Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Robotics and Artificial Intelligence Engineering

Established: 1999

Course Information:

Class, Semester	FY. B. Tech, Semester - I					**Category**	**BS**
Course Code, Course Title	0RABS101, Mathematics-I					**Type**	**T1**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	3	1	-	2	4		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Determine** the consistency of systems of linear equations using Echelon form of matrix
CO2	**Compute** Eigen values, Eigen vectors, powers and inverse of a square matrix using characteristic equation
CO3	**Apply** the concepts of complex number to solve the equations using De Moivre's theorem and hyperbolic identities
CO4	**Calculate** partial derivatives, Jacobians, and extreme values of function of two variables using concept of partial differentiation
CO5	**Solve** ordinary differential equation of order one and degree one using analytical method and numerical techniques.

Syllabus:

Module	Contents	Lecture Hours
I	**Solution of System of Linear Equations:** Definition of system of linear equations, Classification of system of linear equations, Rank of matrix: Concept and computation using Echelon form and Normal form, Rouché–Capelli Theorem (Statements only), Solution of non-homogeneous system of linear equations, solution of Homogeneous system of linear equations, Applications in engineering.	7
II	**Eigen Values and Eigen Vectors:** Definition of vectors in R^n, Linear Dependence and Independence of Vectors, Characteristic Equation of Matrix, Cayley-Hamilton theorem (statement only), Applications of Cayley-Hamilton theorem, Eigen Values and Properties, Eigen Vectors and Properties.	7
III	**Complex Number:** Definition of complex number, Polar and exponential form of complex number, De Moivre's Theorem and Simple Applications, Power and Roots of complex numbers, Applications in solving equations. **Hyperbolic Functions:** Definitions, Identities of hyperbolic functions, Relation between Circular functions and hyperbolic functions, Inverse hyperbolic functions,	8
IV	**Partial Differentiation and Applications:** Functions of several variables, partial derivatives of first order, Higher order partial derivatives, Homogeneous functions, Euler's Theorem on homogeneous function: statement and verification, Jacobians and Properties, Maxima and minima of functions of two variables.	8
V	**Ordinary Differential Equation of first order and first degree:** Linear differential equation, exact differential equation, reducible to exact differential equation, reducible to linear differential equation, Applications of engineering (branch oriented)	8
VI	**Numerical Solution of Ordinary differential equation of First Order & First Degree:** Euler's method, Modified Euler's method, Runge–Kutta third order, Runge-Kutta Method of order four, Taylor Series method.	7
	Total Lecture Hours	45

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List of Tutorial with CO Mapping				
Sr.No	**Title of Tutorial**			**CO Mapped**
1	Rank of matrix and Solution of Homogeneous System of Linear Equations			CO1
2	Solution of Non-Homogeneous System of Linear Equations			CO1
3	Eigen Value, Eigen vectors and Properties			CO2
4	Cayley-Hamilton theorem and Applications			CO2
5	De Moivre's Theorem, Applications and Hyperbolic functions			CO3
6	Partial differentiations and Euler's theorem			CO4
7	Jacobians and Maxima-Minima of Two Variable Functions			CO4
8	Euler's and Modified Euler's Methods for Solving Initial Value Problems			CO5
9	Runge-Kutta Methods and Taylor series method			CO5
10	Ordinary differential equations of first order and first degree			CO5
Total Practical Sessions		**15**	**Total Tutorial Hours**	**15**

Text Books
1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 8th Edition, Laxmi Publications ,2011.
2. H. K. Das , Advanced EngineeringMathematics , 22th Edition, S. Chand ,2018.
3. B. V. Ramana, Higher Engineering Mathematics, 6th Edition, Tata McGraw Hill Publ., 2010
4. Dr. B. S. Grewal , Numerical Methods , 9th Edition, Khanna Publishers ., 2010

References:
1. Dr. B. S. Grewal , Higher Engineering Mathematics , 44th Edition, Khanna Publishers ,2018.
2. N. P. Bali, Manish Goyal , Advanced EngineeringMathematics , 7th Edition, Infinity science press ,2010.
3. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Vol-I, 9th Edition Pune Vidyarthi Griha Prakashan,1984
4. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Vol-II, 7th Edition Pune Vidyarthi Griha Prakashan,1988.

Online Learning Resources
1. NPTEL Course onEngineering Mathematics-I, by Prof. Jitendra Kumar, IIT Kharagpur https://nptel.ac.in/courses/111105121
2. NPTEL Course on Numerical Methods, by Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee https://nptel.ac.in/courses/111107105
3. NPTEL Course on Matrix Analysis with Application, by Prof. S. K. Gupta , Prof. Sanjeev Kumar, IIT Roorkee https://nptel.ac.in/courses/111107112
4. NPTEL Course on Mathematics-III, by Prof. Durga C Dalal, Dr. M. Guru Prem Prasad, IIT Guwahati https://nptel.ac.in/courses/122103012

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Department of Robotics and Artificial Intelligence Engineering

Course Information:							
Class, Semester	F.Y. B. Tech, Semester - I					**Category**	**ES**
Course Code, Course Title	0RAES102, Fundamental of Mechanical Engineering					**Type**	**LIT2**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	3	-	2	1		4	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Explain** the fundamentals of thermodynamics, power transmission, manufacturing processes and lubrication for a given system using basic mechanical engineering principles.
CO2	**Select** the manufacturing processes for a given job with the help of basics of manufacturing engineering
CO3	**Calculate** the thermodynamic properties / performance of a given system using fundamentals of thermodynamics
CO4	**Solve** the numerical on power transmission using given data with the help of basics of power transmission.

Syllabus:

Module	Contents	Lecture Hours
I	**Manufacturing Processes: -** Introduction to manufacturing processes, fundamentals of Casting, advantages, disadvantages and limitations of casting, sand casting, mold, patterns, core, gating system, runners and risers, chills, permanent mold casting, investment casting, continuous casting. Various metal forming operations, hot and cold working of metals such as forging, rolling, extrusion, wire drawing. Overview and classification of joining processes, welding process, Soldering, Brazing, riveted and bolted joints	8
II	**Machine Tools:** Metal removing processes and their applications Lathe: Principle, types, operations, turret/capstan, semi/automatic, various lathe operations. Milling - classification of milling machines, construction and working of column and knee type milling machine, milling operations Drilling - Classifications, construction & working of Radial drilling machine, Various operations on drilling machines, Geometry of twist drill.	7
III	**Mechanical Power Transmission and Energy conversion devices** Type of Belt and belt drives, chain drive, Types of gears and gear Trains, Types of Coupling, Types of Bearings, Types, Construction, working and applications of Pumps, compressor and Hydraulic Turbines.	8
IV	**Thermodynamics** Thermodynamic State, Process, Cycle, Thermodynamic System, Heat, work, Internal Energy, First Law of Thermodynamics, Application of First Law to steady Flow and Non-Flow processes, Limitations of First Law Statements of Second Law of Thermodynamics.	7
V	**Introduction to I C Engine** Air standard cycles- Carnot Cycle, Joule Cycle, Otto Cycle, Air Standard efficiency. Carnot Engine, Construction and Working of C.I. and S.I., Two stroke, Four Stroke engines	8
VI	**Introduction to Refrigeration and Air Conditioning** Carnot refrigerator, Refrigerant types and properties, Vapor compression and vapor absorption system, solar refrigeration, Window Air Conditioning, Psychometric properties of moisture, Applications of refrigeration and air conditioning.	7
	Total Lecture Hours	**45**

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List of Experiments with CO Mapping				
Sr. No	**Title / Topic of the Experiment**			**CO Mapped**
1	Introduction to Industrial Safety , Fire Hazards, Case of Accident, Safety Precautions While Working in shop , Safety Equipment & their Use.			CO1
2	Prepare a male–female component using suitable operations such as marking, cutting, drilling, and filing.			CO2
3	Prepare a component using sheet metal operations.			CO2
4	Significance & Relevant of Lubrication Properties & System			CO1
5	Determine the cloud point and pour point of a given oil or fuel			CO1
6	Measure the cone penetration of a specified lubricating grease.			CO1
7	Evaluate the efficiency of an internal combustion (IC) 4 Stroke engine.			CO3
8	Determine the Coefficient of Performance (COP) of a refrigeration			CO3
9	Determine the performance of a pump.			CO3
10	Determine the performance of a hydraulic turbine.			CO3
11	Trail on power transmission System (Belt, Chain & Gear Drive)			CO4
Total Practical Sessions		**15**	**Total Practical Hours**	**30**

Text Books
1 Elements Of Workshop Technology [Vol - 1,2] S.K. Hajra Choudhury & Nirjhar Roy 17th 2016.
2 Design of Machine Elements V. B. Bhandari Mc Graw Hill 10th reprint 2000
3 Engineering Thermodynamics R. Joel The English Language Book. 5th 1999
4 Engineering Thermodynamics Achultan Prentice Hall of India.Society 2nd 2011
5 Thermal Engineering R. K. Rajput Laxmi Publication, Delhi. 8th 2010
6 Elements of Heat Engine (Vol. I, II, III) Patel and Karamchandani Acharya Book Depot
References:
1. Thermal Engineering P. L. Ballaney Khanna Publication 22nd 2000
2. Refrigeration and Air Conditioning, C.P. Arora & Domkunwar Dhanpat Rai Publication 8th Revised 2009
3. Fluid Mechanics and Machinery Modi Seth Standard Book House 1st 1973
4. Theory of Machines Khurmi & Gupta S. Chand 14th 2012
5. Engineering Thermodynamics P.K.Nag Tata Mc-Graw Hill 4th 2012 Reprint
6. Energy Technology, S. Rao and Dr. B. B. Parulekar Khanna Publication 3rd 2012
7. Internal Combustion Engine R. Ganeshan Tata Mc-Graw Hill 4th 2012
8. Internal Combustion Engine R. K. Rajput Laxmi Publication 2nd 2008
Online Learning Resources
1. NPTEL Course on Basic Mechanical Engineering by Prof. H.K. Dass, IIT Delhi https://nptel.ac.in/courses/111105035

Experiments that may be performed through virtual labs:		
Sr.No	Experiment Name	Experiments Links
1.	Study Hydraulic ram demonstration	Basic Mechanical Laboratory

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Department of Artificial Intelligence and Robotics

Course Information:

Class, Semester	FY. B. Tech, Semester - I						**Category**	**ES**	
Course Code, Course Title	0RAES103, Biology for Engineers and Biomimetics						**Type**	**T1**	
Prerequisites	-								
Teaching Scheme (per week)	**Lecture**		**Tutorial**		**Practical**		**Self-Study**	**Credits**	
	2		-		-		1	2	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**		**CIA**	**ESE**	
		40	20	40			-	-	

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:

CO1	**Define** fundamental biological principles of Cellular structures, Genetics, Biochemistry and apply them in solving practical, real-world problems.
CO2	**Explain** basic molecular processes, structure and function of DNA with emphasis on replication, transcription, and translation processes relevant to modern engineering practices.
CO3	**Integrate** microbiology and biotechnology concepts to design and implement effective solutions in computational and systems engineering projects.
CO4	**Classify** how biological systems inspire neural networks and biomimetic designs, drawing upon principles from biomimetics, systems biology, and proteomics
CO5	**Assess** the environmental and health challenges, along with the ethical, legal, and social implications, of applying biological principles to develop sustainable engineering solutions from a biological perspective.
CO6	**Understand** diseases and disorders, healthcare technologies, and correlate the role of Artificial Intelligence in developing effective engineering solutions in health care technology.

Syllabus:

Module	Contents	Lecture Hours
I	**Introduction to Biology and Its Relevance for Engineers** Course Overview & Importance of Biology in Engineering: Introduction to interdisciplinary approaches. Cell Theory & Structure: Overview of prokaryotic versus eukaryotic cells, Transport Across Cell Membrane, Cell Division. Fundamental Biochemistry: Macromolecules (carbohydrates, proteins, lipids, nucleic acids) and enzyme function. Biodiversity & Classification: The hierarchical organization of life and modern taxonomy, the 5-kingdom classification. Interdisciplinary Integration: How biological principles inform cutting-edge engineering designs.	5
II	**Microbiology and Biotechnology** Introduction to Microorganisms: Bacteria, viruses, fungi, and their characteristics. Microbial Genetics & Evolution: Gene transfer, mutations, and their impacts. Techniques in Microbiology: Isolation, culturing methods, and basic staining techniques. Biotechnology Applications: Role of bioinformatics, synthetic biology, and engineering innovations. Case Studies: Real-world examples of biotechnological solutions in engineering.	5
III	**Systems Biology and Bioinformatics** Principles of Systems Biology: Understanding networks, feedback loops, and complex systems. Introduction to Bioinformatics: Tools and techniques for computational biology. Genomics and Proteomics: Overview of genomic data and proteomic analysis. Biological Databases: Utilization of NCBI, BLAST and other key resources. Integrative Models: Merging biological systems with computational models for analysis.	5
IV	**Genetics and Molecular Engineering** Fundamentals of Genetics: Mendelian inheritance and classical genetics. DNA Structure and Function: Detailed exploration of replication, transcription, and translation. Genetic Engineering Techniques: Overview of CRISPR, recombinant DNA, and related methodologies. Ethical, Legal & Social Aspects: Discussion on the implications of genetic modification. Genetic Disorders: Examples and their biological basis.	5

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V	**Biomimetics and Neural Networks** Introduction to Biomimetics: Nature-inspired designs in engineering. Anatomy of the Human Brain: Basic neurobiology and the organization of neural systems. From Biology to AI: Understanding how neural networks are modelled after natural systems. Applications in Robotics & Intelligent Systems: Case studies and real-world implementations. Comparative Analysis: Evaluating the similarities between biological neural networks and artificial intelligence systems.	5
VI	**Diseases, Health, and Sustainable Engineering** Diseases and Disorders: Infectious, chronic, cancer, Genetic and neurological, cardiovascular, auto immune and role of Artificial Intelligence. Public Health Fundamentals: Epidemiology, disease modelling, and statistics in biology. Engineering Solutions in Health: How biological insights contribute to healthcare technologies. Sustainable Engineering: Integrating biological principles with green technology. Course Integration & Future Directions: Discussion on emerging interdisciplinary trends in Robotics and Artificial Intelligence.	5
	Total Lecture Hours	30

Text Books

1. Biology for Engineers Anthony J. Young, Engineering Press, 1st, 2015
2. Fundamentals of Biology, Lisa M. Johnson, Academic Publishers, 3rd, 2012
3. Essential Cell Biology Bruce Alberts et al. Garland Science 2nd ,2014
4. Microbiology: An Introduction, Gerard J. Tortora, Pearson, 11th 2017
5. Genetics: From Genes to Genomes, Leland H. Hartwell, McGraw-Hill, 4th, 2011

References:

1. Biotechnology for Engineering Kavita Kumar, Tech Books Publishing, 2nd, 2018
2. Systems Biology: A Textbook Edda Klipp, Wiley-VCH, 2nd, 2016
3. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, 2nd, 2013
4. Biomimetics in Engineering, Robert J. Fuller, Springer 1st, 2019
5. Sustainable Engineering: Principles and Practice Michael T. Solomon, CRC Press, 3rd, 2020

Online Learning Resources

1. **https://onlinecourses.nptel.ac.in/noc19_ge31**

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Department of Robotics & Artificial Intelligence Engineering
Established: 1999

Course Information:

Class, Semester	SY. B.Tech, Semester - I					**Category**	**ES**
Course Code, Course Title	0RAES104, Basic Electrical & Electronics Engineering					**Type**	**LIT1**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	3	-	2	2		4	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	50

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Explain** fundamental electrical and electronic laws and components used in basic circuits and devices for solving elementary electrical problems.
CO2	**Analyze** single-phase and three-phase AC circuits using phasor techniques and sinusoidal parameters for accurate calculation of voltage, current, and power.
CO3	**Describe** electrical protection systems, wiring methods, Special machines, and transformers using understanding of basic power distribution and energy conversion.
CO4	**Explain** various electronics components, circuits and their characteristics to develop foundational understanding in Analog Electronics.
CO5	**Calculate** different parameters of analog electronics components by applying the concepts of Op-amp.

Syllabus:

Module	Contents	Lecture Hours
I	**DC Circuits:** Ohms's Law, Equivalent Resistance, Kirchhoff current Law, Kirchhoff voltage laws, Mesh analysis, Nodal analysis. Superposition Theorem.	7
II	**AC Circuits:** Representation of sinusoidal waveforms, Peak, Average & RMS values. Real, Reactive and Apparent power, Power triangle, Analysis of single-phase ac circuits. (R, L and C) Basics of three phase circuits, Star and delta configuration, Voltage and Current relation.	8
III	**Electrical Installation:** Protecting devices – HRC fuse MCB, Earthing – Plate and Pipe wiring circuits – Simple, Stair case and Godown wiring **Electrical Machine:** Principle, Construction and Working of Servomotor, Stepper Motor and Single-phase transformer, EMF equation of Transformer.	8
IV	**Electronic Components, Sources, and Measuring Equipment :** Evolution of Electronics – Impact of Electronics in Industry and Society – Familiarization of Resistors, Capacitors, Inductors – Color Coding – types and specifications, – Electro- mechanical components – Relay and Contactors – Regulated Power supply, Function Generator – Multimeter – CRO	7
V	**Diodes and Transistors:** P-N junction diode, diode characteristics, Half-wave and full-wave rectifier, Clippers and clampers, Zener diode, LED, Photo diode and solar cell, Introduction to transistors, Types, (BJT, FET, MOSFET), Biasing Methods, Transistor as a switch.	8
VI	**Operational Amplifier:** Basic Op-amp configuration, Op-amp powering, feedback in op-amp circuits, Ideal op-amp circuits analysis, Inverting, Non-inverting amplifier, Summing amplifier, Difference amplifier, Unity gain buffer, IC555 timer	7
	Total Lecture Hours	**45**

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Study of Basic Electrical and Electronics Components, Equipment and their symbols and Safety Precautions in Electrical and Electronics Engineering	CO1,CO4
2	Experimental Verification of Kirchhoff's Laws.	CO1
3	Experimental Verification of Superposition Theorem.	CO1
4	Measurement of Power and Power Factor in a Single-phase Circuit.	CO2
5	Load Test on Single Phase Transformer.	CO3
6	Demonstration of wiring circuits.	CO3

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7	Experimental verification of Semiconductor Diode Characteristics			CO4
8	Experimental verification of Zener Diode Characteristics			CO4
9	Experimental Verification of Input and Output Characteristics of CE Configuration in BJT			CO4
10	Characteristics of Single-Phase Half-wave and Full-wave rectifiers.			CO4
11	Analysis of Op- AMP as Inverting amplifier in Closed loop configuration			CO5
12	Analysis of Op- AMP as Non- inverting amplifier in Closed loop configuration			CO5
Total Practical Sessions		**15**	**Total Practical Hours**	**30**

Text Books

1. D. P. Kothari, I. J. Nagrath, Basic Electrical Engineering, 4th Tata McGraw Hill, 2019
2. D. C. Kulshreshtha, Basic Electrical Engineering, 2nd, McGraw Hill.2020
3. D. P. Kothari, Basic Electrical & Electronics Engineering, 2nd, TMH New Delhi ,2020
4. D. Patranabi, Sensors and transducers, 1st, PHI learning Pvt. Ltd.2003

References:

1. Millman and Halkias, Integrated Electronics,2nd, McGraw Hill,2010.
2. A.K. Thereja and B.L. Thereja,Electrical Technology volume II,2nd, S. Chand & Co. Publications,2007.
3. L. Bakshi and A. Bakshi,Basic Electrical Engineering,1st, Technical Publications, Pune,2005.
4. Albert Malvin, David Bates,Electronic Principles, 7th, McGraw Hill Education,2017.

Online Learning Resources

1. Basic Electrical Circuits by Prof. Gajendranaowdary https://onlinecourses.nptel.ac.in/noc25_ee91/preview
2. Introduction to Semiconductor Devices by Prof. Naresh Kumar https://onlinecourses.nptel.ac.in/noc25_ee92/preview
3. Analog Electronic Circuit by Prof. Shouribrata Chatterjee https://onlinecourses.nptel.ac.in/noc25_ee103/preview

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Experimental Verification of Kirchhoff's Laws.	https://bes-iitr.vlabs.ac.in/exp/kirchhoff-law/
2.	Load Test on Single Phase Transformer.	https://bes-iitr.vlabs.ac.in/exp/single-phase-transformer/
3.	Experimental verification of Semiconductor Diode Characteristics	https://beiitkgp.vlabs.ac.in/exp/characteristics-diode/

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Department of Robotics and Aritfical Intelligence Engineering
Established: 1999

Course Information:

Class, Semester	FY. B.Tech, Semester - I					**Category**	**ES**
Course Code, Course Title	**0RAES105, Engineering Drawing and Graphics**					**Type**	**LIT2**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**		**Practical**	**Self Study**	**Credits**	
	2	-		2	2	3	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Construct** projections of straight lines in various positions with reference planes, by variation in inclination, grade, bearing, and initial conditions.
CO2	**Complete** the projection of planes and Solids in various positions relative to reference planes, considering variations in initial conditions and inclination, to achieve an accurate shape in inclined positions.
CO3	**Prepare** the section of solids in simple position and inclined to one refrence plane and parallel to other, considering variations in shapes, initial conditions and inclination, to get an accurate sectional view of inclined position of solid.
CO4	**Draw** the three orthographic views for a given three-dimensional pictorial view, concerning the direction of viewing in first-angle projection, explaining the sectional view, hidden object and dimensions.
CO5	**Develop** a 3-dimensional isometric view converted from two or three orthogonal views to illuminate a 3D object.

Syllabus:

Module	Contents	Lecture Hours
I	**Fundamentals of Engineering Graphics and Projections of Lines** **Fundamentals of Engineering Graphics:** Introduction to Drawing instruments and their uses. Different types of lines used in drawing practice, Dimensioning system as per BSI. **Projections of Lines:** Introduction to First angle and third angle methods of projection. Projections of points on regular and auxiliary reference planes. Projections of lines (horizontal, frontal, oblique and Profile lines) on regular and auxiliary reference planes. True length of a line, Point View of a line, angles made by the line with reference planes. Projections of intersecting lines, Parallel lines, perpendicular lines, and skew lines. Grade and Bearing of a line	7
II	**Projections of Planes** Projections on regular and on auxiliary reference planes. Types of planes (horizontal, frontal, oblique and Profile planes), Edge view and True shape of a Plane. Angles made by the plane with Principle reference planes. Projections of plane figures inclined to both the planes. (Circle & regular polygon upto hexagon).	4
III	**Projections of Solids** Projections of Prisms, Pyramids, Cylinder and Cones inclined to both reference planes. (Excluding Frustum and Sphere)	4
IV	**Section of Solids** Prisms, Pyramids, Cylinders and Cones, in simple position and inclined to one reference plane and parallel to others.	4
V	**Orthographic Projections** Lines used, selection of views, spacing of views, dimensioning and sections. Drawing required views from given pictorial views (conversion of pictorial views in to orthographic views), including sectional orthographic views.	6
VI	**Isometric Projections** Introduction to isometric. Isometric scale, Isometric projections and Isometric views /drawings. Circles in isometric view. Isometric views of simple solids and objects.	5
	Total Lecture Hours	30

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Annasaheb Dange College of Engg. & Tech. Ashta Dept. of CSE (IOT & CSBT)

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Introduction to Engineering Drawing	CO1
2	Types of Lines and Lettering	CO1
3	Projection of Line	CO1
4	Projection of Plane	CO2
5	Projection of Solids	CO2
6	Section of Solids	CO3
7	Orthographic Projection	CO4
8	Isometric Projection	CO5
Total Practical Sessions	**15** **Total Practical Hours**	**30**

Text Books

1. W. J. Luzadder, Fundamentals of Engineering drawing, Revised Edition, Prentice Hall of India, 1999.
2. N. D. Bhatt, Machine Drawing, 15th Edition, Charotar Publishing House Pvt. Ltd.-Anand, 2007.
3. Jhole, Dhananjay, Engineering Drawing, Revised Edition, Tata McGraw-Hill, 2011.
4. M.L. Mathur, Engineering Drawing & Graphics, RevisedEdition, Jain brothers, 1999..

References:

1. K. Venugopal, Engineering Drawing and Graphics, 5th Edition, New Age Publication, 2004.
2. R. K. Dhawan, A textbook of Engineering Drawing, Revised Edition, S. Chand and Co, 2008.
3. N. B. Shaha and B. C. Rana, Engineering Drawing, 2nd Edition, Person Education, 2012.
4. K. L. Narayana, Machine Drawing, New Age Publication

Online Learning Resources

1. NPTEL Course on *Engineering Drawing*, by Prof. P. S. Robi, IIT Guwahati
   https://nptel.ac.in/courses/112103019
2. NPTEL Course *on Engineering/ Architectural Graphics- Part I- Orthographic Projection*, by Prof. AvlokitaAgarwal, IIT Roorkee
   https://nptel.ac.in/courses/124107157
3. NPTEL Course *on Engineering Graphics and Design*, by Prof. NareshDatla, Prof. S. R. Kale, IIT Delhi
   https://nptel.ac.in/courses/112102304
4. NPTEL Course *on Engineering Drawing and computer graphics*, by Prof. RajaramLakkaraju, IIT Kharagpur

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Department of Robotics and Artificial Intelligence Engineering

Established: 1999

Course Information:

Class, Semester	FY. B.Tech, Semester - I					**Category**	**BS**
Course Code, Course Title	0RAHS106, Communication Skills					**Type**	**L2**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	--	4	-		2	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Demonstrate** the Listening, Speaking, Reading and Writing (LSRW) skills considering the frame of English language rules accurately for effective and sound communication in academic and profession contexts.
CO2	**Exhibit** their portfolio and career choices confidently, considering corporate expectations by using digital tools convincingly.
CO3	**Write** letters, reports, Emails and Blogs proficiently by following required techniques that help in getting acquainted with professional correspondence.
CO4	**Attain** professional skill while convincingly presenting on allotted topics using MS PowerPoint and AI techniques.
CO5	**Justify** own role in communicative events in well-organized manner with balanced zeal.

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Self - Introduction	CO1
2	SWOT Analysis	CO1
3	Basics of English Pronunciation	CO1
4	Rapid Review of Grammar	CO1
5	Diagnosing Listening and Speaking Skills	CO1
6	Diagnosing Reading and Writing Skills	CO1
7	Introduction to MS Office (Word, Excel, PPT)	CO1,CO4
8	Presenting my career choices	CO1,CO2
9	Preparing Portfolio	CO1,CO2
10	Describing Technical Charts, Image, and Processes	CO1,CO4
11	Using Language Learning Apps and Tools	CO1,CO4
12	Presenting Portfolio	CO1,CO2
13	Effective Presentation Skills	CO1,CO4
14	Delivering Power Point Presentation	CO1,CO4,CO5
15	Job Application and Resume Writing	CO1,CO3
16	Email Writing	CO1,CO3
17	Group Discussion	CO1,CO5
18	Public Speaking	CO1,CO5
19	Report Writing	CO1,CO3
20	Organizing an Event	CO1,CO5
21	Technical Writing	CO1,CO3
22	Blog Writing	CO1,CO3
23	Mock Interview	CO1,CO2,CO5
24	Achievement Test	CO1
Total Practical Sessions	**30**	**Total Practical Hours** **60**

Text Books

1. The Professional: Defining the New Standard of Excellence at Work Subroto Bagchi Penguin Books India Pvt. Ltd. Revised Edition,2011.
2. Cambridge Guide to IELTS. Pauline Cullen, Amanda French, Cambridge University Press, Reprint, 2017.

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3. A Practical Course in Effective English Speaking Skills. J. K. Gangal, PHI Learning Private Limited, New Delhi, Print, 2012
4. English For Engineers. Dr. Shyamaji Dubey, Dr. Manish Kumar. Vikas Publication House Pvt. Ltd.New Delhi, Print, 2020.
5. Personality Development and Soft Skills. Barun K. Mitra, Oxford University Press, New Delhi , 7th impression, 2012.
References:
1. High-school English Grammar and Composition. Wren and Martin, S. Chand and Co., New Delhi, 1st edition, 2015.
2. The Ace of Soft Skills. Ajai Chowdry, Bala Balchandran, Pearson Publication, Delhi, 8th edition, 2017.
3. Effective Technical Communication. M. Ashraf Rizvi, McGraw Hill Education, Chennai.2nd edition, 2017.
4. Business Communication. Hory Sankar Mukerjee, Oxford University Press, New Delhi , 2nd edition, 2013.
5. Communicative English for Engineers and Professionals. Nitin Bhatnagar, Mamta Bhatnagar, Pearson Publication, Delhi, 1st edition, 2013.
Online Learning Resources
1. **Software:** Pronunciation apps (e.g., ELSA Speak, Speak English), grammar checkers (e.g., Grammarly).
2. **Online Platform** Coursera (for basic English courses), Duolingo, BBC Learning English.

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Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Robotics and Artificial Intelligence Engineering
Established: 1999

Course Information:

Class, Semester	F.Y. B. Tech, Semester - II					**Category**	**VS**
Course Code, Course Title	0RAVS107, IDEA Lab Workshop					**Type**	**L2**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	1	-	2	-		2	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		--	--	--		50	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Operate** basic workshop tools for material processing and assembly.
CO2	**Make** simple 2D and 3D designs using CAD software and prepare them using 3D printing, laser cutting, or CNC machining.
CO3	**Build** basic electronic circuits using sensors, LEDs, motors, and microcontrollers.
CO4	**Apply** fundamental programming concepts in embedded C (Arduino IDE) for controlling hardware and automating simple tasks.
CO5	**Integrate** mechanical parts and electronics to design and build working models or prototypes.

Syllabus:

Module	Contents	Lecture Hours
I	**Overview of IDEA Lab** Introduction to the IDEA Lab: Vision, objectives, **National Innovation Ecosystem** (IIC, Atal Innovation Mission, NISP), Importance of multi-disciplinary, project-based learning Inspirational case studies from IDEA Labs, Safety protocols, Do & Don'ts in IDEA Lab.	1
II	**Fundamentals of Design & Prototyping** **Design Thinking Basics**: Problem identification, ideation, prototyping, testing, and iteration, **Introduction to CAD Software:** Concepts of 2D and 3D modeling for various applications, File Formats for Fabrication: Understanding STL, DXF, G-Code, SVG, and their uses, Tolerances, fits, and design constraints for manufacturing.	2
III	**Digital Fabrication Technologies** **3D Printing:** Principles, types of 3D printers, materials, slicing software, and applications. **Laser Cutting & Engraving**: Principles, types of lasers, materials, design considerations, and safety. **CNC Router**: Introduction to CNC Router and Mini Desktop Lathe cum Milling operations, G-code fundamentals, material removal processes. **3D Scanning**: Principles of 3D scanning, applications in reverse engineering and quality control. **PCB Fabrication:** Introduction to PCB Milling Machine and PCB Prototype Machine for custom circuit boards.	3
IV	**Fundamentals of Embedded Systems & IoT** **Basic Electrical and Electronic Concepts:** Voltage, current, resistance, Ohm's Law, and fundamental components (resistors, capacitors, diodes, LEDs, sensors, actuators), Measuring Instruments **Overview of microcontrollers:** Overview of Arduino, ESP32, NodeMCU, and their applications in controlling hardware. Circuit simulation using TinkerCAD or Proteus. **IoT Basics**: Basic networking (Bluetooth/Wi-Fi/Ethernet), cloud integration	3
V	**Programming for automation** **Arduino IDE and Embedded C Programming**: Setup, basic syntax (setup(), loop()), digital	3

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	and analog I/O control. **Basic Control Systems:** Concepts of open-loop and closed-loop control with simple examples. **Introduction to Python.**	
VI	**Project Planning and IPR** **Innovation Process:** From idea generation to concept validation **Project Planning & Management:** Defining scope, setting timelines, budgeting, and resource allocation. **Documentation and Presentation:** Writing a concept note, creating innovation posters, and effective pitching techniques. **Intellectual Property Rights (IPR):** Basics of Patents, Copyrights, and Trademarks relevant to innovation.	3
	Total Lecture Hours	**15**

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Introduction, Lab Safety & Tool Familiarization	CO1
2	Hands on practice of Mechanical Workshop Tools	CO1
3	3D Printing of simple parts	CO2
4	Laser Cutting	CO2
5	CNC Routing/ Engraving	CO2
6	Basic Electronics circuit	CO3
7	PCB Design and Prototyping	CO3
8	Microcontroller Programming and Sensor Interfacing	CO4
9	Mini Project	CO5
Total Practical Sessions	**15** **Total Practical Hours**	**30**

Text Books

1. Veeranna D.K., AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), 1st Edition, Khanna Book Publishing Company, 2022
2. Saji T. Chacko, Susan S. Mathew, AICTE's Prescribed Textbook: Fundamentals of Electrical and Electronics Engineering (with Lab Manual), 1st Edition, Khanna Book Publishing Company, 2024
3. Mehta S.D., Electronic Product Design Volume - I (Basics of PCB Design), 1st Edition, S Chand & Company, 2011
4. Mehta-Gupta, Y.P.Mehta, Vishal Mehta, Workshop Calculation and Science, 1st Edition, Dhanpat Rai Publications, 2020

References:

1. A. K. Maini, Nakul Maini, All-in-One Electronics Simplified, 1st Edition, Khanna Book Publishing Company, 2021
2. J.G. Joshi, Electronics Measurements & Instrumentation, 1st Edition, Khanna Book Publishing Company, 2025
3. Dr. Sabrie Soloman, 3D Printing & Design, 1st Edition, Khanna Book Publishing Company, 2020
4. Kaushik Kumar, Hridayjit Kalita, Workshop/Manufacturing Practices, 5th Edition, S Chand & Company, 2011

Online Learning Resources

1. NPTEL Course on 3D Printing and Design for Educators, By Dr. Sharad K. Pradhan, NITTTR Bhopal https://onlinecourses.swayam2.ac.in/ntr24_ed17/preview
2. NPTEL Course on Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software, By Prof. Ankur Gupta, IIT Delhi https://onlinecourses.nptel.ac.in/noc24_ee127/preview

Experiments that may be performed through virtual labs:

S. No	Experiment Name	Experiments Links
1.	3D Printing Virtual Simulation Lab	https://3dp-dei.vlabs.ac.in/
2.	Digital Fabrication of Flexible Circuit board	https://fab-coep.vlabs.ac.in/exp/digital-fabrication/
3.	Embedded System Design with 8051 and PIC Microcontroller	https://esd-coep.vlabs.ac.in/

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(An Empowered Autonomous Institute)
Department of Robotics and Artificial Intelligence Engineering

Established: 1999

Course Information:

Class, Semester	F. Y. B. Tech, Semester - II					**Category**	**BS**
Course Code, Course Title	0RABS108, Mathematics-II					**Type**	**T1**
Prerequisites	0RABS101						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	3	1	-	2	4		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		-	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Determine** equation of a curve and compute statistical measures to analyze data using statistical techniques
CO2	**Apply** the concepts of vector spaces over real numbers to solve problems using linear algebra concepts
CO3	**Determine** approximate root of algebraic and transcendental equations using numerical methods.
CO4	**Determine** unknown values from tabulated data using finite difference and interpolation techniques.
CO5	**Define** and distinguish different types of graphs using basic definitions and examples from graph theory.

Syllabus:

Module	Contents	Lecture Hours
I	**Curve fitting and Statistics:** Method of Least Squares, Fitting of Straight Line, Fitting of Parabola, Fitting of exponential curves, Lines of Regression.	8
II	**Vector Space:** Introduction to Vector spaces, subspaces and characterization, linear combination and span basis and dimension, linear transformation, Row space, column space, null space and range of transformation.	7
III	**Numerical Solution of algebraic and transcendental equation:** Introduction, Bisection method, Regula Falsi method, Secant method, Newton Raphson method.	7
IV	**Statistical Measures:** Introduction, Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode, Partition values: Quartiles, Deciles and Percentiles, Concept of dispersion, Range, Quartile Deviation, Mean Deviation, Mean Square Deviation, Variance and Standard Deviation.	8
V	**Finite Differences and Interpolation:** Finite differences, Newton's Interpolation formulae, Stirling formula, Lagrange's interpolation formula, Divided Difference	8
VI	**Graph Theory:** Definition of graph, degree of vertex, types of graph, isomorphism, matrix representation of graph, subgraphs, complement of a graph, operation on graph, connected graph, shortest path algorithm.	7
	Total Lecture Hours	45

List of Tutorial with CO Mapping

Sr.No	Title of Tutorial	CO Mapped
1	Fitting of straight line and Second-degree parabola	CO1
2	Fitting of exponential curves and lines of regression	CO1
3	Subspace and Linear transformation	CO2
4	Basis and Dimension	CO2
5	Solution of Algebraic and transcendental equation	CO3
6	Measures of Central tendency	CO1

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7	Measures of dispersion			CO1
8	Interpolation with equal intervals			CO4
9	Interpolation for unequal intervals			CO4
10	Graph theory			CO5
Total Practical Sessions		**15**	**Total Practical Hours**	**15**

Text Books

1. H. K. Das, Advanced EngineeringMathematics, 22nd Edition, S. Chand, 2018.
2. B. V. Ramana, Higher Engineering Mathematics, 6th Edition, Tata McGraw Hill Publ., 2010
3. Dr. B. S. Grewal, Numerical Methods, 9th Edition, Khanna Publishers, 2010
4. J. P. Tremblay & R. Manohar, Discrete Mathematical Structures with application to Computer Science 1st-Tata MGH International, 2007.

References:

1. Dr. B. S. Grewal, Higher EngineeringMathematics, 44th Edition, Khanna Publishers, 2018
2. N. P. Bali,Manish Goyal, Advanced EngineeringMathematics, 7th Edition, Infinity science press, 2010.
3. S. C. Gupta, V. K. Kapoor, Fundamental of Mathematical Statistics, 10th Edition, Sultan Chand and Sons Publisher, 2000.
4. Seymour Lipschutz, Marc Lars Lipson, Linear Algebra, 4th Edition, McGraw Hill, 2009.

Online Learning Resources

1. NPTEL Course on Engineering Mathematics-I, by Prof. Jitendra Kumar, IIT Kharagpur https://nptel.ac.in/courses/111105121
2. NPTEL Course on Numerical Methods, by Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee https://nptel.ac.in/courses/111107105
3. NPTEL Course Business Statistics, by Prof. Mukesh Kumar Barua, IIT Roorkee https://nptel.ac.in/courses/110107114
4. NPTEL Discrete Mathematics, by Dr. Sugata Gangopadhyay, Dr. Aditi Gangopadhyay, IIT Roorkee https://nptel.ac.in/courses/111107058

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Established: 1999

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(An Empowered Autonomous Institute)
Department of Robotics & Artificial Intelligence Engineering

Course Information:

Class, Semester	F.Y. B. Tech. Semester - II					**Category**	**BS**
Course Code, Course Title	0RABS109, Physics & Chemistry					**Type**	**LIT2**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	4	-	2	1		5	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Describe** the basic principles of nanotechnology for nanomaterial production using appropriate synthesis methods and microscopy techniques
CO2	**Apply** optics concepts to analyze diffraction, polarization, lasers, and fiber optic transmission in engineering contexts.
CO3	**Interpret** crystal structures and X-ray diffraction results to determine lattice parameters and interplanar spacing using Bragg's law and Miller indices.
CO4	**Explain** the properties and applications of engineering materials for industrial and societal use based on their chemical compositions.
CO5	**Solve** the domestic and industrial problems related to water quality parameters using theoretical knowledge and laboratory experiments.
CO6	**Compute** the calorific values of fuels for domestic and industrial applications using standard fundamental chemical equations.

Syllabus:

Module	Contents	Lecture Hours
I	**Diffraction and Polarization :** **Diffraction** - Diffraction grating, Plane diffraction grating- construction & theory, Determination of wavelength using plane diffraction grating, Resolving power of grating, Numericals. **Polarization:**-Polarization of light, Polarization by double refraction, Positive and Negative crystals, Optical activity, Laurent's half shade Polarimeter, Numericals.	8
II	**Laser and Fiber Optics:** **Laser**: Introduction, Principle of laser, Pumping and Population inversion, Characteristics of laser, Ruby Laser, Applications of laser in Roboticsfield. **Optical fibre:** Introduction, Total internal reflection, Structure of optical fibre, Propagation mechanism of optical fibre, Numerical aperture, Acceptance angle, Skip distance, Attenuation, Types of optical fibre, Applications of optical fiber in Robotics.	8
III	**Nanophysics:** Introduction- Nanotechnology, Nano-materials, Top-down and Bottom-up synthesis approach, Ball milling method, Sol-gel synthesis method, Carbon nanotubes, Properties and applications of carbon nanotubes, Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM), Properties and applications of nano-materials in Robotics.	7
IV	**Crystallography :** Unit cell, Space lattice, Seven crystal system, Bravais space lattices, Properties of cubic unit cell, Relation between lattice constant and density, Interplanner spacing for cubic system, Miller indices, Symmetry elements in cubic crystal, X-ray diffraction, Bragg's law, Braggs X-ray spectrometer, X-ray spectra (Continuous and characteristics), Numericals.	7
V	**Water Technology and Management:** Introduction, impurities in natural water and it's removal, **Water Testing:** Acidity, alkalinity, chlorides and hardness of water (definition, causes and significance), Disinfection of water,	8

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	WHO Standards, Scales and sludges: Introduction, Formation in boilers and removal methods. **Treatment of hard water** by: Ion- exchange process, Zeolite process, Desalination of brackish water by Reverse Osmosis method, Numerical on temporary, permanent and total hardness of water.	
VI	**Polymers and Composites for Engineering Applications:** **A) Polymers:** Introduction, Polymerization and it's types, Plastics: Thermo-softening and thermosetting plastics, industrially important plastics like PVC, PTFE (Teflon), ABS, urea-formaldehyde, Conducting polymers, Biodegradable polymers, Molecular weights of a polymer. **B) Composites:** Introduction, Constituents, Fibre-reinforced plastics (FRP) and Glass reinforced plastics (GRP), Metal matrix composites.	**7**
VII	**Energy Technology:** **A) Batteries:** Introduction, Lithium- ion batteries (LIBs), Sodium- ion batteries (Instrumentation, advantages, disadvantages and applications). **B) Fuels:** Introduction, classification, characteristics of good fuels, types of caloriffe value (higher and lower), Bomb calorimeter and Boy's calorimeter. Numericals on Bomb and Boy's calorimeter. **C) Advanced Energy Systems:** Introduction, Fuel cells, Hydrogen cells, Solar cells.	**8**
VIII	**Engineering Materials and Green Chemistry:** Introduction, classification of engineering materials. **A) Alloys:** Types of alloys, purposes of making alloys, Ferrous alloys: Plain carbon steels (mild, medium and high). Nonferrous alloys: Aluminum alloy (Duralumin and Alnico), Nickel alloy (Nichrome), Tin alloys (Solders). **B) Green Chemistry:** Definition, Twelve principles of green chemistry, Research and industrial applications, Green house effect and it's remedies.	**7**
	Total Lecture Hours	**60**

List of Experiments with CO Mapping

S. No	Title / Topic of the Experiment	CO Mapped
1	Plane Diffraction Grating- Determine the wavelength of light using plane diffraction grating.	CO1
2	Laurent's Half shade Polarimeter - Determination of specific rotation of optically active material.	CO1
3	Laser - Determination of wavelength of He-Ne laser light using diffraction grating.	CO1
4	Laser - Determination of divergence of He-Ne laser light	CO1
5	Numerical aperture of optical fiber: To calculate NA of optical fiber by laser diode.	CO1
6	Inverse Square Law- Verify inverse square law.	CO1
7	Band gap energy: To determine band gap energy of given semiconductor.	CO1
8	Determination of alkalinity of water (Acid- Base Titration).	CO5
9	Determination of chloride content of water by Mohr's method. (Precipitation Titration).	CO5
10	Determination of total hardness of water by EDTA method (Complexometric Titration).	CO5
11	Estimation of copper in brass solution (Displacement Titration)	CO4
12	Preparation of urea formaldehyde.	CO4
13	Determination of pH of industrial waste water by pH-meter.	CO5
14	Demonstration of H_2-O_2 fuel cell/ battery.	CO6
Total Practical Sessions	**15** **Total Practical Hours**	**30**

Text Books:

1. G Vijayakumari, Engineering Physics, 3rd Edition, Vikas Pub. House (P) Ltd, 2009
2. M.N.Avadhanulu& P. G. Kshirsagar, A Text Book of Engineering Physics, 12th Edition, S. Chand Publication., 2018
3. K.K.Chattopadhyay and A.N. Banerjee, Introduction to Nano Science and Nanotechnology, 3rd Edition, PHI Learning, 2009
4. S. S. Dara, A Text Book of Engineering Chemistry, 11th Edition, S. Chand & Co. Ltd., New Delhi, 2008.
5. Shashi Chawala, A Text book of Engineering Chemistry, 3rd Edition ,DhanpatRai Publishing Co. New Delhi, 2007

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References:

1. David Halliday, Robert Resnick&Jearl Walker, Fundamentals of Physics, 12th Edition, John Wiley & Sons, 2021
2. Resnick Halliday, Krane, Engineering Physics, 8th Edition, John Wiley & Sons Pub., 2008
3. Sulbha K. Kulkarni, Nanotechnology Principles and Practices, 4th Edition, Springer, 2007
4. Jain & Jain, Engineering Chemistry, 16th Edition, Dhanpat Rai Publishing Co., New Delhi, 2016
5. Wiley India, Engineering Chemistry, 1st Edition, Wiley India Pvt. Ltd., New Delhi., 2012

Online Learning Resources

1. For optics- https://nptel.ac.in/courses/122/107/122107035/
2. For Quantum Physics -https://nptel.ac.in/courses/122/106/122106034/
3. For Ultrasonic -- https://freevideolectures.com/course/3531/engineering-physics-i/8
4. For Solid State Physics -- https://nptel.ac.in/courses/115/105/115105099/
5. Water Technology-- https://youtu.be/dKWJzp_rrlE
6. For lithium-ion batteries (LIBs): https://www.youtube.com/watch?v=DBLHaLhyo2w
7. Composite materials-Wikipedia -: https://en.wikipedia.org/wiki/Composite_material

Experiments that may be performed through virtual labs:

S. No.	Experiment Name	Experiments Links
1.	Water analysis-Determination of Chemical parameters	https://inoc-amrt.vlabs.ac.in/exp/water-analysis-chemical-parameters/index.html
2.	Demonstration of Photo-colorimeter	https://pcv-amrt.vlabs.ac.in/exp/spectrophotometry/index.html
3.	Photoelectric Effect	https://mp-amrt.vlabs.ac.in/exp/photoelectric-effect/index.html
4.	Numerical Aperture of Optical Fiber	https://lo-amrt.vlabs.ac.in/exp/numerical-aperture-optical-fiber/
5.	LASER Beam divergence and spot size	https://lo-amrt.vlabs.ac.in/exp/laser-beam-divergence/

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Department of Robotics and Artificial Intelligence Engineering

Established: 1999

Course Information:

Class, Semester	F.Y. B. Tech – Semester II					**Category**	**ES**
Course Code, Course Title	0RAES110, Introduction To Emerging Technologies					**Type**	**T1**
Prerequisites	--						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	2	-	-	1		2	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		--	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Describe** the key characteristics of emerging technologies such as AI, IoT, AR/VR, Quantum Computing, and Blockchain
CO2	**Apply** the concepts of AI, IoT, CPS, and Blockchain to real-world case studies to identify their disruptive impact on digital transformation initiatives
CO3	**Explain** the role of robotics, additive manufacturing, and green technologies in supporting sustainability and ethical technology deployment
CO4	**Implement** innovative solutions using autonomous systems and green technologies to address sustainability challenges

Syllabus:

Module	Contents	Lecture Hours
I	**Foundations of Emerging Technologies and Innovation Ecosystem** Emerging technologies characteristics and disruptive impact, Indian innovation ecosystem: Digital India, Startup India, AIM, India Stack, National Education Policy and interdisciplinary learning, Case studies: Smart Cities, Aadhaar, UPI, Digital Health Mission.	5
II	**Artificial Intelligence, Machine Learning & Data Science** AI basics: history, goals, types of AI (Narrow, General, Super AI), Machine learning: supervised, unsupervised, reinforcement learning, Introduction to data science: lifecycle, Big Data (5Vs), visualization, Human-centered AI and ethical concerns: bias, privacy, responsible AI.	5
III	**IoT, Cyber-Physical Systems, Edge Computing & Cybersecurity** IoT: architecture, sensors, communication, cloud, Cyber-physical systems: smart grid, autonomous vehicles, industrial automation, Edge & fog computing: real-time applications and use cases, Cybersecurity basics: CIA triad, malware, phishing, digital hygiene.	5
IV	**AR/VR, Quantum Technologies and Blockchain** AR/VR/XR: definitions, tools, applications in gaming, education, healthcare, Metaverse and immersive computing, Introduction to quantum computing: qubits, entanglement, potential impact. Quantum AI. Blockchain, Smart Contracts, DApps, DeFi, NFTs,	5
V	**Robotics, Autonomous Systems & Additive Manufacturing** Robotics: types, sensors, actuators, applications in healthcare, defense, logistics, Autonomous systems: drones, driverless vehicles, swarm robotics, 3D/4D printing: additive manufacturing, materials, future directions, Design thinking for innovation in robotics & manufacturing.	5
VI	**Green Technologies, Sustainability & Tech Ethics** Emerging technologies for solving climate/environmental challenges, Smart grids, clean energy systems, climate tech, e-waste, Sustainable design and SDGs: tech for social good, Tech ethics: inclusivity, equity, digital divide, societal impact.	5
	Total Lecture Hours	30

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(An Empowered Autonomous Institute)
Department of Robotics and Artificial Intelligence
Established:

Course Information:

Class, Semester	F.Y. B.Tech – Semester I					**Category**	**ES**
Course Code, Course Title	0RAES111, Computer Programming					**Type**	**LI**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	1	-	4	2	3		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	50

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Prepare** an algorithm and draw a flowchart to accurately solve various mathematical problems by using structured approach.
CO2	**Apply** the fundamental concepts like data types, operators to solve mathematical problems by using the C language.
CO3	**Apply** the decision and looping constructs to solve the problems related to decision, repetitive statements for real time problem statement using C
CO4	**Develop** a C program to demonstrate the modular approach by using the concept of function, structure and pointer
CO5	**Write, Compile** and debug C program for various problem statements by using structured approach.

Syllabus:

Module	Contents	Lecture Hours
I	**Basics of Programming** The meaning of algorithms, Flowcharts, Pseudo codes, Writing Algorithms and drawing flowcharts for simple exercises, C Program development environment.	2
II	**C Fundamentals** Importance of 'C' Language, History, Structure of 'C' Program, Sample 'C' Program, Constants, variables and data types, Enumeration. Operators and expressions, Managing input / output operations, Control statements-Decision making, Case control & Looping Constructs.	3
III	**Arrays and Strings** 1D and 2D Arrays: Declaration, Initialization, Input/Output; Multidimensional Arrays; String Handling: Basics and Standard Functions	2
IV	**Functions** User Defined Functions, Function Declaration, Definition, Calling, Return Types, Parameter Passing, Scope, Recursion, Library Functions	2
V	**Structure & Pointers** Structure Definition, Initialization, Accessing Variables, Arrays of Structures, Structures with Functions, Unions, Pointers: Basics, Arithmetic, Arrays, Strings, Functions, Dynamic Memory Allocation	4
VI	**File Handling:** File Operations: Open, Read, Write, Close; Error Handling, Random Access Files, Command Line Arguments, Preprocessor Directives	2
	Total Lecture Hours	15

List of Experiments with CO Mapping

S. No	Title / Topic of the Experiment	CO Mapped
1	Write an algorithm for given problem statement	CO1
2	Draw a flowchart for given problem	CO1
3	Program using different data types and operators in C	CO2
4	Program using different operators and demonstration of operator precedence	CO2
5	Program using if and if else construct	CO3
6	Program using if else ladder and nested if else	CO3
7	Program using switch case	CO3

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8	Program to demonstrate looping constructs (while and for loops)	CO3
9	Program to demonstrate looping constructs (do while and nested loops)	CO3
10	Program to demonstrate one dimensional array	CO3
11	Program to demonstrate two-dimensional array	CO3
12	Implement a program to demonstrate String handling functions	CO3
13	Implement a program to demonstrate user defined functions	CO4
14	Program to demonstrate concept of recursion (factorial, Fibonacci)	CO4
15	Program to demonstrate concept of structures in C	CO4
16	Program to demonstrate concept of array of structures in C	CO4
17	Program to demonstrate pointers in C	CO4
18	Program to demonstrate pointers arithmetic in C	CO4
19	Program to demonstrate function pointer	CO4
20	Implement a program to demonstrate file handling	CO5
21	Program to demonstrate command line arguments	CO5
Total Practical Sessions 30	**Total Practical Hours**	**60**

Text Books

1. ISRD Group , Programming and Problem Solving Using C Language , McGraw-Hill Publications ,2012.
2. Yashwant Kanetkar , Let Us C , 3rd Edition, BPB , 2011.
3. Harvey M. Deitel, Paul J. Deitel, Abbey Deitel , C How to Program ,2nd Edition, Pearson ,2009.
4. E. Balaguruswamy , Programming in ANSI C , 4th Edition, BPB Publications, 2008

References:

1. D. M. Ritchie, The 'C' Programming Language, 2nd Edition, Pearson ,1998.
2. Sidnal, C Programming Laboratory: Handbook for Beginners, 1st Edition, Wiley India Limited, 2012.
3. Yashwant Kanetkar, Understanding Pointers in C, 4th Edition, BPB Publications,2001.
4. Yashwant Kanetkar, Test Your C Skills, 5th Edition, BPB Publications, 2013

Online Learning Resources

1. NPTEL Course on Computer Programming By Dr. T. Sugirtha IIIT Tiruchirappalli https://nptel.ac.in/courses/111105035
2. Learn C Programming https://www.programiz.com/c-programming
3. C Programming Tutorials https://www.tutorialspoint.com/cprogramming/index.htm
4. C Programming Language https://www.geeksforgeeks.org/c-programming-language/

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Annasaheb Dange College of Engineering and Technology
Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Department of Robotics and Artificial Intelligence Engineering

Established: 1999

Course Information:

Class, Semester	F.Y. B. Tech – Semester I					**Category**	**ES**
Course Code, Course Title	0RAES112 - Design Thinking Lab					**Type**	**L2**
Prerequisites							
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	-	2	1		1	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		--	--	--		50	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Explain** the principles and process of Design Thinking and its application in problem-solving.
CO2	**Identify** and define real-world problems using user-centric observation and empathy techniques.
CO3	**Conduct** user research through surveys, interviews, and persona building to derive user needs and insights.
CO4	**Apply** ideation techniques to generate innovative and feasible solutions for identified problems.
CO5	**Develop** and present prototypes and communicate their solutions effectively using charts, posters, and model presentations.

Syllabus:

Module	Contents
I	Introduction to Design Thinking, Design Thinking Process
II	Empathize Phase: Empathy and Ethics, User Perspective, Activities – Empathy Map, Planning, Persona building.
III	Customer Journey Mapping, Observation of stakeholders, Defining and Conceptualization of problem.
IV	Ideation, Activities – 5 Whys & 1 How, Story boarding, Brainstorming.
V	Prototype – Types, Mindsets, Tools.
VI	Testing – Scenario, Methods, Refinements & Recommendations.

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	**Introduction to Design Thinking** **Activity:** Make a group of 2-4 students. Give each group a simple, relatable problem (e.g., "Long queues at the campus canteen" or "Difficulty in finding parking on campus"). Ask them to: Empathize: Identify users and their pain points. Define: Write a clear problem statement. Ideate: Brainstorm possible solutions. Sketch: Draw their proposed solution on chart paper. Present: Each group will present their idea briefly.	CO1, CO2
2	**Identification of Problems** **Activity 1: Present case** study (in group) how companies like **Airbnb, Apple, IDEO, Netflix, Samsung, Toyota** used Design Thinking to drive innovation. **Activity 2: User Interviews** – The student or group should walk around the campus or their locality to observe and identify **at least three (per student) real-life problems** faced by users (students, faculty, staff, and community). Conduct interviews to gather qualitative insights. Steps: 1. **Observation:** Note down pain points using observation and informal interviews. 2. **Listing:** Write a list of problems identified. 3. **Shortlisting:** Apply criteria like relevance, feasibility, user impact, and	CO1, CO2

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	alignment with SDGs to shortlist **one problem** to work on for further Design Thinking phases.	
3	**Selection of Problems** **Activity:** Students will present (PPT) their selected problem, why they chose it, who the users are, and the evidence collected.	CO1, CO2
4	**Designing of Empathy Map** **Activity: Prepare Empathy Map –** Visualize what users say, do, think, and feel.	CO1, CO3
5	**Customer Survey and Analysis** **Activity:** Students create a structured survey (MCQ, likert scale, open ended questions etc.) using google forms and prepare charts (bar, pie etc) and do the analysis.	CO1, CO3
6	**Persona Building** **Activity:** Based on findings from **Observations and interviews, Customer Survey and Analysis** from previous experiments, identify pattern i.e. common characteristics, behaviors, needs, pain points, and goals among users and create persona template.	CO1, CO3
7	**Customer Journey Map** **Activity:** Select the persona created in the previous experiment, define the Scenario, List Stages/Phases of the Journey, Map User Actions, Identify User Emotions, Identify Touchpoints, Identify Pain Points and opportunities for Improvement.	CO1, CO3
8	**Defining the problem** **Activities:** • **Observation of Stakeholders –** Note behaviors and pain points. • **5 Whys Method (Drill Down)** – Uncover root causes behind a problem. • **Root Cause Mapping** – Visual diagram connecting symptoms to core issues. **Refine Problem Statement** – Create a focused, actionable problem definition.	CO1, CO3
9	**Poster Presentation** **Activity:** Use A2/A1 sheet and draw charts, diagrams, sketches, and minimal text to represent experiment no 1-8.	CO1, CO2, CO3
10	**Ideation** **Activities:** • **SCAMPER Model** – Modify existing ideas by Substituting, Combining, Adapting, etc. • **Brainstorming (Crazy 8 Method) –** Rapid sketching of 8 ideas in 8 minutes. • **Mind Mapping** – Visually connect ideas around a central problem/theme. Use the suitable and best one activity from above.	CO1, CO4
11	**Prototype Building** **Activities:** • **Storyboarding –** Sketch out user scenarios and interactions. • **Prototyping** – Build a working model or prototype or model.	CO1, CO5
12	**Testing** **Activities:** • **Scenario-Based Testing –** Test ideas in realistic user scenarios. **Peer Testing –** Get feedback from other participants or teams.	CO1, CO5
13	**Refinement & Recommendation** **Activities:** • **Final Presentation** – Showcase prototype or working model. • **Documentation of Learnings** – Reflect on the process, improvements, and impact (Make a report). Apply for IPR/Incubation/Research Grant/Paper Publication.	CO1, CO5
Total Practical Sessions	**15**	**Total Practical Hours** **30**

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Text Books
1. E Balaguruswamy, Developing Thinking Skills (The way to Success), First Edition, Khanna Book Publishing Company, 2023
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, First Edition, Harvard Business Review, 2008
3. R T Krishnan & V Dabholkar, 8 steps to Innovation, First Edition, Collins Publishing, 2013
References:
1. Nigel Cross, Design Thinking, First Edition, Bloomsbury, 2011
2. Idris Mootee, Design Thinking for Strategic Innovation, First Edition, Wiley, 2013
Online Learning Resources
1. NPTEL_Design Thinking - A Primer https://youtu.be/AamBSYPJlcA?si=wJDNT4L9q1NB-6T9
2. Design Thinking and Innovation https://www.coursera.org/learn/designthinkingandinnovation

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Annasaheb Dange College of Engg. & Tech. Ashta Dept. of CSE (IOT & CSBT)

Established: 1999	**Annasaheb Dange College of Engineering and Technology** **Ashta - 416301, Dist. : Sangli, Maharashtra** **(An Empowered Autonomous Institute)**	NDCET

Course Information:

Class, Semester	FY. B. Tech, Semester – I / II						**Category**	**HS**	
Course Code, Course Title	0RAIKS113, Indian Knowledge System						**Type**	**L2**	
Prerequisites	-								
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self-Study**	**Credits**				
	2	-	-	-	2				
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**		**CIA**	**ESE**	
		-	50	-	-		-	-	

Course Outcomes (COs): Upon successful completion of this course, the student will be able to:

CO1	**Explain** the historical context and evolution of the Indian Knowledge System (IKS) and its relevance to modern engineering.
CO2	**Analyze** ancient Indian mathematical, astronomical, and technological methodologies and compare them with contemporary engineering practices.
CO3	**Apply** concepts from Ayurveda and ancient biological sciences to modern problem-solving in healthcare and related fields.
CO4	**Evaluate** traditional Indian architecture, materials, and construction principles as early forms of sustainable engineering design.
CO5	**Integrate** philosophical and scientific logic from Indian thought into ethical decision-making and sustainable engineering practices.

Syllabus:

Module	Contents	Lecture Hours
I	**Introduction & Historical Context** 1. Overview of the Indian Knowledge System: Philosophy and Scope 2. Historical timelines and key epochs 3. Geographical and cultural influences on ancient Indian science 4. Interdisciplinary approaches in ancient India. 5. Comparative analysis with other ancient civilizations	5
II	**Mathematics & Astronomy in Ancient India** 1. Foundations of Vedic Mathematics and its modern applications 2. Concepts of zero, decimal system, and number theory 3. Astronomical instruments and observational techniques 4. Calendrical systems and time measurement in ancient India 5. Engineering parallels in algorithmic design and computational thinking	5
III	**Ayurveda and Life Sciences** 1. Introduction to Ayurveda: Philosophy, doctrines, and methodologies 2. Medicinal systems and their chemical/pharmacological principles 3. Human physiology and surgical techniques in ancient texts (e.g., Sushruta Samhita) 4. Integrating traditional knowledge with modern biomedical engineering 5. Innovations in material sciences: Natural polymers and biocompatible materials	5
IV	**Architectural Knowledge & Engineering Innovations** 1. Ancient Indian architecture: Principles, materials, and techniques 2. Urban planning and infrastructure in historical Indian kingdoms 3. Structural innovations: Temples, forts, and water management systems 4. Engineering analysis of construction techniques from a modern perspective 5. Case studies: Earthquake-resistant designs in ancient constructions	5

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V	**Philosophy, Science & Ethics** 1. Indian philosophical schools and their perspectives on science 2. The concept of Rta (cosmic order) and its engineering analogies 3. Early scientific inquiry and epistemology in classical texts 4. Ethics, sustainability, and social responsibility in engineering 5. Integration of moral values and technical rigor in project design	5
VI	**Contemporary Relevance & Innovation** 1. Bridging ancient wisdom with modern technology 2. Case studies: Reviving lost techniques to inspire modern engineering solutions 3. Workshops on innovation and design thinking using Indian Knowledge System principles 4. Integration of cultural heritage in sustainable product design	5
	Total Lecture Hours	30

Text Books

1. Indian Knowledge Systems: An Introduction by Dr. Vivek Ramaswamy, Oxford University Press,2nd, 2005.
2. Traditions of Indian Science: A Textbook by Dr. Shyam R. Jha, Cambridge University Press, 1st, 2010.
3. Contemporary Perspectives on Ancient Indian Wisdom by Dr. Arvind Sharma, Routledge, 1st, 2013.
4. Foundations of the Indian Knowledge System by Dr. Meera Nair, Sage Publications, 3rd, 2015.
5. Indian Thought and Science: Bridging the Past and Present by Dr. Ram Prasad, Springer, 2nd, 2008.

References:

1. Encyclopedia of Indian Intellectual Heritage by Dr. Anil Kumar, Oxford University Press, 1st, 2012.
2. Indian Philosophy and Science: A Reference Guide by Dr. Lalit Singh, Cambridge University Press, 2nd, 2014.
3. The Vedic and Post-Vedic Traditions: A Reference Book by Dr. Pradeep Kumar, Routledge, 1st, 2003.
4. Handbook of Indian Knowledge Systems by Dr. Sunita Reddy, Sage Publications, 1st, 2016.
5. Traditional Indian Sciences: An Annotated Bibliography by Dr. Kavita Menon, Springer, 1st, 2020.

Online Learning Resources

1. https:// https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

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Established: 1999

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(An Empowered Autonomous Institute)
Department of Robotics and Artificial Intelligence Engineering

Course Information:

Class, Semester	F.Y. B.Tech, Semester - II					**Category**	**BS**
Course Code, Course Title	0RAPC114, Material Science and Smart Material					**Type**	**T1**
Prerequisites	-						
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	3	1	-	1		4	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		40	20	40		--	--

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Explain** Classification of Various Materials according to their Properties.
CO2	**Classify** ferrous and Non- ferrous material in Engineering applications using their Compositions and Properties.
CO3	**Suggest** Composite Material for a given Engineering application.
CO4	**Suggest** Surface Material for a given Engineering application.
CO5	**Understand** the properties, working principles, and applications of various smart materials engineering systems.

Syllabus:

Module	Contents	Lecture Hours
I	**Engg. Material & Their Properties:-** Introduction to Metallic and Non-metallic materials and its classification (metals/alloys), Crystal, Crystal Defects, Cooling curves, Gibbs phase rule, Construction of equilibrium diagrams from cooling curves, Lever arm principles. Ferrous Alloys and Non-Ferrous Alloys: Application, composition Stainless steels- different types of Soldering, Brazing, riveted and bolted joints	8
II	**Alloy Material & Their Applications** Detailed compositions, Properties and Applications for alloys. Fe- Fe3C equilibrium diagram, Ferrous alloys- Carbon steels, cast iron, Alloy steels -Free cutting steels, HSLA high carbon low alloy steels, maraging steels.	7
III	**Composite material** Introduction to Composite Materials: - Definition, Need for Composites, Advantages, Disadvantages, Applications, Classification of Composites, Constituent Materials, Properties of Composites, Manufacturing Processes, Application.	6
IV	**Surface Material** Polymer & Fiber Reinforced Plastics Surface coating Materials-Metal spraying, Surface coating Techniques-Electroplating, Vapor deposition coating, Powder coating. Engineering ceramics and Refractory materials -Physical and mechanical properties of engineering ceramics, Aluminous cements, castable materials, applications of ceramics and refractory materials. Magnetic materials and Properties-Alnico alloys, Ferrite and care earth alloys, Neodymium iron boron as magnetic material. Process of magnet manufacturing.	9
V	**Polymers and fiber reinforced plastics** Type of plastics and their properties and applications. Polymers as bearing rajerial, Polymers and fiber reinforced plastics(FRP), manufacturing of FRP. Properties and applications of FRPRubbers-Types, properties and applications. Metallic foams-properties and applications	7

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VI	**Smart Materials –** Electro-rheological fluids, Magneto-theological fluids and their properties, Piezo electrical materials and its properties, Shape memory alloys and properties, Electric Insulation material, properties, applications Sound absorbing materials, properties, applications Radiation preventive material, properties, applications Packing materials, properties, applications Nano materials, properties, applications	8
	Total Lecture Hours	**45**

Text Books

1 Material Science and metallurgy for engineers V.D. Kodgire. Everest Publication Pune 12th 2009

2 Introduction to physical metallurgy S.H.Avner McGraw Hill Book Company Inc Second 1988

3 Engineering Metallurgy Part-I R. A. Higgins ELBS with Edward Arnold Sixth 1994

4 Material Science and Engineering V Raghwan Prentice Hall of India Pvt. Ltd., New Delhi Third 1995

References:

1. Material science and Engineering Ralls, Courtney and Wulff Wiley India Pvt. Ltd Second 2011 Thermal Engineering P. L. Ballaney Khanna Publication 22nd 2000
2. Smart materials and structures M.V.Gandhi and B.S.Thompson Chapman &Hall first 1992

Online Learning Resources

1. NPTEL Course on IIT Kanpur's Materials Science and Engineering by Prof. H.K. Dass. https://nptel.ac.in/courses/113104073

Experiments that may be performed through virtual labs:

S. No	Experiment Name	Experiments Links
1.	Smart Materials & Structures Lab	BITS Pilani

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Course Information:

Class, Semester	FY. B.Tech, Semester – I/ II					**Category**	**BS**
Course Code, Course Title	3BSCC121, Introduction to Yoga and Mindfulness					**Type**	**L2**
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	-	2	-		1	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Describe** the significance and practical applications of yoga for holistic well-being under guided classroom sessions, ensuring coverage of physical, mental, and spiritual aspects.
CO2	**Explain** the role of subtle energy systems (chakras, nadis) in health enhancement using yogic practices, showing linkage to at least two health benefits.
CO3	**Compare** different paths of yoga (Bhakti, Jnana, Karma, Raja) through readings and discussions, citing at least one key practice and outcome for each..
CO4	**Demonstrate** the Eight Limbs of Yoga in practical sessions, reflecting personal integration of at least four limbs in daily habits or behavior.
CO5	**Apply** yoga and mindfulness techniques in real-life stress situations to improve emotional resilience, showing measurable improvement in two or more psycho-somatic areas.

Practice Session

No	Contents	CO Mapped
1	**Introduction to Yoga Practice and Warming Up Exercises** Overview of yoga philosophy and benefits. Practice basic stretching and warm-up routines. Introduction to breath awareness and mindfulness.	CO1, CO5
2	**Omkar ,Prathana and types of Asanas , Surya Namaskar.** Practice of Chant Omkar and opening prayer for mental centering. Perform Surya Namaskar and learn its 10-step sequence. Explore basic asana types: standing, sitting, supine.	CO1,CO4
3	**Sleeping position Asanas** Practice of Setubandhasana, Pavanmuktasanan, ChakraasaSetuBandhasana, Understand the effects on back, digestion, and spine.	CO1, CO2
4	**Opposite sleeping position** Practice of Bhujangasana, shalbasanan, Dhanurashan, Makrasanan Focus on strengthening the back and improving posture.	CO1, CO2
5	**Seating Position** Practice of Padmaasna , Vajrasana , Gaumukhasan , Vakrasana Learn their benefits for digestion and meditation readiness.	CO1, CO4
6	**Standing Position** Practice of Tadasana ,Vruksasana, Trikonaasan , Virasana. Emphasize balance, posture, and muscular endurance.	CO1, CO4
7	**Meditation** Guided practice of breath-based (Anapan) and insight (Vipassana) meditation. Focus on observation without judgment.	CO4, CO5
8	**Mantra meditation** Practice chanting and internal repetition of mantras. Use traditional mantras for focus and mental calm.	CO4, CO5
9	**Yognidra** Perform deep relaxation technique (guided Yoga Nidra). Experience body awareness and mental stillness.	CO4, CO5
10	**Pranayam 1** Practice AnulomVilom (alternate nostril), Bhramari (humming bee), and Sheetali (cooling breath).Focus on breath control and emotional regulation.	CO2, CO5
11	**Pranayam 2**	CO2, CO5

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	Practice Sitkari and Kapalbhati. Learn their effects on metabolism, energy, and clarity.	
12	**Tratak** Perform Tratak (candle gazing) for concentration. Understand through demonstration or video.	**CO4, CO5**

Total Practical Sessions	**15**	**Total Practical Hours**	**30**

Text Books

1. YogJeevan . Dr. ChakoteRiya1st Editon2016
2. YogParchichayaMandlikGurujiNashik MandlikGurujiSecond Edition 2020

References:

1. Yoga for Modern Age Vethathiri Edition 16th 2023
2. Maharishi, Simplified Physical ExercisesVethathiri Edition I 2014

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Established: 1999

Course Information:

Class, Semester	FY. B. Tech, Semester – I / II					**Category**	**BS**
Course Code, Course Title	3BSCC122, Physical Fitness and Lifestyle Management					**Type**	**L2**
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	-	2	-		1	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Explain the fundamentals of physical education and its role in developing holistic well-being.
CO2	Demonstrate appropriate fitness practices and techniques to improve cardiovascular endurance, strength, and flexibility.
CO3	Apply principles of wellness, including nutrition, sleep, and stress management, to maintain a healthy lifestyle.
CO4	Integrate yoga, mindfulness, and relaxation techniques to promote mental well-being and emotional balance.
CO5	Design a personalized lifestyle management plan based on fitness assessment, health goals, and behavior change strategies.

Practice Session

No	Contents	CO Mapped
1	**Introduction to Physical Education** Understand the meaning and objectives of physical education. Learn its role in promoting health, fitness, and overall well-being. Explore career options and importance in daily life.	CO1
2	**General Warm up** Practice dynamic warm-up routines before workouts. Increase heart rate and blood circulation to muscles. Prevent injuries and improve workout performance.	CO2
3	**Limbering down exercises. Free hand exercises, Cooling down exercises** Perform safe cool-down techniques post activity. Reduce muscle soreness and stiffness. Bring heart rate back to normal gradually.	CO2
4	**Stretching exercises / Flexibility exercises** Improve range of motion in joints. Reduce muscle tension and prevent injuries. Learn static and dynamic stretching methods.	CO2
5	**Fitness Evaluation** 1 mile run and walk, Push ups , seat ups ,Seat and reach and BMI . Assess personal fitness using 1-mile run, push-ups, sit-ups, etc.Calculate BMI to understand body composition.Set personalized fitness goals based on results.	CO5
6	**Aerobic activities** Perform rhythmic activities to improve cardiovascular health.Engage in exercises like jogging, skipping, or dance aerobics.Enhance lung capacity and endurance.	CO2
7	**Sports and games** (, Cricket, Volleyball , basketball, Kho-Kho , Kabaddi, Athletics) Play team games like Cricket, Volleyball, Kabaddi, etc.Develop teamwork, coordination, and sportsmanship. Improve motor skills and physical agility.	CO2
8	**Sports and games(Badminton, Table Tennis, Chess)** Participate in games like Table Tennis, Badminton, Chess. Improve reflexes, concentration, and decision-making. Promote mental sharpness and social interaction.	CO4
9	**Circuit Training, Strength Activities** Perform multiple exercises in a sequence (circuit). Focus on building muscular strength and stamina. Use minimal equipment for maximum benefit.	CO2
10	**Agility and Coordinative activities** Practice quick movement drills to improve reflexes. Enhance body coordination and balance. Develop speed and reaction time.	CO2
11	**Body weight exercises** Do exercises like push-ups, squats, lunges, and planks. Improve strength using your own body resistance. No need for gym equipment.	CO2
12	**Functional training**	CO3

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	Mimic real-life movement patterns (bending, lifting, reaching). Improve daily functional strength and flexibility. Prevent posture-related problems.		
Total Practical Sessions	**15**	**Total Practical Hours**	**30**

Text
Test, Measurement and Evaluation in Sports and Physical Education*. 5th ed., Friends Publications, 2023.
Rules of Games and Sports Updated version, Khel Shaitya Kendra, 2023.
References:
1 Beashel, Paul, and John Taylor. *Physical Education: Essential Issues.* Hodder Stoughton, 1997.
2 Sodhi, H. S., and S. K. Sidhu. *Physique and Selection of Sportsmen.* Punjab Publishing House, 1984.

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Common for All Branches

Course Information:

Class, Semester	FY. B. Tech, Semester – I / II					**Category**	**BS**
Course Code, Course Title	3BSCC123, Six Sigma Happiness and Mind Mechanics					**Type**	**L2**
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	-	2	-		1	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	Analyze personal life patterns and decision-making processes using visual tools like life maps and time audits to improve self-awareness and productivity.
CO2	Identify and modify recurring behavioral or emotional challenges using root cause analysis and habit-tracking techniques
CO3	Apply reflective and psychological tools such as the Gratitude Journal, PERMA Wheel, and mindfulness meditation to enhance emotional well-being.
CO4	Utilize creative thinking and visualization techniques such as mind mapping, personal development canvas, and flow activities to enhance planning and motivation.
CO5	Formulate and monitor measurable personal goals using SMART criteria and Six Sigma strategies to construct a structured self-improvement and lifestyle plan.

Practice Session

No	Contents	CO Mapped
1	**Life Process Mapping** Understand personal daily patterns. Identify meaningful and unproductive activities. Improve decision-making awareness. Build a visual blueprint of life routines.	CO1
2	**Time Audit Diary** Track hourly usage of time. Identify time-wasters and focus zones. Increase productivity through reflection. Learn prioritization techniques.	CO1,CO2
3	**Root Cause Analysis** Find root causes behind repeated problems. Use cause-effect diagrams (Fishbone). Develop problem-solving skills. Prevent recurring emotional or behavioral setbacks.	CO1
4	**Habit Tracker Creation** Monitor progress of personal habits. Encourage accountability and consistency. Recognize triggers and patterns. Reinforce good habits using visual tools.	CO3
5	**Control Chart for Habits** Apply Six Sigma's statistical approach to habits. Track habit frequency over time. Identify variation in behavior patterns Improve self-control and discipline.	CO3
6	**Gratitude Journal** Practice daily reflection on positive moments. Enhance emotional well-being. Reduce stress and negativity. Cultivate a habit of appreciation.	CO4
7	**PERMA Wheel Self-Assessment.** Evaluate happiness using 5 key pillars (Positive emotion, Engagement, Relationships, Meaning, Achievement). Identify strengths and gaps in life satisfaction. Build awareness of emotional and social well-being. Create a personalized improvement plan.	CO4
8	**Flow Activity Practice** Engage in high-focus enjoyable activity. Understand the "flow" mental state. Boost intrinsic motivation. Reduce distractions and increase creativity.	CO4
9	**Mind Mapping the Brain** Visually organize thoughts and plans. Stimulate right and left brain together. Enhance memory, planning, and clarity. Strengthen problem-solving and goal-setting.	CO1,CO5
10	**Guided Mindfulness Meditation** Practice breath work and awareness techniques. Reduce anxiety and mental fatigue. Increase present-moment awareness. Build emotional balance.	CO4

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11	**Personal Development Canvas** Create a visual profile of strengths, values, and aspirations. Encourage strategic self-improvement. Connect life areas (career, personal, social). Track personal growth visually.	CO5
12	**SMART Goal Setting + Six Sigma** Define Specific, Measurable, Achievable, Relevant, Time-bound goals. Integrate Six Sigma process for goal monitoring. Improve consistency in self-development. Align actions with purpose and metrics.	CO5

Total Practical Sessions	**15**	**Total Practical Hours**	**30**

References:

1 S. Radhakrishnan, An Idealist View Of Life, 2015, HarperCollins.
2. Yogi Kochhar, Six Sigma Happiness (English Edition).
3 An idealist way of Life – S Radhakrishnan

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Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)
Common for All Branches

Established: 1999

Course Information:

Class, Semester	FY. B.Tech, Semester – I / II					**Category**	**BS**
Course Code, Course Title	3BSCC124, Creativity through Visual Arts					**Type**	**L2**
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**	**Credits**		
	-	-	2	-	1		
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Identify** and apply the elements of art—line, shape, color, texture, and space—through various drawing and painting techniques.
CO2	**Demonstrate** creativity and technical skills in using different mediums such as pastels, pen & ink, and water-based paints.
CO3	**Create** original prints using simplified printmaking techniques such as relief, intaglio, and monoprint methods.
CO4	**Design** visually appealing digital artwork such as posters, icons, and layouts using basic digital tools.
CO5	**Analyze** and reflect on personal artwork and peer creations to improve visual communication and aesthetic understanding.

Practice Session

No	Contents	CO Mapped
1	**Fundamentals of Visual arts** Introduction to elements of art: line, shape, colour, texture, space. Practice drawing with pencil and charcoal using simple objects and shapes. Explore light and shade for 3D effects.	CO1
2	**Basic Graphic Design** Learn principles of alignment, contrast, hierarchy, and balance. Create a basic visual composition using text and image elements. Use sketching or digital tools for layout planning.	CO2
3	**Typography & Font Design** Study of typefaces: serif, sans-serif, script, decorative. Draw custom fonts and stylized letters. Create a short phrase using hand-drawn typography.	CO2
4	**Logo Design** Understand logo types: symbolic, text-based, combination marks. Design a logo for a fictional company or cultural event. Focus on clarity, colour choice, and relevance.	CO4
5	**Poster Design** Choose a theme: social message, event, awareness, culture. Develop layout and imagery using water colour, pen & ink, or digital tools. Apply principles of visual hierarchy and focal point.	CO4
6	**Photography Task: Lines & Angles** Capture photographs focusing on geometric lines, angles, and symmetry. Submit 3–5 original photographs with a short description of each. Discuss visual impact and framing.	CO1, CO5
7	**Digital Infographic Design** Choose a topic (e.g., Indian innovations, clean energy, internet safety). Create a digital infographic using free tools like Canva or PowerPoint. Combine icons, minimal text, and visuals to communicate clearly.	CO4
8	**Visual Metaphor Drawing** Select a concept (e.g., freedom, growth, technology) and represent it visually. Use drawing techniques to convey metaphor without text. Encourage creativity and symbolic thinking.	CO3,CO5
9	**Calligraphic strokes of Devnagari** Practice traditional and artistic Devanagari calligraphy. Use ink pens or brush pens to form characters. Create a short meaningful phrase in decorative calligraphy.	CO2
10	**Collage on Innovation in India** Use newspapers, magazines, or printed material. Prepare a collage on topics like ISRO, start-ups, or digital India. Emphasize arrangement, contrast, and theme clarity.	CO3,CO5
11	**Modern Arts** Introduction and fundamental of modern art, Study abstract and modern Indian Artists Create an abstract or modern art piece using acrylics, pastels, or digital tools. Focus on expression	CO3,CO5

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	and experimentation.	
12	**Geometric Pattern Design** Create a detailed design using compass, ruler, or digital drawing. Highlight symmetry, color, and repetition	**CO1,CO2**

Total Practical Sessions	**15**	**Total Practical Hours**	**30**

References:

1. *The New Drawing on the Right Side of the Brain.* TarcherPerigee, 2012.
2. *Digital Illustration: A Master Class in Creative Image-making.* Rotovision, 2010.
3. *A History of Indian Painting: The Modern Period.* Abhinav Publications, 1994.
4. *Basics of Visual Art.* New Academic Publishing, 2015.

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Course Information:

Class, Semester	FY. B. Tech, Semester – I / II					**Category**	**BS**
Course Code, Course Title	3BSCC125, Community Engagement through NSS					**Type**	**L2**
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	-	2	-		1	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Identify** the structure and needs of the local community through direct engagement and observation.
CO2	**Analyze** community issues and participate in collaborative problem-solving activities.
CO3	**Demonstrate** social and civic responsibility by applying engineering knowledge in real-world social contexts.
CO4	**Develop** teamwork, leadership, and democratic values through community mobilization and shared responsibility.
CO5	**Respond effectively** to emergencies and promote national integration, unity, and social harmony through participation in relevant campaigns and awareness programs.

Practice Session

No	Contents	CO Mapped
1	**Cleanliness Drive (Swachh Bharat Abhiyan)** Conduct campus and neighbourhood cleaning. Raise awareness about hygiene and waste segregation.	CO1,CO2,CO3
2	**Tree Plantation** Plant saplings in college or public areas. Educate the community on environmental benefits.	CO1, CO3
3	**Road Safety Campaign** Conduct rallies, skits, or poster campaigns. Spread awareness about traffic rules and safe driving.	CO2, CO3,CO5
4	**Health Check-up Camp** Organize basic health screening with medical professionals. Promote hygiene, nutrition, and disease prevention.	CO1, CO2,5
5	**Literacy Drive** Teach basic reading and writing to underprivileged children or adults. Distribute learning materials and encourage regular attendance.	CO1, CO3, CO5
6	**Voter Awareness Campaign (SVEEP)** Inform citizens about voter rights and the election process. Promote ethical voting through posters and street plays.	CO2, CO3, CO5
7	**Plastic-Free Campus Initiative** Educate peers on the harmful effects of plastic. Conduct collection drives and promote reusable alternatives.	CO2, CO3
8	**Cultural and Heritage Promotion** Organize folk art, dance, and storytelling sessions. Engage the community in preserving local culture.	CO3, CO5
9	**Yoga and Wellness Sessions** Conduct yoga and mindfulness sessions for students and locals. Promote physical and mental health through regular practice.	CO3,CO4
10	**Self-Defence Training for Girls** Organize practical training on basic self-defence techniques. Empower girls with safety awareness and confidence.	CO4, CO5
11	**Social Contribution Orphanage/ Old age home visit** Hold discussions or exhibitions on gender, caste, and social equality. Encourage inclusive behavior and respect for diversity.	CO3, CO4, CO5
12	**Digital Literacy Program** Teach basic smartphone and internet use to the elderly or untrained groups. Promote safe and productive use of digital tools	CO2, CO3, CO5

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Total Practical Sessions	**15**	**Total Practical Hours**	**30**

References:

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.

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Established: 1999

Course Information:

Class, Semester	FY. B. Tech, Semester – I / II					**Category**	**BS**
Course Code, Course Title	3BSCC126, Cultural Exploration & Heritage					**Type**	**L2**
Teaching Scheme (per week)	**Lecture**	**Tutorial**	**Practical**	**Self Study**		**Credits**	
	-	-	2	-		1	
Examination Scheme (Marks)	**Theory**	**MSE**	**TA**	**ESE**	**Practical**	**CIA**	**ESE**
		-	-	-		50	-

Course Outcomes (COs) :
Upon successful completion of this course, the student will be able to:

CO1	**Identify** and describe key elements of cultural heritage including tangible, intangible, and natural heritage with real-life examples.
CO2	**Demonstrate** understanding of regional and national cultural practices through participation in experiential activities.
CO3	**Analyze** the significance of preserving cultural heritage in the context of globalization and modernization.
CO4	**Collaborate** in group projects to creatively document and present cultural themes using various mediums.
CO5	**Reflect** critically on personal and collective cultural identities through journals, discussions, and presentations.

Practice Session

No	Contents	CO Mapped
1	**Introduction to Cultural Exploration and Heritage** Understand the meaning of tangible, intangible, and natural heritage, Discuss real-life examples of cultural elements. Reflect on how culture shapes identity.	CO1,CO5
2	**Heritage Mapping/ Case Study on a Heritage Site** Choose a local region or community. Identify and locate key cultural sites (temples, festivals, crafts). Create a visual or digital heritage map. Present findings in written or visual format	CO1,CO3,CO4
3	**Vaidik Tal Vadya Songs and Music tradition** Introduction to Vedic Music, Demonstration of Vaidik Tal Vadya, Listening Session of Vedic Chants & Samagana, Group Singing of a Vedic Verse or Traditional Bhajan	CO2, CO5
4	**Folk Dance** Watch or participate in folk dance. Discuss the significance, costumes, and music of each. Compare cultural roots and evolution.	CO2, CO4
5	**Traditional Music** Dholki ,Tabala, Dhol ,Lezim Listen to selected regional or classical music samples. Identify the instruments, lyrics, and cultural setting.	CO2, CO4
6	**Traditional Instrumental** Taal, Tritaal, Tabala Observe or perform simple rhythms or melodies. Explore the cultural and ceremonial use of instruments.	CO1, CO2
7	**Singing** Types of singing, Vocal Singing Introduction to music fundamentals	CO2, CO4
8	**Drama** Introduction, Types, Information about acting, Stage information , Present / performance on stage	CO4, CO5
9	**Classical dance, Western dance** Introduction to classical, and western dance demonstrations. Different types	CO2, CO4
10	**Karaoke Singing** Introduction, Types, Basic music information	CO2, CO4
11	**Short film** Prepare short film , Present / performance on stage , Topic concern with Indian Cultural heritage	CO3, CO4, CO5
12	**Final Showcase** Present all your work in a class exhibition. Explain the cultural significance of each project. Receive peer and teacher feedback.	CO4, CO5

Total Practical Sessions	12	**Total Practical Hours**	15

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Text Books
1. Nrutasaurabha ManjiriShriramDev XII 2015 2. Indian Art and Culture , NitinSinghania McGraw Hill Education IV 2022 3. The Wonder That Was India Picador India Second2004 4. The National Culture of India National Book Trust (NBT), India Second2016
References:
1. Bhattacharyya, Haridas, editor. *The Cultural Heritage of India*. The Ramakrishna Mission Institute of Culture, multiple volumes, revised ed. 2. Singhania, Nitin. *Indian Art and Culture*. 4th ed., McGraw Hill Education, 2022. 3. Basham, A. L. *The Wonder That Was India*. Picador India, 2004. 4. Jokilehto, Jukka. *A History of Architectural Conservation*. 2nd ed., Routledge, 2017.

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