Academic Program: UG

Academic Year 2024-25

Syllabus

V & VI Semester B.E.

Civil Engineering

SHRI DHARMASTHALA MANJUNATHESHWARA COLLEGE OF ENGINEERING & TECHNOLOGY,

DHARWAD – 580 002

(An Autonomous Institution approved by AICTE & Affiliated to VTU, Belagavi)

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SDM College of Engineering & Technology, Dharwad

It is certified that the scheme and syllabus for V & VI semester of UG program in Civil Engineering is recommended by Board of Studies of Civil Engineering Department and approved by the Academic Council, SDM College of Engineering & Technology, Dharwad. This scheme and syllabus will be in force from the academic year 2024 - 25 till further revision.

Principal Chairman BoS & HoD

SDM College of Engineering & Technology, Dharwad

Vision and Mission of the Institute

Vision:

To develop competent professionals with human values.

Mission:

- To have contextually relevant Curricula.
- To promote effective Teaching Learning Practices supported by Modern Educational Tools and Techniques.
- To enhance Research Culture.
- To involve the Industrial Expertise for connecting Classroom contents to real-life situations.
- To inculcate Ethics and soft skills leading to overall personality development.

DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION

Vision:

To be the center of excellence providing the state of art civil engineering education developing competent engineers responsible for serving modern society.

Mission:

The stated vision can be achieved through:

- The development of robust curricula to meet industrial expectations.
- Interactive teaching-learning process with modern educational tools and soft skills.
- Establishing synergy between teaching and research
- Industry-Institute interaction.

Program Educational Objectives (PEOs)

I. Technical adeptness: The Civil Engineering Graduates will be technically adept to specific fields and other disciplines. Management towards Planning, Design, and Costing. Their technical skills and knowledge will enable them to perform their work with commitment and quality, timeliness with continuous improvement.

II. Interpersonal Skills: Civil Engineering Graduates will exhibit effective interpersonal skills in teams and at the workplace.

III. Awareness of Social impact: Graduates will be made aware of causes of impacts due to the development and to identify remedial measures if necessary.

IV. Professionalism: Understanding of professionalism, ethics, quality performance, sustainability and allow them to be professional leaders and contributors to society through their problem-solving capabilities and executing the work.

V. Continuous Learning: Civil Engineering Graduates will exhibit interest in lifelong learning including studies leading to professional licensure or higher studies in engineering that provides for continued development of their technical ability and management skills.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3. **Design/ development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9. **Individual and teamwork**: Function effectively as an individual and as a

member or leader in diverse teams and in multi-disciplinary settings.

PO10.**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11.**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply the set one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary environments.

PO12.**Lifelong learning**: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context to technological change.

PROGRAM SPECIFIC OUTCOMES(PSOs)

PSO13.**Project inception and design**: Conceptualize projects related to different fields of Civil Engineering, collect relevant data by direct and indirect methods, analyze the project requirement and design the project.

PSO14.**Draft specification**: Select material, prepare estimates/costing, schedule work plans.

PSO15.**Experimentation**: Apply knowledge of different fields of Civil Engineering, conduct experiments, analyze, interpret data, and design the system components.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY DHARWAD

Department of Civil Engineering

Fifth Semester

Scheme of Teaching and Examinations 2024-25

Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	HSMS	22UCVC500	Management, Entrepreneurship & Economics	CV	3	0	0	03	50	100	100	3
2	PCC	22UCVC501	Design of RC Structural Elements	CV	4	0	0	04	50	100	100	4
3	PCC	22UCVC502	Geotechnical Engineering	CV	4	0	0	04	50	100	100	4
4	PEC	22UCVE5XX	Program Elective Course - I	CV	4	0	0	04	50	100	100	4
5	PCCL	22UCVL503	Computer Aided Design Laboratory	CV	0	0	2	03	50	50	100	1
6	PCCL	22UCVL504	Concrete and Highway Laboratory	CV	0	0	2	03	50	50	100	1
7	PROJ	22UCVL505	Minor Project-I	CV	0	0	4	03	50	50	100	2
8	MC	22URMK506	Research Methodology & IPR	CV	2	0	0	02	50	50	100	2
9	MC	22UESK507	Environmental studies	CV	1	0	0	01	50	50	100	1
10	HSMS	22USSK508	Soft Skills-I	CV	0	0	2	-	50	-	50	Audit
11	MC	22UPYK509	Physical Education and Yoga	-	0	0	2	-	50	-	50	Audit
								Total			1000	22
Program Elective Course –I												
11	PEC-I	22UCVE522	Design of Masonry Structures	CV	4	0	0	04	50	100	100	4
12	PEC-I	22UCVE523	Harbour, Dock & Tunnel Engineering	CV	4	0	0	04	50	100	100	4
13	PEC-I	22UCVE524	Alternative Building Materials	CV	4	0	0	04	50	100	100	4
14	PEC-I	22UCVE525	Advanced Concrete Technology	CV	4	0	0	04	50	100	100	4
15	PEC-I	22UCVE526	Open channel Hydraulics	CV	4	0	0	04	50	100	100	4
16	PEC-I	22UCVE527	Pavement materials and design	CV	4	0	0	04	50	100	100	4

HSMS: Humanity and management Science course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, AEC: Ability Enhancement course, MC: Mandatory Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. PEC: Program elective course, PROJ: Project. TD: Teaching department, PSB: Paper setting Board.
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 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.
Minor-Project-I: The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work in higher semesters. A committee constituted by HOD consisting of a minimum of 2 faculty members shall evaluate for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HOD.
Soft Skills-I: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resource. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.
Physical Education/Yoga: All students have to register for the course namely Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out between III semester to the VI 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 PE, and Yoga activities. This course 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.
AICTE activity point: Every regular student who is admitted to the 4-year degree program is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the student's VIII semester grade card. The activities to earn points can be spread over the duration of the program. However, the minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

SDM COLLEGE OF ENGINEERING AND TECHNOLOGY DHARWAD

Department of Civil Engineering

Sixth Semester

Scheme of Teaching and Examinations 2024-25

Sl. No	Course	Course code	Course Title	TD/PSB	Teaching Hours/Week			Examination				Credits
					Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	PCC	22UCVC600	Quantity Surveying and Estimation	CV	4	0	0	03	50	100	100	4
2	PCC	22UCVC601	Structural Analysis – II	CV	4	0	0	03	50	100	100	4
3	PCC	22UCVC602	Hydrology	CV	3	0	0	03	50	100	100	3
4	PEC	22UCVE6XX	Program Elective Course -II	CV	3	0	0	03	50	100	100	3
5	PEC	22UCVE6XX	Program Elective Course -III	CV	3	0	0	03	50	100	100	3
6	OEC	22UCVO6XX	Open Elective Course -I	CV	3	0	0	03	50	100	100	3
7	PCCL	22UCVL603	Geotechnical Engineering laboratory	CV	0	0	2	03	50	50	100	1
8	PCCL	22UCVL604	Software laboratory	CV	0	0	2	03	50	50	100	1
9	PROJ	22UCVL605	Minor Project-II	CV	0	0	4	03	50	50	100	2
10	HSMS	22USSK606	Soft Skills-II	CV	0	0	2	-	50	-	50	Audit
11	MC	22UPYK607	Physical Education and Yoga	-	0	0	2	-	50	-	50	Audit
								Total			1000	23
Program Elective Course - II												
1	PEC-II	22UCVE621	Design of Special RC Structures	CV	3	0	0	03	50	100	100	3
2	PEC-II	22UCVE622	Design of Prestressed Concrete Structure	CV	3	0	0	03	50	100	100	3
3	PEC-II	22UCVE623	Design of RC Bridges	CV	3	0	0	03	50	100	100	3
4	PEC-II	22UCVE624	Matrix Method of Structural Analysis	CV	3	0	0	03	50	100	100	3
5	PEC-II	22UCVE625	Structural Dynamics	CV	3	0	0	03	50	100	100	3
Program Elective Course – III												
1	PEC-III	22UCVE626	Watershed Management	CV	3	0	0	03	50	100	100	3
2	PEC-III	22UCVE627	Advanced Geotechnical Engineering	CV	3	0	0	03	50	100	100	3

3	PEC-III	22UCVE628	Railway and Airport Engineering	CV	3	0	0	03	50	100	100	3
4	PEC-III	22UCVE629	Advanced Surveying	CV	3	0	0	03	50	100	100	3
5	PEC-III	22UCVE630	Temple Architecture and Renovation	CV	3	0	0	03	50	100	100	3
Open Elective Course-I												
1	OEC-I	22UCVO651	Remote Sensing & GIS	CV	3	0	0	03	50	100	100	3
2	OEC-I	22UCVO652	Road safety and traffic management	CV	3	0	0	03	50	100	100	3

HSMS: Humanity and management Science course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, AEC: Ability Enhancement course, MC: Mandatory Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering. PEC: Program elective course, OEC: Open elective course, PROJ: Projects. TD: Teaching department, PSB: Paper setting Board.

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 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 numbers of students' strength for offering Open Elective Course are as prescribed by the DAP.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are entitled to opt for the open electives offered by their parent Department and other departments if 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 are as prescribed by the DAP.

Minor-project-II: It is either a continuation of Minor-Project-I or a new project. The students are expected to identify the state-of-the-art technology in his/her domain of interest by an extensive literature survey and select a topic from an emerging area relevant to their branch/interdisciplinary and define the problem for the project work. The problem could be defined to develop prototypes for industrial needs. A team consisting of not more than 2-4 students shall be guided by a faculty member. This project work is to supplement and prepare the students to take up major project work in higher semesters. A committee constituted by HOD consisting of a minimum of 2 faculty members shall evaluate for CIE with suitable rubrics. The weightage of marks shall be 50% for the committee and 50% for the guide. There is a SEE (viva voce) examination which shall be examined by two internal examiners recommended by the HOD.

Soft Skills-II: Training on communication skills, proficiency in English language and aptitude ability is arranged involving external resource. The external resource person shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 50 marks. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

Physical Education/Yoga: All students have to register for the course namely Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned course coordinator during the first week of respective semester. Activities shall be carried out between III semester to the VI 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 PE, and Yoga activities. This course 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.

AICTE activity point: Every regular student who is admitted to the 4-year degree program is required to earn 100 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the student's VIII semester grade card. The activities to earn points can be spread over the duration of the program. However, the minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fails to earn the prescribed activity points; VIII semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII semester grade card.

V Semester

22UCVC500	Management, Entrepreneurship & Economics	(3-0-0) 3

Contact Hours:39

Course Learning Objective (CLOs): Management, Entrepreneurship & Economics is taught as one of the core subjects in Civil Engineering program. In this course, topics on Management, Planning, Organizing, Staffing, Directing and Controlling, SSI, Government/ Institutional support, Project Formulation, Strategic economic decisions. The delivery of the topics is made through lecture classes. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Define and explain the management and concepts of planning, forecasting and decision making.		11	
CO-2	Define and explain the concepts of organizing, staffing, motivating and controlling.		9,11	
CO-3	Define and explain the concepts of entrepreneurship and the small-scale industries (SSI).		6,8,11	
CO-4	Explain the Government and institutional support to SSI, formulate a project report by identifying the business opportunities.		11	
CO-5	Explain importance of economics in Civil Engineering.		6,8	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level						2		2	2		2				

Contents:

Unit–I

Introduction to Management: Definition, functions of Management.

Planning, Forecasting and Decision Making: Nature of Planning, Planning concepts, Forecasting, Decision making, Tools for decision making. **8 Hrs.**

Unit–II

Organizing and staffing: Nature of organizing, Concepts of Organization, Technical and Modern organization structures, Staffing process in technical organizations, Authority and Power; Delegation, Meeting & Committees.

Motivating and Controlling: Motivation, Process of Motivation, Motivational theories, Leadership and styles, Process of control, Requirements of Effective control system. **8 Hrs.**

Unit–III

Foundations of Entrepreneurship: Meaning of entrepreneur, Functions of entrepreneur, Types of entrepreneurs, Concept of entrepreneurship, Role of entrepreneurs in economic development, Barriers of entrepreneurship.

Small Scale Industry (SSI): Definition, Characteristics, Objectives, Role of SSI in economic development, Advantages of SSI, Steps to start SSI, Definition of Ancillary and Tiny industry. **7 Hrs.**

Unit–IV

Government and Institutional Support: Government and Institutional support to SSI, Objectives and functions of MSME Development Institute, SIDBI, DIC, Single window agency, KIADB, KSSIDC, KSFC.

Preparation of Project: Meaning of project, Importance of project report, Contents of a standard project, Identification of business opportunities, Feasibility studies, Types and purpose. **7 Hrs.**

Unit–V

Economics in Civil Engineering: Introduction, projects, firms and market in Civil Engineering. Benefits of economics and strategic and economic decisions. **9 Hrs.**

Reference Books:

1) Naidu N.V.R. and T. Krishna Rao, “Management and Entrepreneurship”, I.K. International Publishing House, Bangalore. 1st Edition, 2009.
2) Babcock Daniel L., “Managing Engineering and Technology”, PHI. 6th Edition, 2014.
3) Drucker Peter, “The Practice of Management”, Harper Business. Latest Edition, 2006.

22UCVC501	Design of RC Structural Elements	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): Design of reinforced concrete structures is taught as a core course in Civil Engineering program. In this course, introduction to Working Stress Method and Limit State Method of design for design of beams, slabs, columns, footings, staircases are dealt. The delivery of topics will be made

through lecture classes and site visits. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain working stress method and limit state method.		1	
CO-2	Design and detail different types of beams for different support conditions.	1,3	2	6,8
CO-3	Design and detail different types of slabs.	1,3	2	6,8
CO-4	Design and detail columns and footings.	1,3	2	6,8
CO-5	Design different types of staircases.	1,3	2	6,8

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	2.8	2	3			1		1							

Contents:

Unit - I

General features of Reinforced Concrete: Introduction, design loads, materials for reinforced concrete, code requirements of reinforcements, elastic theory of RC sections, moment of resistance of section, balanced, under reinforced and over reinforced sections.

Principles of Limit State Design and Ultimate Strength of RC Section: Philosophy of limit state design, principles of limit states, factor of safety, characteristic and design loads, characteristic and design strength, Analysis of sections for flexure and shear. **12 Hrs.**

Unit - II

Design of Beams: Practical requirements of an RCC beam, designing and detailing of singly reinforced, doubly reinforced and flanged beams. **10 Hrs.**

Unit - III

Design of Slabs: Introduction, general consideration of designing and detailing of slabs, spanning in one direction, spanning in two directions for various boundary conditions and for different support conditions. **10 Hrs.**

Unit - IV

Design of Columns: General aspects, effective length, loads on columns, slenderness limits for columns, minimum eccentricity, design of short axially loaded columns.

Design of Footings: Introduction, loads on foundation, design of isolated footings subjected to axial load. **10 Hrs.**

Unit - V

Design of Staircase: General features, types of staircases, loads on staircases, effective span as per IS code provisions, distribution of loading on stairs, design of staircases. Straight, dog legged and open well stairs. **10 Hrs.**

Reference Books:

1) IS 456-2000 “Plain and Reinforced Concrete Code of Practice”.
2) SP16 - 1980 “Design Aids for Reinforced Concrete”.
3) Pillai and Menon, “Reinforced Concrete Design”, McGraw-Hill, 4th Edition, 2021.
4) Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi, 2nd Edition, 2008.
5) Karve S R. and Shah V.L., “Limit state theory and design of reinforced concrete”, Vidyarthi Prakashan, Pune, 8th edition.
6) Jain A.K., “Limit state method of design,” Nemichand and Bros, Roorkee. 7th Edition, 2012.
7) Krishnaraju N., “Reinforced concrete design”, New Age Publication. 4th Edition, 2019.

22UCVC502	Geotechnical Engineering	(4-0-0) 4

Contact Hours: 52

Course Learning Objective (CLOs): Geotechnical Engineering – I is taught as one of core subjects for Civil engineering program. It consists of various engineering properties of soil and the principles of soil mechanics are imparted to the students. Topics covered include the index properties of soil, soil classification, flow of water through soils, compaction/ consolidation of soils and shear strength of soil along with numerical problems. The delivery of the topics is achieved through lecture classes, problem solving and demonstrations. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the soil formation, phase diagram, derive inter relations, identify soils in the field, explain various index properties of soil.		4	1, 2

CO-2	Explain soil classification, compute the permeability of soils, explain the laboratory methods for determination of permeability, explain seepage / superficial velocity and the quicksand phenomenon.	4		1,2
CO-3	Describe the compaction of soils, Explain the laboratory methods for determining the compaction parameters, explain the field compaction control.	4	2	1
CO-4	Explain the consolidation and its characteristics of soils.		2, 4	1
CO-5	Explain the shear strength of soil, Mohr Coulomb strength theory, explain various laboratory shear tests.		2, 4	1

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1	1.6		2.4											

Contents:

Unit - I

Introduction: Origin and formation of soil, phase diagram, inter relations of soil properties, field identification of soils.

Index Properties of Soils: Definition and importance of Index properties of soils, viz., specific gravity, water content, particle size distribution, consistency limits and indices, in situ density, and density index etc. Determination of specific gravity, particle size distribution and consistency limits. **12 Hrs.**

Unit - II

Classification of Soils: Particle size classification, MIT classification, textural classification, unified soil classification and IS classification, plasticity chart and its importance.

Permeability: Darcy's law, assumptions, and validity; coefficient of permeability and its determination in laboratory, Factors affecting permeability, Permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation, quicksand phenomenon, Capillary phenomenon. **10 Hrs.**

Unit - III

Compaction of Soils: Definition, standard and modified Proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, field

compaction methods, rollers and vibrators, field compaction control, Procter's needle **10 Hrs.**

Unit - IV

Consolidation of soils: Definition, mass-spring analogy, Terzaghi's one dimensional consolidation theory, assumptions, and limitations, normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method, consolidation characteristics of soil viz., co-efficient of consolidation, co-efficient of volume change, co-efficient of compressibility, compression index. Foundation Settlement, ill effects of settlement of soil on buildings, immediate, primary, and secondary settlements. **10 Hrs.**

Unit - V

Shear Strength of Soil: Concept of shear strength, Mohr's strength theory, Mohr Coulomb theory, measurement of shear parameters, direct shear test, unconfined compression test, triaxial compression test and vane shear test, Factors affecting shear strength of soils. **10 Hrs.**

Reference Books:

1) B. C. Punmia, "Soil Mechanics and Foundations", 17th edition, 2017, Laxmi Publications (P) Ltd., New Delhi.
2) Gopal Ranjan and A.S.R Rao., "Basic and applied soil mechanics", 4th edition, 2022, New Age International Publishers, Bangalore.
3) Narasimha Rao A.V. and Venkatramaiah C., "Geotechnical Engineering", 2nd edition, 2007, University Press (India) Ltd., Hyderabad.
4) IS 1498: 2002, "Classification and identification of soils for general engineering purposes".

22UCVL503	Computer Aided Design Laboratory	(0-0-2) 1

Contact Hours: 26

Course Learning Objectives (CLOs): Computer Aided Design Laboratory deals with application of computers in solving Civil Engineering related problems. In this course, topics on spread sheets for Civil Engineering problems, C- Programming for analysis and design of beams are dealt. The evaluation will be carried out through continuous evaluation & Semester End practical examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Develop spread sheets for: design of horizontal and vertical alignment,	**3**	**5**	**1**

	computation of earthwork volume and calibration of notches & weirs.			
CO-2	Develop C programs for calculation and drawing of BM and SF diagrams for beams.	**3**	**5**	**1**
CO-3	Use Civil Engineering software.	**3**	**5**	**1**

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1		3		2										

Contents:

1) Spread sheet for design of horizontal and vertical alignment, computation of earthwork, calibration of notches and weirs, problems on mechanics of materials.
2) Design RC beam using C programming.

22UCVL504 Concrete & Highway Laboratory (0-0-2) 1

Contact Hours: 26

Course learning objectives (CLOs): In this course, characteristics of cement, strength of aggregate, shape tests on aggregate, strength parameters of concrete, properties of bitumen are dealt. The delivery of topics will be made through demonstration and Laboratory work. The delivery of topics will be made through instruction classes, demonstration, and Laboratory work. The evaluation will be carried out through continuous evaluation & Semester End practical examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Perform tests on cement and coarse aggregate.		15	9
CO-2	Perform tests on fresh and hardened concrete.	3	15	9
CO-3	Perform tests on bitumen.		15	9

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level			3						1						2

Contents:

1. **Cement:** Determination of grade of Cement.
2. **Aggregates:** Abrasion**,** Impact, crushing strength, shape tests - Flakiness & Elongation.

3. **Fresh concrete:** Concrete Mix design with and without admixtures, workability - slump, compaction factor and Vee-Bee test.
4. **Hardened concrete:** Compressive strength and NDT.
5. **Bituminous materials and mixes:** Specific Gravity, Penetration, Ductility, Softening point, Flash and fire point, Viscosity. Marshall Stability tests, bitumen extraction. Sub grade Soil CBR Test.

Reference Books:

1) Gambhir. M.L., "Concrete Manual", Dhanpat Rai & sons New Delhi. 5th Edition, 2017.
2) Relevant IS Codes and IRC Codes.

22UCVL505	Minor Project – I	(0-0-4) 2

Contact Hours:52

Course Learning Objective (CLOs): Minor Project–1 is carried out under the guidance of a faculty. In this course, the students will finalize the project title, collect the data required by indirect and direct methods and carry out literature review and formulate the methodology.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Identify the project area.	13	1	9,12
CO-2	Collect data by direct and indirect methods.	2	13	9,12
CO-3	Collect required literature survey and organize them.	1		9,12
CO-4	Define the problem definition from research gap and formulate the methodology.	2		9,12
CO-5	Interpret the test data/ results, draw conclusions and suggest strategies.	15	5	9,12

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	2.5	3			2				1			1	2.5		3

Contents:

Domain-related problems, technical solutions, and recommendations.

Evaluation:

The team consisting of 10-12 students shall be asked to identify the problems related to the community and try to propose a solution. The faculty members handling the courses for that semester shall guide the students. A committee

consisting of a minimum of 3 faculty members shall evaluate at the end for CIE. There is no SEE for Minor project 1.

22URMK506 Research Methodology & IPR (2-0-0) 2

Contact Hours: 26

Course Learning Objectives (CLOs):

The students are expected to learn about the needs and types of research, problem formulation, literature review, measurement, scaling, data collection, testing of hypothesis, result interpretation and report writing. Also expected to learn about the importance of IPR and trademarks.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Formulate** the research problem, carryout literature survey and decide the methodology.	-	2	-
CO-2	**Importance** of Literature survey and need to identify gaps	-	2	5
CO-3	**Describe** measurement and scaling and data collection &report writing			3
CO-4	**Basic** concepts concerning IPR and copy rights	-	4	-
CO-5	**Explain** the need for Trademark and IT act.		5	

POs/PSOs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level		2	1	2	1.5							

Contents:

Unit-I

Research Methodology: Introduction, meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus methodology.

Defining the Research Problem: Research problem, selecting the problem, necessity of defining the problem, technique involved in defining a problem, an illustration. **05 Hrs**

Unit-II

Reviewing the literature: Importance of the literature review in research, How to review the literature, searching the existing literature, reviewing the selected literature and writing about the literature reviewed.

Research Design: Meaning of research design, need for research design, features of a good design, important concepts relating to research design. **05 Hrs.**

Unit-III

Data Collection: Collection of primary data, observation method, interview method, collection of data through questionnaires.

Testing of Hypotheses: What is a Hypothesis? Basic concepts concerning testing of hypotheses, procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, tests of hypotheses.

Interpretation and Report Writing: Meaning of interpretation, technique of interpretation, precaution in interpretation, significance of report writing. **06 Hrs.**

Unit-IV

Meaning and conception of IPR, competing, rationale for protection, international conventions, world court.

Copy right: Historical evolution of the law on copy right, meaning, content.

Patents: Meaning of Patent, purpose and policy object of patent law, gains to inventor, application of patents, joint application, discovery and invention, patentable and non-patentable inventions. **05 Hrs.**

Unit-V

Trademarks: Definitions and conceptions of Trademark, advantages of registration, marks which are not registrable, known and well-known trademarks, application for registration and procedure for registration, procedure and certification of Trademarks.

The Information Technology Act:
Definitions, certifying authority, meaning of compromise of digital signature, offences and penalties, applicability of IPRs, cybercrimes, adjudicating officer, violation, damages and penalties, Cyber regulation appellate tribunal, World Wide Web and domain names and cyber flying, **05 Hrs.**

Reference Books:

1) C.R. Kothari, Gaurav Garg, Research Methodology: Methods and Techniques, New Age International, 4th Edition, 2018.
2) Ranjit Kumar, Research Methodology a step-by-step guide for beginners, SAGE Publications, 3rd Edition, 2011.
3) Fink A, Conducting Research Literature Reviews: From the Internet to Paper, Sage Publications, 2009.
4) N. K. Acharya, Textbook on Intellectual Property Rights, 4th Edition, Asia Law House, Hyderabad.

22UESK507	Environmental Studies	(1-0-0) 1

Contact Hours: 13

Course Learning Objective (CLO):

The students will learn about the need of balanced ecosystem, effects of human activities on environment, optimized use of natural resources including energy extraction and current Environmental issues.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to		**Mapping to POs (1-12) /PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Discuss the concept of ecosystem and effects of human activities on environment.		7	
CO-2	Describe the adverse effects on health and society due to erratic exploitation of natural resources.			6
CO-3	Understand various types of energy, sources of energy.		6	
CO-4	Explain different types of Pollution and concept of Global warming, Ozone layer depletion.		7	
CO-5	Discuss the current developments towards NGO to protect environment.		6	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Mapping Level	-	-	-	-	-	1.6	2	-	-	-	-	-	-	-	-

Course content:

Unit - I

Environment and Effects of Human activities on Environment: Introduction, Ecosystem – Types & Structure of Ecosystem, Impacts of Agriculture & Housing, Mining & Transportation. Environmental Impact Assessment, Sustainable Development. **03 Hrs**.

Unit - II

Natural Resources: Introduction Water resources – Availability & Quality aspects, Water borne diseases, Fluoride problem in drinking water. Material Cycles - Carbon cycle and Nitrogen cycle. **03 Hrs**.

Unit - III

Energy in Ecological System: Different types of energy, Conventional sources & non-conventional sources of energy. Solar energy, Hydro electric energy, Wind energy, nuclear energy, Biomass & Biogas, Fossil Fuels, Hydrogen as an alternative energy. **03 Hrs.**

Unit - IV

Environmental Pollution: Water Pollution, Land Pollution, Air Pollution, Global Warming, Ozone layer depletion. **02 Hrs.**

Unit - V

Current Environmental Issues & Environmental Protection: Environmental Acts & Regulations, Role of Nongovernmental Organizations (NGOs). Introduction to GIS & Remote Sensing, Applications of GIS & Remote Sensing. **02 Hrs.**

Reference Books:

1. P. Meenakshi, “Elements of Environmental Science and Engineering”, Prentice Hall of India Private Limited, New Delhi, 2006.
2. Benny Joseph “Environmental Studies”, Tata McGraw – Hill Publishing Company Limited, 2010.
3. Raj Gopalan “Environmental Studies” Oxford University press, New Delhi, 3rd Edition, 2016.
4. Kaushik and Kaushik “Perspectives in Environmental Studies “, New Age International Private Limited, 2005.
5. D. L. Manjunath “Environmental Studies “, Pearson, Noida, 2016.

22USSK508	**Soft skills - I**	**(0-0-2) Audit**

Contact Hours: 26

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ (13,14)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Explain** the significance of communication in the profession.	-	10	-
CO-2	**Use** the English language with proficiency	-	10	12
CO-3	**Solve** Aptitude related problems	-	9	12
CO-4	**Demonstrate** the competency in the placement activities.	-	9	-

PO's	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-

Contents:

Number System, Linear Equations + Assessment Test ▪ HCF and LCM, Ratios & Proportions + Assessment Test ▪ Percentage, Profit & Loss + Assessment Test ▪ Time, Work & Distance + Assessment Test ▪ Simple and compound Interest, Averages and Mixtures + Assessment Test ▪ Permutations, Probability + Assessment Test ▪ Data analysis **14Hrs**

Cryptarithmetic, Analytical Puzzles, Classification Puzzles, Mathematical Puzzles, Human Relations, Directional tests, Coding and decoding, Series completion – Verbal and Non-verbal, Questions from recent recruitment tests **10 Hrs**

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be made by the department and maintain the relevant documents.

22UPYK509	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and importance of Physical Education & Yoga in day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	-	-	-	-	1	2	-	1	1	-	-	3

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and Wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health. Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, Importance prayer Suryanamaskara,

Asana:- Trikonasana, Ardha Chakrasana, Baddha konasana, Utkatasana.

Pranayama:- Bhramari Pranayamai, Kapalbhati Pranayama.

Mudras:- Chinmaya mudra & Nasika mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Netball, Kabaddi, Football Tug ofwar, Throwball Rules and regulation of all games. **05Hrs**

Unit-V

Modern Technology in Sports and Games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

22UCVE522	Design of Masonry Structures	(4-0-0)4

Contact Hours: 52

Course Learning Objective (CLOs): Design of Masonry Structures is taught as one of elective subjects for civil engineering program. In this course, types of materials, masonry units, masonry construction, strength and stability of masonry construction, permissible stresses, design of masonry construction and gravity retaining walls are dealt. The delivery of topics will be made through lecture classes. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Summarize engineering properties and uses of masonry units. Explain masonry construction strength and stability. Identify defects and crack in masonry and its remedial measures.	1	-	-

CO-2	Explain permissible stresses in masonry construction, calculate slenderness ratio of columns and walls and load distribution on lintels and arches.	1	-	-
CO-3	Design free standing walls and walls subjected to axial/eccentric load with and without openings	1,3	4	-
CO-4	Design solid and cavity walls subjected to concentrated axial load as per IS: 1905.	1,3	4	-
CO-5	Design walls subjected to eccentric loads with and without openings.	1,3	4	-

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3		3	2											

Contents:

Unit - I

Masonry Units, Materials and Masonry Construction: Brick, stone and block masonry unit, strength, modulus of elasticity, water absorption, masonry materials, classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks.

Strength and Stability: Concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression. **12 Hrs.**

Unit - II

Permissible Stresses: Permissible compressive stress, reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile, shear stresses.

Design Considerations: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. **10 Hrs.**

Unit - III

Design of Structural Masonry: Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, free standing wall, design of load bearing masonry for building up to 2 storeys using IS: 1905 and SP: 20 procedures. **10 Hrs.**

Unit - IV

Design of walls subjected to concentrated axial loads: Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings. **10 Hrs.**

Unit - V

Design of walls subjected to eccentric loads: Design criteria – stress distribution under eccentric loads – problems on eccentrically loaded solid walls, cavity walls, walls with piers. **10 Hrs.**

Reference Books:

1) Hendy A W., "Structural Masonry", Macmillan Education Ltd. 2nd Edition, 1998.
2) Dayaratnam P., "Brick and Reinforced Brick Structures", Oxford & IBH. 2nd Edition, 2017.
3) Sinha B. P., Davies S R., "Design of masonry structures" E&FN spon. 3rd Edition, 2004.
4) IS Codes: IS 1905-1987, "Code of practice for structural use of un-reinforced masonry.

22UCVE523 Harbour, Dock and Tunnel Engineering (4-0-0)4

Contact Hours: 52

Course Learning Objectives (CLOs): Harbour, Dock and Tunnel Engineering is taught as one of the elective courses in Civil Engineering program. In this course, harbour layout, natural phenomena viz. winds, waves and tides, Harbour components viz. Breakwaters, Approach Channel, Wharves, Jetties, Quays, Warehouses, Wet and Dry Docks, Navigational Aids viz. Light House, Buoys, Beacons, Sound Signals and Tunnel Surveys, Soft Soil Tunneling methods, Tunneling in Rock, Explosives for Rock Tunneling, Tunnel Lining, Tunnel Ventilation are dealt. The delivery of topics will be made through lecture classes and demonstrations. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Define components of harbours and natural phenomena.		2	1
CO-2	Classify and describe types of harbours and docks.		2	1
CO-3	Classify and characterize signals and navigational aids.		2	1
CO-4	Define, classify and describe components of tunnels and		2	1,6

	methods of tunneling in rock.			
CO-5	Describe and discuss modern tunneling, mucking, ventilation and drainage methods.		2	1,6

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1	2				1									

Contents:

Unit - I

Harbours: Definition of Harbour, classification of Harbours (with sketches), general design features, definition of various terminology. Natural forces on Harbours, winds, waves, tides, currents, effects of each on the Harbour structures. **12 Hrs.**

Unit - II

Harbour structures and docks: Breakwaters, quays and jetties (with sketches). Types (sketches), differences of Harbours and Docks, construction details of dry docks, wet docks-operation, self-docking docks. **10 Hrs.**

Unit - III

Signals: Bouys and Bouyage systems, Light house purpose, construction details, sound signals. **10 Hrs.**

Unit - IV

Tunnels: Definition, components, advantages and disadvantages, Cross sections of tunnels for various purposes (with sketches). Tunnel surveying, transfer of level and grade on surface survey, equipment used, methods of Rock tunneling, drilling patterns, explosives, blasting. **10 Hrs.**

Unit - V

Modern Tunneling methods: Shield tunneling, lining of tunnels, tunnel ventilation and drainage. **10 Hrs.**

Reference Books:

1) Srinivasan R., “Harbours Docks and Tunnel Engineering”, Charotar Publishing House Pvt. Ltd. 30th Revised and Enlarged Edition, 2022.
2) Oza and Oza, “Harbours and Docks”, Charotar Publishing House Pvt. Ltd. 17th Edition.

22UCVE524 Alternative Building Materials (4-0-0)4

Contact Hours: 52

Course Learning Objectives (CLOs): Alternative Building Materials is taught as one of the elective courses in the Civil Engineering program. In this course, the students understand environmental issues due to building materials and the energy

consumption in manufacturing building materials. The course also exposes the students to the study the various masonry blocks, masonry mortar and the study the alternative building materials in the present context. Students shall also understand the alternative building technologies which are followed in present construction field. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the facts of energy, environment, cost effectiveness of different building materials.			1
CO-2	Explain the elements of structural masonry.			1
CO-3	Explain the types, characteristics and strength of mortars.			1
CO-4	Explain and apply the concepts of alternative building materials, types, properties.		1,2,7	
CO-5	Discuss the equipment for production of alternative materials and cost concepts.			1

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	1.2	2					2								

Contents:

Unit - I

Introduction: Energy in building materials, environmental issues concerned to building materials, Global warming and construction industry, environment friendly and cost-effective building technologies, requirements for building of different climatic regions. **10 Hrs.**

Unit - II

Elements of Structural Masonry: Elements of Structural Masonry, Masonry materials, requirements of masonry units, characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite blocks, Stabilized mud block. Manufacture of stabilized blocks, cementations materials, sand, natural & manufactured. **10 Hrs.**

Unit - III

Mortars: Types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar, uses of masonry, masonry bonding,

Compressive strength of masonry elements, Factors affecting compressive strength, Bond strength of masonry, Flexure and shear, Elastic properties of masonry materials. **10 Hrs.**

Unit - IV

Conventional and Non-conventional Materials: Lime, Pozzolana cement, Raw materials & Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes. **12 Hrs.**

Unit - V

Equipment for Production of Alternative Materials and cost concepts: Machines for manufacture of concrete, Equipment for production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis, Case studies using alternatives. **10 Hrs.**

Reference Books:

1) K. S. Jagadish, B.V Venkatarama Reddy and K.S Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International Pvt. Ltd.
2) Arnold W Hendry, “Structural Masonry”, Macmillan Publishers. 2nd Edition, 1998.
3) S. K. Duggal, “Building Materials”, New Age International Pvt. Limited. 5th Edition, 2019.

22UCVE525 Advanced Concrete Technology (4-0-0)4

Contact Hours: 52

Course Learning Objective (CLOs): Advanced Concrete Technology is taught as one of elective courses for Civil Engineering Program. In this course, topics on ingredients of concrete, rheology of concrete, properties of fresh and hardened concrete, special concrete, microstructure of concrete and high strength and high-performance concrete are dealt. The delivery of topics will be made through lecture classes and demonstration. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the constituents and properties of cement and polymers, fibers, adhesives, and sealants		1,2,6	
CO-2	Explain the concept of Rheology of fresh concrete and its applications.	3,4	9	7,12

CO-3	Explain the microstructure of aggregate phase and its importance in concrete.	3,4,5	9	12
CO-4	Explain the special concrete and high performance/high strength concrete.	13	6,7	12
CO-5	Explain methods for special curing, Shotcreting, under water concreting and formwork.	3,13	4	6,12

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2	2	3	2.66	3	1.67	1.5		2			1	3		

Contents:

Unit - I

Introduction: Concrete and reinforcement, constituent materials, composite cement and properties. Types of reinforcements, corrosion of reinforcing steel - electro-chemical process, measures of protection. Polymers, fibers, adhesives and sealants - types and uses. **12 Hrs.**

Unit - II

Properties of fresh concrete: Rheology of Concrete - Introduction, factors affecting rheology of concrete, equation for measuring the rheological parameters, rheometer. **10 Hrs.**

Unit - III

Properties of hardened concrete: Microstructure of the aggregate phase, microstructure of the hydrated cement paste, Interfacial Transition Zone (ITZ) in concrete -microstructure, strength influence of the interfacial transition zone on properties of concrete. Quantitative estimation of product of hydration by Mercury Intrusion Porosimeter, X-Ray Diffraction Analysis (XRD Analysis) and Scanning Electron Microscopy (SEM). **10 Hrs.**

Unit - IV

Special Concretes: Self compacting concrete, High performance and High strength concrete, Bacterial Concrete, Ferro-cement - Definition, fresh & hardened Properties, applications. **10 Hrs.**

Unit - V

Special Topics: 3D printing using Concrete, Curing methods - Steam, water curing. vacuum dewatering of concrete. Shotcrete - definition, wet mix and dry mix process, general use and advantages. Underwater concreting - Introduction, basic requirements, strength, workability. **10 Hrs.**

Reference Books:

1. Shetty M.S., “Concrete Technology -Theory and Practice”, S. Chand and company, New Delhi. 8th Edition, 2018.
2. Neville A.M. & Brooks J.J., “Concrete Technology”, Tans-Atlantic Publications, Philadelphia, USA, 5th Edition, 2011.

3. Gambhir M.L., “Concrete Technology”, Tata McGraw Hill, Education, New Delhi, 5th Edition, 2017.
4. John Newman and Ban Seng Choo, "Advanced Concrete Technology – Process", ISBN 0 7506 51059, Elsevier Ltd
5. IS 456: 2000 – “Plain and reinforced concrete – Code for practice”.
6. IS 10262: 2019 – “Concrete mix proportioning – Guidelines”.
7. IS 383: 2016 – “Coarse and fine aggregate for concrete – Specification”.

22UCVE526	Open Channel Hydraulics	(4-0-0)4

Contact Hours:52

Course Learning Objectives (CLOs): Open channel hydraulics is taught as one of the elective courses in Civil Engineering program. In this course the difference between pipe and open channel flow, momentum equation, uniform flow, design of channel sections, gradually varying flow and rapidly varied flow along with sediment transport are dealt with. The delivery of topics will be made through lecture classes and field visits. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Differentiate between pipe flow and open channel flow, energy and momentum equations.		1,2	
CO-2	Design channel for uniform, critical flow.	3		
CO-3	Explain different forms of gradually varied flow and their profiles.	2	5	
CO-4	Compute gradually varied flow by using direct integration, Bresse’s and Chow’s solution.	3	5	
CO-5	Explain length, height, location of hydraulic jump and application.	3	5	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2	2.5	3		2										

Contents:

Unit - I

Introduction: Introduction, difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, kinetic energy and momentum factors.

Uniform Flow: Concepts, uniform flow equations, conveyance, hydraulic exponent for uniform flow, design of channels for uniform flow. **12 Hrs.**

Unit - II

Critical Flow: Concepts, specific energy, classification of flow, design of channels, section factor, hydraulic exponent for critical flow, and critical depth as a flow measuring consent. **10 Hrs.**

Unit - III

Gradually Varied Flow: Concepts, GVF equation, its different forms, classification and analysis of flow profiles, control sections. **10 Hrs.**

Unit - IV

Gradually Varied Flow Computations: Different methods, direct integration method, Bresse's & Chow's solution, direct step method, standard step method. **10 Hrs.**

Unit - V

Rapidly Varied Flow: Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of hydraulic jumps, length, location, height, applications of hydraulic jump. **10 Hrs.**

Reference Books:

1. Henderson, "Open Channel Flow", Pearson Publication, (1966).
2. Chow V.T., "Open-Channel Hydraulics", The Blackburn Press; Illustrated edition (2009).
3. Subramanya K., Flow in open channel, McGraw-Hill Publication, 5th Edition, 2019.
4. Ranga Raju K.G., Flow through open channels, Tata-McGraw Hill, 5th Edition, 2019.
5. Das M. M., Open Channel Flow, Phi Learning India Pvt. Ltd., 3rd Edition, 2011.

22UCVC527	Pavement Materials and Design	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): Pavement materials and design is taught as one of the elective subjects of civil engineering in which the basic knowledge of materials used in road construction and design of pavement imparted to the students. Topics covered include the subgrade soil and its strength assessment, aggregates, bitumen, cutback bitumen, emulsion, bituminous mixes, design of flexible and rigid pavements. The delivery of the topics is achieved through lecture classes, problem solving and demonstrations. The evaluation is made by means of the internal assessment tests and semester end examination.

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Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSO (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Assess the strength of subgrade soil and aggregates used in the road construction		1	
CO-2	Understand various binder/s and their properties used in road construction.		1,2,3	
CO-3	Design and understand volumetric properties of bituminous mixes.	1,2,3		
CO-4	Design flexible pavement as per IRC guidelines.	1,12		
CO-5	Design rigid pavement and its components as per IRC guidelines.	1,12		

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2	3	3									1			

Contents:

Unit - I

Subgrade soil - Desirable properties-HRB soil classification, determination of CBR and modulus of subgrade reaction with Problems.

Aggregates- Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.

10 Hrs.

Unit – II

Bitumen - Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements.

Bituminous emulsion and Cutbacks-Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion. **11 Hrs.**

Unit - III

Bituminous mixes-Marshall mix design criteria, voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above. **11 Hrs.**

Unit - IV

Design of flexible pavement: Types of pavements, design factors, ESWL and EWL concept, and problems. IRC method of flexible pavement design based on CSA method, IRC 37: 2018. **10 Hrs.**

Unit - V

Design of Rigid Pavement: Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, problems of the above. **10 Hrs.**

Reference Books:

1) Khanna S.K. and Justo C E G., “Highway Engineering”, Nemchand and Bros, Roorkee, Revised Tenth Edition, 2017.
2) Kadiyali L.R., “Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi, Ninth Edition, 2017.
3) Yang H. Huang, “Pavement Analysis and Design”, University of Kentucky
4) Yoder & wit zorac, “Principles of pavement design”, John Wiley & Sons.

VI semester

22UCVC600	Quantity Surveying and Estimation	(4-0-0) 4

Contact Hours: 52

Course Learning Objective (CLOs): Quantity Surveying and estimation is taught as core course in Civil Engineering program. In this course, estimate and types, method of taking out quantities of various items of works for buildings, RCC slab, septic tank, brief and detailed specifications and rate analysis for items of works etc are dealt. The delivery of topics will be made through lecture classes and demonstrations. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level(1)**
CO-1	Explain different types of estimates, units of measurement, sizes and dimensions of various works.	1		
CO-2	Calculate the quantities of various items of works.	1		
CO-3	Calculate the quantities of small civil works - Septic tanks.	1		
CO-4	Evaluate rates for the standard items of works for buildings.	1		6,7
CO-5	Explain brief and detailed specifications for various items of works for building.	14		6,7

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3					2	1		1			1		3	

Contents:

Unit - I

Introduction to building Estimate: Importance of preparing estimates, Procedure & types of estimates, units of measurement, sizes and dimensions of various works. **10 Hrs.**

Unit - II

Estimation of buildings: Methods of taking out quantities by center line method and / or long wall and short wall method for load bearing buildings with flat RCC roofs. **12 Hrs.**

Unit - III

Estimation of minor civil works: Methods of taking out quantities for Septic tank and its types. **10 Hrs.**

Unit - IV

Rate Analysis: Definition and purpose, working out rates for standard items of works for a building. **10 Hrs.**

Unit - V

Specifications: Definition of specification, objective of writing specifications, essentials in specifications, general and detailed specifications of standard items of works in buildings. **10 Hrs.**

Reference Books:

1) Dutta B.N., "Estimating and Costing in Civil Engineering", UBS Publishers and Distributors, New Delhi. 28th Edition, 2020.
2) Chakraborti N., "Estimating and Costing in Civil Engineering", Published by author, Calcutta. 24th Edition, 2010.
3) Schedule of Rates of PWD and Irrigation Department, GOK.
4) Karnataka Public Works Departmental Code.

Pattern of question paper for SEE: There shall be one question from each unit. The question from Unit II to find out quantities of selected items of work for a given residential building shall carry 30 marks. The question from Unit III shall carry 10 marks. The remaining questions shall be from Unit I, IV, and V for 20 marks each.

22UCVC601	Structural Analysis-II	(4-0-0) 4

Contact Hours: 52

Course Learning Objectives (CLOs): Structural Analysis-II is taught as a core course in Civil Engineering program. In this course, topics on redundant trusses, Moment Distribution Method, Slope Deflection Method, Analysis of multi-storey frames, Matrix Methods are dealt. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Analyze statically indeterminate structures by strain energy method.	1,2		
CO-2	Analyze redundant trusses with lack of fit and temperature stresses.	1,2		
CO-3	Analyze statically indeterminate beams, rigid plane frames by slope deflection method and moment	1,2		

	distribution method.			
CO-4	Analyze statically indeterminate beams, rigid plane frames by rotation contribution method.	1,2		
CO-5	Analyze statically determinate beams, rigid plane frames by matrix method.	1,2		

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3	3													

Contents:

Unit - I

Redundant Trusses: Introduction, analysis of statically indeterminate structures using strain energy method, analysis of trusses (Redundant up to second degree), lack of fit in member of indeterminate trusses, temperature stress in redundant trusses. **12 Hrs.**

Unit - II

Moment Distribution Method: Non-sway and sway analysis for continuous beams and frames. 10 **Hrs.**

Unit - III

Slope Deflection Method: Introduction, sign convention, deflection equations, analysis of continuous beams and frames. **10 Hrs.**

Unit - IV

Flexibility Matrix Method: Introduction, analysis of beams and frame by flexibility matrix method. **10 Hrs.**

Unit - V

Stiffness Matrix Method: Introduction, analysis of beams and frames by Stiffness matrix method. **10 Hrs.**

Reference Books:

1) Ramamruthum and R Narayan, “Theory of structures”, published by Dhanpat Rai Publishing company, 9th Edition, 2014.
2) S S Bhavikatti “Structural analysis vol 1 and 2 “, published by Vikas publishing House pvt.ltd, 5th edition, 2021.
3) R vaidyanathan and P Perumal,” Structural analysis vol 2 and 3”, published by Laxmi Publications, 3rd edition, 2016
4) A Ghali and A M Naville and T G Brown, “Structural analysis –a unified classical matrix approach” published by Taylor and Francis ltd, 6th edition, 2009.

22UCVC602	Hydrology	(3-0-0)3

Contact Hours: 39

Course Learning Objective (CLOs): Hydrology is taught as a core course for Civil Engineering Program. In this course, topics on precipitation, losses, runoff, stream flow measurement and ground water hydrology are dealt. The delivery of topics will be made through lecture classes. The evaluation will be carried out through internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Summarize the importance of hydrology, water availability, Explain Horton's hydrological cycle, types of precipitation and estimation.	1		
CO-2	Calculate different losses such as evaporation, infiltration and runoff.		1,2	
CO-3	Analyze and draw different hydrographs.		1,2	
CO-4	Explain different methods of stream flow measurement.		1	
CO-5	Understand ground water hydrology.		1,2	

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	2.2	2													

Contents:

Unit - I

Introduction: Definition of hydrology, importance of hydrology, global water availability, India's water availability, practical applications of hydrology, hydrology cycle (Horton's) qualitative and engineering representations.

Precipitation: Definition, types of precipitation, measurement of rain fall using Symon's and 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, presentation of precipitation data, mass curve, rainfall hyetographs, intensity duration frequency curves. **8 Hrs.**

Unit - II

Losses: Introduction, evaporation process, factors affecting evaporation, measurement using IS class-A Pan, estimation using empirical formulae, Infiltration, factors affecting infiltration capacity, double ring infiltrometer, Horton's infiltration equation, infiltration indices.

Runoff: Definition, concept of catchment, geomorphology of catchment, water budget equation, components, factors affecting runoff, rainfall - runoff relationship using regression analysis. **8 Hrs.**

Unit - III

Theory of Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph and its derivation from simple storm hydrographs, S-curve and its computations. **9 Hrs.**

Unit - IV

Stream Flow Measurement: Introduction, measurement of stage, measurement of discharge by Area – Velocity method, stage discharge, introduction to moving boat only, simple stage discharge relation. **7 Hrs.**

Unit - V

Ground Water Hydrology and Well Hydraulics: Scope and importance of ground water hydrology, occurrence of ground water. Definitions: Aquifers, aquitard, aquifuge, aquiclude, perched aquifer. Aquifer parameters. **7 Hrs.**

Reference Books:

1. Jayarami Reddy, "A Textbook of Hydrology", Lakshmi Publications, New Delhi.: 3rd Edition, 2011.
2. H. M. Raghunath, "Hydrology", New Age International Private Limited, New Delhi. 4th edition, 2022.
3. Ven Te Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi. 1st Edition, 2017.
4. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.David K. Todd and Larry W. Mays, "Ground Water Hydrology", Wiley Publications. 5th Edition, 2020.

22UCVL603 Geo-technical Engineering Lab (0-0-2)1

Contact Hours: 26

Course Learning Objective (CLOs): Geotechnical Engineering Laboratory is taught as one of laboratory for Civil engineering program. In this course, topics on specific gravity of soil, moisture content of soil, grain size analysis and consistency of soil, compaction parameters, shear strength, relative density and various index of soil are dealt. The delivery of topics will be made through instruction classes, demonstration and Laboratory work. The evaluation will be carried out through continuous evaluation & Semester End practical examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Determine index properties of soils and interpret the results.	3	1,4	9,4,15
CO-2	Determine engineering properties of soils and interpret the results.	3	1,4	9,4,15

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	2		3	1.5					1						1

Contents:

Tests for the determination of:

1) Specific gravity by density bottle, by pycnometer.
2) Moisture content by oven drying method and pycnometer.
3) Grain size analysis of soil (Sieve analysis).
4) In situ density by core cutter and sand replacement methods.
5) Consistency limits, liquid limit (Casagrande and cone penetration methods), plastic limit and shrinkage limit.
6) Compaction parameters by Standard Proctor compaction test and modified Proctor compaction test.
7) Coefficient of permeability by constant head and variable head methods.
8) Shear strength by unconfined compression test, Direct shear test, Triaxial test (unconsolidated and undrained), Vane shear test.
9) Relative density

Reference Books:

1) Lambe T.W., “Soil testing for engineers”, Wiley Eastern Ltd., New Delhi.
2) IS 2720 – 1983, “Methods of test for soils”, Part 1 to 36.

22UCVL604 Software Laboratory (0-0-2)1

Contact Hours: 26

Course Learning Objective (CLOs): Software Laboratory is taught as a laboratory course for Civil Engineering Program. In this course, analysis and design of RC building using FEM based software, plotting of survey data using Survey software, preparation of shape and thematic maps using GIS software package are dealt. The evaluation will be carried out through continuous evaluation & Semester End practical examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Design an RC building using FEM based software.	5	6	9
CO-2	Preparation of maps using Total Station/GPS data.	5	6	9
CO-3	Prepare shape and thematic files of features using GIS software.	5	6	9

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level					3	2			1						

Contents:

1) Analysis and design of framed structure using FEM based software package.
2) Preparation of maps using Total Station and GPS data in GIS software.

References:

1. User manual of software package.

22UCVL605 Minor Project – II (0-0-4) 2

Contact Hours: 52

Course Learning Objective (CLOs): Extensive survey is carried out as a project work for Civil Engineering program. In this project work students will formulate, organize and carry out the project work related to water supply, highway, restoration of old tank and new tank projects. The project will be carried out through field surveys and office work. The evaluation will be carried out through presentations and viva voce.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level(1)
CO-1	Use Surveying equipment, schedule and conduct necessary field surveys.	5,9,11		
CO-2	Collect data by direct and indirect methods.	9,13,15		
CO-3	Plan, organize and prepare project	9,13		

	reports.			

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level					3				3		3		3		3

(Any two of the following projects in detail is to be carried out between fifth & sixth semester for a period of 2 weeks; Viva voce conducted along with sixth semester exams). An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks. The students shall submit a project report consisting of designs & drawings. (Total station and GPS to be used). General instructions, Reconnaissance of the sites and fly leveling to be used to establish benchmarks.

1. **New Tank Project**: Alignment of center line of the proposed bund, longitudinal and cross sections of center line, capacity surveys, details at waste weir and sluice points, canal alignment.
2. **Restoration of an Existing Tank**: Alignment of center line of the existing bund, longitudinal and cross sections along the center line, capacity surveys, details at sluice and waste weir.
3. **Water Supply Project:** Examination of sources of water supply, calculation of quantity of water required based on existing and projected population, preparation of village map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tank.
4. **Highway Project:** Preliminary and detailed investigations to align a new road between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

References:

1. Instrument training manuals or user manuals.
2. IRC 72 – 2015, “Guidelines for the design of flexible pavements for low volume rural roads”.
3. IRC 20 – 2002, “Rural roads manual”.
4. IS: 10500- 2012, “Drinking water — specification”.

22USSK606	Soft Skills –II	(0-0-2)Audit

Contact Hours: 26

Course Learning Objectives (CLOs):

This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12) / (13-16)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	**Demonstrate** the skill in sentence completion and faster reading of passages	-	10	-
CO-2	**Use** the English language with proficiency	-	10	12
CO-3	**Demonstrate** the capability of interview facing ability	-	9	12
CO-4	**Demonstrate** the competency in the placement activities.	-	9	-

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-	-

Contents:

Vocabulary ▪ Formatting and feeding correct structures ▪ Synonyms and Antonyms ▪ Analogies ▪ Sentence Completion ▪ Error Detection and Correction ▪ Faster reading of Passages ▪ Essays ▪ Carryover plan - Dictionary Usage 10Hrs

Understanding Discussions ▪ Parameters measured in GDs ▪ Video Analysis of GDs ▪ Knowledge base and Ideas ▪ Taking the initiative ▪ Introduction and Conclusion 4Hrs

Most common personal interview questions ▪ What companies expect ▪ Showing Commitment and Learning Ability ▪ Handling difficult questions ▪ Understanding interviewer psychology ▪ Situation Reaction and Presence of Mind ▪ Dressing right ▪ Interview etiquette 10 Hrs

Evaluation:

Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There

shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

22UPYK607	Physical Education and Yoga	(0-0-2) Audit

Contact Hours: 24

Course Learning Objectives:

1. The course focuses on overall development and importance of Physical Education & Yoga in day to day life.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO1	Gaining the importance of Physical Education & yoga	12		8, 9
CO2	Understanding the benefits & preventive measures of health	12	6	8, 9
CO3	Gaining the knowledge of yoga	12		8, 9
CO4	Understanding the importance of Human Body conditioning & Sports training	12		8, 9
CO5	Get awareness of Modern technology in sports	12		5, 8, 9

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Mapping Level	-	-	-	-	1	2	-	1	1	-	-	3

Contents

Unit-I

Introduction to Physical Education: Meaning and importance, definition, components, benefits of physical education. **04Hrs**

Unit-II

Health and wellness, Anatomy and Physiology: Meaning and importance, definition, components, benefits, health habits, basics of diseases and preventive measures, mental health, physical health, social health, spiritual health, Meaning and definition, first aid, injuries and preventions. **05Hrs**

Unit-III

Introduction of Yoga: Origin and history of Yoga, meaning and definition, benefits, importance prayer Suryanamaskara,

Asana:- Padahastasana, Ardha matsyendrasana, Halasana, Navasana.

Pranayama:- Sitali Pranayama & Nadishodhana Pranayama

Mudras:- Prana mudra & Adhi mudra. **05Hrs**

Unit-IV

Sports Training: Meaning and definitions, warming up, cooldown, methods of exercises, stretching, speed, endurance, flexibility, agility, Athletics, Football, Badmintion, Chess, Teakwondo, Rules and regulation of all games. **05 Hrs**

Unit-V

Modern technology in sports and games: Meaning and definitions, objectives, assisting umpires/ referees, hawk-eye technology, sports specific, computer software, technology in playfields, athletes clothing and equipment, graphics of sports and games, artificial intelligence. **05Hrs**

Reference Books:

1) Petipus, et al., Athlete's Guide to Career Planning, Human Kinetics, 1997
2) The Human Body in Health and Disease with Access 8th Edition 2023.
3) Anatomy and Physiology, Shri K.G. Nadgir College of Physical Education. Dharwad.
4) Health & Wellness Shri K.G. Nadgir College of Physical Education. Dharwad.
5) Nagendra HR., The art and science of Pranayama, 2009
6) Iyengar BKS., The illustrated Light on Yoga(English), 2005

22UCVE621 Design of Special RC Structures (3-0-0)3

Contact Hours: 39

Course Learning Objective (CLO): Design of Special R.C. Structures is taught as one of the core courses for Civil Engineering program. In this course design of flat slabs, grid floors, continuous beams, bunkers and silo's, yield line analysis of slabs and curved beams are dealt. The delivery of topics will be made through lecture classes and site visits. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12) / PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Analyze, design and detail the	2,3		8

	reinforcement for different types of flat slabs.			
CO-2	Analyze, design grid floors as per IS code and Rankin's methods and detail the reinforcement.	2,3		8
CO-3	Determine moment capacities and ultimate load carrying capacities by yield line method, design slabs using Yield Line Method.	2,3		8
CO-4	Differentiate between bunkers and silos and design bunkers and silos.	2,3		8
CO-5	Analyze and design continuous beams and beams curved in plan.	2,3		8

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level		3	3					1							

Unit - I

Design of Flat Slabs: Analysis and design of square and rectangular Flat slabs using direct design method - with and without column head and slab drop. **8 Hrs.**

Unit - II

Design of Grid Floors: Analysis and design of square and rectangular grid floors using Rankine's Method and Approximate method. **8 Hrs.**

Unit - III

Yield Line Analysis of Slabs: Virtual and equilibrium methods, design of square, rectangular, triangular, circular slabs using yield line theory. **8 Hrs.**

Unit - IV

Design of Bunkers and silos: Design of square and circular Reinforced Concrete bunkers and Design of silo's using Johnson's and Airy's Theorem. **8 Hrs.**

Unit - V

Design of Continuous Beams: Design of continuous beam, bending moment envelops, moment redistribution, IS Code provisions.

Beams curved in plan: Introduction and Design of beams curved in plan. **7 Hrs.**

Reference Books:

1. IS 456-2000, "Plain and Reinforced Concrete Code of Practice".
2. SP16 – 1980, "Design Aids for Reinforced Concrete"
3. Krishna Raju N., "Advanced Reinforced Concrete design", New Age Publication. 3rd Edition, 2020.
4. B C Punmia, Ashok Jain, Arun Jain, "Reinforced Concrete Structures", Laxmi Publication, New Delhi. 1st Edition, 2015.

5. S S Bhavikatti, “Advanced RCC Design”, 2nd Edition, 2016.
6. Varghese P.C., “Advanced Reinforced Concrete”, PHI, New Delhi. 2nd Edition, 2011.

22UCVE622 Design of Prestressed Concrete Structures (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs): Design of Prestressed Concrete Structures is taught as one of elective courses in Civil Engineering program. In this course, basic material properties, fundamental principles of prestressing, analysis and design of flexural members, loss of prestress, design of end-blocks and design of composite sections are dealt. The delivery of topics will be made through lecture classes. The evaluation will be carried out through IAs and SEE.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain basic properties of prestressed concrete constituents and analyze different methods.	1	13	
CO-2	Evaluate short term and long-term losses and deflections in prestressing structures.	2		
CO-3	Analyze sections for shear and flexure.	3,8		
CO-4	Analyze stresses in anchorage zones, composite beams and design the end blocks as per relevant I.S. codes.	2,8		
CO-5	Design different types of prestressed concrete beams.	3,8		

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	3	3	3					3					2		

Contents:

Unit-I

Materials: High strength concrete and steel, Stress-Strain characteristics, and properties.

Basic principles of pre-stressing: Fundamentals, Pre-tensioning and post-tensioning systems, tensioning methods and end anchorages Load balancing concept, Stress concept, Strength concept, P Line.

Analysis of sections for flexure: Stresses in concrete due to pre-stress and loads, stresses in steel due to loads, Cable profiles. **9Hrs**

Unit-II

Losses of pre-stress: Various losses encountered in pre-tensioning and post tensioning methods, determination of jacking force.

Deflections: Prediction of short term and long-term deflections of un-cracked members **10 Hrs**

Unit-III

Limit state of collapse and serviceability: IS Code recommendations – Ultimate flexural and shear resistance of sections, shear reinforcement. Limit state of serviceability, control of deflections and cracking. Type of members and flexural tensile stress.

Flexural strength of PSC section: Estimate flexural strength of section using IS code method. **7 Hrs**

Unit-IV

Design of end blocks: Transmission of prestress in pretensioned members, transmission length, anchorage stress in post-tensioned members. Bearing stress and bearing tensile force-stresses in end blocks-Methods, IS Code, provision for the design of end block reinforcement, design of bearing plates.

Analysis of composite PSC beams: Propped and un-propped beams. **7 Hrs**

Unit-V

Design of beams: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections. Permissible stress, design of pre-stressing force and eccentricity, limiting zone of pre-stressing force cable profile. **6 Hrs**

Reference Books:

1) Krishna Raju N., “Prestressed Concrete”, Tata McGraw. 6th Edition, 2018.
2) Ned H Burns and T.Y. Lin, “Prestressed Concrete Structures”, Wiley India. 3rd Edition, 2010.
3) Vanakudre S.B. & Ashish Yeligar, “Prestressed Concrete Materials, Analysis & Design”, Khanna Publishers, New Delhi. 1st Edition, 2020.
4) IS 1343: 2012 “Code of Practice for Prestressed Concrete”.

22UCVE623	Design of Reinforced Concrete Bridges	(3-0-0) 3

Contact Hours:39

Course Learning Objectives (CLOs): Design of Reinforced Concrete bridges is taught as one of the elective courses in Civil Engineering program. In this course, analysis and design of reinforced concrete bridges viz, slab culvert, T beam bridge, and box culvert are dealt. The delivery of topics will be made through lecture classes. The evaluation will be carried out through IAs & Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Analyze and design slab culvert.	1,3	13	
CO-2	Analyze and design T beam slab panel.	1,3	13	
CO-3	Analyze and design cross girder	1,3	13	
CO-4	Analyze and design longitudinal girder.	1,3	13	
CO-5	Analyze and design box culvert.	1,3	13	

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	3		3										2		

Contents:

Unit-I

Design of RCC Slab Culvert: Design of slab culvert for IRC Class AA tracked and Class A Wheel load condition, Dead load Bending moment and Shear force, Length and Breadth of dispersion, Impact factor, Live load Bending moment and Shear force, Design of reinforcement. **10 Hrs**

Unit-II

Design of T Beam Bridge Slab Panel: Design of interior Slab panel Using IRC Class AA Tracked Loading and IRC Class A wheel loading, Pigeaud's curve, Dead load Bending moment and Shear force, Live load bending moment and Shear force, Design of reinforcement. **6 Hrs**

Unit III

Design of Cross Girder: Design of cross girder for dead load & live load using IRC Class AA Tracked load, Dead load Bending moment and Shear force, Live load bending moment and Shear force, Design of reinforcement. **6 Hrs**

Unit-IV

Design of Longitudinal Girder: Design of longitudinal girder using IRC Class AA Tracked, Class A wheel Loading, Reaction factor, Dead load Bending moment and Shear force, Live load bending moment and Shear force, Design of reinforcement. **8 Hrs**

Unit-V

Design of Box Culvert: Design of Box culvert, load combination for DL, LL and Water pressure, Moment Distribution method, Design of reinforcement. **9 Hrs**

Reference Books:

1) Victor D.J and Johnson, "Essentials of Bridge Engineering", Oxford and IBH, 6th edition, 2019.
2) Krishnaraju N., "Design of bridges", Oxford & IBH Publishers, 4th edition 2019.
3) Bindra S.P., "Principles and Practice of Bridge Engineering", Dhanpat Rai Publications, 2012.
4) T R Jagadish and M A Jayaram, "Design of Bridge Structures", PHI, Eastern Economy Edition, 3rd edition, 2021.
5) IRC: 6 – 2017, "Standard Specifications and Code of Practice for Road Bridges"
6) IRC: 21 – 2000, "Standard Specification and Code of Practice for Road Bridge".

22UCVE624 Matrix Method of Structural Analysis (3-0-0) 3

Contact Hours: 39

Course Learning Objective (CLOs): Matrix Method of Structural Analysis is taught as one of elective subjects for civil engineering program. In this program, advanced concepts of structural analysis using matrix method are provided. The delivery of topics will be made through lecture classes. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Formulate flexibility matrix.	2		1
CO-2	Analyze indeterminate structures such as beams, trusses and frames (element approach) using matrix flexibility method.		2	
CO-3	Formulate stiffness matrix.	2		1
CO-4	Analyze indeterminate structures such as beams, trusses, and		2	

	frames (element approach) using matrix stiffness method			
CO-5	Formulate and solve trusses and beams using direct stiffness method		2	1,5

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1	2.4			1										

Contents:

Introduction to flexibility method: Element flexibility matrix, Principle of contra gradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix, Matrix determination of the displacement vector, Determination of member forces and analysis of indeterminate beam problems. **7 Hrs.**

Element flexibility matrix: Principle of contra gradience, and Force Transformation Matrix, Member Flexibility matrix, Construction of structure flexibility matrix, Matrix determination of the displacement vector, Determination of member forces and analysis of trusses and frames. **8 Hrs.**

Fundamentals of the stiffness method: Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix, Truss analysis by stiffness method using Displacement Transformation matrix. **8 Hrs.**

Element stiffness matrix: Equivalent joint loads, Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix, Continuous beams and rigid frame analysis by stiffness method using Displacement Transformation matrix. **8 Hrs.**

Direct Stiffness Method: local and global coordinate systems, direct assembly of element stiffness matrices, analysis of indeterminate structures, trusses, continuous beams & Simple frames. **8 Hrs.**

Reference Books:

1. Weaver W and Gere J H., “Matrix Analysis of Framed Structures”, 3rd edition 2012, CBS Publications, New Delhi.
2. Rajasekaran S, “Computational Structural Mechanics “, 2nd edition, 2001, PHI, New Delhi.
3. Pandit and Gupta, “Theory of Structures”, Vol II, 1st edition, 2015, TMH Publications, New Delhi.

4. Amin Ghali and Adam Neville, “A unified classical and Matrix Approach”, 6th edition, 2017, CRC Press.
5. C S Reddy, “Basic Structural Analysis”, 3rd edition, 2001, TMH Publications, New Delhi.

22UCVE625	Structural Dynamics	(3-0-0) 3

Contact Hours:39

Course Learning Objectives (CLOs): Structural Dynamics is taught as one of the elective courses for civil engineering programs. In this course, mathematical model for single degree, multi degree of freedom systems for un-damped, damped forced and free vibrations are dealt. The delivery of topics will be made through lecture classes. The evaluation will be carried out through IA tests and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain D-Alembert’s principle, SDOFS for free vibration of damped un-damped systems.	1,2	3	
CO-2	Explain Harmonic loading case and vibration isolation system for SDOFS.	1,2	3	
CO-3	Explain the effect of impulse load using Duhamel’s Integral.	1,2	3	
CO-4	Apply the knowledge of Fourier series in structural dynamics.	1,2	3	
CO-5	Analyze the Multi storey shear building under free and forced vibration for damped and un-damped conditions.	1,2	3	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3	3	2												

Contents:

Unit-I

Single Degree of Freedom System: Degrees of freedom, un-damped system, springs in parallel and series. Newton’s laws of motion, free body diagrams.

D'Alembert's principle, solution of the differential equation of motion, frequency and period, amplitude of motion. Damped Single degree of freedom system – viscous damping, equation of motion, damped system - critically, over, under and logarithmic decrement. **8 Hrs**

Unit-II

Harmonic Loading: Response of single degree of freedom system to harmonic loading – un-damped harmonic excitation, damped harmonic excitation, evaluation of damping at resonance, bandwidth method (Half power) to evaluate damping, response to support motion, force transmitted to the foundation, Dynamic Magnification Factor, generalized single degree of freedom system (rigid body and distributed elasticity). **8 Hrs**

Unit-III

Impulse load using Duhamel's integral: Response to general dynamic loading, Impulsive loading and Duhamel's integral – Un damped system, Duhamel's integral –Damped system **8 Hrs**

Unit-IV

Application of Fourier series: Fourier analysis and response in frequency domain – Fourier analysis, Fourier co-efficient for piece-wise linear functions, exponential form of Fourier series, discrete Fourier analysis, fast Fourier transforms. **7 Hrs**

Unit-V

Multi Degree of Freedom System: Introduction, Generalized Co-ordinates and Rayleigh's method, Multistory Shear Building, free vibration – natural frequencies and normal modes, zero modes of vibration, forced vibration – modal superposition method, response of a shear building to base motion. Damped motion of shear building – equations of motions, Introduction to dampers and their types. **8 Hrs**

Reference Books:

1. Mario Paz, "Structural Dynamics, Theory and Computation", CBS Publisher, 2nd Edition, 2004.
2. Mukhopadhyaya, "Vibration, Dynamics and Structural Problems," Oxford IBH Publishers,1st Edition, 2017
3. Clough, Ray W and Penzien J, "Dynamics of Structures", McGraw-Hill, 2nd Edition, 1993.
4. Roy R. Craig, Andrew J. Kurdila, "Fundamentals of Structural Dynamics", John Wiley & Sons, 2nd Edition, 2006.

22UCVE626	Watershed Management	(3-0-0)3

Contact Hours: 39

Course Learning Objective (CLOs): Watershed Management is taught as one of the elective courses in Civil Engineering program. In this course, topics like the concept of watershed management, water demand, water conservation methods, water harvesting, sustainable watershed approach, coastal watersheds, application of Remote Sensing and GIS in watershed management etc. are dealt. The

evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Discuss surface and ground water resources system and, human influences.		1,13	
CO-2	Integrate water resources system in arid and semi-arid regions and explain watershed aquifer for management.		2	13
CO-3	Analyze water resources related issues for conservation and synthesize augmentation of water resources.		3,13	6
CO-4	Design integrated watershed management system.		7,15	
CO-5	Apply modern tools in watershed management.		5	

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	2	2	2		2	1	2						1.67		2

Contents:

Unit - I

Principles of Watershed Management: Basics concepts, hydrology and water availability, surface water, ground water, conjunctive use, human influences in the water resources system. **6 Hrs.**

Unit - II

Water resources systems: Integrated water resources system, river basins, watershed management practices in arid and semi-arid regions, watershed management through wells, management of water supply, case studies, short term and long-term strategic planning. **7 Hrs.**

Unit - III

Conservation of Water: Perspective on recycle and reuse, wastewater reclamation, social aspects of watershed management, community participation, private sector participation, institutional issues, socio-economy, integrated development, water legislation and implementations, case studies.

Water Harvesting: Rainwater management, conservation, storage and effective utilization of rainwater, structures for rainwater harvesting, roof catchments system, check dams, aquifer storage. **11 Hrs.**

Unit - IV

Sustainable Watershed Approach: Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, soil erosion and conservation. **6 Hrs.**

Unit - V

Applications of RS and GIS in Watershed management: Role of decision support system in watershed management, watershed characteristics of coastal regions, coastal aquifer tor management, uniqueness of coastal water resources. **9 Hrs.**

References Books:

1. Singh Vir, Raj., "Watershed Planning and Management", Yash Publishing House, Bikaner.3rd Revised Edition, 2016.
2. Murthy, J. V. S., "Watershed Management in India", New Age Publishers, New Delhi. 2nd Edition, 2017.
3. "Decision Support System for Integrated Watershed Management", Colorad State University. 2012.
4. Tideman, E. M., "Watershed Management", Omega Scientific Publishers, New Delhi, 2002.

Madan Mohan Das and Mimi Das Saikia, "Watershed Management", Prentice Hall India Learning Private Limited, Eastern Economy Edition, 2012.

22UCVE627 Advanced Geotechnical Engineering (3-0-0) 3

Contact Hours:39

Course Learning Objective (CLOs): Geotechnical Engineering – II is taught as one of core courses for Civil engineering program. In this course, topics on principles of soil mechanics in different soil engineering problems, subsurface exploration, dewatering, stresses in soil, lateral earth pressure, stability analysis of earth slopes, bearing capacity of soils, Pile foundations and foundation settlements along with the typical field problems and their solutions are dealt. The delivery of the topics is achieved through lecture classes and demonstrations. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:	**Mapping to POs (1-12)/ PSOs (13-15)**		
	Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**

CO-1	Explain various methods of sub-surface exploration and determine the type of method to be employed.			1
CO-2	Explain the different methods of dewatering, calculate the stress components at a point below the loaded soil mass, explain the pressure distribution diagrams.	3	1,2	
CO-3	Calculate the lateral earth pressure on retaining walls for different backfills and loading conditions, explain the causes / types of slope failures and examine safety of slope.	3	1,2	
CO-4	Derive the general bearing capacity equation and calculate the safe bearing capacity of soil under different conditions of loading and water table.		1,2	
CO-5	Classify piles, calculate bearing capacity of single pile and pile group, explain settlements and their ill effects on the buildings.		1,2	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1.8	2	3												

Contents:

Unit - I

Subsurface Exploration: Importance, exploration program, methods of exploration, boring, sounding tests, geophysical methods, electrical resistivity and seismic refraction methods, types of samples, undisturbed, disturbed and representative samples, samplers, sample disturbance, area ratio, recovery ratio, clearance, stabilization of bore holes, typical boring log. **8 Hrs**.

Unit - II

Drainage and Dewatering: Necessity and importance, sumps and ditches, well point systems, shallow well and deep well. Vacuum and electro osmosis methods.

Stresses in soils: Boussinesq's and Westergard's theories for concentrated and circular loads. Comparison of Boussinesq's and Westergard's analysis. Pressure distribution diagrams, contact pressure, Newmark's chart. **7 Hrs.**

Unit - III

Lateral Earth Pressure: Active and Passive Earth pressures, earth pressure at rest, earth pressure coefficients, earth pressure theories –Rankine's and Coulomb's –assumptions and limitations, graphical solutions for active earth pressure (cohesion less soils only), Cullman's and Rebhan's methods.

Stability of Earth Slopes: Types of slopes, causes and types of failure of slopes, definition of factor of safety, stability of finite slopes, method of slices, Fellineous method, Taylor's stability number, methods of slope retention. **8 Hrs**.

Unit - IV

Bearing Capacity: Definitions of ultimate, net and safe bearing capacity, allowable bearing pressure, Terzaghi's bearing capacity equation & derivation, assumptions and limitations, bearing capacity of footings subjected to eccentric loading, effect of ground water table on bearing capacity, plate load test and its limitations. **8Hrs.**

Unit - V

Pile Foundations: Introduction, types of piles, load carrying capacity of piles, group action in piles, laterally loaded piles, under reamed piles. **8 Hrs.**

Reference Books:

1) B C Punmia, "Soil Mechanics and Foundations", Laxmi Publications (P) Ltd., New Delhi. 17th edition, 2017.
2) Gopal Ranjan and A.S.R Rao., "Basic and applied soil mechanics", New Age International Publishers, Bangalore. 4th edition, 2022.
3) Narasimha Rao A.V. and Venkatramaiah C., "Geotechnical Engineering", University Press (India) Ltd., Hyderabad. 2nd edition, 2007.
4) IS 2131: 2002 - Method for standard penetration test for soils.
5) IS 2132: 2002 - Code of practice for thin-walled tube sampling of soils.
6) IS 2911: 2010 - Design and Construction of Pile Foundations - code of practice, part 1: concrete piles, section 1: driven cast in-situ concrete piles.
7) IS 1892: 2021 - Code of practice for subsurface investigation for foundations.
8) IS 4968: 2007 - Method for subsurface sounding for soils, Part 3: Static cone penetration test.

22UCVE628	Railway and Airport Engineering	(3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs): Railway and Airport Engineering is taught as one of the elective courses for Civil Engineering program. In this course, salient features of permanent way, geometric design of railway, design of turnout are dealt. Further, aspects related to airport planning, design of runway and taxiway are taught. The delivery of topics will be made through lecture classes. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain the importance of rail transport, qualities of ideal permanent way and calculate the quantity of materials to lay railway track.			1,2
CO-2	Design the geometrical elements of railway track.		1,2	
CO-3	Design turnouts, points and crossings and state types of stations, yards and signal systems.			1,2
CO-4	Identify the ideal site for airport construction and design the geometrical elements of runway.		1,2	
CO-5	Design the geometrical element of taxiway and illustrate the various Airport Markings.		1,2	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1.6	1.6													

Contents:

Unit - I

Introduction: Role of railways in transportation, selection of routes.

Permanent way: Gauges in railways, railway track, cross sections, coning of wheels, rails, rail sections, ballast, sleepers, wear on rails, rail joints, welding of rails, creep of rails, rail fixtures, calculation of quantity of materials required for laying of tracks, traction and tractive resistances, tractive power, hauling capacity. Problems on above. **9 Hrs.**

Unit - II

Geometric design of track: grade, ruling gradient, minimum gradient, pusher grade, speed of train, super elevation, cant deficiency, negative cant, speed calculation based on IR formulae for high speed tracks only. Problems on above. **7 Hrs.**

Unit - III

Points and Crossing: turnout, design of turnout, stations and yards, signaling and interlocking, track defects, track maintenance, level crossing, Indian Railway standards and relevant problems. **7 Hrs.**

Unit - IV

Airport planning: Characteristics of aircraft, Airport- classifications and site selection, regional planning .

Runway design: Analysis of wind data, determination of the best orientation of the runway configurations, basic length of the runway, corrections to runway length by ICAO and FAA specification, runway cross sections. Windrose type I & II diagrams. Problems on above. **9 Hrs.**

Unit - V

Taxiway design: Taxiway-Factors affecting the layout of the taxiway, geometrics of taxiway, design of exit taxiways.

Visual aids: Airport Marking**,** Lightings, ILS. **7 Hrs.**

Reference Books:

1. Saxena S.C and Arora S. P., "Railway Engineering", Dhanpat Rai Publications, New Delhi,2018.
2. Agarwal M.M., "Indian Railway Track", Prabha& Co., New Delhi, 20th Revised Edition, 2018.
3. Khanna S.K., AroraM.G and Jain S.S, "Airport Planning and Design", Nemchand Roorkee, Sixth Edition, 2012.
4. Mundrey J. S.**, "**Railway Track Engineering", Tata McGraw Hill Publications, New Delhi. Fourth Edition, 2017.
5. Horenjeff, "Planning and Design of Airports", McGraw Hill Publications, New Delhi, Fourth Edition, 2010.

22UCVE629	Advanced Surveying	(3-0-0)3

Contact Hours: 39

Course Learning Objective (CLO): Advanced surveying is taught as one of the elective courses for Civil Engineering program. In this course, topics on traversing, errors in surveying, vertical curves, calculating areas and volumes and arial survey are dealt. The subject will be taught through classroom lectures, demonstration and by solving numerical. The evaluation will be carried out through Internal evaluation and Semester End Examination.

Course Outcomes (CO):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		3	**2**	**1**
CO-1	Carryout traversing to establish control networks	1		
CO-2	Estimate the accuracy and errors in surveyed data	1		
CO-3	Design vertical curves based on suitability	3	9,6,15	
CO-4	Calculate areas and volumes from survey data	5		

CO-5	Estimate the distance and area from aerial photographs	5	9,8	10

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	3		3		3	2		2	2	1					2

Contents:

Unit - I

Traversing: Traverse Survey and Computations: Latitudes and departures, rectangular coordinates, Traverse adjustments, Bowditch rule and transit rule, Numerical Problems. **8 Hrs.**

Unit - II

Theory of errors: Theory of probability, Accuracy in surveying, errors in computed results, standard error, most probable error, weight, precision and accuracy, propagation of error. **8 Hrs.**

Unit - III

Vertical curve: Types, assumptions, length of vertical curve, change of grade, sight distance, computations and setting out method. **7 Hrs.**

Unit - IV

Areas and Volume: Measurement of area by dividing the area into geometrical figures, area from offsets, mid ordinate rule, trapezoidal and Simpson's one third rule, area from co-ordinates, Measurement of volumes- trapezoidal and Prismoidal formula. **8 Hrs.**

Unit - V

Arial Survey: Introduction, Uses, Aerial photographs, Definitions, Scale of vertical and tilted photograph (simple problems), Ground Co-ordinates (simple problems), Relief Displacements (Derivation), Ground control, Procedure of aerial survey, overlaps and mosaics, Stereoscopes, Derivation Parallax. **8 Hrs.**

Reference Books:

1. Punmia B.C., Jain Ashok K., Jain Arun K "Surveying (Volume-1)," Laxmi Publications, Seventeenth Edition, (2018).
2. Punmia B.C., Jain Ashok K., Jain Arun K., „'Surveying (Volume-2)," Laxmi Publications, Sixteenth Edition, (2019).
3. Arora K.R., "Surveying (Volume – 1)," Standard Book House, Seventeenth Edition, (2019).
4. Duggal, S. K., „'Surveying - Vol. 1," McGraw Hill Education, Fourth edition, (2017).
5. Chandra A. M. Plane Surveying, New Age International Private Limited, Third Edition, (2015).

22UCVE630 Temple Architecture and Renovation (3-0-0)3

Contact Hours: 39

Course Learning Objective (CLO): This course is taught as one of the elective courses for Civil Engineering program. In this course, topics on architectural principles and styles of temple construction across different cultures and periods, Materials, techniques, and craftsmanship involved in the original construction and subsequent renovations of temples are included. To examine the ethical, legal, and social considerations in temple renovation and heritage preservation. To develop practical skills in diagnosing structural issues, proposing renovation solutions, and applying conservation techniques.

Course Outcomes (CO):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		3	**2**	**1**
CO-1	Understand the Historical and Cultural Significance of Temples.			6
CO-2	Apply Principles of Architectural Conservation.			7
CO-3	Analyse and Learn from Renovation Case Studies, Conduct Diagnostics and Damage Assessment.			4
CO-4	Implement Renovation Techniques and Practices.			7
CO-5	Plan and Manage Renovation Projects.			11

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level				1		1	1				1				

Contents:

Unit - I

Introduction to Temple Architecture: This module provides an overview of global temple architecture, focusing on the diversity of styles, symbols, and their significance across different cultures and time periods. It covers the evolution of materials and construction techniques through the ages, providing students with a foundational understanding of how temple architecture has developed and been influenced by various factors. **8 Hrs.**

Unit - II

Principles of Architectural Conservation: In this module, students learn about the ethics and approaches to architectural conservation, including preservation, restoration, and reconstruction. It also covers the legal frameworks and institutions that govern heritage conservation. This module is crucial for understanding the balance between maintaining historical integrity and making necessary renovations. **8 Hrs.**

Unit - III

Case Studies and Diagnostics in Temple Conservation: A comprehensive approach, blending analysis of historical renovation projects with the technicalities of assessing and addressing structural damages. It suggests an integrated study of real-world examples alongside the methodologies for diagnosing and understanding the underlying issues that necessitate renovation. **7 Hrs.**

Unit - IV

Renovation Techniques and Practices: This module compares traditional and modern materials and methods used in temple renovation. It discusses how to manage environmental impacts and ensure the sustainability of renovation projects, equipping students with the knowledge to choose appropriate renovation practices. **8 Hrs.**

Unit - V

Project Planning and Management: The module focuses on the practical aspects of planning and managing renovation projects. It includes drafting renovation proposals, planning, budgeting, stakeholder engagement, and utilizing project management tools and strategies. This module aims to prepare students for the logistical challenges of leading a renovation project. **8 Hrs.**

Reference Books:

1. **"The Stones of Venice" by John Ruskin** - Focuses on Venetian architecture, including temples, emphasizing the importance of preserving the authenticity of ancient buildings.
2. **"Conservation of Cultural Heritage: Key Principles and Approaches" by Hanna M. Szczepanowska** - A comprehensive guide on conservation principles applicable to temple renovation.
3. **"Architectural Conservation in Asia: National Experiences and Practice" by John H. Stubbs and Robert G. Thomson** - Offers insight into architectural conservation practices in Asia, a region rich in temple architecture.
4. **"Time Honored: A Global View of Architectural Conservation" by John H. Stubbs** - Provides a global perspective on conservation practices, including those relevant to temples.

Open Electives

22UCVO651	Remote Sensing and GIS	(3-0-0)3

Total Hrs: 39

Course Learning Objective (CLOs): Remote Sensing and Geographical information systems is taught as one of the Open Elective courses for Civil Engineering Program. In this course, topics on fundamentals of remote sensing platforms, sensors, introduction to GIS, GIS data models querying, analysis and cartographic output are dealt. The subject will be taught through classroom lectures and demonstration. The evaluation will be carried out through IAs & SEE.

Course Outcomes (COs):

ID	Description of the Course Outcome: At the end of the course the student will be able to:	Mapping to POs (1-12)/ PSOS (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain principles of remote sensing technology.		1	
CO-2	Explain use of remote sensing technology for different applications.		4	1
CO-3	Explain GIS is and its applications	5	2	
CO-4	Identify type of data required and use the same for applications.	4	2	
CO-5	Collect, analyze the data and prepare output in the form of maps and tables.	4	2	

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mapping Level	1.5	2		2.67	3										

Contents:

UNIT I

Remote Sensing: Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, and vegetation), Resolution, image registration and Image and False color composite, elements of visual interpretation techniques **7 hrs**

UNIT II

Remote Sensing Platforms and Sensors: Indian Satellites and Sensors characteristics, Remote Sensing Platforms, Sensors and Properties of Digital Data, Data Formats: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. sensors, sensor resolutions (spatial, spectral, radiometric, and

temporal). Basics of digital image processing- introduction to digital data, systematic errors (Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity, Earth Rotation) and non-systematic [random] errors (Altitude, Attitude), Image enhancements (Gray Level Thresholding, level slicing, contrast stretching), image filtering. **8 hrs**

UNIT III

Introduction: What is GIS, components of GIS, GIS Subsystems, Historical roots of GIS, Early & Current Systems, GIS Applications, Modeling Real World Features, Definition of a map, how maps convey descriptive info, how maps convey spatial relationships. **8 hrs**

UNIT IV

GIS Data Models: Spatial Data Models, Vector Data Model, Raster Data Model, Image Data Model, Vector Vs Raster Data Models, Attribute Data Models, File Structures, Database Structures, Sources of Data, Data Input Techniques, Manual Digitizing, Scanning & Vectorization, Co-ordinate Geometry, Existing digital data, Entering attribute data, Data Verification, Errors in Spatial Data, Errors in Attribute Data , Data Editing, Interactive Graphic Editing, , Edge Match/Rubber Sheeting, Data Organization & Storage, Vertical Data Organization, Horizontal Data Organization, Data Quality & Accuracy, Accuracy & Precision. **8 hrs**

UNIT V

GIS Analysis: Measurements, From Vector Data, From Raster Data, Accuracy, Querying Data, Spatial Selection, Logical Selection, Classification, User Controlled, Automatic Overlay Operations, Proximity Analysis, Network Analysis, Cartographic Output, Layout design, Symbology, Vector Display Devices, Raster Display Devices. **8 hrs**

Reference Books:

1. Lillesand, T., Kiefer, R. W., & Chipman, J. "Remote sensing and image interpretation," John Wiley & Sons. 7th Edition, (2015).
2. Jensen, J. R., "Remote Sensing of the Environment: An Earth Resource Perspective," Pearson Education India, 2nd edition, (2013).
3. Jensen, J. R., "Introductory Digital Image Processing - A Remote Sensing Perspective," Pearson Education, Fourth edition, (2017).
4. Chang, K.T., "Introduction to Geographic Information Systems," McGraw Hill Education (India) Private Limited, Ninth edition, (2020).
5. Kumar, D. N., A NPTEL Course on "Remote Sensing: Introduction and basic Concepts," https://nptel.ac.in/courses/105108077

22UCVO652	Road Safety and Traffic Management	(3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs): Road Safety and Traffic Management is taught as one of the open elective courses for Civil Engineering Program. In this course, students are given exposure to measure various aspects of road safety management viz. Accident Analysis, Road Safety Auditing, and various aspects of traffic management viz. Highway capacity, ITS and PPP in highway project. The delivery of topics will be made through lecture classes and field visits. The evaluation will be carried out through IAs & SEE.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs(1-12)/ PSO (1-2-3)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Identify the blackspot and analysis the causes of road accidents.			1,2
CO-2	Carry out road safety auditing across national highway stretch.	1,2,3		
CO-3	Provide first-aid to the accident victims.			1,2
CO-4	Analysis highway capacity at signalized and unsignalized intersection for mixed traffic condition.		1,2	
CO-5	Summarize various traffic management system and financial viabilities of Public-Private Partnership.	1,3,12		

POs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Mapping Level	2	1.75	3									3			

Contents:

Unit-I

1. Definition, Objectives, Scope of Road Safety Management. **02 Hrs**

2. **Road accidents**, Causes, Scientific Investigations and Data Collection, Analysis of Individual Accidents to Arrive at Real Causes; Collision Diagram, Condition Diagram, Blackspot-Identification and Rectification. **05 Hrs**

Unit-II

1 **Road Safety Audit: -** Principles- Procedures and Practice, Code of Good Practice and Checklists. Road Safety Issues and Various Measures through Engineering, education, and enforcement measures for improving road safety.

09 Hrs

Unit-III

1. **Road Safety Management:** First Aid to Accident Victims: First aid techniques, Coordination with hospitals for treatment, Role of insurance companies in providing aid to accident victims.
2. **Motor Vehicle Act 1988 and 2019**: Registration and Licensing Authorities in India: Powers and Duties, Classification of Traffic Offences. Penalties and appeals. **07 Hrs**

Unit-IV

1. **Design Hourly Volume for Varying Demand Conditions:** Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Determination of design hourly volume; critical hour concept.
2. **Highway Capacity**: Factors affecting capacity, level of service; Capacity studies Capacity of different highway facilities including unsignalized and signalized intersections
3. **Intelligent Transport System:** Introduction, Application, ITS in various cities.

08 Hrs

Unit-V

1. **Traffic Management:** Transit System, Cycle Track, Paratransit, Mass Rapid Transit System, Freight Management, safety practices during road works**.**
2. **Public-Private Partnership in Transport Projects:** Benefits from privatization, Forms of Privatization, Government Incentives, Financial Viability of Privately Funded Project. **08 Hrs**

Reference Books:

1) Khanna S.K. and Justo C E G., “Highway Engineering”, Nemchand and Bros, Roorkee, Revised Tenth Edition, 2017.
2) Kadiyali L.R.,“Traffic Engineering And Transport Planning”, Khanna Publishers, New Delhi, Ninth Edition, 2017.
3) Leonard Evans., “Traffic Safety, Science Serving Society”, Revised Second Edition, 2006.
4) IRC: SP-88-2010, “Road Safety Audit Manual”, Indian Roads Congress, New Delhi, India, 2010.
5) IRC: SP-44-1996. “Highway Safety Manual”, Indian Roads Congress, New Delhi, India, 1996.

CIE and SEE Evaluation (from 2024-25 batch)

Courses with LTP 3-0-0 and 4-0-0 or 2-2-0/3-2-0

Continuous Internal Evaluation (CIE):

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two subdivisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course each of 5marks. Total CTA marks-10
- CIE=40 (from tests) +10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question has a maximum of three subdivisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

ASC(IC)/PCC with LTP 2-0-2, 3-0-2 and 2-2-2

Continuous Internal Evaluation (CIE):

Theory CIE component:

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: 3 questions of 10 marks each with maximum of two subdivisions. Q.3 is compulsory and one question to be answered from Q.1 and Q.2.

Course Teacher Assessment (CTA): Totally based on conduction of experiments as set by the course teacher.

Laboratory component assessment:

- 5 marks: for conduction, regularity, involvement, journal writing, etc. A minimum of 75% of attendance is compulsory. If the performance is not satisfactory in the laboratory the student shall be detained and required to reregister for the course whenever offered next.
- 5 marks: Lab Test. A Lab test as per the class timetable has to be conducted at the end for50 marks and scale down to 5 marks.
- CIE for integrated course =40 (from IA tests) +10 (from CTA i.e. lab component) =50 marks.
- There will not be any remuneration for the Final Lab Test since it is CTA of integrated course.
- Copy of the Marks list to be sent to the concerned course instructor immediately after the completion of test for that batch. Original Marks list to be maintained in the department.
- CIE=40(from tests) +10(from CTA i.e., lab component) =50 marks

Semester End Examination (SEE):

- SEE is conducted for100 marks with 3 hours duration. It is reduced to 50 marks.
- Question Paper pattern for SEE: Five units with built in choice. Each question has a maximum of three subdivisions.
- Two questions are to be set from each unit with built in choice, for example Q1 or Q2 in unit –I, Q 3 or Q 4 in unit-II and so on.
- A total of 5 full questions to be answered choosing one full question from each unit. All five units are to be answered compulsorily.
- Each question is of 20 marks.
- The Question paper is to be set for duration of 3 hours both for 3 and 4 credits courses.
- The Question paper is to be set for 100 marks for 3 and 4 credits courses.

AEC/HSMS/UHV Courses with LTP 1-0-0:

Continuous Internal Evaluation (CIE)

- Two Internal Assessment and one Improvement test each of 20 marks and one hour duration.
- Two higher scores from three tests are taken representing 40 marks.
- Question Paper pattern for Internal Assessment: MCQ 20 questions.
- Course Teacher Assessment (CTA): Minimum two components such as quiz, seminar, written assignment, any technical activity related to course etc. each of 5marks. Total CTA marks-10
- CIE=40(from tests) +10(from CTA) =50 marks

Semester End Examination (SEE):

- SEE is conducted for 50 marks of 1 hour duration. There will be 50 MCQs.
- Question Paper pattern for SEE: The question paper will contain 12 MCQ questions drawn from each Unit.
- Students must answer a maximum of 10 questions from each unit.
- All five units are to be answered compulsorily.