composite specimen as per ASTM procedure.
7	Carry out shear test of the composite specimen as per ASTM Procedure.
8	Perform single lap joint strength test as per the ASTM procedure.
9	Perform double lap joint strength test as per the ASTM procedure.
10	Perform double strap butt joint strength test as per the ASTM procedure.

Course Outcomes: At the end of the course, the student will be able to	
CO1	Illustrate the fundamental classification properties and applications of composite materials
CO2	Select suitable fabrication techniques for various composite material
CO3	Apply appropriate theories to determine stresses, strains and static behavior of aircraft structures
CO4	Determine impact and fatigue strength for various aircraft components under different loading conditions
CO5	Determine stress concentration factors and structural loads for aircraft applications

Text Books

1. Composite Materials, PK Sinha, Published by: Composite Centre of

Excellence, AR & DB, Department of Aerospace Engineering I.I.T. Kharagpur July 5, 2006.
2. Design of machine elements, JBK Das and Dr.PL Srinivas murthy, Revised edition July 2018 Sapna book house Bangalore.
3. Design of Machine Elements V.B. Bhandari, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition 2007
4. Basic aerodynamics, fundamentals of flight, Lalith Gupta and Dr.OP Sharma "volume 2 sponsored by Aeronautics research and development board. Himalayan books New Delhi. Print in 2015.
5. Introduction to Aircraft Structural for Engineering students, H.G.Megson, Butterworth-Heinemann Publications, 2017, ISBN 13: 978-93-82291-05-3.

Reference Books

1. Analysis of Aircraft Structures – An Introduction Donaldson, B.K, McGraw-Hill, 1993.
2. Strength of Materials, Timoshenko. S, Vol. I and II, Princeton D Von Nostrand Co, 1990.
3. Principles of composite material and mechanics, Ronald F. Gibson," 2nd Edition Taylor and Francis group 2007.
4. Mechanics of composite materials, Autar k Kaw, 2nd Edition Taylor and Francis year 2006.
5. Aircraft Structures Peery, D.J and Azar, J.J, 2nd edition, McGraw, Hill, N.Y.1993.

Web links and Video Lectures (e-Resources)

1. http://www.ae.iitkgp.ac.in/ebooks
2. https://www.springer.com/in/book/9780387743646

CO -PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	-	1	2	3	2	-	2	1
CO2	2	2	2	-	2	-	1	2	3	2	1	2	1
CO3	3	3	2	3	-	3	-	2	3	1	-	2	1
CO4	3	3	3	2	-	1	-	2	3	1	-	2	1
CO5	3	3	3	3	2	3	-	2	3	1	1	2	1

Semester: V					
Finite Element Methods					
Course Code	**:**	BAE503	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:2:0	**CIE**	**:**	50Marks
Total Hours	**:**	40L	**SEE**	**:**	50Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3Hours
Prerequisites:					
Courses	• Mechanics of Materials • Mathematics-1&2 for ME stream				
Knowledge on Fundamental Concepts	Structural analysis, stress, strain, deformation and material behavior, Hooks law, Linear algebra (matrices, vectors paces), Differential equations, Integration, Numerical methods.				
Knowledge on Connected Tools (If any)	--				

Course Learning Objectives: This course will enable the students

CLO1	Understand the fundamentals and formulation of the Finite Element Method.
CLO2	Analyze one-dimensional structural elements using FEM.
CLO3	Apply two-dimensional, three-dimensional, and isoparametric elements in FEM.
CLO4	Use FEM software for modeling, analysis, and result interpretation.
CLO5	Solve structural, heat transfer, and dynamic problems using FEM

Module-1	**08 Hrs**
Introduction: Basic Concepts, Need for studying FEM, Background Review: Stresses and Equilibrium, Plane stress, Plane strain, Potential energy and Equilibrium. Rayleigh - Ritz Method, Galerkin's Method, Simple applications in structural Analysis. Construction or discrete models - sub domains and nodes - simple elements for the FEM - Simplex, complex and multiples elements Polynomial selection -illustrative examples Elements and shape functions and natural coordinates, Use of local and natural coordinates, compatibility and convergence requirements of shape functions **Textbook 1: Ch1:1.1, 1.2, 1.4, 1.7, 1.9, 1.10, Ch3:3.3.** **Textbook 2: Ch1:1.7, Ch2:2.2, 2.4, Ch:4.1, 4.2,Ch5: 5.1, 5.2,5.3,5.4.**	

Module-2	**08 Hrs**
Fundamentals of Finite Element Method: Construction of shape functions for bar element and beam element, Bar elements, uniform bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis, Frame element, Beam element, problems for various loadings and boundary conditions. **Text book1: Ch8:8.1to 8.8** **Text Book 2: Ch5:5.8,Ch6:6.2,6.3,Ch11:11.1to11.4**	

Module-3	**08 Hrs**
Analysis of Two- and Three-dimensional Elements: Shape functions of Triangular, Rectangular and Quadrilateral elements, different types of higher order elements; constant and linear strain triangular elements. Stiffness matrix Four-Noded Tetrahedral Element (TET 4), Eight-Noded Hexahedral Element (HEXA 8), Tetrahedral elements, Hexahedral elements: Serendipity family, Hexahedral elements: Lagrange family. **Text Book1:Ch7:7.1to7.6**	

Module-4	**08 Hrs**
Theory of Isoparametric Elements: Isoparametric, sub parametric and super-parametric elements, characteristics of Isoparametric quadrilateral elements, structure of computer program for FEM analysis, description of different modules, pre and post processing, Features of software packages, sources of error, Axisymmetric element formulation. Axisymmetric formulation finite element modeling of triangular elements. Strain and Strain displacement matrix for axisymmetric element. **Text Book 2 :Ch5:5.5 to 5.7, 13.1 to 13.8**	
Module-5	**08 Hrs**
Field Problems: Heat transfer problems, Steady state fin problems, 1D heat conduction governing equation, Derivation of element matrices for two dimensional problems, Dynamic consideration- Formulation Hamilton's principle, Element mass matrices. **TextBook1: Ch: 10.1 to 10.5, Ch11:11.2,11.3.**	

Course Out comes: At the end of the course, the student will be able to

CO1	Identify the fundamental concepts of the Finite Element Method to formulate and analyze simple structural problems using discretization and shape functions.
CO2	Analyze bar, beam, truss, and frame elements using Finite Element Method to determine structural responses under mechanical, thermal, and various boundary loading conditions.
CO3	Outline appropriate shape functions for two-dimensional and three dimensional finite elements and element formulations for structural applications.
CO4	Apply isoparametric element concepts and FEM software tools to model, analyze, and interpret complex engineering problems.
CO5	Develop the Finite Element Method to solve heat transfer and dynamic field problems by formulating element matrices and governing equations.

CO-PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	2			2	1		2		2	3	1
CO2	3	3	2	2	2			1	2		2	3	1
CO3	3	3	2	2			1		2	2	2	3	1
CO4	3	3	2						2		2	3	1
CO5	3	3	2	2					2		2	3	

Text Books

1. Finite Elements in engineering, Chandrupatla T. R, PHI, 3rdedition, 2002, ISBN-13: 978-8120321069.
2. Finite element Analysis, Bhavikatti, New Age International, 3rd edition, 2015, ISBN-13:978-8122436716.

Reference Books

1. Finite element analysis in engineering design Rajasekharan.S, Wheeler Publishers.
2. Finite Element Procedures Bathe.KJ, PHI Pvt. Ltd., New Delhi,1996,ISBN-13:978-8126529988.
3. Finite Elements Method in Engineering Rao S.S., Elsevier, 5th edition, 2008, ISBN-13: 978-9380931555

Web links and Video Lectures (e-Resources)

1. https://archive.nptel.ac.in/content/syllabus_pdf/105105041.pdf
2. https://archive.nptel.ac.in/courses/112/105/112105308/
3. https://archive.nptel.ac.in/courses/112/104/112104193/

Semester: V					
Modeling and Analysis Lab (Branch: AE)					
Course Code	**:**	BAEL504	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	(0:0:2)	**CIE**	**:**	50 Marks
Total Hours	**:**	15P	**SEE**	**:**	50 Marks
Course Type	**:**	PCCL	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	• Basic Fluid Mechanics • Aerodynamics • Strength of Materials • Engineering Mechanics • Engineering Graphics
Knowledge on Fundamental Concepts	• Governing equations of fluid flow • Basics of compressible and incompressible flow • Stress-strain relationships and material behaviour
Knowledge on Connected Tools (If any)	• Basics of CAD modelling software

Course Learning Objectives: This course will enable the students	
CLO1	Understand the procedure for geometric modeling of aeronautical components and structures.
CLO2	Learn meshing techniques and their influence on flow and stress analysis accuracy.
CLO3	Analyze aerodynamic and structural behavior using simulation tools and theoretical knowledge.
CLO4	Develop dynamic system simulations and assess real-world aeronautical problems.
Sl. No.	**Experiments List**
1	Modeling of 2-D Incompressible and Inviscid Flow over Symmetrical/Cambered Airfoil, and Plotting of Pressure distribution and Velocity vectors for Subsonic/Supersonic Mach numbers.
2	Modeling of 2-D Compressible and Viscid Flow over Symmetrical/Cambered Airfoil, and Plotting of Pressure distribution and Velocity vectors for Subsonic Mach numbers.
3	Isentropic Flow Analysis in a 2-D Subsonic Diffuser and a Subsonic Nozzle.
4	Isentropic Flow Analysis in a 2-D Supersonic Diffuser and a Supersonic Nozzle.
5	Geometric Modeling and Mesh Generation of a 2-D Pipe and Modeling of Steady and Unsteady Heat Convection and Conduction (Rayleigh Flow).
6	Structural Modeling of Sandwich Beam of Rectangular Cross-section and Analyses for Stress for Unsymmetrical bending case.

7	Structural Modeling and Stress Analysis of a Fuselage Frame.
8	A Plate fixed at one end has a hole in centre and has varying thickness, determine stresses developed due to applied static loads in vertical direction.
9	Simulate a spring- mass- damper system with and without a forcing function though SIMULINK.
10	Simulate a bomb drop from an aircraft on a moving tank in pure pursuit motion.
11	Develop a straight and level flight simulation program using MATLAB.
12	Simulate aircraft Take-off and Landing with trajectory tracing.
Course Outcome : At the end of the course, the student will be able to	
CO1	Develop geometric models of airfoils, nozzles, wings, fuselage frames, pipes and other aeronautical structures / components
CO2	Evaluate suitable computational meshes for aerodynamic, structural and thermal analysis using appropriate meshing techniques and tools.
CO3	Interpret Various domain analysis of aeronautical components using computational simulation tools.
CO4	Analyze MATLAB/SIMULINK-based models to simulate performance parameters at various operating conditions.

CO -PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	3	2	3	-	-	-	-	-	1	3	2
CO2	3	2	3	2	3	1	-	-	-	-	2	3	2
CO3	3	3	3	2	3	2	2	-	-	1	2	3	3
CO4	3	3	3	3	3	2	-	2	2	1	3	3	3

Semester: V					
Gas Turbine Technology					
Course Code	:	BAE525A	**Credits**	:	3
Hours/Week (L:T:P)	:	3:0:0	**CIE**	:	50Marks
Total Hours	:	40L	**SEE**	:	50Marks
Course Type	:	PEC	**SEE Duration**	:	3Hours

Prerequisites:	
Courses	• Aero Engineering Thermodynamics • Aircraft Propulsion
Knowledge on Fundamental Concepts	• Compressors, Turbines, Nozzles
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students

CLO1	Comprehend the types of engines and its applications.
CLO2	Understand the materials required for engine manufacturing.
CLO3	Acquire the knowledge of engine performance and testing.

Module-1	**08Hrs**

Types, Variation & Applications: Types of engines showing arrangement of parts. Operating parameters. Energy distribution of turbojet, turboprop and turbofan engines. Comparison of thrust and specific fuel consumption. Thrust, pressure and velocity diagrams.

Engine Parts: Compressor assembly, types of burners: advantages and disadvantages. Influence of design factors on burner performance. Effect of operating variables on burner performance. Performance requirements of combustion chambers. Construction of nozzles. Impulse turbine and reaction turbine. Exhaust system, sound suppression. Thrust reversal: types, design & systems. Methods of thrust augmentation, after burner system.

Text Book 1: Ch1:1.1 to 1.9,Ch2: 2.1 to 2.6

Module-2	**08Hrs**

Materials and Manufacturing: Criteria for selection of materials. Heat ranges of metals, high temperature strength. Surface finishing. Powder metallurgy. Use of composites and Ceramics. Super alloys for Turbines.

Systems: Fuel systems and components. Sensors and Controls. FADEC interface with engine. Typical fuel system. Oil system components. Typical oil system. Ignition systems, Starting systems. Typical starting characteristics. Various gas turbine starters.

Text Book 1: Ch3: 3.1 to 3.6,Ch4: 4.1 to 4.9, 4.11, Ch5:5.1 to 5.2

Module-3	**08Hrs**

Transient Performance: Introduction, the fundamental transient mechanism Transient performance maneuvers, Engine accel and decel requirements, Transient performance phenomena, Operability concerns, Surge, rotating stall and locked stall – the events and their detection, Surge margin requirements and the surge margin stack up, Control strategies during transient manoeuvres, Transient performance and control models.

Starting: The fundamental starting process, Start processes for major engine types and applications, Engine start requirements, The impact of ambient temperature and pressure, Operability issues, Starting and parameter groups, Control strategies during start maneuvers, Starter system variants and selection.

Wind Milling: Introduction, turbojet wind milling, turbofan wind milling, Turboprop wind milling.

Reference Book 2: Ch7:7.1 to 7.7

Module-4	**08Hrs**
Performance of Gas Turbine Engine Components Axial compressors – design point performance and basic sizing, Axial flow compressors – off design performance Centrifugal compressors – design point performance and basic sizing Centrifugal compressors – off design performance Fans – design point performance and basic sizing Fans – off design performance Combustors – design point performance and basic sizing Combustors – off design performance Axial flow turbines – design point performance and basic sizing guidelines Axial flow turbines – off design performance Radial turbines – design Radial turbines – off design performance Ducts – design Ducts – off design performance. **Text Book 3: Ch5: 5.1 to 5.3, 5.6, 5.10, 5.13& 5.14, Ch6: 6.1 to 6.5, 6.7& 6.8**	
Module-5	**08Hrs**
Engine Testing and Operation: the test cell, performance testing, ground operating procedures, starting a gas turbine engine, engine operation and checks, engine ratings, general electric J.79,Turbojet Engine – a case study. **Types of Engine Testing & Engine Instrument Systems:** normally aspirated testing, types of test beds, ram air testing, altitude testing, altitude test facility, ground testing of engine installed in aircraft, flight testing. Jet thrust measurements in flight, exhaust temperature indicating systems. **Text Book 1: Ch19** **Text Book 2: Ch11**	
Course Outcomes: At the end of the course, the student will be able to	
CO1	Compare the performance of various gas turbine engine components and its applications.
CO2	Analyze various techniques to manufacture gas turbine engine components.
CO3	Examine working principles of various systems of the gas turbine engine.
CO4	Apply suitable material for various operating conditions of gas turbine engine components.
CO5	Evaluate the various methods and instruments used in engine testing.
Text Books	
1. Gas Turbine Engine Technology, Irwin E. Treager, McGraw Hill Education, 3rd edition, 2013, ISBN-13: 978-1259064876. 2. Gas Turbine Performance, P.P Walsh and P. Fletcher, Blackwell Science, 1998, ISBN0632047843.	
Reference Books	
1. Experimental methods for Engineers, J P Holman, Tata McGraw Hill, 7th edition, 2007, ISBN-13: 978-0070647763. 2. Advanced Aero-Engine Testing, AGARD-59, Publication. 3. Military Specifications: Engine, Aircraft, Turbo Jet &Turbofan, MIL–5007E. 4. General Specification for Advance Aero Engine testing', 1973.	

Web links and Video Lectures (e-Resources)
1. https://www.asme.org/learning-development/find-course/basic-gas-turbine-engine-technology 2. https://www.cranfield.ac.uk/courses/short/aerospace/gas-turbine-technology-for-operations-and-maintenance-engineers/

CO -PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO2**
CO1	3	2	-	-	2	-	2	-	3	3	3	3	1
CO2	3	2	-	1	2	-	2	1	3	3	3	3	1
CO3	3	2	-	-	-	3	-	-	3	3	3	3	1
CO4	3	2	-	-	-	-	1	1	3	3	3	3	1
CO5	3	2	-	-	-	-	1	-	3	3	1	3	1

Semester: V					
Research Methodology and IPR (Common to all Branches)					
Course Code	:	BRM507	**Credits**	:	3
Hours/Week (L: T :P)	:	2:2:0	**CIE**	:	50 Marks
Total Hours	:	40Hrs	**SEE**	:	50 Marks
Course Type	:	AEC	**SEE Duration**	:	3 Hours

Prerequisites:	
Courses	Engineering / Technical Communication
Knowledge on Fundamental Concepts	Fundamentals of engineering problem solving, technical report writing, information retrieval, analytical thinking, and professional ethics
Knowledge on Connected Tools (If any)	Familiarity with web search engines, digital libraries, scholarly databases (e.g., Google Scholar), reference management tools, and basic office productivity software

Course Learning Objectives: This course will enable the students to	
CLO1	Familiarize students with research methodologies, problem formulation, and research ethics.
CLO2	Equip students with techniques for literature search, review, and analysis using scholarly databases.
CLO3	Strengthen technical reading and interpretation skills for research documents, algorithms, and datasets.
CLO4	Introduce Intellectual Property Rights and innovation protection procedures.
CLO5	Enhance awareness of IP management, commercialization, and significant IPR case studies.

Module – 1	**08Hrs**
Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship. **Textbook 1**: **Ch. 1, Ch. 5**	
Module – 2	**08Hrs**
Literature Review and Technical Reading: New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. **Attributions and Citations**: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments. **Textbook 1**: **Ch. 2, Ch. 3**	
Module – 3	**08Hrs**
Introduction To Intellectual Property: Role of IP in the Economic and Cultural, Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India. **Patents**: Conditions for Obtaining a Patent Protection. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of	

Patenting. Process of Patenting. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models**.**

Textbook 2: Ch. 1, Ch.2.1

Module – 4	**08Hrs**

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. @#@26092024 Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Acts and Laws. Classification of Trademarks. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Text book 2: Ch. 2.2-2.3

Module – 5	**08Hrs**

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms. Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India. Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. IP Organizations in India. Schemes and Programmes.

Textbook 2: **Ch. 2.4-2.5**

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply research methodologies and ethical practices to address engineering research problems.
CO2	Analyze technical literature and synthesize research findings using appropriate citation practices.
CO3	Interpret research articles, algorithms, datasets, and technical documents in computing domains.
CO4	Implement intellectual property rights procedures for protecting technological innovations
CO5	Evaluate intellectual property case studies and determine suitable protection strategies for research outcomes

Textbooks	
1	"Engineering Research Methodology", Dipankar Deb, Rajeeb Dey and Valentina E. Balas, Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0
2	"Intellectual Property A Primer for Academia", Prof. Rupinder Tewari Ms. Mamta Bhardwaj, Publication Bureau Panjab University Chandigarh, 2021, ISBN: 81-85322-92-

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Reference Books	
1	"Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, SAGE Publications 2018, ISBN: 9781526457080
2	"Principles of Intellectual Property", Dr. N. S. Gopalakrishnan and T. G. Agitha, Eastern Book Company Publisher, 3rd edition, 2023. ISBN: 9788170121572

Web links and Video Lectures (e – Resources)	
1	https://online.vtu.ac.in/course/1-research-methodologies-and-ipr
2	https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr24_ed08

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	3		3			3				2
CO2	2	3		3	1		2		2		3
CO3	2	3		2	2				2		3
CO4	1	1	2			2	3			2	2
CO5	1	3	2	2		2	3		1	2	2

Semester: V					
Rockets & Missiles					
Course Code	**:**	BAE525B	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50Marks
Total Hours	**:**	40 L	**SEE**	**:**	50Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3Hours

Prerequisites:	
Courses	• Aerodynamics • Aircraft Propulsion
Knowledge on Fundamental Concepts	• Types of propellant, Combustion. High speed aerodynamics.
Knowledge on Connected Tools (If any)	---

Course Learning Objectives: This course will enable the students

CLO1	Understand the types of space launch vehicles and missiles.
CLO2	Study the solid and liquid rocket motors
CLO3	Acquire the knowledge on launch vehicle dynamics, attitude control, rocket testing and materials

Module-1	**08 Hrs**

Introduction: Space launch Vehicles and military missiles, function, types, role, mission, mission profile, thrust profile, propulsion system, payload, staging, control and guidance requirements, performance measures, design, construction, operation, similarities and differences. Some famous space launch vehicles and strategic missiles.

Text book 1: Ch1:1.2 & 1.3.

Module-2	**08 Hrs**

Solid Propellant Rocket Motor Systems: Solid Propellant rocket motors, principal features, applications. Solid propellants, types, composition, properties, performance. Propellant grain, desirable properties, grain configuration, preparation, loading, structural design of grain. Liners, insulators and inhibitors, function, requirements, materials. Rocket motor casing – materials. Nozzles, types, design, construction, thermal protection. Igniters, types, construction. Description of modern solid boosters I) Space Shuttle SRB, II) the Arienne SRB

Text Book 1: Ch1:1.3, Ch6: 6.1 to 6.3, 6.5 & 6.6, Ch12:12.1.

Module-3	**08Hrs**

Liquid Propellant Rocket Motor Systems: Liquid propellants, types, composition, properties, performance. Propellant tanks feed systems, pressurization, turbo-pumps, valves and feed lines, injectors, starting and ignition. Engine cooling, support structure. Control of engine starting and thrust build up, system calibration, integration and optimisation – safety and environmental concerns. Description of the space shuttle main engine. Propellant slosh, propellant hammer, geysering effect in cryogenic rocket engines.

Attitude Control of Rockets and Missiles: Rocket Thrust Vector Control – Methods of Thrusts Vector Control for solid and liquid propulsion systems, thrust magnitude control, thrust termination; stage separation dynamics, separation techniques

Text Book 1: Ch13: 13.1, 13.4 to 13.7, Ch15: 15.1 to 15.4.

Module-4	**08Hrs**
Aerodynamics of Rockets and Missiles: Classification of missiles. Airframe components of rockets and missiles, Forces acting on a missile while passing through atmosphere, method of describing aerodynamic forces and moments, lateral aerodynamic moment, lateral damping moment, longitudinal moment of a rocket, lift and drag forces, drag estimation, body upwash and downwash in missiles. Rocket dispersion, re-entry body design considerations. **Launch Vehicle Dynamics:** Tsiolskovsky's rocket equation, range in the absence of gravity, vertical motion in the earth's gravitational field, inclined motion, flight path at constant pitch angle, motion in the atmosphere, the gravity turn – the culmination altitude, multi staging. Actual launch vehicle trajectories. Reusable launch vehicles, future launchers, launch assist technologies. **Text Book 1 : Ch8: 8.4, Ch18 :18.1 to 18.4**	
Module-5	**08Hrs**
Rocket Testing: Ground Testing and Flight Testing, Types of Tests facilities and safeguards, monitoring and control of toxic materials, instrumentation and data management. Ground Testing, Flight Testing, Trajectory monitoring, post –accident procedures. Description of a typical space launch vehicle launches procedure. **Materials:** Criteria for selection of materials for rockets and missiles, requirements for choice of materials for propellant tanks, liners, insulators, inhibitors, at cryogenic temperatures, requirements of materials at extremely high temperatures, requirements of materials for thermal protection and for pressure vessels. **Text Book 1 : Ch21:21.1 to 21.5**	

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the classification, mission roles, performance parameters, and design- operational features of space launch vehicles and military missiles.
CO2	Explain the construction, working principles, and components of solid propellant rocket motor systems, including modern solid boosters.
CO3	Analyze liquid propulsion systems, feed mechanisms, cooling, control strategies, and thrust vector control methods for both solid and liquid systems.
CO4	Evaluate aerodynamic forces, missile flight behavior in the atmosphere, and apply principles of launch vehicle dynamics, staging, and trajectory prediction.
CO5	Demonstrate knowledge of rocket ground/flight testing, safety procedures, and evaluate appropriate material selection for various subsystems of rockets and missiles.

Text Books

1. Rocket Propulsion Element, George P Sutton and Oscar Biblarz, John Wiley and Sons Inc, 7th edition, 2010, ISBN-13: 978-8126525775.
2. 'Missile Aerodynamics, Jack N Neilson, AIAA, 1st edition, 1988, ISBN-13: 978- 0962062902.

Reference Books

1. Missile Configuration Design, S S Chin, Mc Graw hills Book Company 1961.
2. Martin J. L. Turner, Rocket and Spacecraft Propulsion: Principles, Practice and New Developments, Springer, 3rd edition, 2010, ISBN-13: 978-3642088698.
3. Rocket Propulsion and Space-Flight Dynamics, Cornelisse, J.W., Schoyer H.F.R. and Wakker K.F., Pitman, 1979, ISBN-13: 978-0273011415.

Web links and Video Lectures (e-Resources)
1. https://archive.nptel.ac.in/courses/112/106/112106073/ 2. https://archive.nptel.ac.in/courses/101/101/101101086/ 3. https://archive.nptel.ac.in/courses/101/106/101106046/ 4. https://www.gopalancolleges.com/gcem/course-material/ae/basics-of-rockets-missiles/module-1.pdf

CO -PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	3	1
CO2	3	2	2	2	-	-	1	-	-	-	-	3	2
CO3	3	3	2	2	-	-	1	-	-	-	-	3	2
CO4	3	3	3	2	-	-	-	-	-	-	-	3	2
CO5	3	3	2	2	-	1	-	-	-	-	1	3	2

Semester: V					
Basics of Unmanned Aerial Vehicles					
Course Code	**:**	BAE525C	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	• Fundamentals of Aircrafts • Aerodynamics • Aircraft Propulsion
Knowledge on Fundamental Concepts	• Flight principles, • Components, • control mechanisms
Knowledge on Connected Tools (If any)	---

Course Learning Objectives: This course will enable the students

CLO1	Introduce students to the fundamentals, evolution, and classifications of UAVs.
CLO2	Understand the aerodynamic and mechanical principles governing UAV flight.
CLO3	Learn about modern UAV subsystems including navigation, propulsion, control, and payloads.
CLO4	Explore autonomous control systems, autopilot design, and mission planning.
CLO5	Examine real-world applications, current trends, and regulatory frameworks in UAV usage.

Module-1	**08 Hrs**

Introduction to UAVs and Applications : History and evolution of UAVs, UAV types: Fixed-wing, Rotary-wing, Hybrid, Flapping-wing Classification by size, range, weight, and autonomy Modern applications: Agriculture, Delivery, Disaster Response, Surveillance, Mapping, and Defense, Trends: Swarm UAVs, Drone taxis, AI in UAVs

Text Book 1: Ch1: 1.1 to1.4, Ch2: 2.1 to 2.5

Module-2	**08 Hrs**

UAV Airframe, Propulsion, and Aerodynamics: UAV structural design and materials (Carbon fiber, Foam, Composites),UAV configurations: Quadcopter, Hexacopter, VTOL, Hybrid designs, Aerodynamics: Lift, drag, thrust, moments, Propulsion systems: Brushed vs Brushless motors, Propeller selection, Electric vs IC engines, Battery technologies (LiPo, Li-Ion), ESCs, Power distribution.

Text Book 1: Ch3: 3.1 to 3.5 & 6.1 to 6.4.

Module-3	**08 Hrs**

UAV Navigation and Avionics : Navigation systems: GPS, GLONASS, GNSS, RTK,IMU and sensor fusion: Accelerometers, Gyroscopes, Magnetometers, Onboard electronics: Flight controllers (Pixhawk, APM), ESCs, Telemetry modules, Communication systems: RF modules, telemetry, long-range (LoRa), video transmission (FPV systems), Payload integration (camera, LiDAR, thermal sensors)

Text Book 1: Ch6: 6.1 to 6.18 & 7.1 to 7.16.

Module-4	**08 Hrs**
Autonomy, Control, and Mission Planning: Control fundamentals: PID control for UAVs, Autopilot software: ArduPilot, PX4, Mission Planner, Path and mission planning: Waypoints, Geofencing, Real-time object tracking, computer vision basics (OpenCV, YOLO),Introduction to ROS (Robot Operating System) for UAVs. **Text Book 1: Ch8 : 8.1to 8.5**	
Module-5	**08 Hrs**
UAV Laws, Ethics, and Industry Integration: UAV operation laws: DGCA India guidelines, FAA (USA) regulations, Drone registration, No-fly zones, BVLOS operations, Ethical issues: Privacy, data handling, surveillance policies, Case studies: Drone use in warfare, medical delivery, environmental monitoring, Career opportunities and startups in drone tech. **Text Book 2: Ch1: 1.1, Ch23, Ch24 & Ch26**	

Course Outcomes: At the end of the course, the student will be able to

CO1	Explain UAV classification, evolution, and contemporary applications.
CO2	Analyze aerodynamic principles and configurations for stable UAV flight.
CO3	Identify and evaluate UAV subsystems such as propulsion, navigation, and communication systems.
CO4	Apply knowledge of autonomy in UAVs using control algorithms and mission planning tools.
CO5	Interpret UAV operational laws, ethics, and industry standards for safe and legal deployment.

Text Books

1. Introduction To UAV Systems, Paul Gerin Fahlstrom , Thomas James Gleason, 4th Edition, Wiley Publication, 2012 John Wiley & Sons, Ltd
2. Unmanned Aerial Vehicle, Landen Rosen, Publisher: Alpha Editions, ISBN13: 9789385505034.

Reference Books

1. Unmanned Aerial Vehicles: DOD's Acquisition Efforts, Publisher: Alpha Editions, ISBN13: 9781297017544.
2. Handbook of Unmanned Aerial Vehicles, Valavanis, K, Vachtsevanos, George J., Springer, 2015.
3. Unmanned Aerial Vehicles, Valavanis, Kimon P., Springer, 2011.

Web links and Video Lectures (e-Resources)

1. https://www.nasa.gov/aeroresearch/programs/aavp/uav/
2. https://www.thedroneu.com
3. https://www.dronedeploy.com/
4. https://digitalsky.dgca.gov.in/
5. https://nptel.ac.in/courses /101104064/

CO -PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	-	2	-	-	-	-	2	3	-
CO2	3	3	-	-	-	-	-	-	-	-	2	3	-
CO3	3	3	2	2	-	-	-	-	-	2	2	3	2
CO4	3	3	-	2	3	-	-	2	2	-	2	3	2
CO5	3	3	2	2	-	-	2	2	2	2	2	3	2

Semester: V					
Aircraft Systems and Instrumentation					
Course Code	**:**	BAE525D	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	• Fundamentals of Aircrafts
Knowledge on Fundamental Concepts	• Basic Aircraft Systems. • Principle of Operation of Aircraft Systems.
Knowledge on Connected Tools (If any)	• Drone Pilot Training.

Course Learning Objectives: This course will enable the students	
CLO1	Understand the Basic Aircraft Systems.
CLO2	Classify the Aircraft Systems.
CLO3	Categorize different types of Aircraft Instruments and Displays.

Module-1	**08 Hrs**
Aircraft Instruments: Principle of operation, Basic six Fundamental Systems. Altimeter, Airspeed Indicator, Vertical Speed Indicator, Attitude Indicator, Heading Indicator, Turn and Slip Indicator, Turn Coordinator, Pressure Instruments, Pressure Gauges, Differential Pressure. Significance of Aircraft Systems, Need of Aircraft Systems in Civil and Military. **Text Book 1: Ch5: 5.1. Ch6: 6.1.**	
Module-2	**08 Hrs**
Air Data Systems: Air Data Information, Air Data Measurement, Air Data Quantities and Their Importance, Pitot-Static System, Mach meter, Flight Control Systems, Principles of Flight Control System, Flight Control Surfaces, Mechanical Flight Control, Hydraulic Flight Control, Flight Control Linkage Systems, High Lift Control Systems, Fly-By-Wire System, Advantages of FBW. **Text Book 1: Ch4: 4.1.** **Text Book 2: Ch1:1.1 to 1.8.** **Text Book 3: Ch7:7.1 & 7.2. Ch4: 4.1 & 4.2.**	
Module-3	**08 Hrs**
Electrical Systems: Introduction to Electrical System, Power Generation, AC Power, DC Power, Power Generation Control, Standby Power, Inverter, Bus Bars, Battery, Light Aircraft Electrical System, Emergency Power Generation, Ram Air Turbine, Backup Power Converters, Permanent Magnet Generators, Auxiliary Power Unit. **Text Book 2: Ch5:5.1 to 5.5 & 5.10.**	
Module-4	**08 Hrs**
Engine and Fuel Systems: Introduction, Engine Technology and Principles of Operation, Engine Starting, Fuel systems, Introduction, Characteristics of Fuel Systems, Piston and Jet Engines, Fuel Components of multi engines, Lubricating Systems for Piston and Jet Engines, Starting and Ignition systems, Typical examples for Piston and Jet Engines. **Text Book 2: Ch2: 2.1, 2.2 & 2.6. Ch3: 3.1 & 3.2.**	

Engine and Fuel Systems: Introduction, Engine Technology and Principles of Operation, Engine Starting, Fuel systems, Introduction, Characteristics of Fuel Systems, Piston and Jet Engines, Fuel Components of multi engines, Lubricating Systems for Piston and Jet Engines, Starting and Ignition systems, Typical examples for Piston and Jet Engines.

Text Book 2: Ch2: 2.1, 2.2 & 2.6. Ch3: 3.1 & 3.2.

Module-5	**08 Hrs**

Auxiliary System: Basic Air Cycle Refrigeration System, Vapour Cycle System, Cabin Noise, Cabin Pressurisation, Rain Dispersal, Anti-Misting and De-Misting, Aircraft Icing, Ice Detection System, Ice Protection System, Fire Detection and Suppression System, Emergency Oxygen System, Crash Recorder.

Text Book 2: Ch7:7.5, 7.9, 7.10, 7.14 to 7.16. Ch8 – 8.3, 8.6 & 8.12.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand the Basic Aircraft Systems.
CO2	Relate the Air Data Information and Air Data Instruments.
CO3	Learn the Power Systems in Aircraft.
CO4	Identify Engine and Fuel Systems.
CO5	Summarize the Auxiliary Systems.

Text Books

1. Aircraft Instruments, Principles and Applications, E.H.J Pallet, Second Edition, Pearson, ISBN 978-8 1-317-28 13-0. 2009.
2. Aircraft Systems, Mechanical Electrical and Avionics Subsystems Integration, Ian Moir and Allan Seabridge, Wiley India Pvt. Ltd. Edition, Third Edition.
3. "Introduction to Avionics Systems, R.P.G. Collinson, Springer Science, Third Edition, 2011.

Reference Books

1. Aircraft Instruments and Integrated Systems, E.H.J Pallet, Longman Scientific and Technical 1996.
2. Modern Inertial Technology Navigation, Anthony Lawrence, Springer New 2012.

Web links (e-Resources)

1. https://soaneemrana.org/onewebmedia/AIRCRAFT%20INSTRUMENTS%20BY%20E.H.J %20PALLETT%20%28new%29.pdf/
2. https://soaneemrana.org/onewebmedia/AIRCRAFT%20INSTRUMENTS%20&%20INTEGRATED%20SYSTEM%20BY%20E.H.J%20PALLETT.pdf

CO -PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	-	-	2	-	-	1	1	1	1	3	2
CO2	3	2	-	-	2	-	-	1	1	1	1	3	2
CO3	3	2	-	-	2	-	-	1	1	1	1	2	2
CO4	3	2	-	-	2	-	-	2	1	2	1	2	2
CO5	3	2	-	-	2	-	-	2	1	2	1	2	2

Semester: V					
Aviation Management					
Course Code	**:**	BAE525E	**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	• Fundamentals of Aircrafts
Knowledge on Fundamental Concepts	• Principles of Management • Basic Economics and Accounting • Fundamentals of Aviation and Airport Operations
Knowledge on Connected Tools (If any)	---

Course Learning Objectives: This course will enable the students	
CLO1	Acquire the leadership qualities and perception of design feedback system.
CLO2	Realize the customer needs & Quality
CLO3	Understand the airline and airport operation, scheduling and management, general aviation management practices
CLO4	Grasp the broad disciplines of management at different levels of aviation industry
CLO5	Acquire the leadership qualities and perception of design feedback system.

Module-1	**08 Hrs**
Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making. **Text Book 1:Ch:2**	
Module-2	**08 Hrs**
Continuous Process Improvement: Process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem solving methods, Kaizen, reengineering, six sigma, case studies. **Tools and Techniques:** Benching marking, information technology, quality management systems, environmental management system, quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance. **Text Book 1:Ch 5 & Ch7**	
Module-3	**08 Hrs**
Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, Case studies. **Employee Involvement**: Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies. **Text Book 1: Ch3 & Ch4**	

Module-4	**08 Hrs**
Airline and Airport Management: Airline Operation and Scheduling, Data Analysis for Business Decisions, Economic Analysis for Business Decisions, Aircraft Rules and Regulation, Airline Business in the 21st Century. Human Resources Management, Organizational Behaviour, Accounting for Management, Airline Economics. **Text Book 2: Ch14**	
Module-5	**08 Hrs**
Business Application Software: Communication Skills and Business Correspondence, Research Methods in Business, International Business Management, Aviation Systems: Management of the Integrated Aviation Value Chain Aviation Law , Aviation Safety Management and Accident Investigations, Emerging Trends in Management - Case Study Analysis, Entrepreneurship Development, Airline Advertising and Sales Promotion **Text Book 2:Ch7, Ch8 & Ch15**	

Course Outcomes: At the end of the course, the student will be able to

CO1	Analyse customer need and perceptions of design feedback systems
CO2	Infer the customer perception of quality
CO3	Apply the foundational knowledge of airline and airport operation, scheduling and management
CO4	Implement the general aviation management practices
CO5	Prepare for the management at different levels of aviation industry

Text Books

1. Total Quality Management, Dale H. Bester field, Publisher Pearson Education India, ISBN: 8129702606, Edition 03/e Paperback (Special Indian Edition).
2. Introduction to Aviation Management, Andreas Wald, Christoph Fay, Ronald Gleich, LIT Verlag Munster.
3. Aviation Management, Arijit Das, (Ground Service & In-flight Service) Paperback – 1 January 2021.

Reference Books

1. Aviation Management, Ratandeep Singh, Global And National Perspectives Hardcover – 1 January 2008.
2. Airline Management Finance, Mark J. Pierotti.
3. Airline Management Finance, Victor Hughes.
4. A New American TQM, Shoji Shiba, Alan Graham & David Walden, four revolutions in management, Productivity press, Oregon, 1990.

Web links and Video Lectures (e-Resources)

1. https://www.youtube.com/watch?v=6Uk8F3_9ywY
2. https://www.youtube.com/watch?v=_D86iJLAicU

CO -PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	-	2	2	2	2	2	2	3	2
CO2	3	2	1	-	-	2	2	2	2	2	2	3	2
CO3	3	2	1	-	-	2	2		2	2	2	3	2
CO4	3	2	1	-	1	2	2	2	2	2	2	3	2
CO5	3	2	1	1	-	2	2	2	2	2	2	3	2

Semester: V					
Competency Enhancement Course-3 Stream: CSE/ECE/CV/ME					
Course Code	**:**	BCE508	**Credits**	**:**	0
Hours/Week (L:T:P)	**:**	0:2:0	**CIE**	**:**	100Marks
Total Hours	**:**	40	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-
Prerequisites:					
Courses	Introduction to C Programming				
Knowledge on Fundamental Concepts	Programming fundamentals, including variables, Data types, control structures(if, loops) and syntax				
Knowledge on Connected Tools (If any)	--				

Course Learning Objectives: This course will enable the students	
CLO1	Understand and apply fundamental programming concepts using C
CLO2	Develop object-oriented programs in C++
CLO3	Write and debug multi-file programs in C and C++
CLO4	Design and manage databases using SQL in Oracle and My SQL
CLO5	Compare and analyze different database models (RDBMS vs No SQL)

Module-1	**08 Hrs**
C Programming (A): Data Types, Operators and Expressions Input and output Operations Control Flow – Branching, Control Flow – Looping, Statements and Blocks, If Else, Switch, Nesting of If Else, GOTO statement, The while statement, The For statement, The Do statement, Jumps in loops **C Programming (B):**Arrays, Strings, One-dimensional arrays, Initialization of one-dimensional arrays, Two-dimensional Arrays, Initializing Two-dimensional arrays, Multi-dimensional arrays, Dynamic arrays, Declaring and Initializing string variables, Reading Strings from Terminal, Writing Strings to screen, String handling functions, Operations on strings **C Programming (C):**User-defined Functions, Structures, Basics of Functions, Functions Returning Non integers, External Variables, Scope Rules, Header Files, Static Variables, Register Variables, Block Structure, Initialization, Recursion, Category of functions, Functions that return multiple values, Nesting functions, Multi-file programs, Structures and Functions, Arrays of Structures, Pointers to Structures, Self-referential structures **Text book 1, Ch1:1 to 11**	
Module-2	**08 Hrs**

C Programming (D): Unions, Pointers, Difference between Structures and Unions, Accessing the address of a variable, Declaring and Initializing pointer variables, Accessing a variable through its pointers, Chain of pointers, Pointer Expressions, Pointer Increments and Scale Factors, Pointers and character strings, Array of pointers, Pointers as function arguments, Functions returning pointers, Pointers to functions, Drawback of Pointers

File Management in C: The Preprocessor, Defining and Opening a File, Closing a File, Input / Output Operations on Files, Random Access to Files, Command Line Arguments. Macro Substitution, File Inclusion, Compiler Control Directives, ANSI Additions

Text book 1- Ch2:1 to 16

Module-3	**08 Hrs**
C++: Scope Resolution Operator, Structures, Defining function outside the class , Friend functions, Friend class, Array of class objects, Passing class objects to and returning class objects from functions, Nested classes, Namespaces, Dynamic memory allocation using new and deallocation, new handler function **Text book 2- Ch7 to 11**	
Module-4	**08 Hrs**
C++: Scope Resolution Operator, Structures, Defining function outside the class , Friend functions, Friend class, Array of class objects, Passing class objects to and returning class objects from functions, Nested classes, Namespaces, Dynamic memory allocation using new and de allocation, new handler function **Text book 2- Ch7 to 11**	
Module-5	**08 Hrs**
Database Management System : Types of DBMS – Merits and Demerits Oracle and MySQL, SDLC, Architecture (Oracle 10g) - Instance, User Accounts, Client Applications IP, Port Number, SQL Introduction Tables, DDL and DML, Pluggable Databases – Oracle 19c, Architecture Undo and Redo, Operators Constraints Sequences Triggers, Functions – Conversion, String, Math, Aggregate Clauses, Joins, Views, Synonyms, Indexes Stored Procedures, Normalization, Triggers and stored procedures, No SQL Db, normalization – tables **Text book 3 – Ch1 to 8**	
Course Outcomes: At the end of the course, the student will be able to	
CO1	Demonstrate basic C programming skills in data types, control flow, arrays and strings to solve problems.
CO2	Apply advanced C features like functions, structures, pointers, unions and file handling for modular coding.
CO3	Apply C++ OOP concepts, including classes, function overloading, friend functions and dynamic memory management.
CO4	Design and manage databases with Oracle/MySQL, write SQL queries, normalize data and use stored procedures.
CO5	Combine C/C++ programming with database operations to build applications for data storage and retrieval.
Text Books	

1. Let Us C by Yashavant Kanetkar (ISBN- 978-8183331630), 15th Edition, BPB Publications- 2016.
2. Object-Oriented Programming with C++ by E. Balagurusamy (ISBN- 978-9389949186), 8th Edition, Tata McGraw-Hill – 2020
3. Database System Concepts by Abraham Silberschatz, Henry Korth, S. Sudarshan (ISBN- 978-9332901384),6th Edition, McGraw Hill Education-2013

Reference Books

1. Programming in ANSI C, by E. Balaguruswamy, (ISBN- 978-9339219666), 7th Edition, Tata McGraw-Hill - 2017
2. C PROGRAMMING LANGUAGE by Brian W. Kernighan / Dennis Ritchie(ISBN978-9332549449), 2nd Edition, Pearson Education India - 2015

Web links and Video Lectures (e-Resources)

1. https://www.softprayog.in/programming/c-programming-tutorial-data-types-and-expressions/
2. https://www.geeksforgeeks.org/array-of-strings-in-c/
3. https://www.programiz.com/c-programming/c-structures-pointers
4. https://www.w3schools.com/cpp/cpp_oop.asp
5. https://www.geeksforgeeks.org/dbms/

CO -PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	2	-	-	-	-	-	2	1	1
CO2	3	3	-	-	2	-	-	-	-	-	2	1	1
CO3	3	2	-	-	2	-	-	-	-	-	2	1	1
CO4	3	2	3	-	2	-	-	-	-	-	2	1	1
CO5	3	2	3	2	2	-	-	-	-	-	2	1	2

Semester: V					
National Service Scheme (NSS) Stream: CSE/ECE/CV/ME					
Course Code	**:**	BNS509	**Credits**	**:**	0
Hours/Week (L:T:P)	**:**	0:0:2	**CIE**	**:**	100Marks
Total Hours	**:**	24	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-
Prerequisites:					
Courses	Introduction of C Programming				
Knowledge on Fundamental Concepts	Programming fundamentals, including variables, Data types, control structures(if, loops) and syntax				
Knowledge on Connected Tools (If any)	--				

Course Learning Objectives: This course will enable the students

CLO1	Understand the community in general in which they work
CLO2	Identify the needs and problems of the community and involve them in problem – solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Activity– 1	**06 Hrs**
Developing Sustainable Water management system for rural areas and implementation approaches.	
Activity– 2	**06 Hrs**
Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, At manirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	
Activity– 3	**06 Hrs**
Spreading public awareness under rural outreach programs. (Minimum 3 programs).	
Activity– 4	**06 Hrs**
Social connect and responsibilities	

Pedagogy– Guidelines, it may differ depending on local resources available for he study as well as environment and climatic differences, location and time of execution

Sl.	**Topic**	**Group Size**	**Location**	Activity Execution	Reporting	**Evaluation of the Topic**

	1.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations /Government Schemes officers/ campus etc.	Site selection /proper consultation / Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
	2.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Gramapanchayat /public associations /Government Schemes officers/ campus etc.	Group selection /proper consultation / Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
	3.	Spreading public awareness underrural outreach programs. (minimum 5 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations /Government Schemes officers/ campus etc.	Group selection/pro per consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
	4.	Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations /Governmen	Group selection/pro per consultation / Continuous monitoring	Report should be submitted by individual to the	Evaluation as per the rubrics Of scheme and

				t Schemes officers/ campus etc.	/ Information board	concerned evaluation authority	syllabus by NSS officer	

Plan of Action (Execution of Activities for 5th Semester)

Sl. No.	Practice Session Description
1	Lecture session by NSS Officer
2	Selection of topic, Commencement of activity and its progress
3	Execution of Activity
4	Case study based Assessment, Individual performance
5	Sector wise study and its consolidation
6	Video based seminar for 10 minutes by each student At the end of Semester with Report.

- In the 5th semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 5th semester, consolidated report of all activities compiled report should be submitted as per the instructions.

Course Outcomes: At the end of the course, the student will be able to

CO1	Exploit the importance of his / her responsibilities towards society.
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field of societal problems.
CO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services

Assessment Details for CIE (100 Marks)

Weightage	CIE-100Marks
Selection of Topic, Commencement of activity and its progress	40Marks
Case study based Assessment	20Marks
Sector wise study and its consolidation	20Marks
Video based seminar for 10minutes by each student at the end of Semester with Report	20Marks
Total Marks for the course in the semester	100Marks

Suggested Learning Resources:

Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

CO -PO MAPPING													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	-	-	-	-	3	3	-	-	-	-	1	1
CO2	3	-	-	-	-	3	3	-	-	-	-	1	1
CO3	3	-	-	-	-	3	3	-	-	--	-	1	1
CO4	3	-	-	-	-	3	3	-	-	-	-	1	1
CO5	2	3	3	-	-	3	2	3	3	-	-	1	1

Semester: V					
Physical Education (PE) (Sports & Athletics) Stream: CSE/ECE/CV/ME					
Course Code	**:**	BPE509	**Credits**	**:**	0
Hours/Week (L:T:P)	**:**	0:0:2	**CIE**	**:**	**100Marks**
Total Hours	**:**	24	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students	
CLO1	Impart foundational knowledge on the importance of physical fitness, food, and nutrition for a healthy lifestyle and personal well-being.
CLO2	Develop awareness and proficiency in general fitness components such as agility, flexibility, and cardiovascular endurance through standardized physical fitness tests.
CLO3	Enhance motor skills and techniques in a selected sport (Badminton, Basketball, or Athletics) through structured practice and application of fundamental game-specific skills.

Module-1	**04 Hrs**
Orientation A. Fitness B. Food & Nutrition	

Module-2	**04 Hrs**
General Fitness & Components of Fitness A. Agility –Shuttle Run B. Flexibility–Sit and Reach C. Cardiovascular Endurance–Harvard step Test	

Module-3	**16 Hrs**
Specific games (Any one to be selected by the student) A. Badminton(Fore hand low /high service, back hand service, smash, drop) B. Basketball (Dribbling, passing, shooting etc.) C. Athletics(Field events–Throws)	

Course Outcomes: At the end of the course, the student will be able to	
CO1	Understand the fundamentals of fitness, food and nutrition and their role in a healthy lifestyle.
CO2	Demonstrate understanding of general fitness components such as agility, flexibility and cardiovascular endurance through standard fitness tests
CO3	Apply basic techniques, rules and strategies in the chosen sport (Badminton, Basketball, or Athletics)
CO4	Develop sport-specific skills to enhance performance in both practice and competitive situations
CO5	Exhibit teamwork, discipline and sportsmanship during training and game play

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes–2,each of 15marks	30
3.	Final presentation/exhibition/Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	100

CO -PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	2	-	-	-	3	-	-	-	-	-	-	-
CO2	3	3	-	-	-	3	-	-	2	-	-	-	-
CO3	2	3	-	-	-	3	2	3	3	-	-	-	-
CO4	2	3	-	-	-	3	2	3	3	-	-	-	-
CO5	2	2	-	-	-	-	3	3	3	-	-	-	-

Semester: V					
Yoga Stream: CSE/ECE/CV/ME					
Course Code	**:**	BYO509	**Credits**	**:**	0
Hours/Week (L:T:P)	**:**	0:0:2	**CIE**	**:**	100Marks
Total Hours	**:**	15Hrs	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students	
CLO1	Adopt healthy lifestyle practices and maintain mental hygiene to promote physical and mental well-being
CLO2	Develop emotional intelligence and foster emotional stability through self awareness and mindfulness practices
CLO3	Impart moral values and enhance self-awareness to facilitate personal growth and attain higher levels of consciousness

Module-1	**03 Hrs**
Ashtanga Yoga Basics: Patanjali's Ashtanga Yoga–definition, need & importance, Introduction to 3 limbs: Asana, Pranayama, Pratyahara	
Module-2	**03 Hrs**
Asana Overview: Meaning, need & benefits of Asanas, Classification: Sitting, Standing, Prone, Supine	
Module-3	**03 Hrs**
Sitting Asanas: Ardha Ushtrasana, Vakrasana, Yoga mudrain Padmasana, Standing **Asanas:** Urdhva Hastothan asana, Hastapad asana, Parivritta Trikon asana Utkat asana, Technique, precautions & benefits	
Module-4	**03 Hrs**
Prone Asanas: Padangushtha Dhanurasana, Poorna Bhujangasana/ Rajakapotasana **Supine Asanas**: Sarvangasana, Chakrasana, Navasana / Noukasana, Pavanamuktasana Technique, precautions & benefits	
Module-5	**03 Hrs**
Pranayama Practice: Meaning need & benefits of Pranayama, Breathing practice: 60 strokes/min, 3 rounds, Typesof Pranayama: Ujjayi, Sheetali, Sheektari, Technique, precautions & benefits	

Course Outcomes: At the end of the course, the student will be able to	
CO1	Describe the origin, history, objectives, and fundamental concepts of Yoga and its various schools.
CO2	Demonstrate Surya namaskara and various types of Asanas with correct techniques, precautions, and benefits
CO3	Differentiate between yogic and non-yogic practices
CO4	Apply yogic principles to promote physical and mental well-being.

Text Books

1. Light on Yoga by BKS Iyengar, Thorsons Publishers, ISBN-10 : 8172235011
2. Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245

3. Yoga Instructor Course hand book published by SVYASA University, Bengaluru

Reference Books
1. Yogapravesha in Kannada by Ajitkumar 2. Yoga for Children –step by step – by Yamini Muthanna
Web links and Video Lectures (e – Resources)
1. https://www.youtube.com/watch?v=KB-TYlgd1wE 2. https://www.youtube.com/watch?v=aa-TG0Wg1Ls

Semester: VI					
Music Stream: CSE/ECE/CV/ME					
Course Code	**:**	BMU509	**Credits**	**:**	0
Hours/Week (L:T:P)	**:**	0:0:2	**CIE**	**:**	100 Marks
Total Hours	**:**	26	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Course Learning Objectives: This course will enable the students

CLO1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
CLO2	Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system.
CLO3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
CLO4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.

Module-1	**03 Hrs**
Preamble: Contents of the curriculum intended to promote music as language to develop an analytical, creative and intuitive understanding. For this the student must experience music through study and direct participation in improvisation and composition. **Origin of the Indian Music:** Evolution of the Indian music system, understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela **Text book 1: V-1 Ch:1-4**	
Module-2	**03 Hrs**
Compositions: Introduction to the types of composition in Carnatic Music – Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, Notation System. **Text book 2: Ch: 4-7**	
Module-3	**03 Hrs**
Composers: Biography and contributions of Purandaradasa, Thyagaraja, Mysoroasudevacharya, Kanakadasa **Text book 3: Ch:2-5**	
Module-4	**03 Hrs**
Music Instruments: Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. **Text book1:V-4 – Ch:2-6**	
Module-5	**14 Hrs**
Abhyasa Gana: Singing the swara exercises (SaraleVarase Only), Botatio writing for saralevarase and sulafisapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathiswara, oekrithi in a mela raga. **Text book1, V:1&2**	

Course Outcomes: At the end of the course, the student will be able to

CO1	Outline the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala.

CO2	Identify and interpret basic Carnatic compositions using standard notation.
CO3	Summarize the contributions of composers.
CO4	Classify Indian musical instruments and describe their construction and use.

CO5	Demonstrate basic Carnatic vocal skills through selected exercises and compositions.

Text Books

1. South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, The Indian Music Publishing House, Chennai.
2. A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, CBH Publications
3. Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi.

Reference Books

1. Music of India, B. Chaitanya Deva, Munshiram Manoharlal Publishers
2. Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, Asian Educational Services

CO -PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1	PSO1	PSO2
CO1	3	-	1	-	1	-	1	1	1	-	1	-	-
CO2	3	-	3	1	2	1	2	1	1	-	1	-	-
CO3	1	-	-	-	1	1	1	-	1	-	-	-	-
CO4	2	-	2	-	3	1	1	1	1	-	1	-	-
CO5	3	-	-	1	2	1	1	1	1	-	1	-	-

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Preparing Competent Aeronautical Engineers To Serve the Society

Department Mission

- Strengthening the Fundamental concepts in Aeronautical Engineering.
- Building Analytical ability among students with innovative problem-solving techniques.
- Training students in multidisciplinary research areas in collaboration with Industries embedding the culture of continuous learning.
- Imparting skillset in line with emerging industrial needs with leadership qualities
- Making students responsible citizens to serve society with ethics and values.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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