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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

VI Semester
Scheme & Syllabus of B.E. Programme
Civil Engineering
(2024 Scheme)

Core Values

Spiritual, Judicious, Commitment, Integrity, Trustworthy



AICTE | NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300 | NBA | NAAC A+ | QS I-GAUGE GOLD | INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

SJC INSTITUTEOF TECHNOLOGY,CHIKKABALLAPURA

An Autonomous Institution Under VTU from 2024 – 2025

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SCHEME OF TEACHING AND EXAMINATION – B.E.

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

6th Semester

CIVIL ENGINEERING												
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**TD/ PSB**	**Teaching Hours / Week**			**Examination**				
					L	**T**	**P**	**SEE Duration (Hrs)**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	BCV601	Hydrology and Irrigation Engineering	PCC	Civil	3	2	0	**3**	**50**	**50**	**100**	**4**
2	BCV602	Advanced Concrete Technology	IPCC	Civil	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BCV623x	Professional Elective Course – II	PEC	Civil	3	0	0	**3**	**50**	**50**	**100**	**3**
4	BCV624x	Professional Elective Course – III	PEC	Civil	3	0	0	**3**	**50**	**50**	**100**	**3**
5	BCV645x	Open Elective Course – I	OEC	Civil	3	0	0	**3**	**50**	**50**	**100**	**3**
6	BCV636	Major Project Phase – I	PROJ	Civil	0	0	4	**-**	**100**	**-**	**100**	**2**
7	BCVL607	Software Application Lab	PCCL	Civil	0	0	2	**3**	**50**	**50**	**100**	**1**
8	BCE608	Competency Enhancement Course - 4	NCMC	CDCAC	0	2	0	**-**	**100**	**-**	**100**	**0**
9	BIK609	Indian Knowledge System	NCMC	Any Dept.	1	0	0	**-**	**100**	**-**	**100**	**0**

10	BNS610	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	-	**100**	-	**100**	**0**
	BPE610	Physical Education (PE) (Sports & Athletics)		Physical Education Director								
	BYO610	Yoga		Yoga Teacher								
	BMU610	Music		Music Teacher								
									700	**300**	**1000**	**20**

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

Professional Elective Course – II

Course Code	Course Name	Course Code	Course Name
BCV623 A	Traffic Engineering	**BCV623 C**	Industrial Wastewater Treatment
BCV623 B	Foundation Engineering	**BCV623 D**	Urban Drainage and Flood Risk Management

Professional Elective Course – III

Course Code	Course Name	Course Code	Course Name
BCV624A	Railways, Harbors, Tunnel and Airport	**BCV624C**	Applied Geotechnical Engineering
BCV624B	Design of Formwork and Scaffolding	**BCV624D**	Earthquake Resistant Structures

Open Elective Course – I

Course Code	Course Name	Course Code	Course Name
BCV645A	Water Conservation and Rain Water Harvesting	**BCV645C**	Disaster Management and Mitigation
BCV645B	Integrated Waste Management for a Smart City	**BCV645D**	Environmental Protection and Management

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

(B.E.) 2024-25 may please be referred.
National Service Scheme /Physical Education/Yoga/Music: All students have to register for any one of the courses namely National Service Scheme(NSS), Physical Education (PE) (Sports & Athletics),Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rdsemester to the 6th semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work

Semester: VI						
Hydrology and Irrigation Engineering **Stream:CV**						
Course Code	**:**	BCV601		**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:2:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L+12 T		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Water Resources Engineering.
Knowledge on Fundamental Concepts	Basic science, Environmental Studies
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the concept of hydrology and the components of the hydrologic cycle such as precipitation, infiltration, evaporation, and transpiration.
CLO2	Estimate runoff and apply the concept of unit hydrograph in hydrological analysis.
CLO3	Illustrate different methods of irrigation, methods of water application, and irrigation procedures.
CLO4	Design canals and canal networks based on the water requirements of various crops.
CLO5	Examine the concepts of floods and droughts and discuss the importance of water conservation.

Module – 1	**08Hrs**
Hydrology: Introduction, Hydrologic cycle (Horton's) qualitative and engineering representation. **Precipitation:**Forms and types, measurement of rain fall using Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data. Spatial analysis of rain fall data using thession polygon &isohyetal method. **Losses from Precipitation:** Evaporation process, factors affecting evaporation, measurement using IS class-A Pan, Reservoir evaporation and control. Factors affecting Evapo-transpiration. **Text Book 1:** Ch.1	
Module – 2	**08Hrs**
Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis, runoff estimation using empherical formulas. **Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations. **Text Book 1:** Ch.3	
Module – 3	**08Hrs**
Irrigation: System of irrigation: surface and ground water, flow irrigation, lift irrigation. Methods of irrigation: surface, sprinkler and drip/micro irrigation. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation. **Text Book 1:** Ch.5	
Module – 4	**08Hrs**
Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals.	

Standard sections. Regime channels, Design of canals by Lacey's and Kennedy's method (No numerical examples).
Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam. General principles of design of spillways, life of reservoir.
Text Book 1: Ch.5

Module – 5	**08Hrs**

Flood Management: Indian rivers and floods, Causes of floods, Alleviation, Levees and floodwalls, Flood ways, Channel improvement, Flood damage analysis.
Drought Management: Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning.
Origin – Classification and types – Properties of aquifers – Governing equations – Steady and unsteady flow – Artificial recharge – RWH in rural and urban areas.
Water Harvesting: Rainwater collection, small dams, runoff enhancement, runoff collection, Restoration and rejuvenation of water bodies (ponds and lakes)
Text Book 1: Ch.5

Topics for Self - learning	
Module – 1	Explain the importance of water resources in daily life.
	Identify and classify different types of rain gauges and describe their applications.
Module – 2	Analyze the factors affecting runoff from a catchment.
	Explain the components and characteristics of a simple hydrograph.
Module – 3	Discuss the advantages and disadvantages of drip irrigation systems.
	Identify major crops and describe crop seasons in India.
Module – 4	Classify different types of canals and explain their uses.
	Explain the functions and evaluate the benefits of reservoirs.
Module – 5	Analyze the causes and effects of floods and droughts.
	Describe and evaluate rainwater harvesting methods in urban and rural areas.

Course Outcomes: After completing the course,the students will be able to	
CO1	Apply hydrological principles to evaluate hydrological processes and their measurements.
CO2	Analyze rainfall and runoff characteristics to develop hydrographs.
CO3	Determine the quantity and frequency of irrigation for various crops using appropriate irrigation methods.
CO4	Evaluate different types of canals and compute reservoir capacity for water resources planning.
CO5	Assess flood and drought conditions to justify the importance of water conservation measures.

Text Books	
1	Engineering Hydrology, K. Subramanya, 6th Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2023, ISBN: 9789355327940.
2	A Textbook of Hydrology, N. Jayaram Reddy, 4th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2021, ISBN: 9789381159828.
3	Irrigation and Water Power Engineering, B. C. Punmia, P. B. B. Lal and Ashok Kumar Jain, 18th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2023, ISBN: 9788131808146.

Reference Books	
1	Hydrology: Principles, Analysis and Design, H. M. Raghunath, 3rd Edition (Reprint), New

	Age International Publishers, New Delhi, 2018, ISBN: 9788122431827.
2	Textbook of Irrigation Engineering, R. K. Sharma and T. K. Sharma, Latest Reprint Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2019, ISBN: 9788120405080.
3	Applied Hydrology, VenTe Chow, David R. Maidment and Larry W. Mays, International Edition, McGraw Hill Education, New York, 2017 Reprint, ISBN: 9780071001748.
4	Water Resources and Water Power Engineering, P. N. Modi, 11th Edition, Standard Publishers Distributors, New Delhi, 2020, ISBN: 9788189401290.
5	Irrigation Engineering and Hydraulic Structures, S. K. Garg, 39th Revised Edition, Khanna Publishers, New Delhi, 2024, ISBN: 9789352602354.

Web links and Video Lectures (e – Resources)	
1	**Unit Hydrograph Concept: https://www.youtube.com/watch?v=6xB3BZoxczA&list=PLzz056xzvpUWKYQl9WBbgR5nHiiVhERKK&index=2**
2	**Drought Management: https://www.youtube.com/watch?v=vEkfwnvvHDs**
3	**Watershed Management: Flood Control: https://www.youtube.com/watch?v=-32O1D7r1EY**

CO – PO MAPPING

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

Semester: VI						
Advanced Concrete Technology **Stream: CV**						
Course Code	**:**	BCV602		**Credits**	**:**	4
Hours/Week (L: T: P)	**:**	3:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L+12 P		**SEE**	**:**	50 Marks
Course Type	**:**	IPCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Civil Engineering, Construction Materials, Concrete Technology
Knowledge on Fundamental Concepts	Basics of cement composition and properties, concrete mix proportioning, material properties, concrete curing and hardening.
Knowledge on Connected Tools (If any)	Relevant IS codes provision

Course Learning Objectives: This course will enable the students to	
CLO1	Analyze role of constituent materials and admixtures in modifying concrete properties.
CLO2	Examine the behaviour, production, and applications of special concretes such as fibre-reinforced, ferrocement, lightweight, and high-density concretes.
CLO3	Develop High-Performance Concrete (HPC) and Ultra-High-Performance Concrete (UHPC) mixes.
CLO4	Apply polymer-based concretes and industrial waste materials for sustainable construction practices.
CLO5	Analyze the use of advanced concretes in real-world applications with respect to durability, economy, and sustainability.

Module – 1	**08 Hrs**
Constituent Materials: Role of constituents, Components of modern concrete, Rheology, Mineral and Chemical admixtures and their effect on properties of concrete. Introduction to Nano-materials. **Special Cements:** Need, Classifications, Blended cements, modified hydraulic cements, calcium aluminate cements, calcium sulphate-based binders, calcium sulfo aluminate cements, shrinkage compensating (or) expansive cements, macro defect-free cements, phosphate cements, fast setting cements, their Performance and prescriptive specifications, Properties and applications. **Text Book 1**: Ch.1	
Module – 2	**08 Hrs**
Fibre Reinforced Concrete: History, mechanism, different types of fibres, Aspect ratio, Volume of fibres, Orientation of fibres, balling effect, properties of fibre reinforced concrete, applications of fibre reinforced concrete. Types of fibre reinforced concrete. **Ferrocement:** Definition, different materials used, casting techniques, properties of Ferro cement, applications. **Text Book 2:** Ch.20	
Module-3	**08 Hrs**
Light Weight Concrete: Introduction, classification, properties, strength and durability, mix proportioning. **High Density and High Strength Concrete:** Radiation shielding ability of	

concrete, materials for high density concrete and high strength concrete, mix proportioning, properties in fresh and hardened state.

Text Book 3: Ch.7

Module – 4	**08 Hrs**

High Performance Concrete: Constituents, mix proportioning, properties in fresh and hardened states, applications & limitations

Ultra-High-Performance Concrete: Constituents, mix proportioning, properties in fresh and hardened states, applications & limitations, durability characteristics, Microstructural characterization, Applications, Construction & economic Aspects along with carbon units and embodied energy.

Text Book 4: Ch.12

Module – 5	**8 Hrs**

Polymer Concrete: Polymers, resins, polymerization, different types of polymer concrete like polymer impregnated concrete, polymer concrete (Resin concrete) and polymer modified concrete, their properties and applications.

Concrete from Industrial wastes:

a. Blast Furnace Slag Cement Concrete
b. Fly-Ash Concrete
c. Silica Fume Concrete
d. Recycled Aggregate Concrete

Text Book 4: Ch.12

SL NO.	**LABORATORY EXPERIMENTS**
1	Determine the workability of normal and admixture-modified concrete using the slump test.
2	Perform the slump-flow (T50) test to evaluate the flowability and passing ability of SCC/HPC.
3	Determine the setting time of special/blended cements using the Vicat apparatus.
4	Evaluate the flexural strength and toughness characteristics of fibre-reinforced concrete.
5	Determine the density, water absorption, and compressive strength of lightweight concrete.
6	Conduct the compressive strength test to assess the performance of polymer-modified (resin) concrete.

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply constituent materials, special cements and nano-materials to assess concrete properties.
CO2	Analyze the properties and applications of fibre-reinforced concrete and ferrocement.
CO3	Evaluate the suitability of lightweight, high-density and high-strength concretes for specialized applications.
CO4	Design High-Performance Concrete (HPC) and Ultra-High-Performance Concrete (UHPC) mixes.
CO5	Assess polymer concrete and industrial waste-based concretes for sustainable construction.

Text Books

1	Properties of Concrete, A. M. Neville, 5th Edition, Pearson Education, 2012, ISBN: 9780273755807.
2	Concrete Technology: Theory and Practice, M. S. Shetty, 9th Edition, S. Chand Publishing, New Delhi, 2019, ISBN: 9789352533800.
3	Advanced Concrete Technology, Zongjin Li, 2nd Edition, John Wiley & Sons, 2022, ISBN: 9781119806196.
4	Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta and Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education, 2014, ISBN: 9780071797870.

Reference Books	
1	High-Performance Concrete, Pierre-Claude Aïtcin, 1st Edition (Reprint), CRC Press, 1998, ISBN: 9780419192701.
2	Special Concrete and Composites, Ravindra K. Dhir, Kevin A. Paine and Moray D. Newlands, 1st Edition, Thomas Telford Publishing, 2002, ISBN: 9780727731763.
3	Fiber Reinforced Cement Composites, S. P. Shah and P. N. Balaguru, 1st Edition, McGraw-Hill International Editions, 1992, ISBN: 9780070561472.
4	Nanotechnology for Smart Concrete, G. F. Huseien, N. Hafizah, A. Khalid and N. Hafizah, 1st Edition, CRC Press, Taylor & Francis Group, 2022, ISBN: 9781032184371.

Web links and Video Lectures (e – Resources)	
1	**Fibre Reinforced Concrete:** **https://www.youtube.com/watch?v=OLYKpuotii8**
2	**Ultra-High-Performance Concrete:** **https://www.youtube.com/watch?v=EN78W9NWKlA**
3	**Concrete from Industrial Wastes:** **https://www.youtube.com/watch?v=3HkR-DajtIw**

CO-PO MATRIX

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

Semester : VI						
Traffic Engineering **Stream:CV**						
Course Code	**:**	BCV623A		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Transportation Engineering
Knowledge on Fundamental Concepts	Basic road design principles and geometric elements, Fundamentals of traffic flow and road user behavior.
Knowledge on Connected Tools (If any)	**----**

Course Learning Objectives: This course will enable the students to	
CLO1	Apply fundamental concepts, scope, and significance of traffic engineering in transportation systems.
CLO2	Describe traffic data collection, analysis, and remedial measures.
CLO3	Apply probabilistic and queuing techniques to analyze traffic flow and safety.
CLO4	Analyze traffic safety, planning, design, operation, and control issues.
CL05	Apply Intelligent Transportation Systems (ITS) in traffic management

Module – 1	**08 Hrs**
Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration. **Text Book 1:** Ch.2	
Module – 2	**08 Hrs**
Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident Analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of Service-Concept, applications and significance. **Text Book 1:**Ch.3,Ch.4,Ch.5,Ch.6,Ch.9	
Module – 3	**08 Hrs**
Traffic Design and Visual Aids: 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. **Text Book 1:** Ch. 13,Ch. 14	
Module – 4	**08 Hrs**
Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement	

measures, Promotion and integration of public transportation, Promotion of non-motorized transport. **Text Book 1:** Ch. 18

Module – 5	**08 Hrs**
Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education. **Text Book 1:** Ch. 20, Ch. 21, Ch. 22	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret traffic planning principles, road characteristics, and traffic flow.
CO2	Analyze traffic survey data for forecasting and level of service evaluation.
CO3	Design intersections, traffic control devices, and non-motorized transport facilities.
CO4	Evaluate traffic safety, environmental impacts, and sustainable transport solutions.
CO5	Apply traffic management strategies and intelligent transport systems for urban mobility.

Text Books	
1	Traffic Engineering and Transport Planning, L. R. Kadiyali, 8th Edition, Khanna Publishers, New Delhi, 2020, ISBN: 9789386173423.
2	Highway Engineering, S. K. Khanna, C. E. G. Justo and A. Veeraragavan, 11th Edition, Nem Chand & Bros., Roorkee, 2017, ISBN: 9788185240930.

Reference Books	
1	Highway Traffic Analysis and Design, R. I. Salter and N. B. Hounsell, 4th Edition, Palgrave Macmillan, London, 1996, ISBN: 9780333648476.
2	Principles of Highway Engineering and Traffic Analysis, Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, 7th Edition, Wiley India Pvt. Ltd., New Delhi, 2023, ISBN: 9781119721888.
3	Traffic and Highway Engineering, Nicholas J. Garber and Lester A. Hoel, 6th Edition, Cengage Learning, New Delhi, 2019, ISBN: 9781337631020.
4	Traffic Management: Planning, Operations and Control, John E. Tyworth, Latest Available Edition, Addison-Wesley Publishing Company, 1996, ISBN: 9780805308297.
5	IRC: SP: 88–2019 – Manual on Road Safety Audit, Indian Roads Congress, 1st Edition, Indian Roads Congress, New Delhi, 2019.
6	IRC: SP: 43–1994 – Guidelines on Low-Cost Traffic Management Techniques for Urban Areas, Indian Roads Congress, 1st Edition, Indian Roads Congress, New Delhi, 1994.
7	IRC Codes, Specifications and Guidelines on Traffic Planning and Management, Indian Roads Congress, Latest Revisions, Indian Roads Congress, New Delhi, 2024.

Web links and Video Lectures (e– Resources)	
1	**Traffic Planning and Characteristics**: https://www.youtube.com/watch?v=gvgwYeXyn_U
2	**Traffic Design and Visual Aids:** **https://www.youtube.com/watch?v=q9A51VmSZJk**

3	**Traffic Management:** **https://www.youtube.com/watch?v=smJnmrS6btQ&list=PLKqKlgTJhAyOGZroBgQdIm22r41sEq4JC**

CO – PO MAPPING

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

Semester: VI						
Foundation Engineering **Stream: CV**						
Course Code	**:**	BCV623B		**Credits**	**:**	3
Hours/Week (L: T: P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Soil Mechanics,
Knowledge on Fundamental Concepts	• Index and engineering properties of soils • Soil classification systems • Permeability, seepage, compaction and consolidation • Shear strength of soils • Stress distribution in soil masses
Knowledge on Connected Tools (If any)	Relevant IS Codal Provisions.

Course Learning Objectives: This course will enable the students to	
CLO1	Plan and conduct subsurface investigations to obtain soil characteristics and evaluate the suitability of foundation systems
CLO2	Apply geotechnical principles in the design of shallow foundations.
CLO3	Analyze different types of settlement in footings and rafts.
CLO4	Examine various types of pile foundations and estimate their bearing capacity.
CLO5	Analyse the principles and applications of well foundations.

Module – 1	**08 Hrs**
Site Investigation and Selection of Foundation: Scope and Objectives, Methods of Exploration, Auguring and Boring, Wash Boring and Rotary Drilling, Depth and Spacing of Bore Holes,Soil Samples, Representative and Undisturbed, Sampling Methods Split Spoon Sampler, Thin Wall Sampler, Stationary Piston Sampler, Penetration Tests (SPT and SCPT),Data Interpretation, Strength Parameters,Bore Log Report and Selection of Foundation. **Text Book 1:**Ch 32 **Text Book 2:**Ch 17	
Module – 2	**08 Hrs**
Bearing Capacity and Shallow Foundation: Location and Depth of foundation, Codal Provisions, Bearing Capacity of Shallow Foundation on Homogeneous Deposits,Terzaghi's Formula and BIS formula,Factors Affecting Bearing Capacity Bearing Capacity from In-Situ Tests (SPT, SCPT and Plate Load) ,Allowable Bearing Pressure, Seismic Considerations in Bearing Capacity Evaluation, Determination of Settlement of Foundations on Granular and Clay Deposits,Total and Differential Settlement, Allowable Settlements, Codal Provision, Methods of Minimizing Total and Differential Settlements. **Text Book 1:**Ch 24 **Text Book 2:**Ch 23	
Module – 3	**08 Hrs**
Foundation Settlement: Settlement Analysis, Data for settlement analysis, computation of settlement, Concept, immediate, consolidation and secondary settlements (no derivations), Tolerance. BIS specifications for total and differential settlements of footings	

and rafts.

Footings and Rafts: Types of Isolated Footing, Combined Footing, Mat Foundation, Contact Pressure and Settlement Distribution, Proportioning of Foundations for Conventional Rigid Behavior, Minimum Thickness for Rigid Behavior, Applications, Compensated Foundation, Codal Provisions.

Text Book 3: Ch :11 Ch: 15

Module – 4	**08 Hrs**

Pile Foundation: Types of Piles and Functions ,Factors Influencing the Selection of Pile , Carrying Capacity of Single Pile in Granular and Cohesive Soil , Static Formula ,Dynamic Formulae (Engineering News and Hileys),Capacity from In-Situ Tests (SPT and SCPT), Negative Skin Friction , Uplift Capacity, Group Capacity by Different Methods, Settlement of Pile Groups , Interpretation of Pile Load Test (Routine Test Only), Under Reamed Piles, Capacity under Compression and Uplift , Cohesive -Expansive ,Non Expansive — Cohesionless Soils ,Codal Provisions.

Text Book 1: Ch:26 **Text Book 2:**Ch :25

Module – 5	**08 Hrs**

Well Foundation: Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts. Drilled Piers & Caissons: Introduction, construction, advantages and disadvantages of drilled piers. Design of open, pneumatic and floating caissons. Advantages and disadvantages of floating caissons.

Text Book 1: Ch: 27 **Text Book 2:**Ch: 27

Course Outcomes: After completing the course,the students will be able to	
CO1	Develop subsurface investigation plans and determine soil parameters for foundation suitability assessment.
CO2	Analyze the performance of shallow foundations and assess immediate, consolidation, and differential settlements.
CO3	Evaluate foundation settlement behavior and select appropriate footing and raft foundation systems for varying site conditions.
CO4	Determine the bearing and load-carrying capacities of pile foundations using theoretical, empirical, and field-based approaches.
CO5	Assess and recommend suitable well foundation solutions considering settlement requirements, loading conditions, and geotechnical constraints

Text Books	
1	Soil Mechanics and Foundation Engineering, B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, 17th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2022, ISBN: 9789354602499.
2	Soil Mechanics and Foundation Engineering, K. R. Arora, 8th Edition, Standard Publishers Distributors, New Delhi, 2017, ISBN: 9788180141120.
3	Geotechnical Engineering, C. Venkataramaiah, 6th Edition, New Age International Publishers, New Delhi, 2023, ISBN: 9789389802689.
4	Foundation Engineering, P. C. Varghese, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012, ISBN: 9788120342958.

Reference Books	
1	Basic and Applied Soil Mechanics, Gopal Ranjan and A. S. R. Rao, 3rd Edition, New Age International Publishers, New Delhi, 2016, ISBN: 9788122436563.
2	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series), V. N. S. Murthy, 3rd Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2018, ISBN: 9788123928685.
3	oil Mechanics, T. William Lambe and Robert V. Whitman, SI Edition Reprint, Wiley India Pvt. Ltd., New Delhi, 2017, ISBN: 9788126517619.
4	Indian Standard Codes for Foundation Engineering (IS 1904, IS 6403, IS 8009, IS 2950, IS 2911 and other relevant codes), Bureau of Indian Standards, Latest Revisions, Bureau of Indian Standards, New Delhi, 2024.

Web links and Video Lectures (e – Resources)	
1	**Site Investigation and Selection of Foundation:** https://www.youtube.com/watch?v=zVbB6lnsTIQ
2	**Bearing Capacity and Shallow Foundation:** https://www.youtube.com/watch?v=rTJp4KRIgWM
3	**Pile Foundation:** https://www.youtube.com/watch?v=ymMSz3qTfJU
4	**Well Foundation:** https://www.youtube.com/watch?v=lNfQZyXjifE

CO-PO MATRIX

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

Semester : VI						
Industrial Wastewater Treatment **Stream: CV**						
Course Code	**:**	BCV623C		**Credits**	:	3
Hours/Week (L: T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Water supply and Waste Water Treatment Engineering
Knowledge on Fundamental Concepts	Water Chemistry and Microbiology
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students to	
CLO1	Describe the characteristics, quality requirements, and sources of domestic and industrial water and wastewater.
CLO2	Apply appropriate physico-chemical and biological treatment processes for the treatment of industrial effluents.
CLO3	Design integrated treatment systems for industrial effluent management.
CLO4	Analyze real-world industrial case studies and suggest suitable source reduction and treatment options
CLO5	Explore waste minimization and treatment strategies.

Module – 1	**08 Hrs**
Introduction: Importance of treatment of industrial waste water, Difference between domestic and industrial wastewater, effects on streams and on Municipal Sewage treatment plants, and receiving water bodies. Regulatory frame work and standards governing industrial waste water discharge. effluent and stream standards and legislation to Control water pollution.**Text Book 1:** Ch 1.1-1.5	
Module – 2	**08 Hrs**
Industrial Wastewater Treatment: Physico–Chemical Treatment Processes – Equalization, Neutralization, Oil Separation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors. **Text Book 1:** Ch 3.1-3.6	
Module – 3	**08 Hrs**
Advanced Treatment Methods: Removal of Inorganic, Organic solids, suspended, colloidal and dissolved solids – Adsorption, Ion Exchange, UASB, Gas stripping. AOP. Treatment and disposal of sludge – Anaerobic digestion, Sludge drying beds, centrifuge, thickening - filter press, multi stage evaporators, sludge conditioning **Text Book 1:** Ch 6.1-6.8. Ch 11.1-11.15	
Module – 4	**08 Hrs**
Individual and Common Effluent Treatment Plants: Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse Industrial reuse , Present status and issues - Disposal on water and Land. **Text Book 2:** Ch 22	
Module – 5	**08 Hrs**
Case Studies: Industrial manufacturing process description, wastewater characteristics,	

source reduction options and waste treatment flow sheet for Dairy- Sugar- Textiles – Tanneries – Pulp and paper – metal finishing, Sugar and Distilleries **Text Book 2:** Ch 6, 7, 9, 10,11

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze industrial wastewater characteristics and assess their environmental impacts.
CO2	Select appropriate treatment technologies for various industrial effluents.
CO3	Evaluate advanced treatment methods for the removal of complex contaminants and sludge management.
CO4	Design wastewater treatment systems for various industries, including reuse and zero liquid discharge (ZLD) schemes.
CO5	Develop waste minimization and treatment strategies based on industrial case studies

Text Books	
1	Industrial Water Pollution Control, W. Wesley Eckenfelder Jr., 3rd Edition, McGraw-Hill Education, New York, 2000, ISBN: 9780070190818.
2	Industrial Wastewater Treatment, A. D. Patwardhan, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2017, ISBN: 9788120352537.

Reference Books	
1	Wastewater Treatment: Concepts and Design Approach, M. N. Rao and A. K. Datta, Revised Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2017, ISBN: 9788120417137.
2	Pollution Control in Process Industries, P. Mahajan, Reprint Edition, Tata McGraw-Hill Publishing Company, New Delhi, 2010, ISBN: 9780074601662.
3	Handbook of Industrial Pollution and Control (Vol. I & II), S. C. Bhatia, 1st Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2003, ISBN: 9788123908854.
4	Industrial Waste Treatment Handbook, Nelson Leonard Nemerow, Franklin J. Agardy and Joseph A. Sullivan, 2nd Edition, Elsevier Science & Technology Books, Amsterdam, 2007, ISBN: 9780750679636.

Web links and Video Lectures (e – Resources)	
1	**Industrial Wastewater Treatment:** **https://www.youtube.com/watch?v=uuS22nWDqjk**
2	**Individual and Common Effluent Treatment Plants**: **https://www.youtube.com/watch?v=JoD2lmG31q8**
3	**Source, Characteristics and Methods of Treatment for Different Industrial Wastewater: https://www.youtube.com/watch?v=L9D8hhbXQUw**

CO – PO MAPPING

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

Semester: VI					
Urban Drainage and Flood Risk Management **Stream: CV**					
Course Code	**:**	BCV623D	**Credits**	**:**	3
Hours/Week (L:T:P:S)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40 L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	03 Hours

Prerequisites:	
Courses	Environmental Engineering, GIS.
Knowledge on Fundamental Concepts	Engineering Hydrology, Fluid Mechanics, Environmental Engineering, Engineering Mathematics.
Knowledge on Connected Tools (If any)	MS Excel, Python/MATLAB, AutoCAD/Civil 3D.

Course Learning Objectives: This course will enable the students to	
CLO1	Apply the principles of hydrology and hydraulics in urban environments.
CLO2	Apply design and analysis principles to urban drainage and sewer systems.
CLO3	Analyze storm water quality, flood risks, and drainage system sustainability.
CLO4	Examine climate adaptation and resilience in drainage system design.
CLO5	Explore real-world drainage practices using case studies and modeling software.

Module – 1	**08 Hrs**
Introduction to Urban Drainage: Importance and objectives of urban drainage systems, Urbanization and its impact on the hydrological cycle, Differences between rural and urban runoff. **Hydrology for Urban Areas:** Rainfall analysis: intensity, duration, frequency (IDF) curves Estimation of runoff: Rational method, Time of concentration, hydrograph analysis. **Text Book 1:** Ch.1 and 5.	
Module – 2	**08 Hrs**
Urban Stormwater Management: Types of drainage systems: combined, separate, partially separate, Stormwater quantity and quality issues, Low Impact Development (LID) and Sustainable Urban Drainage Systems (SUDS), Green infrastructure: green roofs, bioswales, rain gardens. **Climate Change and Urban Drainage:** Impacts of climate variability on urban hydrology**,** Adaptation and resilience strategies. **Text Book 1:**Ch.2.	
Module – 3	**08 Hrs**
Design of Urban Drainage Systems: Hydraulic design of storm sewers (Manning's Equation), Inlet and manhole design, Detention and retention basins, Design storms and return periods, Software tools (e.g., SWMM) **Sewer Systems and Wastewater Management:** Sewer types and layouts**,** Sewer materials and appurtenances**,** Hydraulic design of sanitary sewers**,** Infiltration and inflow estimation. **Text Book3:**Ch.6 and 7	
Module – 4	**08 Hrs**
Flood Risk and Management: Urban flooding: causes and consequences**,** Flood modeling and mapping**,** Flood control strategies**,** Early warning systems and emergency response.	

Water Quality in Urban Runoff: Pollutants in storm water runoff**,** First flush phenomenon**,** BMPs for urban runoff pollution control**,** Monitoring and assessment of water quality. **Text Book 4:** Ch.1, 2 and 3	
Module – 5	**08 Hrs**
Operation, Maintenance and Rehabilitation: Inspection and maintenance of drainage systems, Rehabilitation techniques, Asset management. **Case Studies and Practical Applications:** Local and international examples of urban drainage projects**,** Modeling and simulation exercises**,** Design projects or term papers. **Text Book 1:** Ch.17 and 18	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze hydrological changes due to urbanization and estimate urban runoff.
CO2	Design sustainable urban stormwater systems using LID/SUDS approaches.
CO3	Develop urban drainage networks and sewer systems using analytical methods and software tools.
CO4	Evaluate urban flood risks and apply BMPs for stormwater quality management.
CO5	Assess case studies, maintenance practices, and asset management strategies for urban drainage systems.

Text Books	
1	Urban Drainage, David Butler, John W. Davies and Christopher M. Digman, 4th Edition, CRC Press, Taylor & Francis Group, 2018, ISBN: 9781138676507.
2	Urban Hydrology, Hydraulics, and Storm water Quality, Richard H. McCuen, 1st Edition, John Wiley & Sons, 2004, ISBN: 9780471431589.
3	Flood Risk Management, Theodore V. Hromadka II and Prasada Rao (Editors), 1st Edition, Intech Open, 2018, ISBN: 9789535134657.

Reference Books	
1	Urban Water Cycle Processes and Interactions, Jiri Marsalek et al., 1st Edition, UNESCO-IHP and Taylor & Francis, 2006, ISBN: 9789231049662.
2	Water Quality: Prevention, Identification and Management of Diffuse Pollution, Vladimir Novotny and Harold Olem, 1st Edition, John Wiley & Sons, 1994, ISBN: 9780471353737.
3	Water Resources Engineering, Larry W. Mays, 3rd Edition, John Wiley & Sons, 2020, ISBN: 9781119490579.
4	Water-Resources Engineering, David A. Chin, 3rd Edition, Pearson Education, 2012, ISBN: 9780132833213.
5	Storm Water Management Model (SWMM) User's Manual Version 5.1, Lewis A. Rossman, Latest EPA Edition, U.S. Environmental Protection Agency (EPA), 2015.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=yB4FCF_aPKs
2	https://youtu.be/OUUQTBH6nj4?si=SwMyzy6d34xCEK-8
3	https://youtu.be/aDWTvAstKIs?si=ZrR8FkM8m1oAt4fj

CO-PO MAPPING

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

Semester : VI					
Railways, Harbors, Tunnel and Airport **Stream: CV**					
Course Code	**:**	BCV624A	**Credits**	**:**	3
Hours/Week(L:T:P:S)	**:**	3:0:0	**CIE**	**:**	50 Marks
Total Hours	**:**	40 L	**SEE**	**:**	50 Marks
Course Type	**:**	PEC	**SEE Duration**	**:**	3 Hours

Prerequisites	
Courses	Transportation Engineering, Surveying and Geomatics, AutoCAD/Civil 3D.
Knowledge on Fundamental Concepts	Basics of railways, harbours, tunnels, and airports.
Knowledge on Connected Tools (If any)	AutoCAD, Civil 3D, GIS, MATLAB, OpenRoads, STAAD, ArcGIS.

Course Learning Objectives: This course will enable the students to	
CLO1	Explain planning principles for railways, harbors, tunnels, and airports.
CLO2	Describe the design elements and construction methods used in modern infrastructure.
CLO3	Analyze the integration of multiple transportation modes for sustainable development.
CLO4	Develop airport and railway layouts based on ICAO and Indian standards.
CLO5	Examine runway and taxiway markings and lighting systems in compliance with ICAO or FAA standards.

Module – 1	**08 Hrs**
Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only). **Text Book 1:** Ch.1-10	
Module – 2	**08 Hrs**
Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways. **Text Book 2:**Ch.8, 9,18 and 20	
Module – 3	**08 Hrs**
Harbour and Tunnel Engineering: Definition of Basic Terms: Planning and Design of Harbors: Requirements, Classification, Location and Design Principles – Harbor Layout and Terminal Facilities, Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works. Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation. **Text Book 3:**Ch.1-12, Ch.13,14,15,21,22 and 23	
Module – 4	**08 Hrs**

Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, Components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area. **Text Book 4:** Ch.1,5,6,8 and 10

Module – 5	**08 Hrs**
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting. **Text Book 4:** Ch.1,5,6,8 and 10	

Course Outcomes: After completing the course,the students will be able to	
CO1	Interpretthe planning principles, operational requirements, and functional components of railways, harbours, tunnels, and airports
CO2	Examine the design considerations, geometric features, and construction methodologies used in modern transportation infrastructure systems.
CO3	Analyze the integration of different transportation modes and evaluate their contribution to sustainable and efficient mobility.
CO4	Design railway and airport layouts in accordance with ICAO standards, Indian regulations, and established engineering practices.
CO5	Assess runway and taxiway markings, lighting systems, and airside facilities for compliance with ICAO and FAA operational and safety requirements

Text Books	
1	A Textbook of Railway Engineering, S. C. Saxena and S. P. Arora, 2024 Edition, Dhanpat Rai & Sons, New Delhi, 2024, ISBN: 9788189928834.
2	Railway Engineering, Satish Chandra and M. M. Agrawal, 2nd Edition, Oxford University Press, New Delhi, 2013, ISBN: 9780198083535.
3	Harbour, Dock and Tunnel Engineering, R. Srinivasan, 30th Edition, Charotar Publishing House Pvt. Ltd., Anand, 2022, ISBN: 9789385039416.
4	Airport Engineering: Planning, Design and Development of 21st Century Airports, Norman J. Ashford, Saleh Mumayiz and Paul H. Wright, 4th Edition, John Wiley & Sons, 2011, ISBN: 9780470398555.

Reference Books	
1	Transportation Engineering Volume–II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, C. Venkataramaiah, 6th Edition, Universities Press, Hyderabad, 2023, ISBN: 9789391370923.
2	Airport Planning and Design, S. K. Khanna, M. G. Arora and S. S. Jain, Latest Revised Edition, Nem Chand & Bros., Roorkee, 2019, ISBN: 9788185240978.
3	Introduction to Transportation Engineering, James H. Banks, 2nd Edition, McGraw-Hill Education, 2010, ISBN: 9780072431803.
4	A Course in Docks and Harbour Engineering, S. P. Bindra, 8th Edition, Dhanpat Rai & Sons, New Delhi, 2018, ISBN: 9788187433668.
5	IRC Codes and Specifications, Indian Roads Congress, Latest Revisions, Indian Roads Congress, New Delhi, 2024.

Web links and Video Lectures (e – Resources)	
1	**Railway Planning:** https://www.youtube.com/watch?v=Ro6yS9uz76U&list=PLLy_2iUCG87A6xpDI_OJcWynns4e-st5T
2	**Tunnel Engineering:** https://www.youtube.com/watch?v=twpAYrmRR8M&list=PLiYAH68F-CTB4CE8VUgJqmlE-8GpRb_Vg
3	**Airport Planning:** https://www.youtube.com/watch?v=UNRVaMykHPc&list=PLRo6dG4oqePfxRj7cUGdroz7Ly5lrC-dt

CO-PO Mapping

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

Semester: VI						
Design of Formwork and Scaffolding **Stream: CV**						
Course Code	**:**	BCV624B		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Engineering Mechanics, Mathematics, Building Materials.
Knowledge on Fundamental Concepts	Structural elements, load transfer, construction techniques, drawings, and materials.
Knowledge on Connected Tools (If any)	MS Excel, MS Project/Primavera.

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the Fundamentals and Applications of Formwork Systems
CLO2	Apply Principles of Formwork Planning, Design and Safety
CLO3	Estimate and Optimize Formwork Costs and Resources
CLO4	Evaluate Modular and Special Formwork Systems and Scaffolding Practices
CLO5	Analyze and Mitigate Formwork Failures through Technical and Safety Compliance

Module – 1	**8 Hrs**
Introduction to Formwork: Classification, benefits, objectives, areas of competitiveness, selection of Formwork, formwork materials, accessories and consumables, application of Tools. Formwork for Foundation, Wall, Columns, Slab and Beam. Conventional drawings. Vertical Application of Conventional Foundation Formwork, Formwork components, Components, assembly and de-shuttering of formwork System, Flex System, Heavy Duty Tower System, safety of work, Formwork for stairs, Load Bearing Tower. **Text Book 1:** Ch.1, 2, 4, 5, 6 & 7	
Module – 2	**8 Hrs**
Planning and Design of Formwork: Formwork planning and monitoring, basics of formwork design, design assumptions and design methods. Design of wall formwork, slab formwork and checks. Formwork drawing Concept and Preparation Guidelines, BOQ Calculation and Checklist. **Text Book 1:** Ch.3, 10 & 11	
Module-3	**8 Hrs**
Formwork Cost Estimation and Optimization: Schedule of formwork, Mobilization distribution, BOQ, Quantity Calculation, Cost optimization. **Text Book 1:** Ch.12 & 13	
Module-4	**8 Hrs**
Modular and Special formwork, Scaffolding: Modular and Special formwork: Advantages and Limitations, Shuttering and de-shuttering, applications, Aluminum formwork - Drawings & Components, Activities, High rise construction, Table lifting system. **Scaffolding:** Modular scaffold Installation sequence, Tie and material specification, Ladder	

safety, Loading Classification, application, Components of L&T Modular Scaffolding system, Access scaffold Do's and Don'ts. Innovation and Global practices. **Text Book 1:** Ch.14,15 & 16
Module-5 | **8 Hrs**
Formwork Building and Erection: Formwork assembly for Wall & Column Panels, Equipment and Layout, Plant and Machinery, Formwork erection and safety, Inspection and Corrections, Plant and Machinery, Code and Contractual Requirements. **Formwork Failures:** Causes, design deficiency, safety in formwork, prevention of formwork failures. **Text Book 1:** Ch.17 & 18

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the types, components, materials, and applications of conventional and modern formwork systems.
CO2	Design formwork drawings and prepare BOQs for structural elements.
CO3	Evaluate formwork costs and schedules through quantity take-offs and mobilization planning.
CO4	Assess modular, aluminum, special formwork, and scaffolding systems for construction applications.
CO5	Evaluate formwork failures and recommend appropriate prevention and safety measures.

Text Books	
1	Formwork for Concrete Structures, K. N. Jha, 1st Edition, McGraw Hill Education (India), New Delhi, 2012, ISBN: 9781259004643.
2	Formwork for Concrete Structures, Robert L. Peurifoy, Garold D. Oberlender and Clifton J. Schexnayder, 4th Edition, McGraw-Hill Education, New York, 2018, ISBN: 9781259012501.
3	S 14687: Guidelines for Falsework for Concrete Structures, Bureau of Indian Standards, Latest Revision/Reaffirmed Edition, Bureau of Indian Standards, New Delhi, 2021.

Reference Books	
1	Concrete Pressure on Formwork (Report R108D), CIRIA, Latest Available Edition, Construction Industry Research and Information Association (CIRIA), London, Reprint Edition.
2	IS 456: Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, Latest Revision/Reaffirmed Edition, Bureau of Indian Standards, New Delhi, 2021.

Web links and Video Lectures (e – Resources)	
1	**Introduction to Formwork: https://www.youtube.com/watch?v=v30j0YfapQw**
2	**Planning and Design of formwork: https://www.youtube.com/watch?v=KFqtas8YhVE&list=PLAH7b05Vz14G8Q4CA_ufs19oethxX86K9**
3	**MIVAN Form Work: https://www.youtube.com/watch?v=tBguN9TTEYQ**

CO – PO MAPPING

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

Semester: VI						
Applied Geotechnical Engineering **Stream: CV**						
Course Code	**:**	BCV624C		**Credits**	**:**	3
Hours/Week (L: T: P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Engineering Mathematics, Mechanics, Materials Science, Physics, Basic Engineering Principles.
Knowledge on Fundamental Concepts	Soil Mechanics, Foundation Engineering, analytical and problem-solving skills.
Knowledge on Connected Tools (If any)	---

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the basic concepts of soil mechanics and their role in foundation engineering.
CLO2	Describe geotechnical investigations with emphasis on in-situ methods.
CLO3	Apply soil bearing capacity theories in the design of shallow and pile foundations.
CLO4	Analyze internal stresses in soil for proportioning shallow and deep foundations.
CLO5	Examine slope stability and earth pressures on retaining structures.

Module – 1	**08 Hrs**
Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method). **Text Book 2:** Ch :18 **Text Book 3:** Ch :15,16 & 17	
Module – 2	**08 Hrs**
Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart. Foundation Settlement: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1). **Text Book 2:** Ch :10 **Text Book 3:** Ch :11	
Module – 3	**08 Hrs**
Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction. Stability of Slopes,Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts. **Text Book 2:** Ch :9 and 13 **Text Book 3:** Ch :18,19 & 20	
Module – 4	**08 Hrs**

Bearing Capacity of Soil: Bearing Capacity of Shallow Foundation: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test. **Text Book 2:** Ch :14 & 15 **Text Book 3:** Ch :23 & 24

Module – 5	**08 Hrs**
Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation). **Text Book 2:** Ch :15 & 16 **Text Book 3:** Ch :25,26 & 27	

Course Outcomes: After completing the course,the students will be able to	
CO1	Analyze subsurface conditions, soil parameters, and dewatering techniques for engineering works.
CO2	Evaluate stress distribution and settlement beneath footings on sand and clay.
CO3	Assess earth pressures, slope stability, and slope analysis methods.
CO4	Design shallow foundations using bearing capacity theories.
CO5	Evaluate pile and well foundations and estimate the load-carrying capacity of single and group piles.

Text Books	
1	Principles of Soil Mechanics and Foundation Engineering, V. N. S. Murthy, 2nd Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2019, ISBN: 9788123928685.
2	Soil Mechanics and Foundation Engineering, K. R. Arora, 8th Edition, Standard Publishers Distributors, New Delhi, 2017, ISBN: 9788180141120.
3	Foundation Engineering, P. C. Varghese, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012, ISBN: 9788120342958.
4	Soil Mechanics and Foundation Engineering, B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, 17th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2022, ISBN: 9789354602499.

Reference Books	
1	Soil Mechanics, T. William Lambe and Robert V. Whitman, SI Edition Reprint, Wiley India Pvt. Ltd., New Delhi, 2017, ISBN: 9788126517619.
2	Geotechnical Engineering: Principles and Practices, Donald P. Coduto, Man-chu Ronald Yeung and William A. Kitch, 3rd Edition, Pearson Education, 2016, ISBN: 9789332574496.
3	Geotechnical Engineering, Shashi K. Gulhati and ManojDatta, 1st Edition (Reprint), Tata McGraw-Hill Education, New Delhi, 2017, ISBN: 9780070702432.
4	Indian Standard Codes for Foundation Engineering (IS 1904, IS 6403, IS 8009, IS 2950, IS 2911 and other relevant codes), Bureau of Indian Standards, Latest Revisions, Bureau of Indian Standards, New Delhi, 2024.

Web links and Video Lectures (e – Resources)	
1	**Soil Exploration:** **https://www.youtube.com/watch?v=2Tki6m5FzFY&list=PLslAXFRpo-_zigo5nByJ7qLn46ZprDexS**

2	**Stress in Soils:** https://www.youtube.com/watch?v=_xbPj610ins&list=PL7aULcvvgJj-8L3Pkrqgo9Z6kol22VFVH
3	**Lateral Earth Pressure:** https://www.youtube.com/watch?v=IbBbMAH8_f8
4	**Bearing Capacity of Soil:** https://www.youtube.com/watch?v=rTJp4KRIgWM&t=40s

CO-PO MAPPING

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

Semester: VI						
Earthquake Resistant Structures **Stream: CV**						
Course Code	**:**	BCV624D		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Structural Analysis, RCC Design, Basic Engineering Mechanics
Knowledge on Fundamental Concepts	Basic concepts of vibrations and dynamics, stress-strain behaviour, load transfer mechanisms
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the causes of earthquakes, seismic waves, tectonic movements, and seismic zoning of India.
CLO2	Apply structural analysis methods such as response spectrum and equivalent lateral force methods as per IS 1893.
CLO3	Examine structural irregularities, base isolation, and damping in seismic behaviour.
CLO4	Explain ductile detailing principles for RCC members and energy dissipation techniques.
CLO5	Analyze masonry behaviour during earthquakes and retrofitting methods as per relevant codes.

Module – 1	**03 Hrs**
Introduction to Engineering Seismology: Terminologies, Causes of earthquakes and global tectonic activity, Theory of Plate Tectonics, Fault types and their characteristics, Geological and tectonic features of India, Classification of Earthquakes, Origin and propagation of seismic waves, Types and characteristics of seismic waves, Characteristics of ground motion, Magnitude and Intensity scales, Seismic instruments, Seismic Zoning Map of India as per IS 1893, Earthquake hazards in India and their consequences, Earthquake risk evaluation and mitigation. **Text Book 1:** Ch.2, 3, 5 **Text Book 2:** Ch.4, 5, 7	
Module – 2	**03 Hrs**
Introduction to Structural Dynamics: Basic concepts of Single Degree of Freedom (SDOF) system – Free and forced vibration, Resonance phenomenon and its relevance during earthquakes. Characteristics of earthquake ground motion. Concept of response history and structural response to ground motion. **Response Spectrum:** Definition and significance; elastic and inelastic response spectrum; characteristics and typical shape; introduction to tripartite (D-V-A) spectrum, Use of response spectrum in design, Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS1893. **Text Book 2:** Ch.5, 7	
Module – 3	**03 Hrs**

Seismic Performance of Buildings and Overview of IS-1893: Types of damages to buildings observed during past earthquakes, Vertical and Horizontal irregularities and their consequences, Design provisions for irregularities as per IS-1893, Concept of soft and weak storey; configuration problems; importance of continuous load path, Architectural aspects of earthquake-resistant buildings, Seismic design philosophy, Structural modelling for seismic analysis; lateral load resisting systems. Damping devices and Base isolation system.

Effect of Infill Masonry Walls on Frames: Modeling considerations and behavior during earthquakes. Masonry buildings – failure patterns, slenderness of walls, strength in shear and flexure, concepts for earthquake-resistant masonry design – codal provisions.

Text Book 3: Ch.3, 6 **Text Book 4:** Ch.3, 5, 7

Module – 4	**03 Hrs**

Design of Reinforced Concrete Buildings for Earthquake Resistance: Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893 and IS 13920. Structural behaviour, design and ductile detailing of shear walls.

Text Book 3: Ch.9

Module – 5	**03 Hrs**

Earthquake Resistant Design of Masonry Buildings: Seismic demand, seismic capacity, Overview of linear and nonlinear analysis procedures, Performance-Based Seismic Design, Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel, sill Bands and corner strengthening, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

Text Book 5: Ch.8, 10

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret earthquake causes, seismic waves, tectonics, and India's seismic zoning maps.
CO2	Analyze structural response using response spectrum and equivalent lateral force methods per IS 1893.
CO3	Evaluate effects of irregularities, base isolation, and damping on building seismic performance.
CO4	Apply ductile detailing for RCC members and assess energy dissipation during earthquakes.
CO5	Assess masonry seismic performance and recommend retrofitting strategies per codes.

Text Books	
1	Earthquake Resistant Design of Structures, Pankaj Agarwal and Manish Shrikhande, 3rd Edition, PHI Learning Pvt. Ltd., New Delhi, 2023 Reprint, ISBN: 9788120345461.
2	Earthquake Resistant Design of Structures, S. K. Duggal, 3rd Edition, Oxford University Press, New Delhi, 2019, ISBN: 9780199093847.
3	Dynamics of Structures: Theory and Applications to Earthquake Engineering, Anil K. Chopra, 5th Edition, Pearson Education, 2019, ISBN: 9780134555120.
4	Seismic Analysis of Structures, T. K. Datta, 1st Edition (Reprint), Wiley India Pvt. Ltd., New Delhi, 2018, ISBN: 9788126518456.
5	Earthquake Resistant Design of Building Structures, Vinod Hosur, 1st Edition, Wiley India Pvt. Ltd., New Delhi, 2017, ISBN: 9788126552829.

Reference Books	
1	Earthquake Resistant Design and Risk Reduction, David J. Dowrick, 2nd Edition, John Wiley & Sons, 2009, ISBN: 9780470747675.

2	Design of Earthquake Resistant Buildings, Minoru Wakabayashi, 1st Edition (Reprint), McGraw-Hill Education, 1994, ISBN: 9780074633926.
3	Seismic Design of Reinforced Concrete and Masonry Buildings, T. Paulay and M. J. N. Priestley, 1st Edition, John Wiley & Sons, 1992, ISBN: 9780471549156.
4	IS 13920:2016 – Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, Bureau of Indian Standards, Latest Revision, BIS, New Delhi, 2016.
5	IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, Latest Revision, BIS, New Delhi, 2016.
6	IS 13828:1993 – Improving Earthquake Resistance of Low Strength Masonry Buildings, Bureau of Indian Standards, BIS, New Delhi, 1993.
7	S 4326:2013 – Earthquake Resistant Design and Construction of Buildings – Code of Practice, Bureau of Indian Standards, BIS, New Delhi, 2013.
8	IS 13935:2009 – Repair and Seismic Strengthening of Buildings – Guidelines, Bureau of Indian Standards, BIS, New Delhi, 2009.

Web links and Video Lectures (e – Resources)	
1	**Introduction to Engineering Seismology:** **https://www.youtube.com/watch?v=PNJvFTwA1jQ&list=PLgMDNELGJ1CYUg39ngts4kxqt4A7T8VbX**
2	**Introduction to Structural Dynamics:** **https://www.youtube.com/watch?v=6cbuMonSrfw&list=PLFW6lRTa1g83W9uxZklis4lGs6ypQNgcq**
3	**Seismic Performance of Buildings and Overview of IS-1893:** **https://www.youtube.com/watch?v=_FLjhQvo7oA**
4	**Earthquake Resistant Design of Masonry Buildings:** **https://www.youtube.com/watch?v=ZRiRffl7FOI**

CO – PO MAPPING

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

Semester : VI						
Water Conservation and Rain Water Harvesting **Stream: CV**						
Course Code	**:**	BCV645A		**Credits**	**:**	3
Hours/Week (L: T: P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	OEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Environmental Studies, Basics of Hydrology, Geography or Earth Sciences
Knowledge on Fundamental Concepts	Basic knowledge of water cycle and rainfall patterns, Understanding of water quality parameters, Basic drawing and interpretation of technical diagrams.
Knowledge on Connected Tools (If any)	Basic knowledge of GIS and remote sensing, Survey tools

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the hydrological cycle and rainfall patterns in India.
CLO2	Describe water resources in geographical and socio-economic contexts.
CLO3	Examine groundwater resources and rainwater harvesting methods.
CLO4	Develop basic water conservation and rainwater harvesting system drawings.
CLO5	Interpret water management laws and assess water footprints.

Module – 1	**08 Hrs**
Water and its importance: Monsoon- types and behavior in India, rainfall characteristics and distribution, onset and withdrawal of effective rains, dry spells and wet spells, critical dry spells, water loss from the soil, measurement and factors, Importance and issues relating water status Scenario of water in Karnataka: sources, geographical distribution, quality. Water (hydrological) cycle, influence of human activity on the water cycle, Surface water resources. **Text Book 1:**Ch.1	
Module – 2	**08 Hrs**
Elementary Knowledge of Ground Water: General aquifer. Water quality and its impact on human beings. Water harvesting: need, principles of water harvesting, general water harvesting methods - rain water harvesting methods, classes, benefits, approach, rooftop rainwater harvesting, subsurface barrier/dykes, farm ponding, etc mostly used in rural areas. **Text Book 2:** Ch.2	
Module-3	**08 Hrs**
Groundwater Recharge: Factors affecting groundwater recharge, Revival of traditional techniques for water harvesting. Calculation of available rain water for harvesting. Preparation of suitable technical drawing and design of rain water harvesting structure. **Text Book 2:** Ch.2 **Text Book 3:** Ch.2	
Module – 4	**08 Hrs**
Elementary Conservation of Water: Importance, knowledge regarding conservation/saving of water in daily use, in agriculture, in industries. Water Conservation strategies- Limiting the consumption, Reuse and recycling, Elimination of losses, Pollution prevention. **Text Book 4:**Ch.3	

Module – 5	8 Hrs
Subsurface Investigation of Ground Water: General, geophysical methods and its importance. Present law regarding water management Water footprints- blue water footprint, green water footprint, grey water footprint. Sustainability assessment. **Text Book 4:**Ch.4	

Course Outcomes: After completing the course,the students will be able to	
CO1	Explain monsoons, rainfall patterns, and the water cycle in India.
CO2	Evaluate surface and groundwater resources and quality, with focus on Karnataka.
CO3	Apply water harvesting techniques in rural and urban contexts.
CO4	Design basic water conservation systems and evaluate their efficiency.
CO5	Interpret water laws, footprints, and sustainability methods.

Text Books	
1	Hydrology and Water Resources Engineering – K. Subramanya, 3rd Edition, McGraw Hill Education (India), 2017, ISBN: 9789352605224.
2	Rainwater Harvesting: Theory and Practice – A.K. Bhattacharya, 2nd Edition, PHI Learning Pvt. Ltd., 2019, ISBN: 9789389347883.
3	Water Resources Engineering – Larry W. Mays, 3rd Edition, Wiley India Pvt. Ltd., 2019, ISBN: 9788126562456.
4	Water Conservation and Management – S.N. Ghosh, 2nd Edition, PHI Learning Pvt. Ltd., 2018, ISBN: 9789387472839.

Reference Books	
1	Principles of Water Resources: History, Development, Management and Policy – Thomas V. Cech, 4th Edition, Wiley, 2021, ISBN: 9781119801801.
2	Water Harvesting and Conservation – D.C. Sharma, 2nd Edition, TERI Press, 2018, ISBN: 9789386530295.
3	Groundwater Assessment, Development and Management – K.R. Karanth, 2nd Edition, McGraw Hill Education, 2018, ISBN: 9789353164249.
4	Sustainable Water Resources Management – Mohan Munasinghe and Mohan Seneviratne, 1st Edition, Elsevier, 2021, ISBN: 9780128239986.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/105105110
2	https://nptel.ac.in/courses/105101214
3	https://www.youtube.com/watch?v=fx1uUek3Iqg
4	https://nptel.ac.in/courses/105105214
5	https://www.youtube.com/watch?v=8i3uAYrNfO0

CO-PO Mapping

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

Semester: VI					
Integrated Waste Management for a Smart City **Stream: CV**					
Course Code	**:**	BCV645B	**Credits**	**:**	3
Hours/Week (L: T:P)	**:**	3:0:0	**CIE**	**:**	50
Total Hours	**:**	40 L	**SEE**	**:**	50
Course Type	**:**	OEC	**SEE Duration**	**:**	03

Prerequisites:	
Courses	Environmental Engineering.
Knowledge on Fundamental Concepts	Environmental Studies
Knowledge on Connected Tools (If any)	-

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the basics of municipal solid waste management.
CLO2	Describe waste generation factors and quantity estimation methods.
CLO3	Explain solid waste treatment and disposal techniques.
CLO4	Examine the management and recycling of C&D waste.
CLO5	Analyse the sources, impacts, and regulations of e-waste.

Module – 1	**08 Hrs**
Introduction To Solid Waste Management: Municipal Solid Waste Sources; composition; generation rates Swachh Bharat Mission and Smart Cities Program, Current Issues in Solid Waste Management and Review of MSW Management Status in First List of 20 Smart Cities in the Country. Integrated solid waste management and concept of 3R's, role of stake holders.**Text Book 1:**Ch 2.	
Module – 2	**08 Hrs**
Municipal Solid Waste Management – Fundamentals: Municipal Solid Waste, Characteristics and Quantities, Collection, Transportation, Segregation and Processing. Factors affecting waste generation and methods to estimate the quantity of waste generated. **Text Book 1:**.Ch.2	
Module – 3	**08 Hrs**
Disposal of Municipal Solid Waste: Landfill, Biochemical Processes and Composting, Energy Recovery from Municipal Solid Waste. Municipal Solid Waste (MSW) Rules 2016. Waste to Energy concepts, Incineration, Biogas recovery and Refuse derived fuels RDFs. **Text Book 1:** Ch.2	
Module – 4	**08 Hrs**
Construction and Demolition (C&D) Waste Management: Overview of C&D Waste – Sources, Effects, and Regulations, Beneficial Reuse of C&D Waste Materials, treatment, disposal, Legislation and case studies of Construction waste. **Text Book 1:** Ch.2	
Module – 5	**08 Hrs**
Electronic Waste (E-Waste) Management: Sources, Effects, Issues and Status in India and globally, controlling measures, E-Waste Management Rules 2016 and Management Challenges, treatment, disposal, Legislation and case studies of Construction waste. **Text Book 1:** Ch.2	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the physical, chemical, and biological characteristics of solid wastes to facilitate their classification and management
CO2	Design waste collection, storage, transfer, and transportation systems for municipal solid waste.
CO3	Evaluate and recommend suitable waste processing and treatment methods for solid and hazardous wastes.

CO4	Evaluate disposal alternatives, including sanitary landfills and waste-to-energy systems.
CO5	Formulate sustainable waste management strategies by integrating reduce, reuse, and recycling principles.

Text Books	
1	Solid Waste Engineering: A Global Perspective, William A. Worrell, P. AarneVesilind and Christian Ludwig, 3rd Edition, Cengage Learning, 2017, ISBN: 9781305635203.
2	Integrated Solid Waste Management: Engineering Principles and Management Issues, George Tchobanoglous, Hilary Theisen and Samuel A. Vigil, Reprint Edition, McGraw Hill Education, 2019, ISBN: 9789339205249.
3	Manual on Municipal Solid Waste Management, Central Public Health and Environmental Engineering Organisation (CPHEEO), Revised Edition, Ministry of Housing and Urban Affairs, Government of India, 2016, ISBN: 9789351251958.

Reference Books	
1	Solid Waste Management Rules, 2016, Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, 2016.
2	E-Waste Management Rules, 2022, Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, 2022.
3	Construction and Demolition Waste Management Rules, 2016, Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, 2016.

Web links and Video Lectures (e – Resources)	
1	**Introduction to solid waste:** **https://www.youtube.com/watch?v=k0ktJRoRcOA**
2	**Disposal Of Municipal Solid Waste:** **https://www.youtube.com/watch?v=GjKXTjLs020**
3	**Construction and Demolition (C&D) Waste Management:** **https://www.youtube.com/watch?v=W4s8OqlIHAc**
4	**Electronic Waste (E-Waste) Management**: **https://www.youtube.com/watch?v=_r5rHyMHKEg&list=PL3MO67NH2XxJngITU5LDb2md2TX4Gqex-**

CO-PO Mapping

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

Semester : VI						
Disaster Management and Mitigation **Stream : CV**						
Course Code	**:**	BCV645C		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	OEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basics of Civil Engineering, Geography and Environmental Science, urban planning and infrastructure etc
Knowledge on Fundamental Concepts	Geological and Meteorological Processes, Environmental Science, Civil Engineering Concepts etc
Knowledge on Connected Tools (If any)	ArcGIS / QGIS,Google Earth Engine etc

Course Learning Objectives: This course will enable the students to	
CLO1	Explain disaster terminologies and classify disasters based on type and impact.
CLO2	Examine the causes and impacts of disasters on different communities.
CLO3	Describe the disaster cycle and disaster risk reduction (DRR) measures.
CLO4	Analyze the link between development projects and disaster vulnerability.
CLO5	Evaluate India's disaster risk management framework and disaster case studies

Module – 1	**08 Hrs**
Introduction to Disasters: Definition of disaster, hazard, vulnerability, resilience and risks. Types of disasters – earthquake, landslide, flood, drought, fire, etc.; classification, causes and impacts including social, economic, political, environmental, health and psychosocial impacts. Differential impacts in terms of caste, class, gender, age, location and disability. Global trends in disasters: urban disasters, pandemics, complex emergencies and climate change. Dos and don'ts during various types of disasters. **Text Book 1:**Ch 1-1.1-1.6 **Text Book 2:**Ch 1-1.1-1.6,Ch 2-2.1,2.2	
Module – 2	**08 Hrs**
Approaches To Disaster Risk Reduction: Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural nonstructural measures in DRR, Factors affecting Vulnerabilities, , Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Rehabilitation measures and long term reconstruction. **Text Book 1:**Ch 4-4.1-4.9**Text Book 2:**Ch 3-3.1-3.9	
Module – 3	**08 Hrs**
Interrelationship between Disasters and Development: Factors affecting vulnerabilities, differential impacts, impact of development projects such as dams, embankments and changes in land use; climate change adaptation; IPCC scenarios and scenarios in the context of India; relevance of indigenous knowledge, appropriate technology and local resources. **Text Book 2:**Ch 4-4.1-4.3,Ch 5-5.1-5.3	
Module – 4	**08 Hrs**
Disaster Risk Management in India: Hazard and vulnerability profile of India, components of disaster relief: water, food, sanitation, shelter, health and waste management; institutional arrangements for mitigation, response and preparedness; Disaster Management Act and Policy; other related policies, plans, programmes and legislation; role of GIS and information technology in preparedness, risk assessment, response and recovery phases of disaster; disaster damage assessment.	

Text Book 1: Ch 3-3.1-3.9	**Text Book 2:**Ch 5-5.1-5.7	
	Module – 5	**08 Hrs**
Disaster Management: Applications and Case Studies: Case studies of the Bhopal Gas Disaster, Gujarat Earthquake, Odisha Super Cyclone, South Indian Tsunami, Bihar Floods, Surat Plague, landslides in North-East India, heat waves in Andhra Pradesh and Odisha, cold waves in Uttar Pradesh, Bengal Famine; best practices in disaster management; local knowledge, appropriate technology and local responses; indigenous knowledge; development projects in India (dams, SEZs) and their impacts. **Text Book 2:**Ch 6-6.1-6.10		

Course Outcomes: After completing the course, the students will be able to	
CO1	Classify disasters, hazards, vulnerabilities, risks, and resilience concepts.
CO2	Differentiate various natural and man-made disasters based on their causes and impacts.
CO3	Evaluate disaster risk reduction strategies, preparedness plans, and early warning systems.
CO4	Analyze the relationship between disasters, development, and climate change.
CO5	Develop disaster management solutions using insights from case studies and community practices.

Text Books	
1	Disaster Management, Dr. Mrinalini Pandey, 2nd Edition, Wiley India Pvt. Ltd., New Delhi, 2021, ISBN: 9788126561703.
2	Disaster Management and Preparedness, Nidhi Gauba Dhawan and Ambrina Sardar Khan, 2nd Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2022, ISBN: 9789390709633.

Reference Books	
1	Disaster Management in Hills, Dr. Satender, 2nd Edition, Concept Publishing Company Pvt. Ltd., New Delhi, 2018, ISBN: 9789351253044.
2	Manual on Natural Disaster Management in India, M. C. Gupta, Revised Edition, National Institute of Disaster Management (NIDM), New Delhi, 2019, ISBN: 9789387765092.

Web links and Video Lectures (e–Resources)	
1	**Introduction to Natural Hazards:** https://www.youtube.com/watch?v=Xsg8aydKyto
2	**Integrated Approach to Disaster Risk Management: Prevent, Residual risk Prepare, Respond, Recover: https://www.youtube.com/watch?v=xjlPmSXj24Y**

CO – PO MAPPING

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

Semester: VI						
Environmental Protection and Management **Stream : CV**						
Course Code	**:**	BCV645D		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 L		**SEE**	**:**	50 Marks
Course Type	**:**	OEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Environmental studies
Knowledge on Fundamental Concepts	Environment, management
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students to	
CLO1	Identify present-day environmental issues at global and local levels.
CLO2	Describe the environmental and social impacts of developmental activities.
CLO3	Explain major ecological problems and their effects.
CLO4	Discuss environmental problems in the context of sustainable development.
CLO5	Outline the principles of environmental protection and management systems.

Module – 1	**08 Hrs**
Environmental Management Standards: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection. **Text Book 1:**Ch 1: 1.1 – 1.9, Ch 2: 2.1 – 2.8, Ch 3:3.1-3.5	
Module – 2	**08 Hrs**
Environmental Management Objectives: Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards **Environmental Management System:** EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and clean technology, closing the loops, zero discharge technologies. **Text Book 1:**Ch 4: 4.1 – 4.8 Ch 5: 5.1 – 5.5	
Module – 3	**08 Hrs**
Continual Improvement And Pollution Prevention: Environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.**Text Book 2:**Ch.4-10	
Module – 4	**08 Hrs**
Environmental Audit: Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Nonconformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit. **Text Book 1:**Ch 8: 8.1 – 8.13	
Module – 5	**08 Hrs**

Applications: Applications of EMS, Waste Audits and Pollution Prevention Control: Textile, Sugar, Pulp & Paper, Electroplating, Tanning industry. Hazardous Wastes - Classification, characteristics Treatment and Disposal Methods, Transboundary movement, disposal. **Text Book 1:**Ch 9: 9.1 – 9.15

Course Outcomes: After completing the course, the students will be able to	
CO1	Classify environmental problems and corporate environmental management practices.
CO2	Analyze environmental management objectives, standards, and pollution prevention strategies.
CO3	Apply Environmental Management Systems (EMS) and the ISO 14001 framework.
CO4	Evaluate environmental audits and performance metrics based on ISO 19011.
CO5	Develop EMS-based solutions for pollution prevention and hazardous waste management.

Text Books	
1	Installing Environmental Management Systems: A Step-by-Step Guide, Christopher Sheldon and Mark Yoxon, 2nd Edition, Routledge (formerly Earthscan Publications), 2018, ISBN: 9781138466501.
2	ISO 14001:2015 Environmental Management Systems – Requirements with Guidance for Use, International Organization for Standardization (ISO), Latest Edition, ISO Publications, Geneva, 2015 (Reaffirmed), ISBN: 9780580806118.

Reference Books	
1	ISO 14001:2015 and ISO 14004:2016 Environmental Management Systems – Requirements and General Guidelines on Implementation, International Organization for Standardization (ISO), Latest Edition, ISO Publications, Geneva, 2016, ISBN: 9780580921545.
2	ISO 19011:2018 Guidelines for Auditing Management Systems, International Organization for Standardization (ISO), 3rd Edition, ISO Publications, Geneva, 2018, ISBN: 9780580478490.
3	Environmental Management Systems Handbook for Refineries: Polluting Less While Producing More, Nicholas P. Cheremisinoff and Madelyn L. Graffia, 1st Edition, CRC Press, 2020, ISBN: 9780367573059.
4	Environmental Management: Principles and Practice, C. J. Barrow, 3rd Edition, Routledge, 2021, ISBN: 9780367496969.

Web links and Video Lectures (e – Resources)	
1	**Environmental Management System:** https://www.youtube.com/watch?v=BYqLRGawoH0
2	**ISO14001 Environmental Management Systems (EMS) Standard:** **https://www.youtube.com/watch?v=oRCNIrqtKN4**

CO – PO MAPPING

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

Semester: VI						
Major Project Phase – I						
Course Code	**:**	BCV636		**Credits**	**:**	2
Hours/Week(L:T:P)	**:**	0:0:4		**CIE**	**:**	100 Marks
Total Hours	**:**	--		**SEE**	**:**	--
Course Type	**:**	Project		**SEE Duration**	**:**	--

Course Learning Objectives: This course will enable the students to	
CLO1	Apply engineering knowledge to solve real-world and research problems.
CLO2	Design and validate solutions using appropriate tools and technologies.
CLO3	Plan and manage projects to achieve desired objectives.
CLO4	Follow professional ethics and sustainable engineering practices.
CLO5	Collaborate effectively in teams and communicate project outcomes clearly.

Project work:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students.

* In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) **Single discipline**: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives andMethodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the Project report shall be the same for all the batch mates.

(ii) **Interdisciplinary**: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable.

The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives andMethodology), project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze civil engineering problems using engineering fundamentals and domain knowledge.
CO2	Evaluate literature to identify research gaps and formulate project objectives.
CO3	Develop a project plan with suitable methodology, design approach, and milestones.

CO4	Integrate modern engineering tools and software for analysis and design of engineering solutions.
CO5	Demonstrate professional ethics, teamwork, and effective communication through reports and presentations.

CO – PO MAPPING

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

Semester: VI						
Software Application Lab **Stream: CV**						
Course Code	**:**	BCVL607		**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	30 L		**SEE**	**:**	50 Marks
Course Type	**:**	PCCL		**SEE Duration**	**:**	03 Hours

Prerequisites:	
Courses	Elements of Civil Engineering, Analysis of Structures
Knowledge on Fundamental Concepts	Units, Scale,
Knowledge on Connected Tools (If any)	Google Sketchup, Autodesk AutoCAD, STAAD Pro/ETABS, QGIS, MS Excel.

Course LearningObjectives: This course will enable the students to	
CLO1	Apply industry-standard software in a professional engineering environment.
CLO2	Develop 3D model drawings for engineering applications.
CLO3	Examine the elements of finite element modeling, load specifications, and boundary conditions.
CLO4	Analyze results for final engineering design.

Sl.No.	**Experiments**
1.	**Introduction and Applications of Google Sketchup Software:** • **Templates and units** • **Introduction of Tools:** Contraction Tools, Drawing Tools, Edit Tools, Large Tools Set, Principal Tools, Stale Tools, Views Tools, etc.., • **Creating 3D Models:** Import AutoCAD drawings and Develop 3D Model.
2.	**Analysis of Following Structural Elements using STAAD Pro/ ETABS software** • Continuous beams • Portal frames • Plane trusses
3.	**Applications of Microsoft Excel software:** • Computation of earthwork. • Design of horizontal curve by offset method. • Design of super elevation.
4.	**GIS applications using open-source QGIS software:**

	• To create shape files for point, line and polygon features with a map as reference. • To create decision maps for specific purpose.
5.	**Demonstration Experiments.** • Creating a plan, structural model and analysis of multi-storied building. • Creating a model of building and the effect of earth quake. • Create a model of large span roof and analyse.

Course Outcomes: After completing the course, the students will be able to	
CO1	Develop 3D models using SketchUp tools for professional engineering applications.
CO2	Analyze structural models and the behavior of different structural elements.
CO3	Evaluate maps generated using QGIS tools for engineering decision-making.
CO4	Design earthwork calculations, highway curves, and superelevation using MS Excel tools.
CO5	Assess structural models under different loading and boundary conditions.

Reference Books	
1	Building Drawing with an Integrated Approach to Built Environment, M. G. Shah, C. M. Kale and S. Y. Patki, 5th Edition, Tata McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2012, ISBN: 9780071077873.
2	Building Construction, Gurucharan Singh, Latest Edition, Standard Book House, New Delhi, 2019, ISBN: 9788189401214.
3	Civil Engineering Drawing, Gurucharan Singh, 7th Edition, Standard Publishers & Distributors, New Delhi, 2018, ISBN: 9788180140044.

CO-PO Mapping

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

Semester: VI						
Competency Enhancement Course - 4						
Course Code	**:**	BCE608		**Credits**	**:**	0
Hours/Week(L:T:P)	**:**	0:2:0		**CIE**	**:**	100 Marks
Total Hours	**:**	12 T		**SEE**	**:**	-
Course Type	**:**	NCMC		**SEE Duration**	**:**	-

Prerequisites:	
Courses	AutoCAD
Knowledge on Fundamental Concepts	-
Knowledge on Connected Tools	NA

Course Learning Objectives: This course will enable the students to	
CLO1	Interpret the fundamentals of Autodesk Revit Architecture and Building Information Modeling (BIM).
CLO2	Apply detailing techniques such as flooring, roofing, balconies, materials, and site components in architectural models.
CLO3	Create and manage projects using levels, grids, and structural and architectural elements.
CLO4	Generate realistic visualizations through rendering, camera views, and walkthrough animations.
CLO5	Develop design and problem-solving skills using Revit tools to complete professional projects.

Module - 1	**3 Hrs**
Introduction to Revit Architecture & BIM: Overview of Autodesk Revit Architecture, Prerequisites & Software Setup, Course Objectives & Scope, Introduction to Building Information Modeling (BIM), What is BIM, Uses of BIM in Architecture, BIM Workflow & Process, Importance of BIM in IndustryRevit User Interface, Navigation Tools, Tabs, Toolbars and Properties, Commonly Used Tools in Architectural Modeling. **Text Book 2 :** Ch.1&2	
Module - 2	**3 Hrs**
Basic Modeling: Starting a New Architectural Project, Project Templates, Units & Levels Setup, Creating the Building Layout, Line Diagrams & Floor Plans, Importing/Linking AutoCAD Drawings, Creating Basic Architectural Elements, Walls, Doors, Windows, Basic Floor Creation. **Text Book 1 :** Ch.3	
Module-3	**6 Hrs**
Detailing the Model: Adding Architectural Details, Flooring, Ceilings, Roofing, Balcony Design, Material Application & Custom Materials, Massing & Site Tools, Creating Topo Surfaces, Adding Site Components (Trees, Vehicles, etc.), 3D Model Enhancement, Extrusions & Openings**Text Book 3 :** Ch.9&11	
Module - 4	**8 Hrs**
Visualization & Presentation: Rendering in Revit Architecture, Applying Lighting & Materials for Realistic Effects Camera Views & Perspectives, Creating Walkthrough Animations, Preparing Sheets & Layouts for Presentation **Text Book 3:**Ch.12	
Module - 5	**20 Hrs**
Professional Application & Skills Development: Review of Project Workflow, Structural Coordination & Model Checking, Documentation & Annotation Tools, Skills Learned, Design Visualization, BIM Coordination, Efficient Modeling Practices and Final Project Preparation	

starting from data acquisition to final deliverables. **Text Book 1:**Ch.7

Course Outcomes: After completing the course, the students will be able to	
CO1	Use Revit to create and manage architectural elements such as levels, grids, walls, floors, roofs, and columns.
CO2	Apply detailing tools to develop architectural models with structural and site components.
CO3	Create 3D visualizations, renderings, and walkthrough animations for design presentation.
CO4	Prepare professional drawings, schedules, annotations, and project documentation.
CO5	Execute a complete architectural project using Revit from design to final presentation.

Text Books	
1	Autodesk Revit Architecture Essentials, Paul F. Aubin, 2nd Edition, Wiley, 2023, ISBN: 9781119874219.
2	BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers, Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, 4th Edition, Wiley, 2018, ISBN: 9781119287538.
3	Mastering Autodesk Revit 2024, Lance Kirby, Eddy Krygiel, Marcus Kim, 2024 Edition, Sybex (Wiley), 2023, ISBN: 9781394165866.

Web links and Video Lectures (e – Resources)	
1	https://bimhandbook.com
2	https://www.autodesk.com/products/revit/overview
3	https://www.nibs.org/bim
4	https://help.autodesk.com/view/RVT/2024/ENU/
5	https://help.autodesk.com/view/RVT/2024/ENU/
6	https://www.autodesk.com/support/technical/article/caas/sfdcarticles/sfdcarticles/Revit.html

CO – PO MAPPING

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

Semester: VI						
Indian Knowledge Systems						
Course Code	**:**	BIK609		**Credits**	**:**	-
Hours/Week(L:T:P)	**:**	1:0:0		**CIE**	**:**	100 Marks
Total Hours	**:**	15 L		**SEE**	**:**	-
Course Type	**:**	NCMC		**SEE Duration**	**:**	-

Prerequisites:	
Courses	Environmental Studies, Indian Philosophy or Ethics
Knowledge on Fundamental Concepts	Basic understanding of ancient Indian civilization, literature
Knowledge on Connected Tools (If any)	---

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the foundational concepts of Indian Knowledge Systems (IKS)
CLO2	Explore the contributions of traditional Indian knowledge to various fields in the humanities and sciences
CLO3	Recognize the relevance and applications of traditional knowledge in professional domains
CLO4	Develop an appreciation for the interdisciplinary nature of IKS
CLO5	Analyze the integration of IKS with contemporary academic and professional practices

Module – 1	**5 Hrs**
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge. **Text Book 1:** Ch.1,2&3 **Text Book 2:** Ch. 2&3	
Module – 2	**5 Hrs**
Traditional Knowledge in Humanities and Sciences: Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology. **Text Book 1:** Ch.4,5,6&7 **Text Book 2:** Ch. 3&4	
Module-3	**5 Hrs**
Traditional Knowledge in Professional domain: Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals. **Text Book 1:** Ch.8,9,10,11&12 **Text Book 2:** Ch. 5,6&7	

Course Outcomes: After completing the course,the students will be able to	
CO1	Elucidate the scope, significance and philosophical foundations of Indian Knowledge Systems (IKS).
CO2	Compare traditional knowledge systems with indigenous and western knowledge frameworks.
CO3	Identify the applications of traditional Indian knowledge in humanities and scientific domains.
CO4	Demonstrate an understanding of traditional Indian contributions to professional domains.
CO5	Relate traditional knowledge systems to contemporary global frameworks such as Sustainable Development Goals (SDGs).

Text Books	
1	Introduction to Indian Knowledge System: Concepts and Applications, B. Mahadevan, VinayakRajat Bhat and NagendraPavana R. N., 2nd Edition, PHI Learning Private Limited, New Delhi, 2024, ISBN: 978-9354439758.
2	Traditional Knowledge System in India, Amit Jha, Revised Edition, Atlantic Publishers & Distributors (P) Ltd., New Delhi, 2021 (Reprint), ISBN: 978-8126912230.

ReferenceBook	
1	Knowledge Traditions and Practices of India, Kapil Kapoor and Avadesh Kumar Singh, Vol. 1, Revised Edition, D.K. Print world (P) Ltd., New Delhi, 2017 (Reprint), ISBN: 978-8124603335.

Web links and Video Lectures (e – Resources)	
1	**Introduction to Indian Knowledge Systems (IKS):** https://www.youtube.com/watch?v=LZP1StpYEPM
2	**Roots of Ayurveda: https://nptel.ac.in/courses/121106003**
3	**Traditional Knowledge:** https://unctad.org/system/files/official-document/ditcted10_en.pdf

CO – PO MAPPING

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

Semester: VI						
National Service Scheme (NSS)						
Course Code	**:**	BNS610		**Credits**	**:**	-
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	100 Marks
Total Hours	**:**	24 L		**SEE**	**:**	-
Course Type	**:**	NCMC		**SEE Duration**	**:**	-

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

Activity– 1	**08Hrs**
Plantation and adoption of plants. Know your plants.	
Activity – 2	**08 Hrs**
Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	
Activity – 3	**08 Hrs**
Govt. school Rejuvenation and helping them to achieve good infrastructure.	

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.	**Topic**	**Group Size**	**Location**	**Activity Execution**	**Reporting**	**Evaluation of the Topic**
1	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Place 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	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.	Place 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	Govt. school	May be individual	Villages/ City Areas / Grama	Place selection/prop	Report should be submitted by	Evaluation as per the

	Rejuvenation and helping them to achieve good infrastructure.	or team	panchayat/ public associations/Government Schemes officers/ campus etc.	er consultation/ Continuous monitoring / Information board	individual to the concerned evaluation authority	rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities for 6th 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 6th 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 6th 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	Exploit the importance of his / her responsibilities towards society.
CO2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field of societal problems.
CO5	Appraise the importance of ethical issues and team working abilities pertaining to the social services.

Assessment Details for CIE (100 Marks)

Weightage	CIE- 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 the 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 Matrix

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

Semester: VI						
Physical Education (PE) (Sports & Athletics)						
Course Code	:	BPE610		**Credits**	:	-
Hours/Week(L:T:P)	:	0:0:2		**CIE**	:	100 Marks
Total Hours	:	12 P		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Develop awareness about common postural deformities and equip students with techniques for stress management to enhance physical and mental well-being.
CLO2	Enable students to acquire the basic rules, techniques, and motor skills of selected games such as Throw Ball, Table Tennis, or Athletics, and to encourage regular participation in physical activities.
CLO3	Improve cardiovascular fitness, flexibility, and coordination through structured aerobic exercises.

Module – 1	**4 Hrs**
Orientation A. Postural deformities. B.Stress management	
Module – 2	**16 Hrs**
Specific games (Any one to be selected by the student) A. Throw ball B.Table Tennis C.Athletics (Field Events- Jumps) – Any event as per availability of Ground.	
Module-3	**4 Hours**
Aerobics	

Course Outcomes: After completing the course, the students will be able to	
CO1	Identify common postural deformities and suggest corrective measures
CO2	Apply basic stress management techniques to enhance physical and mental well-being
CO3	Demonstrate fundamental skills, rules and techniques of a selected game (Throw Ball / Table Tennis / Athletics – Field Events)
CO4	Exhibit improved coordination, flexibility, endurance and cardiovascular fitness through aerobic exercises
CO5	Integrate principles of physical fitness, posture correction and stress management into daily routines for holistic health

Scheme and Assessment for auditing the course and Grades:

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

CO – PO MAPPING

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

Semester: VI						
Yoga						
Course Code	:	BYO610		**Credits**	:	-
Hours/Week (L:T:P)	:	0:0:2		**CIE**	:	100 Marks
Total Hours	:	12 P		**SEE**	:	-
Course Type	:	NCMC		**SEE Duration**	:	-

Course Learning Objectives: This course will enable the students to	
CLO1	Describe patanjali'sashtanga yoga and its role in holistic well-being.
CLO2	Perform the suryanamaskar sequence with correct breathing and posture.
CLO3	Identify different types of asanas with their techniques and benefits.
CLO4	Utilize the knowledge of kapalabhati with proper technique and safety measures.
CLO5	Apply pranayama techniques to enhance physical and mental health.

Module - 1	**02 Hrs**
Patanjali'sAshtanga Yoga: Introduction, its need and importance, Eight limbs of Yoga – overview, **Yama:** Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha **Niyama:**Shoucha, Santosha, Tapa, Svaadhyaya, Eshvarapranidhana **Text Book 1:** Ch. 1 (Part 1)	
Module - 2	**02 Hrs**
Surya Namaskar: Concept and significance of Surya Namaskar, 12-step Surya Namaskar sequence, Practice - 4 rounds of Surya Namaskar, Breathing coordination and posture alignment. **Text Book 1:** Ch. 2 (Part 2)	
Module - 3	**03 Hrs**
Asanas: Meaning of Asana, Need and importance of practicing Asanas, Classification of Asanas, Sitting Asanas -Sukhasana, Paschimottanasana, Standing Asanas - ArdhakatiChakrasana, ParshvaChakrasana, Prone Line Asana -Dhanurasana, Supine Line Asanas -Halasana, Karna Peedasana, For each Asana - Meaning by name, Technique of performing, Precautionary measures, Benefits **Text Book 1:** Ch. 2 (Part 2)	
Module - 4	**02 Hrs**
Kriyas: Introduction to Shatkarmas (Cleansing practices), Meaning and importance of Kapalabhati, Technique of Kapalabhati (40 strokes/min, 3 rounds), Precautionary measures and benefits. **Text Book 1: Ch. 3 (Part 3)**	
Module - 5	**03 Hrs**
Pranayama: Meaning, need, and importance of Pranayama, Types of Pranayama and their benefits, For each type - Meaning by name, Technique, Precautionary measures, Benefits, Types included – Suryanuloma-Viloma, Chandranuloma–Viloma, Suryabhedana, Chandra Bhedana, Nadishodhana **Text Book 1:** Ch. 3 (Part 3)	

Course Outcomes: After completing the course,the students will be able to	
CO1	Summarize patanjali'sashtanga Yoga and its significance in promoting daily well-being.

CO2	Demonstrate suryanamaskar with correct sequence, breathing and posture alignment.
CO3	Classify various types of asanas with their benefits and precautions.
CO4	Utilize the knowledge to practice kapalabhati with correct technique, breathing rhythm and safety guidelines.
CO5	Apply pranayama to improve overall physical fitness and mental wellness.

TextBook	
1	Light on Yoga (Illustrated Edition), B. K. S. Iyengar, Revised Edition, HarperCollins India, 2017 (Reprint), ISBN: 978-8172236060.

Reference Books	
1	Teaching Methods for Yogic Practices, Dr. M. L. Gharote and Dr. S. K. Ganguly, 4th Edition, Kaivalyadhama Yoga Institute Publications, 2008, ISBN: 978-8189485245.
2	Yoga Instructor Course Handbook, Faculty of Yoga Studies, S-VYASA University,S-VYASA Publications, 2021, ISBN: Not Available.
3	Yogapravesha (Kannada), AjitKumar,Kannada Yoga Publications, 2018.
4	Yoga for Children: Step by Step, YaminiMuthanna,Yoga Publication Trust, Bengaluru, 2016.

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

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						2			2		
CO2						2	2	3	2		2
CO3						2	2	3	2		2
CO4						2	2	3	2		2
CO5						2	2	3	2		2

Semester : VI					
Music					
Course Code	:	BMU610	**Credits**	:	-
Hours/Week(L:T:P)	:	0:0:2	**CIE**	:	100 Marks
Total Hours	:	12 P	**SEE**	:	-
Course Type	:	NCMC	**SEE Duration**	:	-

Course Objectives: This course will enable the students to	
1	Understand the foundational concepts of Indian classical music, including the evolution and structure of Shruthi, Nada, Swara, Laya, Raga, Tala and Mela systems.
2	Recognize and describe various types of Carnatic compositions such as Geethe, Jathi, Swara, Swarajathi, Varna, Krithi and Thillana, along with the basics of the notation system.
3	Appreciate the contributions of key composers like Purandaradasa, Thyagaraja and Mysore Vasudevacharya to Indian music and understand their musical legacy.
4	Identify and explain the classification and basic construction of traditional Indian musical instruments, including string, wind, percussion and idiophones, with appropriate examples.
5	Demonstrate basic vocal proficiency through the practice of SaraleVarase exercises, notations for SuladiSaptaTala in Mayamalavagowla raga and performance of selected compositions such as Geethe, JathiSwara and Krithi.

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

Course Outcomes: After completing the course,the students will be able to	
CO1	Outline the evolution of Indian music and key concepts like Shruthi, Swara, Raga and Tala.
CO2	Identify and interpret basic Carnatic compositions using standard notation.
CO3	Summarize the contributions of composers.

CO4	Classify Indian musical instruments and describe their construction and use.
CO5	Demonstrate basic Carnatic vocal skills through selected exercises and compositions.

Text Books	
1	South Indian Music (Vol. I–VI), Prof. P. Sambamoorthy, 11th Edition (Reprint), The Indian Music Publishing House, Chennai, 2019.
2	A Textbook of Carnatic Music, Dr. S. Bhagyalekshmy, CBH Publications, Thiruvananthapuram, 2021 (Reprint).
3	Karnataka SangeethaCharitre, Dr. V. S. Sampathkumaracharya, Edition, Kannada University, Hampi, 2018, ISBN: Not Available.

Reference Books	
1	Music of India, B. Chaitanya Deva, Revised Edition, MunshiramManoharlal Publishers Pvt. Ltd., New Delhi, 2011, ISBN: 978-8121511534.
2	Essentials of Musicology in South Indian Music, Prof. S. R. Janakiraman, Reprint Edition, Asian Educational Services, New Delhi, 2016, ISBN: 978-8120602837.

CO – PO MAPPING

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

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

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

Department Vision

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

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