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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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

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

Estd : 1986

IV Semester
Scheme & Syllabus of B.E. Programme
Civil Engineering
(2025 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

||jai sri gurudev||
Sri Adichunchanagiri Shikshana Trust (R.)
SJC INSTITUTE OF TECHNOLOGY
(An Autonomus Institute Under VTU Belagavi & Approved by AICTE, New Delhi)
Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF (151-300), QS-I Gauge GOLD Rated
Estd.:1986
Post Box #20, B.B. Road, Chikkaballapur - 562 101, Karnataka

B.E. in Civil Engineering

Scheme of Teaching and Examinations 2025

Outcome-Based Education (OBE) and Choice-Based Credit System(CBCS)(Effective from the academic year 2025-26)

IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board(PSB)	Teaching and Learning Scheme					Examination				Credits
					CI		LI	TW & SL	Total Hours	Duration in hours	CIE Marks	SEE Marks	Total	
					L	T	P	SL						
1	PCC	1BCV401	Concrete Technology	CIVIL	42	0	0	48	90	3	50	50	100	3
2	IPCC	1BCV402	Fluid Mechanics and Hydraulic Machines	CIVIL	42	0	28	50	120	3	50	50	100	4
3	PCC	1BCV403	Transportation Engineering - I	CIVIL	42	28	0	50	120	3	50	50	100	4
4	IPCC	1BCV404	Structural Analysis	CIVIL	42	0	28	50	120	3	50	50	100	4
5	PCCL	1BCVL405	Survey Practice	CIVIL	0	0	28	02	30	3	50	50	100	1
6	AEC	1BCVL406x	Ability Enhancement Course Laboratory**	CIVIL	0	0	28	02	30	2	50	50	100	1
7	BSC	1BBN407	Biology for Engineers(ME and CV Streams)	Chemistry/Biology	14	0	0	16	30	2	50	50	100	1
8	SDC	1BEP408	Environmental Science Project	CIVIL	0	0	0	30	30	2	50	50	100	1
9	HSSM	1BMP409	Metaphysical Science	CIVIL	14	0	0	16	30	2	50	50	100	1

10	NCMC	1BNS410	National Service Scheme	Campus	NSS Coordinator	0	0	0	28	28	--	100	---	100	PP
		1BPE410	Physical Education		Physical Education Director									
		1BYO410	Yoga		Yoga Teacher									
		1BMU410	Music		Music Teacher									
		1BNC410	National Cadet Corps - II		NCC coordinator									
11	NCMC	1BCE411	Competency Enhancement Course-2	CDCAC		14	0	0	14	28	--	100	---	100	PP
12	NCMC	1BMATDIP412	Additional Mathematics - II	Maths Dept.		14	0	0	14	28	--	100	---	100	PP
Total												**750**	**450**	**1200**	**20**

Ability Enhancement Course(Laboratory)1BCVL406x			
1BCVL406A	Water Distribution System Modelling Lab	**1BCVL406C**	3D Modelling and Rendering Lab
1BCVL406B	Construction Skill Lab	**1BCVL406D**	BIM – Mechanical, Electrical and Plumbing Lab

Semester: IV						
Concrete Technology **Stream: CV**						
Course Code	**:**	1BCV401		**Credits**	**:**	3
Hours/Semester (L:T:P:SL)	**:**	42:0:0:48		**CIE**	**:**	50 Marks
Total Hours	**:**	90		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Building Materials and Construction Technology
Knowledge on Fundamental Concepts	Concrete Behaviour and Sustainability
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explore the fundamental properties of concrete materials, their behaviour, and standard testing methods.
CLO2	Design concrete mixes and evaluate advanced materials with the support of modern optimization techniques.
CLO3	Assess sustainable practices, durability aspects, and testing methods for long-lasting concrete.
CLO4	Apply effective construction practices and quality control measures in concrete works.
CLO5	Explore emerging technologies and AI-based solutions in concrete engineering.

Module – 1	**08 Hrs**
Fundamentals of Concrete Materials and Behaviour: Cement, Heat of Hydration and Its Control, Aggregates and Grading, W/C Ratio, Admixtures, Workability and Rheology of Fresh Concrete, Microstructure of Hardened Concrete, Strength Development and Maturity Concept, Elasticity, Creep and Shrinkage of Concrete. Microstructure of Hardened Concrete and Its Relation To Performance, Strength Development Including Maturity Concept, Elasticity, Creep And Shrinkage of Concrete And Linkage To Durability and Quality Control as per BIS Provisions. **Text Book 1:** Ch. 2, Ch. 3, Ch. 4, Ch. 5, Ch. 6, Ch. 7 **Text Book 2:** Ch. 1, Ch. 2, Ch. 3, Ch. 4, Ch. 5	
Module – 2	**08 Hrs**
Concrete Mix Design and Advanced Materials: Concrete Mix Design Using BIS and ACI Methods With Step By Step Procedures, Mix Proportioning For Special Concretes (SCC, High Strength), Durability-Based Mix Design Considering Exposure Conditions, Introduction to AI Based Mix Optimization Tools, Use of Supplementary Cementitious Materials (Flyash, GGBS, Silica Fumes), Fiber-Reinforced Concrete and Its Applications, High Performance and Ultra-High Performance Concrete,UHPFRC and Quality Control; Acceptance Criteria as Per BIS 10262 -2019 Provisions. **Text Book 1:** Ch. 9, Ch. 10, Ch. 11, Ch. 12 **Text Book 2:** Ch. 6, Ch. 7, Ch. 8, Ch. 9	
Module – 3	**08 Hrs**
Sustainable, Durable and Smart Concrete Technologies: Carbon Footprint and Embodied Energy of Concrete, Green Concrete and Sustainability Metrics, Use of Recycled Aggregates and Industrial By-Products, Carbon Sequestration In Concrete, Self-Healing Concretes, Service Life Prediction Models, Non-Destructive Testing (NDT) Methods, Durability Design Codes and Standards, AI-Based Predictive Maintenance Of Structures. **Text Book 1:** Ch. 13, Ch. 14, Ch. 15 **Text Book 2:** Ch. 10, Ch. 11, Ch. 12	

Module – 4	08 Hrs
Concrete Construction Practices and Quality Management: Ready-Mix Concrete (RMC), Construction Joints and Expansion Joints. Surface Finishing Techniques and Curing Compounds, Crack Identification and Control Methods, Inspection and Auditing Procedures, Retrofitting Methods (Jacketing, Grouting, FRP Wrapping), Construction Equipment and Automation Tools, Waste Management at Construction Sites. **Text Book 1:** Ch. 8, Ch. 16, Ch. 17 **Text Book 2:** Ch. 13, Ch. 14	
Module – 5	**08 Hrs**
Emerging Technologies and Digital Innovations in Concrete Engineering: Smart Sensors and Iot In Concrete Monitoring, Additive Manufacturing Materials For 3D Printing, Augmented Reality (AR) and Virtual Reality (VR) In Construction, Digital Twin Models For Concrete Structures, Robotics and Automation in Concrete Construction, Blockchain For Supply Chain Transparency in Concrete Materials, Big Data Analytics In Construction Management. Block Chain For Supply Chain Transparency and Material Traceability and Big Data Analytic For Quality Control Productivity and Decision Making in Construction Projects. **Text Book 1:** Ch. 11, Ch. 15, Ch. 17 **Text Book 2:** Ch. 9, Ch. 12	

Topics for Self-learning	
Module – 1	Explore nano materials in concrete, including nano silica, nano clay and graphene.
	Examine the role of AI in predicting concrete strength development
Module – 2	Compare BIS, ACI, and European concrete mix design methods.
	Investigate machine learning approaches for concrete mix optimization.
Module – 3	Study self-healing concrete using bacteria and encapsulated agents.
	Assess recent advancements in Non-Destructive Testing (NDT).
Module – 4	Evaluate digital quality control systems in concrete construction.
	Explore construction automation and robotic concrete placement techniques.
Module – 5	Analyze the application of Artificial Intelligence in predictive maintenance of structures.
	Examine the role of robotics in concrete construction and inspection.

Course Outcomes: After completing the course, the students will be able to	
CO1	Assess the properties and behavior of concrete materials in both fresh and hardened states.
CO2	Design concrete mixes and evaluate advanced materials using conventional and AI-based methods.
CO3	Assess sustainability aspects and durability performance of concrete using modern technologies and testing methods.
CO4	Apply appropriate construction practices and quality control techniques for durable concrete structures.
CO5	Analyze and implement emerging digital technologies and AI applications in concrete engineering.

Text Books	
1	Concrete Technology: Theory and Practice, M.S. Shetty, S. Chand Publishing; Latest Edition; ISBN: 978-9355014207.
2	Concrete Technology, A.M. Neville and J.J. Brooks, Pearson Education; 2ndEdition; ISBN: 978-0273732198.

3	Concrete Technology:R P Rethaliya,2nd edition, Charotar Publishing House Pvt. Ltd.,2018, ISBN-13:978-9385039317

Reference Books	
1	Advanced Concrete Technology, Zongjin Li, John Wiley & Sons; 2ndEdition; ISBN: 978-1119045172.
2	Properties of Concrete, A.M. Neville, Pearson Education; 5thEdition; ISBN: 978-0273755807.
3	High Performance Concrete, P.C. Aïtcin, CRC Press; 1stEdition; ISBN: 978-0419191402.
4	Concrete Permeability and Durability Performance, Roberto J. Torrent, CRC Press; 1st Edition; ISBN: 978-0367439114.

Web links and Video Lectures (e – Resources)	
1	**Concrete Technology IIT Delhi :**https://nptel.ac.in/courses/105102012
2	**The Future of Smart Infrastructure - Self-Healing Concrete – Mimicrete**: https://nptel.ac.in/courses/105106197
3	**Concrete: Material IIT Delhi: https://www.youtube.com/watch?v=uPAE2ZcFdo4**

CO – PO – PSO MAPPING

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

Semester: IV Stream: CV					
Fluid Mechanics and Hydraulic Machines					
Course Code	**:**	1BCV402	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:0:28:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Mathematics, Physics, Elements of Mechanics.
Knowledge on Fundamental Concepts	Calculus, Differential Equations, Basic Mechanics, Properties of Matter
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Apply the fundamental properties of fluids and hydrostatic laws to measure fluid pressure.
CLO2	Analyze fluid kinematics and dynamics and their applications in engineering systems.
CLO3	Apply flow measurement techniques for pipe flow design and energy loss calculations.
CLO4	Analyze the flow properties of open channels using energy principles.
CLO5	Evaluate the performance characteristics of hydraulic Turbines and Pumps in Real-World Applications.

Module – 1	**08 Hrs**
Fluids and Their Properties: Units and Dimensions- Properties of Fluids- Mass Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Vapor Pressure, Surface Tension and Capillarity. **Fluid Statics:** Basic Definition, Hydro Statics Law, Pascal's Law, Manometers and pressure gauges. Total Pressure and Center of Pressure on Vertical and Inclined Plane Surfaces. **Text Book 1:** Ch 1:1.2 -1.6, Ch 2: 2.2 - 2.7	
Module – 2	**08 Hrs**
Kinematics of Fluids: Types of Fluid Flow: Steady and Unsteady, Uniform and Non-Uniform, One, Two and Three-Dimensional Flow, Laminar and Turbulent, Compressible and Incompressible Flow, Rate of Flow, Derivation of Three-Dimensional Continuity Equation in Differential Form, Related Problems. **Dynamics of Fluid Flow:** Derivation of Euler's Equation and Bernoulli's Equation with Assumption and Limitation, Problem on Bernoulli's Equation with and Without Losses, Application of Bernoulli's Equation - Venturimeter, Orifice Meter and Pitot Tube Related Problems. **Text Book 1: Ch 5 :** 5.2 – 5.6 , Ch 6: 6.4 - 6.7	
Module – 3	**08 Hrs**
Open Channel Flow and Hydraulic Structures: Classification of open channel flow, Uniform and non-uniform flow, Hydraulic jump, Most economical channel sections, Flow measurement in open channels, Weirs and notches, Applications in irrigation and drainage systems. **Impact of Jet On Vanes:** Impact of Jet on Stationary and Moving Flat Vanes – Vertical, Inclined, Curved and Related Numerical Concept of Velocity Triangles. **Text Book 1:** Ch 16: 16.2 - 16.8, Ch 17:17.2 -17.4	
Module – 4	**08 Hrs**
Flow Through Pipes: Laminar and turbulent flow, Reynolds number and transition, Head losses in pipes, Major losses (Darcy–Weisbach equation), Minor losses, Pipes in series and parallel, Water hammer and surge tanks.	

Pumps: Classification, Centrifugal, Reciprocating Pumps, Multistage Pumps(For Tube Wells),Submersible pumps, Components, Working Principle and Efficiencies (No Derivation), Priming, Cavitation. **Text Book 1:** Ch 7: 7.12-7.15,Ch 18:18.2 -18.9
Module – 5 **08 Hrs**
Turbines: Introduction to Turbines, Classification of Turbines, Heads and Efficiencies of Turbine, Pelton Wheel & Francis Turbine Components, Working Principle and Hydraulic Efficiencies (No Derivation) and Related Simple Numerical. **Smart Hydraulic Systems and Modern Applications:** Introduction to smart water infrastructure, Sensors and IoT in hydraulic systems, SCADA systems for water networks, Smart pumps and automated valves, Hydraulic modelling and simulation tools (EPANET, SWMM). AI predicts failures of pumps, turbines, valves, and bearings before breakdown occurs. Hydro pneumatic systems **Text Book 1:** Ch 19:19.1 -19.9

Practical Component of IPCC	
	List of Experiments
1.	Verification of Bernoulli's equation.
2.	Calibration of Venturi meter.
3.	Calibration of notches and weirs (Trapezoidal, Triangular notch and ogee weir).
4.	Determination of major /minor losses in pipes.
5.	Determination of efficiency of jet on flat and curved vanes.
6.	Determination of coefficients of discharge for orifice.
7.	Determination of coefficients of discharge for mouth pieces.
8.	Determination of efficiency of centrifugal pump.
9.	Determination of efficiency of Francis turbine.
10.	Determination of efficiency of Pelton wheel.

Topics for Self - learning	
Module – 1	Examine the effects of Surface tension and capillary action in soils and groundwater movement.
	Analyze Case studies on dam failures caused by hydrostatic pressure effects.
Module – 2	Explore Flow visualization techniques using dyes and particle tracking.
	Investigate Real-world use of Bernoulli's principle in hydraulic engineering.
Module – 3	Assess the Hydraulic jump applications in spillways and energy dissipation structures.
	Study Smart irrigation systems using sensors and IoT.
Module – 4	Evaluate Water hammer incidents and mitigation measures in real pipelines.
	Examine Smart water distribution networks.
Module – 5	Explore Hydro-pneumatic water supply systems in smart buildings.
	Investigate Smart irrigation system using sensors and automated valves.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the fundamental properties of fluids and hydrostatic laws to measure fluid pressure and forces on submerged surfaces.
CO2	Analyze fluid motion using kinematic and dynamic principles.
CO3	Design pipe flow systems using flow measurement techniques considering energy losses and efficiency.
CO4	Design open channel flow systems using energy concepts and optimum geometric properties for efficient fluid transport

CO5	Analyze the working principles, classifications, and performance characteristics of hydraulic turbines and pumps in real-world applications.

Text Books	
1	Fluid Mechanics and Hydraulic Machines, Dr. R.K. Bansal, Lakshmi Publications, 9th Edition, 2017. ISBN-13. 978-8170083115
2	Hydraulics and Fluid Mechanics , P.N. Modi and S.M. Seth, Standard Book House, 20th Edition, 2017. ISBN 13 9788189401269
3	A Textbook of Fluid Mechanics and Hydraulic Machines, R. K. Rajput, S. Chand and Company Ltd. 11th Edition 2011 Reprint. ISBN: 9385401378

Reference Books	
1	Fluid Mechanics, John F. Douglas, Gasiorek&Swaffield,Prentice Hall, 6th Edition, 2011.ISBN-13: 9780273717720
2	Fluid Mechanics in SI Units, Russell C. Hibbeler, Pearson Publication 1st Edition, 2016.ISBN-13: 9781292089355
3	Open Channel Hydraulics, Vente Chow, McGraw Hill Publications, 2009.ISBN-13**:** 978-1932846188
4	Fluid Mechanics, Munson, Okiishi, Wiley Publishers 7th edition 2015.ISBN-13:978-8126553433

Web links and Video Lectures (e – Resources)	
1	**Properties of fluid:** https://www.youtube.com/watch?v=TgD3nEO1iCA
2	**Fluid Fundamental Concepts, Fluid Properties:** https://www.youtube.com/watch?v=clVwKynHpB0
3	**Fluid Kinematics:** https://www.youtube.com/watch?v=NIl2BAQSde0
4	**Flow Through Pipes:** https://www.youtube.com/watch?v=f0TRQq8k3Vc
5	**Flow in open channels:** https://www.youtube.com/watch?v=DxKJnR-Lnf4
6	**Impact of jet on vanes:** https://www.youtube.com/watch?v=7HGR_jAx7OU
7	**Hydraulic Turbines:** https://www.youtube.com/watch?v=9M4peF-_Bv8&list=PLdoIhVhbPQV7Wq_iGNvmrf-r-xYZYzRBO&index=1

CO – PO – PSO MAPPING

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

Semester: IV					
Transportation Engineering – I **Stream: CV**					
Course Code	**:**	1BCV403	**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:28:0:50	**CIE**	**:**	50 Marks
Total Hours	**:**	120	**SEE**	**:**	50 Marks
Course Type	**:**	PCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Engineering Mechanics
Knowledge on Fundamental Concepts	➢ Basic Concepts of Physics, Fundamentals of Surveying and Geometry ➢ Basic Understanding of Materials Used For Road Construction
Knowledge on Connected Tools (If any)	➢ Basic Knowledge of AutoCAD, Ms Excel and Surveying Instruments

Course Learning Objectives: This course will enable the students to	
CLO1	Outline fundamental concepts of transportation systems, road classifications, and highway planning processes.
CLO2	Illustrate principles of highway geometric design including sight distance and alignment elements.
CLO3	Describe properties of highway materials, pavement types and drainage system requirements.
CLO4	Discuss traffic characteristics, data collection methods and applications of AI in analysis.
CLO5	Summarize traffic design principles, control devices, and intersection design methods as per standards.

Module – 1	**08 Hrs**
Introduction: Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport, M R Jayakar Committee Recommendations, Road Classifications And Road Patterns, Current Road Development Programmes In India, Highway Development In India (Example Bharatmala Pariyojna), Highway Planning, Planning Surveys And Interpretation, Highway Planning In India As Per IRC Guidelines. **Highway Alignment:** Factors Affecting Highway Alignment (Terrain, Traffic, Environmental And Social Aspects), Engineering Surveys For Alignment Conventional And Modern Methods, Drawings And Reports, Highway Projects, Preparation Of Detailed Project Report Including Basic Cost Estimation, Land Acquisition Consideration And Environmental Aspects. **Text Book 1:** Ch 1: 1.1 – 1.6, Ch 2: 2.1 – 2.4, Ch 3: 3.1 – 3.5 **Text Book 2:** Ch 1: 1.2, Ch 4: 4.1 – 4.2	
Module – 2	**08 Hrs**
Highway Geometric Design: Factors affecting geometric design of roads, Cross Sectional Elements, Sight distances, Horizontal alignment - Transition curve, super elevation, Extra widening, Vertical alignment – gradients, summit and valley curves. (No derivations), Problems on Sight distance, Super elevation, extra widening of curves, Length of transition	

curve, Length of summit and valley curve.
Text Book 1: Ch 4: 4.1 – 4.6
Text Book 2: Ch 6: 6.1 – 6.8.

Module – 3	**08 Hrs**

Highway materials and pavements: Desirable properties of aggregates with reference to standard tests (with emphasis on Gradation, Abrasion and Impact with reference to IRC Guide lines- CBR, Compaction and Drainage) for pavement design, soil subgrade and Bitumen, Application of bituminous emulsion, Desirable properties of Bituminous Mixes, Introduction to Marshall Mix Design.

Pavement design: Factors Controlling design of highway pavements, Pavement types- Flexible and Rigid, Component parts of pavements and their functions; types of joints used in rigid pavement. Critical stresses in flexible and rigid pavement.

Highway drainage: Significance and requirements, Surface drainage system and Design-Examples, sub surface drainage system, Types of cross drainage structures their choice and location. *(*No Numerical on design of Longitudinal drain).

Text Book 1: Ch 6: 6.1 – 6.6, Ch 7: 7.1 – 7.6, Ch 11: 11.1 – 11.6
Text Book 2: Ch 12: 12.1 – 12.4, Ch 13: 13.1 – 13.2, Ch 14: 14.1 – 14.4

Module – 4	**08 Hrs**

Traffic Characteristics and Studies: Objectives, Scope of Traffic Engineering. Traffic Characteristics: Road user & vehicular characteristics, Reaction time of driver and PIEV theory, Traffic studies - volume, spot speed, speed and delay, parking, accident, origin & destination, objectives of studies and data collection, method of study, analysis. Statistical applications in traffic studies and traffic forecasting, Level of Service-Concept. Problems on Spot speed studies, Speed and delay studies and accident studies.

Applications of Artificial Intelligence in Traffic Data Analysis, Prediction and Traffic Management.

Text Book 1: Ch 5: 5.1 – 5.5
Text Book 2: Ch 1: 1.2 – 1.3, Ch 2: 2.1 – 2.2, Ch 3: 3.1-3.3, Ch 4: 4.2 4.6, Ch 5: 5.1 - 5.3, Ch 6: 6.1 - 6.3

Module – 5	**08 Hrs**

Traffic Design and Visual Aids: PCU concept, factors affecting PCU, Traffic signs, Intersection, Types of intersections, Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks, Traffic Furniture – Introduction, its Importance with practical case studies, Brief about Road Arboriculture, Problems on Signal design by IRC method.
Text Book 1: Ch 5: 5.6 – 5.9
Text Book 2: Ch 6: 6.10 – 6.12

Topics for Self learning	
Module – 1	**Bharatmala Pariyojana and Modern Highway Development in India:** Study of objectives, phases, economic corridors, expressways, role of NHAI and impact on national connectivity.
	Modern Techniques in Highway Alignment and DPR Preparation: Application of GIS, GPS, Drone Survey, LiDAR, Remote Sensing, Environmental Impact Assessment (EIA), and land acquisition considerations in highway projects.

Module – 2	**Road Geometric Design Standards as per IRC Guidelines :** Study of IRC provisions for highway cross-section elements, sight distance, horizontal and vertical alignment, curves, gradients and safety aspects.
	Application of Computer-Aided Design Tools in Highway Geometric Design: Introduction to AutoCAD Civil 3D/OpenRoads tools for highway modelling, alignment design, profile preparation and quantity estimation.
Module – 3	**Sustainable Highway Materials and Pavement Technologies**: Study of recycled pavement materials, modified bitumen, warm mix asphalt, geosynthetics and sustainable pavement construction practices.
	Modern Pavement Evaluation and Maintenance Techniques: Study of pavement condition assessment, pavement management systems, non-destructive testing methods and use of technology in pavement maintenance.
Module – 4	**Artificial Intelligence Applications in Traffic Engineering** : Study of AI and Machine Learning applications in traffic volume prediction, congestion analysis, accident prediction and intelligent traffic management.
	Road Safety Engineering and Accident Investigation Techniques: Study of road safety audits, black spot identification, accident data analysis and preventive measures for reducing road crashes.
Module – 5	**Intelligent Transportation Systems (ITS) and Smart Traffic Management**:Study of adaptive traffic signals, Variable Message Signs (VMS), automatic traffic monitoring, electronic toll collection and smart mobility solutions.
	Traffic Furniture, Road Arboriculture and Sustainable Urban Road Design : Study of road furniture, safety devices, landscaping along highways, roadside plantation, pedestrian facilities and cycling infrastructure with case studies.

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret highway planning data, surveys and classification systems used in transportation engineering.
CO2	Evaluate geometric design parameters such as curves, gradients and super elevation for safety.
CO3	Analyze material characteristics, pavement behavior and drainage performance under field conditions.
CO4	Assess traffic data, forecasting technique and AI-based methods for traffic management.
CO5	Design traffic control systems, signals and intersection layouts using standard IRC guidelines.

Text Books	
1	Highway Engineering, S.K. Khanna, C.E.G. Justo and A. Veeraragavan, Revised 10th Edition, 2022, Nem Chand & Bros, ISBN: 9788185240947.
2	Highway Engineering, Dr. L.R. Kadiyali, 10th Edition, 2019, Khanna Publishers, ISBN: 9789386173133.
3	Traffic Engineering and Transport Planning, Dr. L.R. Kadiyali, 9th Edition (Reprint 2025), Khanna Publishers, New Delhi, ISBN: 9788174092205

Reference Books

1	Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, 5th Edition, 2020, Cengage Learning, ISBN: 9781337631044.
2	Highway Engineering, S.S. Rangwala, 12th Edition, 2022, Charotar Publishing House, ISBN: 9789385039577.
3	Recent Topics in Highway Engineering, Hamid Yaghoubi (Ed.), 2024 Edition, 2024, Intech Open, ISBN: 9780854668571.
4	Highway Materials And Pavement Testing, S.K. Khanna, C.E.G. Justo and A. Veeraragavan, 5th Edition, 2013, Nem Chand & Bros, ISBN: 9788185240589

Web links and Video Lectures (e – Resources)	
1	**Introduction to Civil Engineering Profession:** https://onlinecourses.nptel.ac.in/noc26_ce61/
2	**Geometric Design of Highways:** https://onlinecourses.nptel.ac.in/noc22_ce94/
3	**Traffic Engineering:** https://onlinecourses.nptel.ac.in/noc22_ce41/
4	**Practical Engineering:** https://www.youtube.com/@PracticalEngineeringChannel

CO – PO MAPPING

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

Semester: IV						
Structural Analysis **Stream: CV**						
Course Code	**:**	1BCV404		**Credits**	**:**	4
Hours/Semester (L:T:P:SL)	**:**	42:0:28:50		**CIE**	**:**	50 Marks
Total Hours	**:**	120		**SEE**	**:**	50 Marks
Course Type	**:**	IPCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Engineering Mechanics, Strength of Materials
Knowledge on Fundamental Concepts	Strength, Material Behavior, Loads, Bending Moment & Shear Force, Differentiation and Integration
Knowledge on Connected Tools (If any)	AutoCAD

Course Learning Objectives: This course will enable the students to	
CLO1	Identify structural elements and determine the degree of static and kinematic indeterminacy for various structural systems.
CLO2	Apply energy principles including virtual work and Castigliano's theorems to compute deflections in structural elements.
CLO3	Compute axial forces, bending moments, and cable lengths in three-hinged arches and suspension cables under point and distributed loads.
CLO4	Formulate and solve structural problems involving slope deflection and moment distribution in continuous beams and frames.
CLO5	Assemble and solve matrix equations for structural analysis using stiffness and flexibility approaches.

Module – 1	**08 Hrs**
Introduction to Structural Systems: Classification of structures: beams, trusses, arches and frames. Load types: dead, live, seismic, snow, wind, thermal, dynamic and impact. Idealization of structures (Structural forms). Compatibility conditions, Degree of freedom, Linear and nonlinear analysis, Static and kinematic indeterminacies of structural systems. **Deflection of Beams:** Moment area method: Derivation, Mohr's theorems, sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts. **Text Book 1:** Ch 1: 1.1-1.5, Ch 2: 2.1-2.5, Ch 3: 3.1-3.2, Ch 6: 6.1-6.9, Ch 10: 10.1-10.2 **Text Book 2:** Ch 1: 1.1-1.14, Ch 3: 3.1-3.7	
Module – 2	**08 Hrs**
Arches and Cable Structures: Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and different levels- Stiffening trusses for suspension cables. **Text Book 1:** Ch 8: 8.1-8.2, Ch 7: 7.1-7.12 **Text Book 2:** Ch 2: 2.1-2.6, Ch 3: 3.1-3.3	
Module – 3	**08 Hrs**
Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy≤3. **Text Book 1:** Ch 11: 11.1-11.6 **Text Book 2:** Ch 6: 6.1-6.3	
Module – 4	**08 Hrs**

Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤3. **Text Book 1:** Ch 12: 12.1-12.7 **Text Book 2:** Ch 9: 9.1-9.3
Module – 5 **08 Hrs**
Matrix Method of Analysis (Flexibility method): Introduction, Axis and Coordinates, Flexibility matrix, analysis of continuous beam and plane trusses using system approach. **Matrix Method of Analysis (Stiffness method):** Introduction, Stiffness matrix, analysis of continuous beam. Analysis of simple orthogonal rigid frames using system approach. **Text Book 1:** Ch 15:15.1-15.3, Ch 17:17.1-17.4, Ch 18: 18.1-18.7

Practical Component of IPCC	
	List of Experiments
1.	Modelling of structural members such as beams, trusses, arches and frames.
2.	Assignment of supports, material properties, section properties & loads to various structural members.
3.	Analysis of various types of beams using software.
4.	Analysis of 2D frames using software to interpret SFD & BMD.
5.	Analysis of truss using software to interpret actual forces.
6.	Analysis of 3D frames using software to interpret SFD & BMD.
7.	Analysis of multistorey building using software to interpret SFD & BMD.

Suggested Open Ended Experiment	
1.	Develop and analyse alternative structural systems for a given span and loading condition to identify the most efficient solution.
2	Investigate the structural behavior of a multi-storey frame under varying loading and support conditions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the behavior of beams, trusses, arches and frames under various loads
CO2	Apply Moment Area Method to determine deflections in beams.
CO3	Analyze arches, cables and continuous beams and determine structural responses such as bending moment, shear force and thrust.
CO4	Analyze indeterminate structures by Slope Deflection Method, Moment Distribution Method, Flexibility Method and Stiffness Method.
CO5	Model and analyze structural systems using structural analysis software such as STAAD.Pro/ETABS and interpret the results.

Text Books	
1	Basic Structural Analysis, Reddy, C.S., Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 3rd edition, 2011. · ISBN: 9780070702769
2	Theory of Structures,Pandit and Gupta, Vol-1, Tata McGraw Hill, New Delhi, 1st Edition, 2017, ISBN: 978007463493
3	Structural Analysis, Hibbeler, R.C, Pearson, New Delhi, 9th edition., 2012, ISBN: 9789332586147.

Reference Books	
1	Theory of Structures, S. Ramamrutham, Dhanpat Rai Publishing Company Private Limited, New Delhi, 9th Edition, 2014, ISBN-13: 978-9384378103.

2	Structural Analysis, S S Bhavikatti, Vikas Publishing house Pvt. Ltd, New Delhi, 5th Edition, 2021, ISBN-13: 978-81-947519-8-4.
3	Elementary Structural Analysis, Norris C.H., Wilbur J.B., McGraw Hill International Book, 3rd Edition, 2016, ISBN 13: 9352604717.
4	STAAD.Pro - Bentley Software Documentation, Manual.

Web links and Video Lectures (e – Resources)	
1	**NPTEL- IIT Delhi:** https://archive.nptel.ac.in/courses/105/105/105105166/
2	**NPTEL-IIT Kharagpur:** https://nptel.ac.in/courses/105105166
3	**STAAD Pro User Manual:** https://docs.bentley.com/LiveContent/web/STAAD.Pro%20UserManual-v18/en/STAAD.Pro_User_Manual_en.pdf
4	**Manual on Structural Analysis and Design Lab:** https://www.northsouth.edu/assets/files/CEE%20Publications/CEE%20330L%20Manual.pdf

CO – PO – PSO MAPPING

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

Semester: IV						
Survey Practice **Stream: CV**						
Course Code	**:**	1BCVL405		**Credits**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02		**CIE**	**:**	50 Marks
Total Hours	**:**	30		**SEE**	**:**	50 Marks
Course Type	**:**	PCCL		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Surveying
Knowledge on Fundamental Concepts	Engineering Mathematics, Surveying instruments.
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Apply the basic principles of engineering surveying and measurements.
CLO2	Demonstrate conventional surveying instruments necessary for engineering practice.
CLO3	Make use of Total station in the survey of various construction projects.
CLO4	Choose modern surveying instruments based on applications.
CLO5	Execute effective field surveying procedures.

List of Experiments	
1.	The exhibit on chain, compass and plane table surveying accessories. To measure distance between two points using direct ranging.
2.	Measurement of distance between two points using direct ranging.
3.	Determination of reduced levels of points using dumpy level/ auto level (differential levelling and inverted levelling).
4.	Measurement of horizontal and vertical angles by Theodolite.
5.	Setting out simple and compound curves by Rankine's method using Theodolite.
6.	Determination of the Tacheometric constant with line of sight horizontal and inclined.
7.	Setting up of Total station. Features and components of Total station.
8.	Measurement of horizontal and vertical distance, horizontal and vertical angles using Total station.
9.	Setting out the central line of a residential building.
10.	Conduct Longitudinal sectioning and cross sectioning using Total station.
11.	Prepare contour maps using Total Station data
12.	Demonstrate the basics of UAVs/drones, sensors, and LiDAR technology.

Open Ended Experiments	
1	Carry out suitable surveying (Longitudinal section and cross section) for the construction of pipeline work.
2	Prepare a layout plan of SJCIT campus.
3	Create a digital map using total station coordinate data.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply direct ranging and levelling techniques to measure distances and determine reduced levels in field conditions.
CO2	Apply theodolite and total station to measure angles, distances, coordinates, and set out engineering works.
CO3	Analyze survey data for tacheometry, curve setting, and contour mapping.

CO4	Prepare survey drawings such as longitudinal sections, cross sections, and project layouts using field data.
CO5	Evaluate the effectiveness and accuracy of modern surveying tools (GPS, drones, LiDAR) for engineering applications.

Text Books	
1	Surveying Volume 1, Dr. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications , 18th Edition, 2024, ISBN:978-8170088530.
2	Surveying Volume 2, Dr. B C Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications , 17th Edition, 2023, ISBN:978-8170088837.
3	Surveying Volume 1, S K Duggal, McGraw Hill Education, 5th Edition, 2019 , ISBN-13: 978-9353167509.

Reference Books	
1	Surveying Volume – 1, Dr. K R Arora, Standard Book House, 17th Edition, 2019, ISBN-13:978-8189401238
2	Surveying and Levelling, N N Basak, McGraw Hill Education, 2nd Edition, 2017 , ISBN:978-9332901537
3	Advanced Surveying, Gopi Satheesh, R Satish Kumar, N Madhu, Pearson Education, 3rd Edition, 2025, ISBN-13: 978-9361597176
4	B Bhatta, Remote Sensing and GIS, Oxford University Press, New Delhi, 2nd Edition, 2011, ISBN-13:978-0198071723

Web links and Video Lectures (e – Resources)	
1	**Land Surveying Key Benefits:** https://enterprise.dji.com/surveying/land-surveying
2	**The Global Positioning System**: https://www.gps.gov/applications/survey/
3	**Introduction to Total Station:** https://www.youtube.com/watch?v=bbs5AEPstl4
4	**GPS Surveying - Introduction and Components:** https://www.youtube.com/watch?v=KHI4TEeexuM&list=PLLy_2iUCG87DwNVc3Mz1yYlRA42jSQ1t
5	**Drone Surveying:** https://www.youtube.com/watch?v=RXUi2cX4CkU

CO – PO – PSO MAPPING

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

Semester: IV						
Water Distribution System Modelling Lab **Stream: CV**						
Course Code	**:**	1BCVL406A		**Credits**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02		**CIE**	**:**	50 Marks
Total Hours	**:**	30		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Water Supply & Waste Water Engineering.
Knowledge on Fundamental Concepts	Basics of Water Supply systems.
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Apply practical concepts of water distribution systems.
CLO2	Analyze behaviour and performance of distribution networks.
CLO3	Apply modelling tools for network analysis and calibration.
CLO4	Design efficient and reliable water distribution systems.
CLO5	Evaluate water quality and operational performance in distribution networks.

List of Experiments	
1.	Introduction to Water Distribution Network Lab.
2.	Study of EPANET / Water GEMS interface.
3.	Network analysis using EPANET / Water GEMS.
4.	Calibration of water distribution network models.
5.	Water quality assessment in distribution systems.
6.	Head and capacity calculation of service reservoirs for a real service area.
7.	Design of a complete water distribution system for a town, village, or city zone.
8.	AI in water distribution network models.

Open Ended Experiments	
1	Optimization of Water Distribution Network for Minimum Cost and Maximum Efficiency.
2	Assess the influence of leaks on network performance.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply principles of hydraulics to model municipal water distribution systems using appropriate software tools.
CO2	Analyze network performance by evaluating pressure, flow, and head loss under different operating conditions.
CO3	Analyze extended period simulations (EPS) to assess system behavior over time and varying demand patterns.
CO4	Design service reservoirs and pumping systems to meet demand, pressure requirements, and operational efficiency.
CO5	Evaluate water quality parameters, including chlorine decay, to ensure safety and compliance within distribution networks.

Text Books	
1	Water Distribution Modeling, Walski, Chase &Savic, 1st Edition, 2001, Publisher: Haestad Press, ISBN: 978-0965758048
2	Water Distribution System Handbook, Larry W. Mays, 2nd Edition, 2011, Publisher:

	McGraw-Hill, ISBN: 978-007134231

Reference Books	
1	CPHEEO Manual on Water Supply and Treatment, Edition: Third Edition, Year of publication by the Controller of Publications, Delhi, 1999.
2	EPANET 2.2 / Water GEMS User Manuals, 2020, Publisher: United States Environmental Protection Agency, Department: Office of Research and Development, Place: Cincinnati, Ohio, USA, Report No, EPA/600/R-00/057.

Web links and Video Lectures (e – Resources)	
1	**How to Design Water Supply Network with EPANET 2.2:** https://www.youtube.com/watch?v=SvZ9u9bcjko
2	**Design Of Water Distribution Network Using EPANET:** https://www.youtube.com/watch?v=fhnJnSLAhUU
3	**How to Design Water Supply System:** https://www.youtube.com/watch?v=FBu_DU-hK04

CO – PO – PSO MAPPING

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

Semester: IV						
Construction Skill Lab **Stream: CV**						
Course Code	**:**	1BCVL406B		**Credits**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02		**CIE**	**:**	50 Marks
Total Hours	**:**	30		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Mathematics, Basic Construction Materials
Knowledge on Fundamental Concepts	Building Planning and Drawing
Knowledge on Connected Tools (If any)	Surveying Instruments

Course Learning Objectives: This course will enable the students to	
CLO1	Apply knowledge of construction materials, tools, equipment, and safety practices used in building works.
CLO2	Develop Setting out construction site layouts using measuring tape and basic surveying instruments
CLO3	Apply construction techniques for excavation, PCC, masonry, and plastering works in building projects.
CLO4	Develop skills in concrete mix proportioning, reinforcement detailing (bar bending, cutting, tying), and formwork for structural elements
CLO5	Understand flooring, tiling, Electrical, plumbing basics, and painting and finishing works in construction

List of Experiments	
1.	Identify construction materials, safety PPEs, tools, tackles, and equipment used in construction.
2.	Perform building setting-out using tapes and surveying instruments.
3.	Demonstrate earthwork excavation procedures and safety measures for PCC laying, foundations, and column reinforcement.
4.	Prepare cement mortar and concrete mixes for various construction works.
5.	Construct size stone masonry walls up to plinth level and carry out soil backfilling operations.
6.	Apply basic bar bending schedule (BBS) principles, including cutting lengths, stirrup bending, overlaps, hooks, anchorage lengths, chairs, and tying practices.
7.	Execute formwork installation for plinth beams, tie beams, columns, beams, and roof slabs.
8.	Construct masonry walls using different brick bonds such as stretcher, header, Flemish, and English bonds.
9.	Perform ceiling, internal wall, and external wall plastering works.
10.	Examine different types of flooring and carry out wall tile/dado installation works.
11.	Apply the basics of electrical systems, wiring, CCTV, smart homes, and plumbing through demonstrations.
12.	Execute painting and finishing works while applying PPE and HSE practices.

Suggested Open Ended Experiment	
1	Design a sustainable residential building incorporating suitable construction materials and services.
2	Develop a digital quantity estimate and BBS for a small building project.

3	Analyze construction defects in a model structure and recommend preventive measures.
4	Investigate the use of prefabricated components to improve construction speed and quality.
5	Prepare a construction methodology and safety plan for a small building project.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply knowledge of construction materials, tools, equipment, and safety practices used on construction sites.
CO2	Apply chain and tape measurements to mark foundation lines for a simple building plan.
CO3	Analyze the importance of proper excavation dimensions and safety precautions in foundation work.
CO4	Analyze the importance of reinforcement detailing in RCC structures.
CO5	Analyze the importance of plumbing systems in building construction.

Text Books	
1	Building Construction, Sushil Kumar, 20th edition, Standard Publishers,2026,ISBN : 9788180141683.
2	Concrete Technology, M. S. Shetty, S. Chand Standard book for mix design and concrete practices, Laxhmi publications, 2016, ISBN-13: 978-8131804285
3	A Manual of Civil Engineering Practical Work, S. Ramamrutham, DhanpatRai Publishing.2011,ISBN-13: 978-9384378127

Reference Books	
1	Construction Planning, Equipment, and Methods, R.L. Peurifoy, Clifford J. Schexnayder, McGraw-Hill.2011,ISBN-13: 978-0070706996
2	Construction Management and Planning, B. Sengupta & H. Guha, Tata McGraw-Hill.1995,ISBN-13:978-0074623985
3	Building Construction, B. C. Punmia, Arun Kumar Jain & Ashok Kumar Jain, Laxmi Publications.2026, ISBN 13: 9788131804285
4	Construction Planning, Equipment and Methods, R. L. Peurifoy et al, McGraw-Hill. ISBN-10: 9780070706996 ·

Web links and Video Lectures (e – Resources)	
1	**Types of Brick Bond:** https://www.youtube.com/watch?v=5KfcVWNCI9Q
2	**How To Prepare Bar Bending Schedule :** https://www.youtube.com/watch?v=lV4zP3JKi4Q
3	**What Is Finishing Work In Construction:** https://www.youtube.com/watch?v=QzaQQ3vYslE

CO – PO – PSO MAPPING

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

Semester: IV						
3D Modelling and Rendering Lab **Stream: CV**						
Course Code	**:**	1BCVL406C		**Credits**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02		**CIE**	**:**	50 Marks
Total Hours	**:**	30		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Engineering Graphics, Computer Aided Building Drawing
Knowledge on Fundamental Concepts	Building components, orthographic projections, building plans and basic architectural drawings.
Knowledge on Connected Tools (If any)	AutoCAD.

Course Learning Objectives: This course will enable the students to	
CLO1	Apply the fundamentals of 3D modelling and architectural visualization workflows.
CLO2	Develop skills in creating architectural models.
CLO3	Learn scene setup and visualization techniques.
CLO4	Apply material, lighting and rendering techniques.
CLO5	Enable execution of a complete architectural visualization project from modelling to presentation.

Sl.No.	**Experiments**
1.	Understand the fundamentals of modelling software.
2.	Model basic architectural components using modelling software.
3.	Create a 3D model of a residential room.
4.	Develop a 3D model of a small residential building.
5.	Integrate advanced architectural components into a building model.
6.	Understand the fundamentals of rendering software.
7.	Export models from modelling software for rendering applications.
8.	Configure interior and exterior building scenes for rendering.
9.	Create and apply materials and textures through material mapping.
10.	Set up interior and exterior lighting for realistic visualization.
11.	Render interior and exterior views of architectural models.
12.	Optimize rendered outputs and apply post-processing techniques for enhanced visual quality.

Open Ended Experiments	
1	Develop a 3D model of a residential room and evaluate different space-planning alternatives for functionality and aesthetics.
2	Design and model a small residential building based on user requirements and local building regulations.
3	Compare different modelling approaches for creating architectural components and assess their efficiency and accuracy.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply SketchUp tools to construct basic 3D architectural models.
CO2	Analyze detailed 3D building models with appropriate components and spatial organization.
CO3	Apply scene setup techniques and visualize principles using 3DS Max.

CO4	Apply materials, lighting and rendering techniques using V-Ray.
CO5	Create a complete architectural visualization project following industry standards.

Text Books	
1	Mastering Autodesk 3DS Max, George Omura, Sybex Publications, 2nd Edition, 2015, ISBN: 978-1118941188.
2	V-Ray 5 for 3DS Max 2020: 3D Rendering Workflows, Jamie Cardoso, CRC Press, 2nd Edition, 2021, ISBN: 978-0367625504.
3	Architectural Rendering with 3ds Max and V-Ray: Photorealistic Visualization, Markus Kuhlo and Enrico Eggert, Focal Press, 1st Edition, 2010, ISBN: 978-0240814773.
4	SketchUp for Site Design: A Guide to Modelling Site Plans, Terrain, and Architecture, Bonnie Roskes, Wiley Publications, 2nd Edition, 2014, ISBN: 978-1118662977.
5	The Aubin Academy Master Series: 3ds Max Modelling for Architecture, Paul F. Aubin, Delmar Cengage Learning, 1st Edition, 2013, ISBN: 978-1435459144.

Reference Books	
1	V-Ray My Way: A Practical Designer's Guide to Creating Realistic Imagery Using V-Ray and 3ds Max, Lee Wylde, Focal Press, 1st Edition, 2012, ISBN: 978-0240812786.
2	Photography and Rendering with V-Ray, CiroSannino, GC Edizioni, 1st Edition, 2012, ISBN: 978-8896627099.
3	SketchUp for Dummies, Daniel Tal, Wiley Publications, 3rd Edition, 2019, ISBN: 978-1119617938.
4	Rendering and Mental Ray with 3ds Max, Aaron F. Ross and Peter Ratner, Focal Press, 1stEdition, 2008, ISBN: 978-0240809892.
5	Enhancing Architectural Drawings and Models with Photoshop, Scott Onstott, Sybex Publications, 2nd Edition, 2010, ISBN: 978-0470634349.

Web links and Video Lectures (e – Resources)	
1	**How to Model a House in SketchUp:** **https://www.youtube.com/watch?v=LXpXVAgRLV0&t=55s**
2	**Civil Engineering Knowledge | House Construction 3D Model :** **https://www.youtube.com/watch?v=iR3ZIVNo-2c&list=PLW-sR5RWZevmtHjMfaZJmALTDBLUMaIIP&index=2**
3	**3ds Max | D5 Render Ultimate Architectural Walkthrough Masterclass:** https://www.youtube.com/watch?v=ekTBAzV2x2o&list=PLEReudIJKtZg

CO – PO – PSO MAPPING

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

Semester: IV						
BIM – Mechanical, Electrical and Plumbing Lab **Stream: CV**						
Course Code	**:**	1BCVL406D		**Credits**	**:**	1
Hours/Semester (L:T:P:SL)	**:**	0:0:28:02		**CIE**	**:**	50 Marks
Total Hours	**:**	30		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Engineering Graphics, Computer Aided Building Drawing, Basic Building Planning or Building Construction
Knowledge on Fundamental Concepts	Basic understanding of building components, architectural drawings such as plans, elevations, sections, building layout and construction elements
Knowledge on Connected Tools (If any)	Basic familiarity with AutoCAD and 3D modeling tools.

Course Learning Objectives: This course will enable the students to	
CLO1	Develop BIM-based MEP and structural models.
CLO2	Create HVAC ducting and fire protection layouts.
CLO3	Generate coordinated structural and MEP documentation.
CLO4	Analyze BIM coordination and clash detection.
CLO5	Apply industry-standard BIM workflows for building service

List of Experiments	
1.	Understand the fundamentals of BIM and the Revit interface.
2.	Create an architectural base model using Revit.
3.	Configure HVAC systems and perform space analysis for building environments.
4.	Model duct networks and air distribution systems for HVAC applications.
5.	Place HVAC equipment and generate equipment schedules.
6.	Prepare HVAC schedules and project documentation.
7.	Develop a fire-fighting system model using BIM tools.
8.	Generate fire protection system documentation and drawings.
9.	Model sprinkler systems and associated pipe networks.
10.	Create foundation layouts and structural grid systems.
11.	Model structural framing elements and reinforcement details.
12.	Perform BIM coordination and detect clashes among architectural, structural, and MEP systems.

Suggested Open Ended Experiment	
1	Develop a BIM model for a small residential or commercial building and evaluate its advantages over conventional CAD-based design.
2	Create and compare alternative architectural base models for the same building to optimize space utilization and functionality.
3	Design an HVAC system for a selected building and analyze its performance based on occupancy and space requirements.

Course Outcomes: After completing the course, the students will be able to	
CO1	Building Information Modelling (BIM) concepts and workflows for MEP and structural systems.
CO2	Develop HVAC system models including ducts, air terminals, and mechanical equipment using Revit MEP.
CO3	Create firefighting systems with sprinkler layouts, piping networks, and related documentation.
CO4	Model structural components such as foundations, columns, beams, and slabs using Revit Structure.
CO5	Generate BIM-based schedules, sections, detailed drawings, and coordinated project documentation.

Text Books	
1	BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors and Facility Managers, Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston,Wiley Publications, 3rd Edition, 2018, ISBN: 978-1119287537.
2	Mastering Autodesk Revit Architecture, Paul F. Aubin, Wiley Publications, 2nd Edition, 2015, ISBN: 978-1119059813.

Reference Books	
1	Building Information Modelling for Construction Management, Rafael Sacks, Charles Eastman, Ghang Lee and Paul Teicholz, Wiley Publications, 2nd Edition, 2018, ISBN: 978-1119287568.
2	Autodesk Revit Architecture Essentials,Ryan Duell and Tobias Hathorn,Sybex Publications, 1st Edition, 2015, ISBN: 978-1119059592.
3	Integrating BIM in Construction Projects, Brad Hardin and Dave McCool,Wiley Publications, 2nd Edition, 2015, ISBN: 978-1118942765.

Web links and Video Lectures (e – Resources)	
1	**Understand Building Information Modelling: https://www.youtube.com/watch?v=sZygHGWiHc8**
2	**Starting New HVAC Project : https://www.youtube.com/watch?v=oROLNfdpG74&list=PL1ney1pPb_edr7AJ_eOqpGliyq6sZ3Zbd**
3	**Revit BIM Complete Project (Architecture + Structure) In Detail Scheduling Quantification & Costing : https://www.youtube.com/watch?v=602zbkf8RN4**

CO – PO – PSO MAPPING

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

Semester: IV					
Biology for Engineers (ME and CV Streams)					
Course Code	:	1BBN407	**Credit**	:	1
Hours/Semester (L:T:P:SL)	:	14:0:0:16	**CIE**	:	50 Marks
Total Hours	:	30	**SEE**	:	50 Marks
Course Type	:	BSC	**SEE Duration**	:	2 Hour

Prerequisites:	
Courses	Biology and Chemistry
Knowledge on Fundamental Concepts	-
Knowledge on Connected Tools (If any)	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the structure and functions of cells, biomolecules, stem cells, enzymes, vitamins, and hormones, and their significance in engineering.
CLO2	Relate human organ systems to engineered devices such as prosthetics, bionic eyes, pacemakers, ventilators, and dialysis systems.
CLO3	Understand bio-inspired designs and emerging bioengineering technologies, including tissue engineering, bioprinting, self-healing materials, and bioremediation.

Module – 1	**05 Hrs**
Fundamentals of Biology and Biomolecules - Cell structure and functions, Plant and Animal cells, Prokaryotic and Eukaryotic cells, Stem cells and applications, Biomolecules: Carbohydrates, Proteins, Lipids and Nucleic acids, Enzymes, Vitamins and Hormones. **Text book -1, Ch-1 and Text book -2, Ch-1.**	
Module – 2	**05 Hrs**
Human Organ Systems and Engineering Designs - Brain as CPU and prosthetic devices, Eye as camera and bionic eye, Heart as pump: ECG, pacemakers and stents, Lungs as purification system: Ventilators and spirometer, Kidney as filtration system: Dialysis technologies. G-Forces, Effects of Positive and Negative G-forces, Microgravity Effects on Bones, Muscles and Blood Circulation **Text book -1, Ch-2-3 and Text book -2, Ch-2-3.**	
Module – 3	**04 Hrs**
Nature-Inspired Engineering and Bioengineering Trends - Echolocation and Sonar, Photosynthesis and Solar Cells, Lotus Leaf Effect and Self-cleaning Surfaces, Bird Flight and Aircraft Design, Velcro inspired by Plant Burrs, Kingfisher Beak and Bullet Train Design, Tissue Engineering and Bio printing, Self-healing Bio concrete and Bioremediation. Applications of Bio mimic in UAVs and Modern Aircraft. **Text book -1, Ch-4-5 and Text book -2, Ch-4-5.**	

Topics for Self-learning	
Module – 1	Stem Cells and Their Applications in Regenerative Medicine
	Role of Biomolecules in Healthcare and Industrial Applications
Module – 2	Prosthetic Devices and Recent Advances in Bionic Organs
	Bionic Eye and Advanced Vision Restoration Technologies
Module – 3	Tissue Engineering and Bio printing
	Self-Healing Bio concrete

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the fundamental concepts of biology, biomolecules, and their engineering applications.
CO2	Relate the structure and functions of human organ systems to biomedical devices and engineering solutions.
CO3	Apply bio-inspired principles and discuss emerging bioengineering technologies for sustainable and innovative engineering applications.

Text Books	
1	**Biology for Engineers** – Rajendra Singh C. and Rathnakar Rao N., Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2	**Biology for Engineers** – S. Thyagarajan, N. Selvamurugan, M.P. Rajesh, R.A. Nazeer, W. Thilagaraj, S. Barathi and M.K. Jaganathan, Tata McGraw-Hill Education, New Delhi, 2012.

Reference Books	
1	**Biology for Engineers** – Arthur T. Johnson, CRC Press, Taylor & Francis Group, 2011.
2	**Biomimetics: Nature-Based Innovation** – Yoseph Bar-Cohen, CRC Press, 2012.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/121106008?utm_source=chatgpt.com
2	https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009/?utm_source=chatgpt.com
3	https://onlinecourses.nptel.ac.in/noc22_bt18/preview?utm_source=chatgpt.com

CO – PO MAPPING

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

Semester: IV					
Environmental Science Project					
Course Code	:	1BEP408	**Credit**	:	1
Hours/Semester (L:T:P:SL)	:	0:0:0:30	**CIE**	:	50 Marks
Total Hours	:	30	**SEE**	:	50 Marks
Course Type	:	SDC	**SEE Duration**	:	2 Hours

Course Learning Objectives: This course will enable the students to	
CLO1	Understand complex, real-world environmental issues, including climate change, biodiversity loss, and pollution dynamics.
CLO2	Apply scientific, technological, and engineering principles to analyze structural environmental problems.
CLO3	Train in field-based methodologies, including site surveys, environmental auditing, and data collection protocols.
CLO4	Instill critical thinking and interdisciplinary problem-solving skills required to design sustainable, preventive, or remedial solutions.
CLO5	Develop professional competencies in teamwork, collaborative project management, and effective communication of environmental findings.

Restrictions and professional conduct:
Environmental Science Projects should be academic, socially responsible, technically focused, and politically neutral. Students and faculty must maintain professionalism, ethical conduct, and respect while working with communities and stakeholders, and avoid any political, ideological, commercial, or disruptive activities. Projects should also consider practical constraints such as cost, resources, safety, environmental impact, and stakeholder cooperation.

Methods for project identification:
Students may identify the project topic using one or more of the following methods: interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.; review of issues highlighted in print and electronic media, and social networks; and, after selecting a broad topic, collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:
The following structured sequence of activities is to be carried out during the semester:

Sl. No.	**Project title**	**Measurable engineering outcome**	**Mapped POs**	**SDGs**
1	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13
3	Afforestation	Identify a degraded area, prepare plantation layout, and	PO2, PO3, PO4, PO6,	SDG 11, SDG 13,

		demonstrate survival-rate tracking and maintenance schedule for saplings.	PO7, PO11	SDG 15
4	Biogas generation and power generation	Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 11, SDG 12
5	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 9, SDG 11
6	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction.	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
10	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11
11	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17
12	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13

14	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
15	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9
16	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17	Food security initiatives / cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 9, SDG 12

Suggested Learning Resources

Textbooks

1. Benny Joseph, Environmental Studies, Tata McGraw-Hill, 2nd Edition.
2. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 2005.
3. Erach Bharucha, Textbook of Environmental Studies, University Press, latest edition as available in library.
4. M. P. Poonia and S. C. Sharma, Environmental Studies, Vikas Publishing House, latest edition as available Garg, N. R., *Project-Based Learning in Engineering Education*, Pearson India Education Services, Noida.

Reference Books

1. R. Sivakumar, Principles of Environmental Science and Engineering, Cengage Learning, 2nd Edition.
2. G. Tyler Miller Jr., Environmental Science: Working with the Earth, Thomson Brooks/Cole, 11th Edition.
3. Pratibha Singh, Anoop Singh, and Piyush Malaviya, Text Book of Environmental and Ecology, Acme Learnin 1st Edition.
4. S. M. Prakash, Environmental Studies, Elite Publishing House, Mangalore, 3rd Edition, 2018.

Teaching Learning Process:

The suggested TLP for Community / Societal Project is as follows;

Week	**Teaching–Learning Activity**	**Faculty Role**	**Student Activity**	**Output / Evidence**
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan

2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic
3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record
4	Problem statement and objective formulation	Review and refine problem statement	Prepare problem statement, scope, and objectives	Approved problem statement
5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and responsibilities	Plan activities, divide roles, and prepare schedule	Work plan / Gantt chart
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note / design outline
9	Data processing / calculations / sizing / mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype / model / audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model / draft DPR / map / app
11	Testing, refinement, and implementation planning	Evaluate technical correctness and improvements	Test prototype or validate proposal with users	Test results / revised output
12	Field implementation / demonstration / awareness activity	Facilitate community interaction and documentation	Conduct implementation or demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
	Presentation	Conduct mock	Prepare	

14	preparation and viva practice	presentation and feedback	slides/poster and rehearse	Presentation deck
15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

Assessment structure:

A. Continuous Internal Evaluation (CIE) – 50 marks

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totaling 50 marks:

CIE pass requirement:

- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.
- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

B. Semester End Examination (SEE) – 100 marks (scaled to 50)

- Examination duration: 2 hours.
- Maximum examination marks: 100 (scaled to 50).
- The SEE shall be conducted batch-wise by two examiners, one faculty from the same department and one from a different department appointed by the Principal.

SEE pass requirement and overall passing rule:

- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40; otherwise, the student is awarded grade F (Fail).

CIE Rubric — Continuous Internal Evaluation (Total 50 marks):

Criterion	**Weight (marks)**	**Excellent (Full marks)**	**Good**	**Fair**	**Needs Improvement**
Problem identification & relevance to society/environment	8	Problem clearly identified with strong evidence of relevance and well-defined scope.	Relevant problem with clear scope and adequate evidence.	Problem defined but justification is weak.	Problem unclear or not relevant.
Formation of problem statement; engineering approach, innovation & feasibility	10	Precise statement; sound, innovative, feasible approach.	Adequate statement; feasible with minor gaps.	Partial statement; marginal feasibility.	Missing or infeasible.
		Thorough		Limited	

Interaction with stakeholders; data collection, analysis & interpretation	8	engagement; comprehens ive data and well-interpreted analysis.	Good engagement; adequate data and analysis.	engagement; incomplete data and superficial analysis.	Little or no stakeholder contact; no data/analysis.
Project documentation; clarity, organization & problem-solving demonstrated	10	Complete, well-organized, analytical, and strong problem-solving.	Complete and clear with some analytical content.	Basic with omissions; problem-solving limited.	Missing/ poorly organized; no clear problem-solving.
Communication & presentation skills	6	Confident, structured, and answers queries fully; visuals effective.	Clear and satisfactory; responds to most queries.	Acceptable but lacks clarity or confidence; weak responses.	Poor or absent; unable to respond.
Contribution & benefit to society (impact, sustainability)	8	Clear, demonstra ble societal benefit and realistic sustainabil ity path.	Benefit plausible; sustainabi lity considered with minor gaps.	Limited or unclear benefit; sustaina bility weak.	No evident benefit or sustainability.

SEE Rubric — Semester End Examination (Will be conducted for 100 marks; later scaled to 50 marks):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & relevance to society/ Environment	16	Clearly articulated with strong evidence and context.	Clear with reasonable evidence.	Problem stated but evidence/c ontext weak.	Poorly defined or irrelevant.
Formation of problem statement; engineering approach, innovation & feasibility	20	Precise; demonstrates engineering depth, novelty and feasibility.	Technically sound and feasible with minor limitations.	Basic; limited technical depth or feasibility concerns.	No viable engineering approach or infeasible plan.
Interaction with stakeholders; data collection, analysis & interpretatio n	16	Excellent engagement; rigorous data collection and insightful analysis.	Good engageme nt and acceptable analysis.	Superficial data collection and limited analysis.	Inadequate or no data; poor analysis.
Project					

documentation ; clarity, technical rigor & problem-solving demonstrated	20	Comprehensive, technically rigorous, and systematic.	Complete and technically correct with minor gaps.	Lacks technical depth or has notable omissions.	Missing key elements or technically incorrect.
Communication, presentation & viva-voce responses	12	Presents expertly, defends work persuasively and answers all queries correctly.	Good presentation and satisfactory answers to most queries.	Adequate but fails to answer some technical questions.	Poor presentation and unable to defend work.
Contribution & benefit to society; impact assessment & sustainability	16	Clear, evidence-based impact assessment with scaling recommendations.	Reasonable impact discussion and sustainability considerations.	Limited evaluation of impact or sustainability.	No coherent assessment of impact or sustainability.

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify and analyse environmental problems through field interaction and technical assessment.
CO2	Develop skills in project planning, field survey, data collection, implementation, documentation, teamwork and communication.
CO3	Formulate feasible environmental problem statements and solutions considering practical constraints and sustainability aspects.
CO4	Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.
CO5	Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.

CO – PO MAPPING

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

Semester: IV						
Metaphysical Science (Common to All Branches)						
Course Code	:	1BMP409		**Credits**	:	1
Hours/Week(L:T:P:SL)	:	14:0:0:16		**CIE**	:	50 Marks
Total Hours	:	30		**SEE**	:	50 Marks
Course Type	:	HSSMC		**SEE Duration**	:	2 Hours.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basic concepts of metaphysics, ontology, and epistemology.
CLO2	Explain metaphysical perspectives on the universe, mind, and consciousness.
CLO3	Explore the relationship between quantum metaphysics, healing and modern science.

Module 1	**05 Hrs**
Foundations of Metaphysics, Ontology and Epistemology **Introduction to Metaphysics:** Definition, scope and historical roots (Aristotle, Plato, Kant). Distinction between Metaphysics, Physics and Spirituality. **Branches of Metaphysics:** Ontology, Cosmology and Epistemology. **Fundamental metaphysical questions:** Reality, existence, abstract entities, morality. **Ontology (Study of Being):** Materialism, Idealism and Dualism, Problem of Universals: Realism vs. Nominalism **Epistemology (Study of Knowledge):** Rationalism (Descartes) and Empiricism (Locke, Hume), Theories of Truth: Correspondence, Coherence and Pragmatic, Skepticism and Constructivism, Simulation Theory and Descartes' Evil Demon **Text Book 2: Ch.1-5**	
Module 2	**05 Hrs**
Cosmology, Mind and Consciousness **Metaphysical Cosmology:** Philosophical and Physical Cosmology, Time, Space and Origin of the Universe, Anthropic Principle and Fine-Tuning Debate, Creation, Causality and Infinite Regress, Multiverse Theory and its Metaphysical Implications, Ancient Cosmologies: Vedic, Taoist and Indigenous Perspectives. **Mind and Consciousness:** Nature of Mind and Consciousness, Mind-Body Problem: Dualism vs. Physicalism, Theories of Consciousness: Integrated Information Theory (IIT), Global Workspace Theory and Panpsychism, Eastern and Western Perspectives on Self and Consciousness, Artificial Intelligence and Machine Consciousness, Role of Consciousness in Observation and Decision Making **Text Book 1: Ch.1-2, Text Book 2: Ch.6-8**	
Module 3	**05 Hrs**
Quantum Metaphysics, Healing and Engineering Perspectives Basics of quantum mechanics (superposition, entanglement, observer effect), Quantum Theory and Consciousness, Quantum Healing: Deepak Chopra's Model, Biofield Theory,	

Chakras and Subtle Energy Systems, Placebo Effect, Intention and Non-local Healing, Applications and Engineering Perspectives of Bio-resonant Technologies, Scientific evidence, limitations and ethical considerations in Quantum Healing. **Text Book 1: Ch. 3-15**

Topics for Self-learning	
Module – 1	• Indian Perspectives on Metaphysics (Advaita Vedanta, Buddhism and Jainism) • Philosophy of science and scientific realism
Module – 2	• Consciousness in meditation and mindfulness practices • AI ethics and machine consciousness • Latest developments in neuroscience and consciousness research
Module – 3	• Emerging biofeedback and wearable health technologies • Engineering applications of meditation and neurotechnology

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the fundamental concepts of metaphysics, ontology and epistemology in understanding reality and existence.
CO2	Analyze metaphysical perspectives on cosmology, consciousness and the nature of the universe.
CO3	Evaluate the relationship between quantum theory, consciousness, healing practices and their relevance to emerging engineering applications.

Text Books	
1	Quantum Metaphysics, Tarja Kallio-Tamminen, ISBN 952-10-1927-1 Otamedia, Oy 2004.
2	Metaphysics-A Very Short Introduction, Stephen Mumford, Sl. No. 20129780191640261, 0191640263, OUP Oxford, 2012

Reference Books	
1	Deepak Chopra M.D., Quantum Healing (Revised and Updated): Exploring the Frontiers of Mind/Body Medicine, 2015.
2	Deepak Chopra M.D., Quantum Body: The New Science of Living a Longer, Healthier, More Vital Life, 2023.

Web links	
1	https://www.yogajournal.com/meditation/
2	https://youtube.com/shorts/JgCVh6wwgNg?si=R87-PGIrUSII774w
3	https://www.youtube.com/watch?v=XvyuUqlX7fE
4	https://core.ac.uk/download/pdf/14914967.pdf
5	https://www.youtube.com/watch?v=_ba0yIAZ9ok

6	https://www.youtube.com/watch?app=desktop&v=fzxohf49loU
7	https://www.youtube.com/watch?v=SSGKowtXS3Y
8	https://www.youtube.com/watch?v=r_piRatnFlY

CO–PO Mapping

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

Semester: IV					
NATIONAL SERVICE SCHEME (Common to All Branches)					
Course Code	**:**	1BNS410	**Credit**	**:**	PP
Hours/Semester (L:T:P:SL)	**:**	0:0:0:28	**CIE**	**:**	100 Marks
Total Hours	**:**	28	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	**---**
Knowledge on Fundamental Concepts	Basic understanding of social responsibility, environmental awareness, community welfare, sustainable development, ethics, teamwork, and communication skills.
Knowledge on Connected Tools (If any)	Basic use of smartphones, internet, digital communication tools (email, WhatsApp, Google Forms), presentation software (PowerPoint/Canva), video recording tools, and office productivity software (MS Word/Google Docs) for documentation and report preparation.

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the community, identify its needs and problems, and apply knowledge to develop practical solutions for sustainable community development and welfare.
CLO2	Develop social and civic responsibility, leadership, teamwork, communication, and community participation skills through collaborative and service-oriented activities.
CLO3	Demonstrate ethical values, democratic attitudes, effective group-living skills, and responsible citizenship while contributing to social service and community development.

Activity– 1	**10 Hrs**
Environmental Sustainability: Plantation and adoption of plants (Know Your Plants), water conservation techniques, role of stakeholders, and implementation of sustainable environmental practices.	
Activity – 2	**09 Hrs**
Community Development and Rural Entrepreneurship: Organize National Integration and Social Harmony programs (minimum two), prepare actionable business proposals to enhance village income, and support community-based development initiatives.	
Activity – 3	**09 Hrs**
Educational and Social Welfare Initiatives: Government school rejuvenation, improving infrastructure, enhancing student academic performance and enrolment in higher/technical/vocational education through awareness and mentoring activities.	

Topics for Self learning	
Activity – 1	Plantation, biodiversity conservation, and sustainable water management practices.
	Climate change, environmental protection, and the role of citizens in

	conservation.
Activity– 2	National integration, social harmony, and community leadership.
	Rural entrepreneurship, village development, and government support schemes.
Activity – 3	School development, educational awareness, and mentoring for higher education.
	Social responsibility, volunteerism, and community engagement for sustainable development.

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

Sl. No.	Topic	Group Size	Location	Activity Execution	Reporting	Evaluation of the Topic
1.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual al or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual al or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for 4th Semester)

Sl. No.	Practice Session Description
1.	Lecture session by NSS Officer
2.	Selection of topic, Commencement of activity and its progress
3.	Execution of Activity
4.	Case study based Assessment, Individual performance
5.	Sector wise study and its consolidation

6.	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In the 4th semester, each student should do activities according to the scheme and syllabus.
- At the end of the semester student performance has to be evaluated by the NSS Officer for the assigned activity progress and its completion.
- At the end of the 4th semester, consolidated report of all activities compiled report should be submitted as per the instructions.

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze environmental and societal issues and propose practical, sustainable solutions by demonstrating social responsibility and civic awareness.
CO2	Evaluate and implement government and community-driven initiatives to address societal challenges and promote community development and welfare.
CO3	Demonstrate ethical values, teamwork, leadership, effective communication, and civic responsibility while participating in social service and community engagement activities.

Assessment Details for CIE (100 Marks)

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

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

CO – PO MAPPING

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

Semester: IV						
Physical Education (Common to All Branches)						
Course Code	:	1BPE410		**Credits**	:	PP
Hours/Week(L:T:P:SL)	:	0:0:0:28		**CIE**	:	100 Marks
Total Hours	:	28		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Develop an understanding of ethical principles and moral values and their importance in sportsmanship, fair play, and personal conduct in games and athletic activities.
CLO2	Acquire practical skills and demonstrate technical proficiency in selected sports or athletic events through structured physical training and performance.
CLO3	Understand the role of effective organization, administration, and management in the successful conduct of sports events and athletic programs.

Module – 1	**6 Hrs**
Ethics and Moral Values A. Ethics in Sports B. Moral Values in Sports and Games	
Module – 2	**16 Hrs**
Specific Games (Any one to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Athletics (Track Events) – Any event as per availability of Ground	
Module-3	**6 Hrs**
Role of Organization and administration	

Topics for Self-learning	
Module – 1	Sportsmanship, Fair Play and Ethical Decision-Making in Sports
Module – 2	Rules, Techniques and Performance Analysis of Volleyball / Track Events
Module – 3	Planning, Organization and Management of Sports Events

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the ethical principles, moral values, and sportsmanship essential for responsible participation in sports and games.
CO2	Perform the fundamental skills and techniques of the selected game or athletic event with discipline and teamwork.
CO3	Discuss the role of sports organizations and administration in the promotion and management of sports activities.

Scheme and Assessment for auditing the course and Grades:

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

CO – PO MAPPING

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

Semester: IV					
Yoga (Common to All Branches)					
Course Code	:	1BYO410	**Credit**	:	PP
Hours/Semester (L:T:P:SL)	:	0:0:0:28	**CIE**	:	100 Marks
Total Hours	:	28	**SEE**	:	---
Course Type	:	NCMC	**SEE Duration**	:	---

Prerequisites:	
Courses	**--**
Knowledge on Fundamental Concepts	• Basic understanding of physical fitness, health and personal hygiene. • Awareness of body posture, breathing, and general wellness practices.
Knowledge on Connected Tools (If any)	**--**

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the philosophy and principles of Patanjali's Ashtanga Yoga for holistic well-being.
CLO2	Demonstrate the correct techniques of Surya Namaskar, Yogasanas, Kriyas, and Pranayama with appropriate safety measures.
CLO3	Practice Yogic techniques to enhance physical fitness, mental wellness, and healthy lifestyle habits.

Module - 1	**04 Hrs**
Foundations of Ashtanga Yoga: Patanjali's Ashtanga Yoga: Introduction, need and importance, Eight Limbs of Yoga – Overview, Yama: Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha, Niyama: Shoucha, Santosha, Tapa, Svaadhyaya, Eshvarapranidhana. **Text Book 1: Ch. 4**	
Module - 2	**05 Hrs**
Surya Namaskar and Yogasanas: Surya Namaskar: Concept, significance, 12-step sequence, breathing coordination, posture alignment, and practice of four rounds, Asanas: Meaning, need, importance, classification, Practice of Sitting, Standing, Prone, and Supine Asanas (Sukhasana, Paschimottanasana, Ardhakati Chakrasana, Parshva Chakrasana, Dhanurasana, Halasana, Karna Peedasana) with techniques, precautions and benefits. **Text Book 1: Ch. 3, 4**	
Module - 3	**05 Hrs**
Kriyas and Pranayama: Kriyas: Introduction to Shatkarmas, Kapalabhati – meaning, importance, technique, precautions, and benefits, Pranayama: Meaning, need, importance, techniques, precautions, and benefits, Types of Pranayama: Suryanuloma–Viloma, Chandranuloma–Viloma, Suryabhedana, Chandrabhedana, Nadishodhana. **Text Book 1: Ch. 5, T-2: Ch. 2**	

Topics for Self learning	
Module – 1	Role of Yama and Niyama in personal and professional ethics

Module – 2	Scientific benefits of Surya Namaskar and Yogasanas in stress management and lifestyle disorders
Module – 3	Advanced Pranayama, Meditation, and Yoga for mental health and holistic wellness

Course Outcomes: After completing the course, the students will be able to	
CO1	Summarize the philosophy, principles, and significance of Patanjali's Ashtanga Yoga and its role in healthy living.
CO2	Demonstrate Surya Namaskar, selected Yogasanas, Kapalabhati and Pranayama using proper techniques and precautions.
CO3	Practice appropriate Yogic techniques to improve physical fitness, mental concentration, emotional balance, and overall wellness.

Text Book	
1	Light on Yoga, B.K.S. Iyengar, HarperCollins Publishers India, 2006, ISBN: 978-81-7223-501-7.
2	Asana Pranayama Mudra Bandha, Swami Satyananda Saraswati, Yoga Publications Trust, Bihar School of Yoga, Munger, 2008, ISBN: 978-81-86336-14-4

Reference Books	
1	Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly, 4th Edition, Kaivalyadhama Publishers, ISBN-10 : 9788189485245
2	Yoga Instructor Course hand book published by SVYASA University, Bengaluru
3	Raja Yoga, Swami Vivekananda, Advaita Ashrama, Kolkata, 2018, ISBN: 978-81-7505-151-5.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/playlist?list=PLzF4lOyPf_Z9yQ_Gphjh1wZ5fEhMg6hmP
2	https://www.youtube.com/playlist?list=PLOzRYVm0a65cCcY4qKX5MIyJxBt7hJgQY
3	https://youtu.be/KB-TYlgd1wE
4	https://youtu.be/aa-TG0Wg1Ls

CO – PO MAPPING

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

Semester: IV					
Music (Common to All Branches)					
Course Code	**:**	1BMU410	**Credit**	**:**	PP
Hours/Semester (L:T:P:SL)	**:**	0:0:0:28	**CIE**	**:**	100 Marks
Total Hours	**:**	28	**SEE**	**:**	-
Course Type	**:**	NCMC	**SEE Duration**	**:**	-

Prerequisites:	
Courses	Familiarity with school-level cultural or music activities is beneficial
Knowledge on Fundamental Concepts	Basic awareness of vocal music and musical instruments.
Knowledge on Connected Tools (If any)	Metronome or Tala application for rhythm practice. Audio playback device (mobile phone/laptop) for listening to compositions.

Course Learning Objectives: This course will enable the students to	
CLO1	Interpret the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
CLO2	Contrast the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
CLO3	Demonstrate basic vocal proficiency through the practice of Sarale Varase exercises, notations for Suladi Sapta Tala in Mayamalavagowla raga and performance of selected compositions such as Geethe, Jathi Swara and Krithi.

Module – 1	**05 Hrs**
Composers: Biography and contributions of Purandaradasaru, Thyagarajaru, Mysuru vasudevacharyaru, Kanakadasaru. **Text Book 3:** Ch. 2-5	
Module – 2	**05 Hrs**
Music Instruments Classification and construction of string instruments, wind instruments, percussion Instruments, Idiophones (Ghana Vaadya), Examples of each class of instruments. **Text Book 1:**V-4 – Ch. 2-6	
Module – 3	**04 Hrs**
Abhyasa Gana Singing the swara exercises (Sarale Varase Only), Botatio writing for sarale varase andsulafi sapta tala (Only in mayamalavagowla raga), singing 4 geethe in malahari and one jathi swara, oe krithi in a mela raga. **Text Book 1:** V-1 & 2 **Text Book 2:** Ch.2-4	

Topics for Self learning	
Module – 1	Contributions of the trinity of Carnatic music (Thyagaraja, Muthuswami Dikshitar, Syama Sastri)
	Women composers and their contributions to Indian Classical Music
Module – 2	Modern electronic musical instruments used in Indian Music
	Evolution and global influence of traditional Indian musical instruments
Module – 3	Voice culture techniques and vocal health for singers

	Introduction to digital music learning tools (Shruthi Box, Tala Apps, and Online Music Platforms)

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the contributions of composers.
CO2	Classify Indian musical instruments and describe their construction and use.
CO3	Illustrate basic Carnatic vocal skills through selected exercises and compositions.

Text Books	
1	South Indian Music – Vol. I to VI, Prof. P. Sambamoorthy, 2019thEdition,2021. The Indian Music Publishing House, Chennai, ASIN : B093Y3TL52 Chapters:2,3,4,5,6
2	A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, 4th Edition ,2008,CBH Publications , ISBN 81 85 381 50 Chapters:2,3,4
3	Karnataka Sangeetha Charitre, Dr. V. S. Sampathkumaracharya, Kannada University, Hampi Chapters:2,3,4,5

Reference Books	
1	History of South Indian (Carnatic) Music (From Vedic Times to the Present) , R Rangaramanuja ayyangar ,2019 edition ,Vipanchi charitable trust publisher ISBN: 9788187723158.
2	Music of India, B. Chaitanya Deva, 2nd edition , 1995 Munshiram Manoharlal Publishers. ISBN-10 : 8121501954
3	Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, 2013 Edition, Asian Educational Services
Web links and Video Lectures (e – Resources)	
1	https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39
2	https://www.youtube.com/live/RfM4lAJQgCc?si=xfK0b6exvkBujugr
3	https://youtu.be/DZA_cSb0Zo8?si=55M6QAC2T8VqZN39

CO – PO MAPPING

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

Semester: IV					
National Cadet Corps - II (Common to All Branches)					
Course Code	:	1BNC410	**Credit**	:	PP
Hours/Semester (L:T:P:SL)	:	0:0:0:28	**CIE**	:	100 Marks
Total Hours	:	28	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Prerequisites:	
Courses	National Cadet Corps (1BNC309), if NCC was the option chosen in III Semester
Knowledge on Fundamental Concepts	NCC, National Integration, Disaster Management, Social Awareness
Knowledge on Connected Tools (If any)	**-**

Course Learning Objectives: This course will enable the students to	
CLO1	Acquire general knowledge of health, hygiene and preventive well-being practices prescribed for NCC cadets
CLO2	Gain awareness of environmental conservation and natural-resource management as taught to NCC cadets
CLO3	Understand the elements of personality development and leadership traits expected of a responsible citizen

Module – 1	**05 Hrs**
Health and Hygiene – General Awareness : Structure and Functioning of the Human Body; Hygiene and Sanitation (Personal and Food Hygiene). Physical and Mental Health (general awareness); Infectious and Contagious Diseases and their Prevention. First Aid in Common Medical Emergencies (awareness only); Introduction to Yoga Exercises.	
Module – 2	**05 Hrs**
Environment Awareness and Conservation – General Awareness: Natural Resources – Conservation and Management; Water Conservation and Rain Water Harvesting. Waste Management; Pollution Control – Water, Air, Noise and Soil. Energy Conservation; Wildlife Conservation and Projects in India.	
Module – 3	**04 Hrs**
Personality Development and Leadership – General Awareness: Introduction to Personality Development; Factors Influencing Personality (Physical, Social, Psychological and Philosophical); Self-Awareness. Interpersonal Relationship and Communication Skills; Leadership Traits and Types of Leadership. Attitude – Assertiveness and Negotiation; Time Management; Stress Management Skills; Interview Skills.	

Topics for Self learning	
Module – 1	Reading on personal hygiene/sanitation practices; a short note on common infectious diseases and their prevention
Module – 2	Short report on a local water-conservation or waste-management initiative; awareness reading on a wildlife conservation project in India
Module – 3	Preparation of a short self-awareness/communication-skills reflection note; practice of a mock interview with peers

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the structure and functioning of the human body and describe common health, hygiene and preventive practices

CO2	Describe key concepts of environmental conservation, natural-resource management and pollution control
CO3	Exhibit an understanding of personality development, leadership traits, communication and stress/time-management skills

Text Books	
1	Cadet's Handbook – Common Subjects (SD/SW), Directorate General NCC, Ministry of Defence, Government of India, Edition dated 06 May 2013 (or latest edition).
2	NCC Handbook for 'A', 'B' and 'C' Certificate Examinations, Upkar Prakashan, Latest Edition.

Reference Books	
1	Personality Development and Leadership – A Cadet's Guide, published by DGNCC, Latest Edition.
2	Ministry of Environment, Forest and Climate Change – awareness publications on conservation, Latest Edition.
3	NCC Directorate/Group HQ training literature and circulars, as issued from time to time.

Web links and Video Lectures (e – Resources)	
1	Directorate General National Cadet Corps – https://www.nccindia.gov.in/
2	Ministry of Environment, Forest and Climate Change – https://moef.gov.in

CO – PO MAPPING

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

Semester: IV						
Competency Enhancement Course - 2 (Common to All Branches)						
Course Code	:	1BCE411		**Credits**	:	PP
Hours/Week(L:T:P: SL)	:	14:0:0:14		**CIE**	:	100 Marks
Total Hours	:	28		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Prerequisites:	
Courses	Competency enhancement course-1
Knowledge on Fundamental Concepts	Arithmetic operations, fractions, decimals and elementary algebra. comprehension of basic English
Knowledge on Connected Tools (If any)	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Enhance Quantitative Problem-Solving Skills
CLO2	Master Data Interpretation and Visual Analysis
CLO3	Strengthen Logical Reasoning and Spatial Intelligence
CLO4	Develop Advanced Verbal Aptitude and Communication Accuracy
CLO5	Sharpen Critical Thinking through Assumptions and Analytical Judgement

Module – 1	**6 Hrs**

Data Interpretation: Approach to interpretation - simple arithmetic, rules for comparing fractions, Calculating (approximation) fractions, short cut ways to find the percentages, Classification of data– Tables, Bar graph, line graph, Cumulative bar graph, Pie graph, Combination of graphs. Combination of table and graphs

Text Book 1: Ch 36

Module – 2	**6 Hrs**

Pipes & Cisterns: Speed, Time, and Distance, Core concepts of speed, time, and distance with formula-based problem-solving techniques. Understanding the relationships between speed, time, and distance, and applying them to real-world scenarios.

Relative Speed: Calculating relative speed in scenarios involving objects moving in the same or opposite directions. Application of relative speed in solving problems on overtaking, crossing, and meeting points.

Average Speed: Techniques for calculating average speed over multiple journeys or varying speeds. Application in mixed-distance and mixed-speed problems.

Problems on Trains: Solving problems involving trains, including crossing stationary and moving objects. Concepts of platform length, tunnel length, and calculating crossing times for accurate results.

Boats and Streams: Understanding upstream and downstream speeds, including the effect of current on boat movement. Solving problems based on effective speed in both still water and flowing water scenarios.

Races: Concepts of time, distance, and lead in competitive races. Analyzing head-starts, leads, and gaps between racers, and calculating who wins and by how much.

Text Book 1: Ch14-18

Module-3	**6 Hrs**

Cubes and Dice: Introduction to the properties and visualizations of cubes and dice. Understanding different orientations and views of cubes and dice, including adjacent and opposite faces. Solving problems related to numbering, coloring, and arranging cubes and dice. Techniques to quickly analyze and answer questions on folding/unfolding and rotation. Application in spatial reasoning and enhancing 3D visualization skills.

Puzzles: Developing logical thinking and problem-solving skills through a variety of puzzles. Types of puzzles, including number puzzles, pattern recognition, arrangement, and logical deduction. Strategies for approaching and solving puzzles efficiently. Practice with common puzzle formats found in competitive exams and aptitude tests. Enhancing analytical abilities, critical thinking, and creative problem-solving through diverse puzzle exercises.

Verbal Aptitude:

Reading Comprehension: Introduction to Reading Skills, Emphasizing the importance of regular reading for comprehension, vocabulary, and overall verbal aptitude. Understanding how strong reading skills benefit areas beyond comprehension, like analytical thinking and verbal reasoning. Establishing a daily reading habit to improve focus and retention.

Para Jumbles: Techniques for logically ordering jumbled sentences into a coherent paragraph. Understanding linkages between sentences, transitional words, and thematic flow.

Sentence Completion: Strategies for filling in the blanks with appropriate words or phrases. Developing skills to recognize context, tone, and logical flow for accurate sentence completion.

Antonyms/Synonyms: Building a strong vocabulary by mastering antonyms and synonyms. Practice with context-based word selection to improve vocabulary and precision in language.

Text Book 2: Ch 6-9,13-16

Module-4	**6 Hrs**

Verbal Aptitude

Error in Sentences: Identifying common grammatical errors in sentences, including subject-verb agreement, tense consistency, and pronoun usage. Understanding sentence structure and common pitfalls in grammar for error detection.

Sentence Rearrangement: Techniques to rearrange words or phrases to form coherent and grammatically correct sentences. Focus on grammar, context, and logical structure for rearrangement accuracy.

Idioms and Phrases: Understanding and correctly using idioms and phrases in context. Building familiarity with common idioms to enhance comprehension and verbal accuracy.

Verbal Analogies: Solving analogies by identifying the relationships between words or phrases. Developing logical thinking to understand and complete analogy-based questions.

Text Book 1: Ch 28-29

Module-5	**6 Hrs**

Permutation and Combination : Understanding the difference between the

permutation and combination, Rules of Counting-rule of addition, rule of multiplication, factorial function, Concept of step arrangement, Permutation of things when some of them are identical, Concept of 2n, Arrangement in a circle.
Probability: Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes.
Crypt arithmetic: Basic concepts, addition, subtraction, multiplication of coded alphabets, Types of cryptarithm.
Statements and Assumptions: Identifying implicit assumptions within a statement. Developing the ability to read between the lines and recognize underlying premises.
Statements and Conclusions: Analyzing a given statement to derive logical conclusions. Differentiating between valid and invalid inferences based on the provided information.
Cause and Effect : Understanding cause-effect relationships and identifying causation or correlation between events. Analyzing statements to determine whether one event directly influences another.
Reference Book 1: Ch1-6

Topics for Self learning	
Module – 1	Data sufficiency, caselet DI and interpretation of radar/scatter graphs.
Module – 2	Circular track problems, unit conversions and applications in transportation and logistics.
Module – 3	Mirror images, paper folding, advanced puzzles and vocabulary building through reading.
Module – 4	Cloze tests, critical reasoning, workplace vocabulary and commonly confused words.
Module – 5	Set theory, Venn diagrams, conditional probability and decision-making case studies.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply arithmetic and logical reasoning to solve problems.
CO2	Develop spatial and logical skills to solve cube, dice, puzzle and seating arrangement questions.
CO3	Improve reading, vocabulary, and grammar through para jumbles, sentence completion and idioms.
CO4	Enhance verbal reasoning by solving analogies, rearranging sentences and identifying assumptions and conclusions.
CO5	Apply combinatorics and probability to solve permutation, combination and crypt arithmetic problems.

Text Books	
1	Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal Chand Publishing. – 2023.
2	Word Power Made Easy by Norman Lewis (ISBN- 978-0143424680), , Published by PENGUIN INDIA - 2015
3	How to Prepare for Quantitative Aptitude for the CAT by Arun Sharma (ISBN- 978-9339205126), 6th Edition, McGraw-Hill Education - 2014

Reference Books	
1	Puzzle Test & Seating Arrangements by K. Kundan (ISBN: 9789394666023),1st Edition, BSC Publishing Company Pvt Ltd. - 2023
2	A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal, 2025-26 Edition, S. Chand Publishing -2024

Web links and Video Lectures (e – Resources)	
1	https://youtu.be/KWZ0lR8cCwc
2	https://youtu.be/mBtBD1N7ywQ
3	https://youtu.be/B9MhxmcwnpQ
4	https://youtu.be/VaEbefWFIlc
5	https://youtu.be/3AL_6EQmnkY

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**										**1**
CO2	**2**	**2**										
CO3	**1**	**1**								**3**		
CO4	**2**	**2**								**2**		**1**
CO5	**3**	**3**										**1**

Semester: IV					
Additional Mathematics-II **(For Lateral Entry Students of all the Branches)**					
Course Code	:	1BMATDIP412	**Credits**	:	PP
Hours/Semester (L:T:P:SL)	:	14:0:0:14	**CIE**	:	100
Total Hours	:	28 L	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Prerequisites:	
Courses	Basic Mathematics
Knowledge on Fundamental Concepts	Basic differentiation and integration
Knowledge on Connected Tools (If any)	Basic computer knowledge.

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the geometric properties of curves using differential calculus.
CLO2	Describe the concepts of probability to understand and use probability theory for analyzing uncertainty and solving related problems.
CLO3	Demonstrate the numerical methods for modeling and solving complex engineering and scientific problems where analytical solutions are difficult to obtain.

Module – 1	**05 Hrs.**
Differential Calculus: Successive differentiation-problems. Taylor's & Maclaurin's series expansions-problems. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.	
Module – 2	**05 Hrs.**
Basic Probability Theory: Introduction, Sample space and Events, Axioms of Probability. Addition and Multiplication theorem. Conditional Probability. Independent events. Baye's theorem, Problems.	
Module – 3	**05 Hrs.**
Numerical Method -II: Numerical solution of first-order ordinary differential equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of order 4, Milne's predictor-corrector method. Problems.	

Topics for Self learning	
Module – 1	**Applications:** Maxima and minima for function of two variables.
	Self-study: Method of Lagrange's undetermined multipliers.
Module – 2	**Applications**: Analyze the performance of the algorithms.
	Self-Study: Random Variables
Module – 3	**Applications:** Estimating the approximate solutions of ODE.
	Self-Study: Adam-Bashforth method.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply and interpret the geometric properties of curves in polar coordinates by applying the principles of differential calculus.
CO2	Apply concepts of probability theory and to solve related problems.
CO3	Analyze the numerical techniques to solve numerical solution of first-order ordinary

	differential equations.

Text Books	
1	Higher Engineering Mathematics", B. S. Grewal,44th Edition, 2021, Khanna Publishers, ISBN:978-81-933284-9-1. Chapter. 4,5,26,32.
Reference Books	
1	Advanced Engineering Mathematics", Kreyszig, E., Kreyszig, H.& Norminton, E. J. 2025. 11th Edition, Wiley India Pvt. Ltd. ISBN: 9789373329949
2	Higher Engineering Mathematics", Ramana, B. V. 2025. 1st Edition, McGraw Hill Education (India) Pvt. Ltd., ISBN: 9780070634190

Web links and Video Lectures (e – Resources)	
1	http://nptel.ac.in/courses.php?disciplineID=111
2	http://www.class-central.com/subject/math(MOOCs)
3	http://academicearth.org/

CO – PO MAPPING

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

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

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

Department Vision

Building Competent Civil Engineers with a Societal Perspective

Department Mission

- Providing Conducive Learning Environment focusing on Planning, Analysis, Design and Detailing of Sustainable Infrastructure
- Imparting Training, Research and Consultancy in Collaboration with Research Institutes and Industries
- Equipping Students with Employability Skills through Internships, Industrial Interactions and Field Visits
- Exploring Comprehensive Environmental Aware Solutions for Various Fields of Civil Engineering with Multidisciplinary Approach
- Imbibing Lifelong Learning, Professionalism and Ethics among Civil Engineering Students

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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