

SYLLABUS

(With effect from 2018-19)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2018-19)

V & VI Semester

Bachelor Degree

in

Civil Engineering

Out Come Based Education

with

Choice Based Credit System



P.E.S. College of Engineering

Mandya - 571 401, Karnataka

(An Autonomous Institution Affiliated to VTU, Belagavi,

Grant -in- Aid Institution (Government of Karnataka), World Bank Funded College (TEQIP)

Accredited by NBA, New Delhi and Approved by AICTE, New Delhi.)

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ-571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

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Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight Undergraduate and Six Postgraduate programs. It consists of four M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills, Personality Development modules and Technical Skills have been added to the existing curriculum of the academic year 2018-19. Internship have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Technical Skills and Skill Oriented Lab are included in all undergraduate programs.

Dr. Umesh D.R.
Deputy Dean (Academic)
Associate Professor,
Dept. of Computer Science & Engg.

Dr. Nagarathna
Dean (Academic)
Professor,
Dept. of Computer Science & Engg.



PES College of Engineering

VISION

“PESCE shall be a leading institution imparting quality engineering and management education, developing creative and socially responsible professionals”

MISSION

- Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching -learning practices
- Impart engineering and managerial skills through competent and committed faculty using Outcome Based Educational curriculum
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs
- Promote research, product development and industry-institution interaction.

DEPARTMENT OF CIVIL ENGINEERING

The Civil Engineering Department was started in the year 1962 as one of the first branches in P.E.S. College of Engineering, Mandya with an intake of 40. The department has carved a niche for itself by offering the most competent instructional programs to the students. The department is running an undergraduate programme with an intake of 120 and it has started PG in CAD Structures with an intake of 18 in the year 2006. The department has been recognized as research centre under VTU, Belgaum. The department is accredited by NBA, New Delhi for five years (2004-2009). The department is well equipped with laboratories, computing facilities, independent library and other infrastructure. The department has well qualified and experienced teaching faculties. The department also takes up consultancy work pertaining to planning, structural designs of buildings, testing of materials, soil investigation.

Vision

To attain Excellence in imparting quality civil engineering education to meet the societal needs.

Mission

- Impart civil engineering and managerial skills with state of art infrastructure, competent and committed faculty using outcome based educational curriculum.
- Promote research, project management and consultancy
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.



The Program Educational Objectives (PEOs)

- Apply technical competence in the field of Civil Engineering with a strong background in basic science and mathematics.
- Analyze and interpret data to design or evaluate civil engineering systems to satisfy societal needs with the use of modern tools including higher education.
- Function effectively as an individual and or to work in a team on multispecialized civil engineering projects with professional ethics and effective communication skills inculcating the habit of life-long learning.

Program Specific Outcomes (PSOs)

The Program specific outcomes have been derived from the PSC's defined by ASCE. By the time of graduation, Civil Engineering students will be able to

PSO1: Apply knowledge of basic science to analyze and solve problems in the core area of Civil Engineering such as Structural, Geotechnical, Transportation, Environmental, Hydraulics and Water resources engineering.

PSO2: Analyse, Plan, design, quality assessment and cost estimate of Civil Engineering structures with professional ethics.

PSO3: Work in a consulting organization or can be an entrepreneur to investigate and supervise Civil Engineering structures using modern tools and technology to provide sustainable solutions to meet the societal needs.

Programme Outcomes (PO)

Engineering program must demonstrate that their students attain the following outcomes:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.



4. **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.
5. **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.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



Department of Civil Engineering
P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

V Semester

Sl. no	Course code	Course Title	Teaching Department	Hrs/Week			Credits	Examination Marks		
				L	T	P		CIE	SEE	Total
1	P18CV51	Construction Management & Entrepreneurship	Civil	4	-	-	4	50	50	100
2	P18CV52	Water Supply and Treatment	Civil	4	-	-	4	50	50	100
3	P18CV53	Analysis of Indeterminate Structures	Civil	4	-	-	4	50	50	100
4	P18CV54	Design of RC Structural Elements	Civil	4	-	-	4	50	50	100
5	P18CV55X	Professional Elective -I	Civil	2	2	-	3	50	50	100
6	P18CVL56	Concrete Laboratory	Civil	-	-	3	1.5	50	50	100
7	P18CVL57	Highway Laboratory	Civil	-	-	3	1.5	50	50	100
8	P18CVL58	Skill Oriented Laboratory – I (Competency in Survey & Analysis Software)	Civil	-	-	2	1	50	50	100
9	P18CV591	Technical Skills - I (Proficiency in Civil Engineering)	Civil	-	2	-	1	50	50	100
10	P18HU510	Aptitude and Reasoning Development - Advance(ARDI)	HM	-	2	-	1	50	50	100
Total							25	500	500	1000
P18CV55X : Professional Elective -I						Technical Skills -I				
Sl.no	Course Code	Course Title	Sl. no	Course Code	Course Title					
1	P18CV551	Applied Geology	1	P18CV591	Proficiency in Civil Engineering					
2	P18CV552	Matrix Method of Structural Analysis								
3	P18CV553	Construction Quality and Safety Management.								
4	P18CV554	Pavement Evaluation & Management								

VI –Semester

Sl. No.	Course Code	Course Title	Teaching	Hrs / Week			Credits	Examination Marks		
			Department	L	T	P		CIE	SEE	Total
1	P18CV61	Waste Water Collection and Treatment	Civil	4	-	-	4	50	50	100
2	P18CV62	Geotechnical Engineering.-I	Civil	4	-	-	4	50	50	100
3	P18CV63	Advanced Design of RC Structures	Civil	4	-	-	4	50	50	100
4	P18 CV 64X	Professional Elective –II	Civil	2	2	-	3	50	50	100
5	P18 CVO65X	Open Elective -I	Civil	3	-	-	3	50	50	100
6	P18CVL66	Geotechnical Engineering Laboratory	Civil	-	-	3	1.5	50	50	100
7	P18CVL67	Extensive Surveying	Civil	-	-	3	1.5	50	50	100
8	P18CVL68	Skill Oriented Laboratory(Competence in Project Management & Mapping, Spatial analysis in Hydrology)	Civil	-	-	2	1	50	50	100
9	P18HU693	Technical Skills– II (Internals of C Programming)	HM		2	-	1	50	50	100
Total							23	450	450	900
List of Electives										
P18CV64X : Professional Elective -II						P18CVO65X : Open Elective -I				
Sl. No	Course Code	Course Title	Sl.No	Course Code	Course Title					
1	P18CV641	Alternative Building Materials and Masonry Structures	1	P18CVO651	Building Science and Engineering.					
2	P18CV642	Reinforced Earth Structures	2	P18CVO652	Basic Transportation Engineering					
3	P18CV643	Solid Waste Management	3	P18CVO653	Occupational Health and Safety					
4	P18CV644	Traffic Engineering								



Course Title :CONSTRUCTION MANAGEMENT & ENTREPRENEURSHIP			
Course Code : P18CV51	Semester : V	L-T-P:H : 4-0-0: 04	Credits : 04
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age :CIE: 50% ,SEE : 50%	
Prerequisites : NIL			
<u>Course Learning Objectives (CLO's)</u>			
This Course aims to,			
1	Understand the concept of Engineering economics and to study the different comparison methods.		
2	To know the concept of construction management and understand the different managements.		
3	To evaluate various construction equipment.		
4	Study and understand the concept of planning, scheduling and the techniques necessary for construction project.		
5	To know the basic ideas about entrepreneurship and develop skill to work individually as an entrepreneur.		

<u>Course content</u>	
UNIT –I	
ENGINEERING ECONOMICS: Demand and supply, break-even analysis, Time value of money, cash flow diagrams, interest rate, simple interest, compound interest, interest formulae, compound interest factors, Equated monthly installment (EMI),Present worth comparisons method, future worth comparison method, annual worth comparison method, Introduction to depreciation causes of depreciation, basic methods of depreciation, Problems on above.	
12 Hrs	
Self Study Component : Concept of rate of return (ROR)	
UNIT –II	
MANAGEMENT OF CONSTRUCTION: Introduction, classification of construction works, various stages in the construction of a project, the construction team. Definition of an organization management, value engineering and job plan. Materials management: Importance, objective, cost, functions and uses of material management. Safety management: Importance of safety causes of accidents, safety measures. Quality management: Quality control in construction, importance and elements of quality, quality control, quality assurance techniques and documentation	
12 Hrs	
Self Study Component : Management information system	



UNIT –III	
MANAGEMENT OF CONSTRUCTION EQUIPMENT: Introduction, need for mechanization, factors affecting selection of construction equipment, factors affecting the cost of owning and operating the construction equipment, planning of infrastructure for mechanization. Classification of construction equipment: Earth moving, hauling, hoisting, conveying, aggregate and concrete production equipment. Problems on cost of owning and operating the construction equipment	
08 Hrs	
<i>Self Study Component</i> : Pumping and dewatering Equipment	
UNIT –IV	
PLANNING FOR CONSTRUCTION PROJECT: Steps involved in planning, objectives, principles and advantages of planning. Bar charts, milestone charts, job layout, work break down structure. Program evaluation and review technique (PERT): Introduction to time estimates, earliest expected time (T_E), latest allowable occurrence time (T_L), slack, critical path. Critical path method (CPM): Earliest event time, latest event time, combined tabular form, activity time, float and critical activity.	
10 Hrs	
<i>Self Study Component</i> : Line of balance technique	
UNIT –V	
ENTREPRENEUR AND ENTREPRENEURSHIP: Concept of entrepreneur, characteristics of an entrepreneur, distinguish between entrepreneur and manager. Functions of entrepreneur, types of entrepreneur. Institutional finance: KIADB, KSSIDC, DIC, KSFC Preparation of project report: Meaning of project, project identification, project selection, project report, need and significance of project, guidelines by planning commission for project report.	
10 Hrs	
<i>Self Study Component</i> : SIDO, NSIC	

Text Books :	
1	Construction Engineering and Management by S. Seetharaman, Umesh publications, New Delhi
2	Management & Entrepreneurship by K Venkataramana, Seven Hill publications, Bangalore.
3	Engineering Economics by R.K.Hegde, Swapana book house, Bangalore



Reference Books :	
1	Construction Planning Equipment's and Methods by Peurifoy,R.L. Mc,Graw Hill publication
2	Entrepreneurship Development by S.S. Khanka, Published by S. Chand & Co. Ltd. New Delhi.
3	Management Science for Civil Engineering by Gururaj, Sreehari Satish, Subhash publications, Bangalore.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of engineering fundamentals to calculate present and future worth of money using different interest factors and comparisons.[PO1,PO2,PSO1,PSO2]
2. Understand the concept of Construction management.[PO2,PO4,PSO2]
3. Understand the concept of project planning and computing CPM and PERT.[PO3,PSO2]
4. Evaluate various construction equipment and develop skill to work individually as a entrepreneur.[PO9,PO11,PSO3]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
1	Apply the knowledge of engineering fundamentals to calculate present and future worth of money using different interest factors and comparisons.	2	2													2	1	
2	Understand the concept of Construction management.		2		2												1	
3	Understand the concept of project planning and computing CPM and PERT			2													2	
4	Evaluate various construction equipment and develop skill to work individually as a entrepreneur.									2		2						2



Course Title : WATER SUPPLY AND TREATMENT			
Course Code: P18CV52	Semester: V	L–T–P–H : 4–0–0 : 04	Credits:04
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age :CIE: 50% ,SEE : 50%	
Prerequisites : -			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Understand the importance of safe drinking water, different water demands, population forecasting per capita consumption for city/town, different water sources along with intake structures and pumps and to apply the knowledge to solve engineering problems.
2	Summarize drinking water quality parameters and analysis (Examination) procedure for compliance with standards.
3	Explain types of aeration and to understand sedimentation, coagulation and flocculation and to apply design concepts to sedimentation units
4	Understand different types of filtration units and disinfection types, to apply design concepts to filtration units.

<u>Course content</u>	
UNIT -I	
INTRODUCTION: Role of water, need for protected water supply. Types of water demands, Fire demand–estimation by different empirical formulae, Per capita consumption, population forecasting-different methods with merits & demerits, variations in demand of water, peak factors, design periods.	
INTAKE STRUCTURES – Different types, factor of selection and location of intakes.	
PUMPS- Necessity, power of pumps, Design of the economical diameter for the rising main.	
12 Hrs	
Self Study Component: Sources: Surface and subsurface sources – suitability with regard to quality and quantity.	
UNIT -II	
QUALITY OF WATER: Concept of safe water, wholesomeness & palatability, water borne diseases. Examination of Water - Objectives – Physical, chemical and Microbiological Examinations. Drinking water standards-BIS&WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc.	
WATER TREATMENT: Introduction, objectives, treatment flow-chart showing units & impurities removed. AERATION- Principles, Objectives, types of aerators	
10 Hrs	
Self Study Component: Examination/ tests for physical, chemical, Biological water quality, sampling methods.	



UNIT -III	
SEDIMENTATION: Introduction, objectives, types of settling, factors affecting settling, Theory of settling, settling tanks-types, design of circular, rectangular tanks only. COAGULATION AND FLOCCULATION: Coagulant aided sedimentation: Problems, objectives, common coagulants, factors affecting, jar test, chemical feeding, flash mixing, Flocculation and clari- flocculation.	
10Hrs	
Self Study Component: Different methods of coagulant feeding, inlet and outlet arrangement for sedimentation tanks	
UNIT -IV	
FILTRATION: Theory of filtration, types of filters- slow sand, rapid sand gravity and pressure filters including construction, operation, cleaning and their design –under drainage system, back washing of filters. DISINFECTION: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, types of chlorination, use of bleaching powder, Numericals.	
10Hrs	
Self Study Component: Operational problems in filters, Chemistry of Chlorination..	
UNIT -V	
DISTRIBUTION SYSTEMS: System of supply, service reservoirs and their capacity determination, methods and layout of distribution systems. MISCELLANEOUS: Pipe appurtenances, various valves, type of fire hydrants, pipe fitting, MISCELLANEOUS TREATMENT: Water softening – Definition, methods of removal of hardness by lime soda process ,zeolite process and reverse osmosis process Removal of colour, odour, taste, adsorption technique, fluoridation and de fluoridation.	
10Hrs	
Self Study Component : Nalgonda Technique for defluoridation, layout of water supply in buildings	

Text Books :	
1	Environmental Engineering-I – B.C. Punmia & Ashok Jain, Lakshmi Publications (P) Ltd.
2	Water supply Engineering – S.K.Garg, Khanna Publishers, New Delhi.

Reference Books :	
1	Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi.
2	Environmental Engineering- Howard S. Peavey, Donald R. Rowe, George

Note: Self-study is for 5 marks only in CIE and not in SEE



Course outcomes

After learning all the units of the course, the student will be able to

1. Apply knowledge of mathematics to forecast population of community to determine total quantity of water to meet demands of community.[PO1,PSO1]
2. Apply knowledge of basic science for testing and analyze the drinking water quality parameters from public health consideration as per standards.[PO1 & PO2,PSO1,PSO2]
3. Design various water treatment units to remove selected impurities in raw water [PO3,PSO2]
4. Analyze the community pipe network of water distribution. [PO2,PO7,PSO2]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
01	Apply knowledge of mathematic to forecast population of community to determine total quantity of water to meet demands of community.	3															3		
02	Apply knowledge of basic science for testing and analyze the drinking water quality parameters from public health consideration as per standards.	2	3														2	3	
03	Design various water treatment units to remove selected impurities in raw water			3														3	
04	Analyze the community pipe network of water distribution.		3			2												3	



Course Title : ANALYSIS OF INDETERMINATE STRUCTURES			
Course Code: P18CV53	Semester : V	L-T-P : H : 4- 0 - 0 : 4	Credits : 04
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age :CIE : 50% , SEE : 50%	
Prerequisites : Strength of materials , Basic Structural Analysis			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Learn the energy concept in dealing the indeterminate Pin jointed plane truss, using Castiglione's theorems.
2	Apply knowledge of mathematics and engineering in calculating slope, deflection, bending moment and shear force using slope deflection, moment distribution method and Kani's method.
3	Analyze structural system and interpret data.
4	Use the techniques, such as stiffness and flexibility methods to solve engineering problems
5	Communicate effectively in design of structural elements

<u>Course content</u>	
UNIT -I	
INDETERMINATE TRUSS ANALYSIS: Analysis of indeterminate trusses by Strain Energy Method, using Castiglione's theorem with static indeterminacy ≤ 3 .	
12 Hrs	
Self Study Component: Problems involving lack of fit and temperature stresses in trusses.	
UNIT -II	
SLOPE DEFLECTION METHOD: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with Static indeterminacy ≤ 3 .	
10 Hrs	
Self Study Component: Additional numerical problems involving Static indeterminacy greater than 3 by Slope Deflection method.	
UNIT -III	
MOMENT DISTRIBUTION METHOD: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with Static indeterminacy ≤ 3 .	
10 Hrs	
Self Study Component: - Additional numerical problems involving Static indeterminacy greater than 3 by moment distribution method.	



UNIT -IV	
KANI'S METHOD: Introduction, Basic Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements with static indeterminacy ≤ 3 . Analysis of frames with and without sway.	
10 Hrs	
<i>Self Study Component:</i> Additional numerical problems involving Static indeterminacy greater than 3 by kani's method.	
UNIT -V	
FLEXIBILITY MATRIX METHOD OF ANALYSIS: Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with static indeterminacy ≤ 3 . STIFFNESS MATRIX METHOD OF ANALYSIS: Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of simple orthogonal rigid frames using system approach with kinematic indeterminacy ≤ 3 .	
10 Hrs	
<i>Self Study Component :</i> Analysis of pin jointed plane truss by flexibility and stiffness method (System approach)	

Text Books :	
1	Basic Structural Analysis, Reddy C.S. – Second Edition, Tata McGraw Hill Publication Company Ltd
2	Theory of Structures, Vol. 2 – S.P. Gupta, G.S. Pandit and R. Gupta, Tata McGraw Hill Publication Company Ltd.
3	Structural Analysis-II, S.S. Bhavikatti – Vikas Publishers, New Delhi.
4	Structural Analysis, L S Negi and R S Jangid, Tata McGraw-Hill Publishing Company Ltd.

Reference Books :	
1	Indeterminate Structural Analysis – J. Sterling Kinney, Oxford and IBH Publishing Co.
2	Elementary Structural Analysis- Noris C.H., Wilbur J. B., McGraw Hill International Book Edition.
3	Advanced Structural Analysis- Ashok K. Jain., Nem Chand & Bros., Roorkee. India.
4	Structural Analysis- D.S. PrakashRao., A Unified Approach, University Press.
5	Intermediate Structural Analysis- C.K. Wang., McGraw Hill Publications.

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

After learning all the units of the course, the student will be able to

1. Analyze the redundant truss structures by strain energy method. [PO1, PO2, PSO1, PSO2]
2. Analyze the continuous beams and frames by Slope Deflection method [PO1,PO2,PSO1,PSO2]
3. Analyze the continuous beams and frames by moment distribution method and Kani’s method and understanding its iterative nature of obtaining solutions.[PO1,PO2,PSO1,PSO2]
4. Analyze the continuous beams and frames by flexibility and stiffness matrix method of system approach. [PO1,PO2,PSO1,PSO2]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
1	Analyze the redundant truss structures by strain energy method.	2	3														2	3	
2	Analyze the continuous beams and frames by Slope Deflection method.	2	3														2	3	
3	Analyze the continuous beams and frames by moment distribution method and Kani’s method and understanding its iterative nature of obtaining solutions.	2	3														2	3	
4	Analyze the continuous beams and frames by flexibility and stiffness matrix method of system approach.	2	3														2	3	



Course Title : DESIGN OF RC STRUCTURAL ELEMENTS			
Course Code: P18CV54	Semester: V	L – T – P – H : 4–0–0 : 4	Credits: 04
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age :CIE:50% , SEE : 50%	
Prerequisites: Strength of Materials, Analysis of Structures.			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	To provide basic knowledge of mathematics, science and engineering in the areas of limit state of collapse and serviceability of R C elements.
2	To imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design and detailing of R C elements for strength and durability.
3	Enable the students to identify, formulate and solve engineering problems of R C elements subjected to flexure, shear and torsion.
4	To give procedural knowledge to design a system, component or process as per needs and specifications of R C elements such as beams, slabs, columns and footings subjected to various load combinations with different boundary conditions.
5	To show the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to wrong design, use of poor quality of materials and faulty construction methods

<u>Course content</u>	
UNIT -I	
INTRODUCTION TO LIMIT STATE DESIGN: Philosophy and principle of limit state design along with the assumptions, Partial safety factors Characteristic Load and Strength. Introduction to stress block parameters, Concept of balanced, under and over reinforced sections. Limit state of collapse in flexure of rectangular sections with examples.	
12 Hrs	
<i>Self Study Component:</i> Philosophy of ultimate load method and working stress method	
UNIT -II	
LIMIT STATE OF COLLAPSE IN FLEXURE, SHEAR AND TORSION: Limit state of collapse in flexure of flanged sections with examples. Limit state of collapse in shear and torsion with examples. Importance of bond, anchorage, lap length.	
10 Hrs	
<i>Self Study Component :</i> Deflection and cracking using IS codal provisions	
UNIT -III	
LIMIT STATE DESIGN OF BEAMS: Design of singly Reinforced, Doubly Reinforced, Flanged Beams, T , L beams and Continuous beams.	
10 Hrs	
<i>Self Study Component:</i> Load calculation on beams in RC Structure.	



UNIT -IV	
LIMIT STATE DESIGN OF SLABS AND STAIRS: Design of one way and two way slabs with different end conditions. Design of dog legged and open well stairs.	
10 Hrs	
<i>Self Study Component:</i> Design of Tread riser types of stair.	
UNIT -V	
LIMIT STATE DESIGN OF COLUMNS AND FOOTINGS: Design of short axially loaded RC columns, with uniaxial and bi-axial moments. Footings with axial load and moment – Square and Rectangular types.	
10 Hrs	
<i>Self Study Component :</i> Design of Three bay frame for using Relevant codes	

Text Books :	
1	SINHA S. N. , Reinforced Concrete Design, Tata McGraw Hill Publications.
2	Unnikrishna Pillai and Devdas Menon , Reinforced Concrete Design, TMH, 3 rd Edition 2009

Reference Books :	
1	Park and Paulay , Reinforced Concrete, John Wiley and Sons
2	Punmia B C, Jain A K and Jain A K , Reinforced Concrete Design, Lakshmi Publications, New Delhi.
3	Jain A K , Limit State Method of Design, Nem Chand and Brothers, Roorkee.
4	Karve S R and Shah V L , Limit State Theory And Design Of Reinforced Concrete – Vidyanthi Prakashan, Pune.
5	N Subramannaya , Design of RC Structures, Oxford IBH

Note: Self study is for 5 marks only in CIE and not in SEE



Course outcomes

After learning all the units of the course, the student will be able to

1. Apply the knowledge of engineering fundamentals and understand different method of design and terms terminology in design methods.[PO1,PSO1]
2. Identify Analyse and Design using limit state methods for beam elements using relevant codes.[PO2,PO3,PO4,PO6,PO7,PO8,PO9,PO12,PSO2,PSO3]
3. Identify Analyse and Design using limit state methods for Slab and stair elements using relevant codes.[PO2,PO3,PO4,PO6,PO7,PO8,PO9,PO12,PSO2,PSO3]
4. Identify, Analyse and Design using limit state methods for column and Footing elements using relevant codes.[PO2,PO3,PO4,PO6,PO7,PO8,PO9,PO12,PSO2,PSO3]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)											Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
01	Apply the knowledge of engineering fundamentals and understand different method of design and terms terminology in design methods	3													3		
02	Identify Analyse and Design using limit state methods for beam elements using relevant codes.		3	3	2		2	2	3	2				3		3	3
03	Identify Analyse and Design using limit state methods for Slab and stair elements using relevant codes		3	3	2		2	2	3	2				3		3	3
04	Identify Analyse and Design using limit state methods for column and Footing elements using relevant codes.		3	3	2		2	2	3	2				3		3	3



Professional Elective –I			
Course Title : APPLIED GEOLOGY			
Course Code : P18CV551	Semester: V	L-T-P : H : 2-2-0 :4	Credits : 03
Contact Period : 52 Hrs	Exam Hours :03 Hrs	Weightage: CIE: 50% ; SEE : 50%	
Prerequisites : NIL			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1.	To study the origin, development, ultimate fate of various surface features, nature of geographic distribution of rocks and engineering properties of rock on the earth of the earth
2.	To gain knowledge about the structures of the rocks and their considerations in the selection of site for dams, tunnels, bridges and highways
3.	To learn about geo-morphological agents such as river, wind, sea waves, and their implications in implementing civil engineering projects.
4.	To learn the application of Topographic maps, remote sensing and GIS in Civil engineering practices and natural resource management.

<u>Course content</u>	
UNIT –I	
GENERAL GEOLOGY: Earth structure- Lithosphere- Internal structure of the earth- Composition – Scope of Geology in Engineering - Geological Agencies - External Agencies - Weathering, Wind, River, Sea, Landslide - Internal Agencies - Earthquake, Plate Tectonics, Ground Water.	
12 Hrs	
Self Study Component: Plate tectonics, wind, sea	
UNIT –II	
MINERALS OF THE EARTH'S CRUST: Rock Forming Minerals - Physical Properties of Minerals – Quartz group, Feldspar group, Mica - Calcite - Clay Minerals and its importance , Indian resource of Coal and Petroleum.	
09 Hrs	
Self Study Component : quartz group, Feldspar group, Mica group, Calcite	
UNIT –III	
ROCKS OF THE EARTH'S CRUST: Rocks and their study - Rock Cycle - Igneous Rocks - Sedimentary Rocks - Metamorphic Rocks - Engineering Properties, Uses and Indian Occurrence of the following rocks - Granite, Diorite, Dolerite, Pegmatite, Basalt, Shale, Sandstone, Limestone, Breccia and Conglomerate, Gneiss, Schist, Slate, Quartzite and Marble.	
09 Hrs	



Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

Self Study Component: Granite, Diorite, Dolerite, Pegmatite, Basalt, Shale, Sandstone, Limestone, Breccia, Conglomerate, Gneiss, Schist, Slate, Quartzite and marble

UNIT –IV

STRUCTURAL FEATURES OF ROCKS: Introduction - Terminology - Outcrop - Geological Map - Clinometers – Geological Structures – Folds, Faults and Joints - Engineering Considerations involves Structures.

10 Hrs

Self Study Component : Outcrop, Geological map

UNIT –V

GEOLOGY FOR ENGINEERING PROJECTS: Geological Investigations - Geophysical Investigations - Remote Sensing Techniques - Geological Considerations for Dam Reservoirs, Tunnels and Road Cuts - Practice in Geology - Electrical Resistivity Meter, Geological Maps - Identification of Minerals and Rocks.

12 Hrs

Self Study Component: Remote Sensing, Identification of Minerals & Rocks

Text Books :

1	A Text Book of Geology , P.K. Mukerjee, World Press Pvt., Ltd. Kolkata.
2	Text Book of Engineering and General Geology , Parbin Singh, Published by S.K. Kataria and Sons, New Delhi
3	Physical and Engineering Geology , Garg .S.K, Khanna Publication, New Delhi, 1999



Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

Reference Books :	
1	Earthquake Tips - Learning Earthquake Design and Construction - C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
2	Principles of Engineering Geology and Geotechnics , Dimitri P Krynine and William R Judd CBS Publishers and Distributors, New Delhi.
3	Principles of Engineering Geology , K V G K Gokhale, BS Publications, Hyderabad.
4	Ground water Assessment, Development and Management by K.R. Karanth, Tata Mc Graw Hills.
5	Groundwater Hydrology , K. Todd ,Tata Mac Grow Hill, New Delhi.
6	Engineering Geology , D. Venkata Reddy, New Age International Publications, New Delhi.
7	Engineering Geology , S.K Duggal, H.K Pandey and N Rawal, McGraw Hill Education (India) Pvt, Ltd. New Delhi.
8	Structural Geology , M.P Billings ,CBS Publishers and Distributors, New Delhi.
9	Outlines of Geophysical Prospecting- A Manual for Geologists , M. B. Ramachandra Rao, Prasaranga, University of Mysore, Mysore

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

After learning all the units of the course, the student is able to

1. Students will able to apply the knowledge of geology and its role in Civil Engineering [PO1, PO7, PSO1]
2. Students will effectively utilize earth's materials such as mineral, rocks and water in Civil engineering practices. [PO3, PO4, PSO2]
3. Analyze the natural disasters and their mitigation. [PO3, PO7, PSO2]
4. Assess various structural features and geological tools in ground water exploration, [PO4, PO5, PO11, PSO3]
5. Natural resource estimation and solving civil engineering problems. [PO4, PO5, PO11, PSO3]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
1	Students will able to apply the knowledge of geology and its role in Civil Engineering	1						2								1		
2	Students will effectively utilize earth's materials such as mineral, rocks and water in Civil engineering practices.			1	2												1	
3	Analyze the natural disasters and their mitigation.			2				1									2	
4	Assess various structural features and geological tools in ground water exploration				1								2					2
5	Natural resource estimation and solving civil engineering problems.				2	2							2					2



Professional Elective –I			
Course Title : MATRIX METHODS OF STRUCTURAL ANALYSIS			
Course Code : P18CV552	Semester : V	L-T-P : H : 2-2-0 : 4	Credits : 03
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age : CIE : 50% , SEE : 50%	
Prerequisites: Strength of materials, Basic Structural Analysis.			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Apply knowledge of mathematics and engineering in Apply matrix algebra to solve the problems of structural analysis.
2	Apply knowledge of mathematics and engineering in stiffness and flexibility approaches of matrix methods for structural analysis.
3	Apply knowledge of mathematics and engineering for Apply flexibility and stiffness methods (element approach) to truss, beam and plane frame problems to evaluate the internal forces and displacement of members.
4	Apply knowledge of mathematics and engineering to apply matrix methods for advanced structural analysis and computer applications.

<u>Course content</u>	
UNIT -I	
ENERGY CONCEPTS : Brief history of structural mechanics, structural systems, degrees of static and kinematic indeterminacies, geometrical and material non-linearity, concepts of stiffness and flexibility, energy concepts in structural analysis, strain energies – axial, flexural and shear, real work and complementary work. Principle of virtual displacement for a rigid body and deformable body, principle of potential energy, stationary complementary energy, minimum complementary energy. Development of flexibility and stiffness matrices with reference to the given coordinates.	
12 Hrs	
Self Study Component: Maxwell Betti's theorem of reciprocal displacement	
UNIT -II	
TRANSFORMATION MATRIX: Relationship between element and system, transformation of information from system forces to element forces using equilibrium equations, transformation of information from system displacement to element displacement, contra gradient laws, element stiffness and flexibility matrices (bar, beam). Generation of system stiffness/ flexibility matrix using uncoupled element stiffness/ flexibility matrices. Analysis of statically indeterminate structures - trusses and continuous beams by flexibility matrix method (element approach).	
10 Hrs	
Self Study Component : Analysis of plane truss subjected to temperature change ,lack in fit by flexibility methods	



UNIT -III	
FLEXIBILITY MATRIX METHOD: Analysis of statically indeterminate rigid jointed plane frames by flexibility matrix method (element approach)	
STIFFENESS MATRIX METHOD: Analysis of statically indeterminate structures truss by stiffness matrix method (element approach)	
10 Hrs	
<i>Self Study Component:</i> Analysis of continuous beam subjected to support settlement	
UNIT -IV	
STIFFENESS MATRIX METHOD: Analysis of statically indeterminate structures continuous beams and simple frames by stiffness matrix method (element approach)	
10 Hrs	
<i>Self Study Component :</i> Considerations of temperature change & support settlement	
UNIT -V	
DIRECT STIFFENESS METHOD: Local and global coordinate systems, rotation transformation matrix, direct assembly of element stiffness matrices. Analysis of indeterminate structures (i) Plane truss and (ii) continuous beam.	
10 Hrs	
<i>Self Study Component:</i> Analysis considerations of plane frame.	

Text Books :	
1	Basic Structural Analysis , C.S.Reddy, , TMH, New Delhi 2001
2	Structural Analysis-A Matrix Approach , G.S.Pandit & S.P.Gupta, 2 nd Edition, TATA McGraw Hill.

Reference Books :	
1	Matrix Analysis of Framed Structures , W.Weaver and J.H.Gere., Van Nostrand, 1980.
2	Advanced Structural Analysis with computer Application ,A.K.Jain, Nemchand and Brothers Roorkee, India
3	Fundamentals of Structural Mechanics , M.L. Gambhir., PHI, New Delhi.
4	Computational Structural Mechanics , S. Rajashekar, PHI, New Delhi 2001.

Note: Self study is for 5 marks only in CIE and not in SEE



Course outcomes

Student will be able to

- 1 Apply matrix algebra to solve the problems of structural analysis. [PO1, PO2, PSO1].
- 2 Apply stiffness and flexibility approaches of matrix methods for structural analysis. [PO2,PO3,PSO2]
- 3 Apply flexibility and stiffness methods (element approach) to truss, beam and plane frame problems to evaluate the internal forces and displacement of members. [PO2, PO3, PSO2].
- 4 Apply matrix methods for advanced structural analysis and computer applications.[PO2, PO3,PSO2]

Course Articulation Matrix(CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
01	Apply matrix algebra to solve the problems of structural analysis.	3	3												3		
02	Apply stiffness and flexibility approaches of matrix methods for structural analysis.		3	3												3	
03	Apply flexibility and stiffness methods (element approach) to truss, beam and plane frame problems to evaluate the internal forces and displacement of members.		3	3												3	
04	Apply matrix methods for advanced structural analysis and computer applications.		3	3												2	



Professional Elective –I			
Course Title : CONSTRUCTION QUALITY AND SAFETY MANAGEMENT			
Course Code: P18CV553	Semester: V	L–T– P :H : 2–2–0: 4	Credits:03
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age : CIE : 50%,SEE : 50%	
Prerequisites : NIL			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Describe the quality management principles, & control processes related to construction projects.
2	Demonstrate the knowledge of Total Quality Management for quality certification of construction projects.
3	Define the safety concepts pertaining to safety management in construction industry.
4	Illustrate the safety practices to mitigate common hazards in construction site.

<u>Course content</u>	
UNIT -I	
QUALITY: Principles, Concepts in Quality Management, Managing for quality, Impact of Quality Management in Business, and Commerce. Quality Control, Quality costs and its components, Features of Quality, Determinants of service Quality, Need for Quality management in industry	
10 Hrs	
<i>Self Study Component:</i> Objectives, structure, steps in formation of Quality Circle.	
UNIT -II	
TOTAL QUALITY MANAGEMENT: Meaning and Scope, TQM models – Oakland Model, integrated model of TQM, Building blocks of TQM, 3-D Model of TQM, Benefits of TQM program, causes for TQM failures, Remedial measures, Quality Manuals, System Procedures. ISO: 9001:2000 - Process Approach, Compatibility with other management systems, certification Procedure, ISO: 9000 for construction, ISO 14000: Environmental Management – general requirements, , Planning, Implementation and operation	
12 Hrs	
<i>Self Study Component:</i> Environmental Policy, Checking and Corrective action.	
UNIT -III	
QUALITY CONTROL IN CONSTRUCTION PROJECTS: QC in concreting, Brick work, stone masonry, Formwork, Foundations, Piling work, Structural work, Woodwork & Timber, Painting, Electrical system, Waste recovery and maintenance	
08 Hrs	
<i>Self Study Component:</i> Roles and Responsibilities of Leader/ Deputy leader, Prerequisites for a successful leader	



UNIT -IV	
Safety Management: Introduction, salient features of safety programs, general safety programs for construction. Safe working environment, Safety clauses in contract documents, Safety programme, Safety policy, Safety department, safety officers, safety records, safety training. SAFETY STANDARDS Indian standards for safety in construction, BIS standards, American National Standards.	
10 Hrs	
Self Study Component : Safety lacunae in Indian Construction Industry	
UNIT -V	
CONSTRUCTION ACCIDENTS AND SAFETY: Accident- Causes, Effects and Safety measures, Legal requirements, Responsibility of the employers. Reporting occurrence of accidents, Reporting occurrence of hazards, Action to be taken by the Site-in-charge in case of accidents	
12 Hrs	
Self Study Component: Common Hazards- Materials, Movement, Drowning, Openings, Weight.	
Text Books :	
1	Project Planning and Control with PERT and CPM , by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
2	Construction Safety Management , NICMAR Publications, Hyderabad, October 2003

Reference Books :	
1	Total Quality in Construction Projects , by Hellard R.B.: Achieving profitability with customer satisfaction, Thomas Telford, London, 1993
2	Construction safety , Jimmy W. Hinze, Prentice hall Inc 1997

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes:

After studying this course, students will be able to;

1. Describe the quality management principles, & control processes related to construction projects. [PO2, PO11, PO12, PSO2]
2. Demonstrate the knowledge of Total Quality Management for quality certification of construction projects. [PO1, PO11, PO12, PSO2]
3. Define the safety concepts pertaining to safety management in construction industry. [PO1, PO11, PSO3]
4. Illustrate the safety practices to mitigate common hazards in construction site. [PO1, PO11, PSO1]



Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Describe the quality management principles, & control processes related to construction projects.		2										2	1		2
02	Demonstrate the knowledge of Total Quality Management for quality certification of construction projects.	1											3	1		2
03	Define the safety concepts pertaining to safety management in construction industry.	1											2			2
04	Illustrate the safety practices to mitigate common hazards in construction site.	1											3		2	



Professional Elective –I			
Course Title : PAVEMENT EVALUATION AND MANAGEMENT			
Course Code : P18CV554	Semester : V	L-T-P : H : 2-2-0: 4	Credits : 03
Contact Period : 52 Hrs	Exam Hours : 03 Hrs	Weight age : CIE : 50% , SEE : 50%	
Prerequisites : Transportation Engineering			

Course learning objectives (CLO's)	
This course aims to,	
1	Understand the structural and functional requirements of pavements
2	Carry out the structural and functional evaluation of both flexible and rigid pavements
3	Identify the factor causing the deterioration of pavement and conducting the test.
4	The measures taken to improve the deteriorate pavement condition, such as overlay.
5	The use of models for pavement management

Course content	
UNIT –I	
Introduction to pavement evaluation: Structural and functional requirements of flexible and rigid pavements. Distress and different types of failures in pavements. Functional and structural deterioration of flexible and rigid pavements.	
10 Hrs	
<i>Self-Study Component:</i> Deterioration models	
UNIT –II	
Structural and functional evaluation of pavements: Structural deterioration of pavements, causes, effects, methods of treatment. Structural evaluation of flexible pavements by Rebound deflection method, Analysis of data, interpretation and applications." Use of FWD and other methods for evaluation of flexible and rigid pavements and their application. Rating methods.	
12 Hrs	
<i>Self-Study Component:</i> Use of modern equipment for pavement surface condition measurements.	
UNIT –III	
Functional deterioration of pavements: causes, effects, methods of treatment. Pavement surface condition - Causes, effects, methods of measurement. Functional evaluation and treatment of: (a) Pavement slipperiness (b) Riding quality and unevenness (c) Rutting (d) Cracking (e) Potholes (f) Edge breaking etc. Rating methods.	
10 Hrs	
<i>Self-Study Component:</i> Use of modern equipment for pavement surface condition measurements and application.	
UNIT –IV	
Evaluation of Pavement Structural Condition & Overlay Design: Evaluation by non-destructive tests such as FWD, Benkelman Beam rebound deflection, Plate load test. Evaluation by destructive test methods, and specimen testing.	
Overlay Design: Design of Flexible overlay over flexible pavement, choice of overlays on existing flexible& rigid pavement.	



10 Hrs
Self-Study Component: Wave propagation and other methods.
UNIT –V
Model Pavements & pavement management: prediction models for pavement deterioration – need- measures to be predicted requirements-basic types of predication models. Application of expert system for managing pavement.
10 Hrs
Self-Study Component: HDM and other deterioration model.

Text Books :	
1	Principles of pavement design , Yoder,E.J., and Witzak, 2 nd ed. John Wiley and sons, 1975.
2	Text book of highway Engineering , Khanna and Justo, Newchand brothers, Roorke-2011
3	Design of functional pavements , Yang, McGraw Hill Book Co.
4	Modern Pavement Management , Hass R., Hudson.W.R., Zaniewisti.J.,Krieger Publishing Company, Florida, 1994.
5	Design and performance of road pavements , David and Paul Croney, – third edition, Mc Grawhill, 1998.

Reference Books :	
1	Pavement Analysis , PerUlitz– Elsevier Amsterdam.
2	Highway Hand Book by FAW , Publication from NUS, Singapore.
3	Traffic and Highway Engineering Nicholas J.Garber, Lester A. Hoel, , Third Edition Thompson Learning
4	IRC 81, 1997 , Guidelines for Strengthening of Flexible Road Pavements using Benkelman Beam Deflection Technique
5	IRC SP 16, 2004 Guidelines for Surface Evenness of Highway Pavements
6	IRC SP 17 , Recommendation about Overlays on Cement concrete Pavements

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes (CO's)

After learning all the units of the course, the student is able to

1. Understand the structural and functional requirements of pavements.[PO1, PO4, PO12]
2. Analyze and evaluate structural and functional adequacy of pavements.[PO1, PO2, PO3, PO4, PO12]
3. Different tests conduction of pavement and measure taken to improve the pavement condition such as overlay design.[PO1, PO2, PO6, PO12]
4. Development of prediction model for pavement condition and its usage for pavement management.[PO1, PO4, PO5, PO11]



Course Articulation Matrix (CAM)

Sl. no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand the structural and functional requirements of pavements.	3			1								2	2		
2	Analyze and evaluate structural and functional adequacy of pavements.	3	3	2	1								2	2		
3	Different tests conduction of pavement and measure taken to improve the pavement condition such as overlay design.	2	2				2						2			1
4	Development of prediction model for pavement condition and its usage for pavement management.	1			1	2							2			2



Course Title : CONCRETE LABORATORY			
Course Code : P18CVL56	Semester : V	L-T-P : H : 0-0-3: 3	Credits : 1.5
Contact Period : 39 Hrs	Exam Hours : 03 Hrs	Weight age :CIE:50%,SEE: 50%	
Prerequisites: Concrete Technology.			

Course Learning Objectives (CLO's)	
This Course aims to,	
1	Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy
2	Characterize the physical properties of cement and correlate with the specifications of relevant IS codes.
3	Determine the properties of fresh concrete and hardened concrete.
Course content	
UNIT –I	
TESTS ON CEMENT:	
1. Normal Consistency	
2. Setting time	
3. Soundness test	
4. Compression strength test	
5. fineness test by Sieve analysis	
6. Blaine's Air permeability Test	
7. Specific gravity of cement.	
15 Hrs	
TESTS ON CONCRETE :	
I. FRESH CONCRETE:	
8. Workability–Slump	
9. Compaction factor	
10. Vee Bee Consistometer test.	
II. HARDENED CONCRETE:	
11. Compression strength	
12. Split tensile tests.	
13. Test on flexural strength of RCC beams.	
12 Hrs	
TESTS ON Special Concrete: SELF COMPACTED CONCRETE.(S.C.C.)	
I. FRESH CONCRETE:	
14. Slump test.	
15. Flow tests (V Funnel Test., L Box Test., U Box Test., Fill Box Test)	
II. HARDENED CONCRETE:	
16. Compression strength	
17. Split tensile tests	
12 Hrs	



Text Books :

1	Concrete Technology , Theory and Practice : M. S. Shetty & A K Jain , 8th Edition, S. Chand Publishing.
2	Concrete Technology , M L Gambhir , THIRD EDITION, Tata McGraw-Hill Education, 2004

Reference Books :

1	Relevant IS codes.
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Course Outcomes (COs)

At the end of the course the student will be able to:

1. Determine the physical properties of cement like consistency, setting time, compressive strength. [PO1,PO9,PO12,PSO1]
2. Correlate the results of basic cement tests with relevant IS codes. [PO1, PO2, PO6, PO7, PO8, PSO1]
3. Determine the properties of fresh concrete and hardened concrete of nominal concrete. [PO1, PO2, PO6, PO7, PO8, PSO1]
4. Determine the properties of fresh concrete and hardened self compacted concrete. [PO1, PO2, PO5,PO6, PO7, PO8, PSO1]

Sl. no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
1	Determine the physical properties of cement like consistency, setting time, compressive strength.		3										2			2	2	
2	Correlate the results of basic cement tests with relevant IS codes.	2	2				2	2	2							2		
3	Determine the properties of fresh concrete and hardened concrete of nominal concrete.	2	2				2	2	2							2		
4	Determine the properties of fresh concrete and hardened self compacted concrete.	2	2			2	2	2	2							2		



Course Title : HIGHWAY LABORATORY			
Course Code : P18CVL57	Semester : V	L-T-P : H : 0-0-3: 3	Credits : 1.5
Contact Period : 39 Hrs	Exam Hours : 03Hrs	Weight age :CIE:50%,SEE: 50%	
Prerequisites: Transportation Engineering.			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Determine the basic physical properties of road aggregates.
2	Determine the basic properties of bitumen.
3	Determine the mechanical properties of bituminous mixes.
4	Gain the knowledge and analyse the properties subgrade soil

<u>Course content</u>	
1) Tests on Road Aggregates	
	a) Aggregate Impact Test b) Los Angeles Abrasion Test c) Aggregate Crushing Value Test d) Specific Gravity Test and Water Absorption Test e) Shape Tests i. Flakiness Index ii. Elongation Index iii. Angularity Number
	15 Hrs.
2) Tests on Bituminous Materials	
	a) Penetration Test b) Ductility Test c) Softening Point Test d) Specific Gravity Test e) Viscosity Test f) Flash and Fire Point Test
	12 Hrs.
3) Tests on Bituminous Mixes	
	a) Bituminous Mix Design by Marshall Method (Demonstration only)
	3 Hrs.
4) Tests on Subgrade Soil	
	a) Compaction Test (Standard and Modified) b) California Bearing Ratio Test c) Wet sieve analysis
	9 Hrs.



Text Books :

1	Highway Materials Testing Laboratory Manual , S K Khanna, C E G Justo and A Veeraragavan, Nem Chand Bros, Roorkee.
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Reference Books :

1	Highway Material and pavement Testing- S.K.Khanna, CEG Justo, A.Veeraragavan-Nemi Chand & Bros Roorkee
2	Highway Engineering , L R Kadiyali, Khanna Publishers, New Delhi.

Course Outcomes

After learning all the units of the course, the student is able to

1. Determine the physical properties of aggregates and correlate with the specifications of relevant IS codes. (PO1, PO2, PO4, PO8, PSO1, PSO2)
2. Understand the basic properties of bitumen. (PO1, PO2, PO7, PO8, PSO1, PSO2)
3. Understand the mechanical properties of bituminous mixes. (PO2, PO3, PO4, PO8, PSO2, PSO3)
4. Carryout investigations of subgrade soil and to assess its suitability. (PO3, PO4, PO5, PSO2, PSO3)

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
1	Determine the physical properties of aggregates and correlate with the specifications of relevant IS codes	1	2		2				1							1	2	
2	Understand the basic properties of bitumen	1	2					3	1							1	2	
3	Understand the mechanical properties of bituminous mixes		2	2	2				2								2	3
4	Carryout investigations of subgrade soil and to assess its suitability			2	3	3											2	3



Course Title : Skill Oriented Laboratory-I (Competency in Survey & Analysis Software)			
Course Code : P18CVL58	Semester : V	L-T-P : H :0-0-2 :02	Credits :01
Contact Period : 26 Hrs	Exam Hours :02 Hrs	Weight age : CIE 50% ,SEE 50%:	
Prerequisites: Strength of Materials, Basic Structural Analysis, Surveying Practice.			

Course Learning Objectives (CLO's)	
This Course aims to,	
1	Apply principles of surveying for solving relevant engineering problems
2	Identify the components of Total station.
3	Interpret the different measurement techniques for various applications.
4	To understand the earth work quantities using e-survey.
5	Compute necessary data for setting out building sewer line using total station

Course content	
Part –A	
1	E-Survey : <ol style="list-style-type: none"> Determination of area using total station. Traversing area using total station Contouring using total station. plotting using CAD & E-SURVEY Stake out area using total station. Distance, gradient, difference in height between two inaccessible points using total station Earth work quantity calculations using e-survey. Profile survey longitudinal section, cross section using total station plotting using CAD & E-SURVEY Demonstration on the use of virtual globe/Google earth to extract coordinates and contours <p style="text-align: right;">16 Hrs</p>
Part-B	
2	STAAD Pro : Analysis of two dimensional structural systems using STAAD Pro. : <ol style="list-style-type: none"> Overview of Structural Analysis and Design Introduction to STAAD Pro. Analysis of Continuous beams, Analysis of Frames <p style="text-align: right;">10 Hrs</p>



Text Books :

1	Higher Surveying , B.C.Punmia,Ashok.K.Jain, Arun.K.Jain, Lakshmi Publications Pvt Ltd, New Delhi
2	Surveying (Volume 1, 2, 3) , K.R. Arora, “”Standard Book House, New Delhi.
3	Surveying Vol. 1 , S.K. Duggal, Tata McGraw Hill Publishing Co. Ltd. New Delhi.

Reference Books :

1	Plane Surveying , Chandra A.M. New age International.
2	Fundamentals of Surveying , S.K.Roy , Practice Hall of India, New Delhi.

Course Outcomes

After learning all the units of the course, the student is able to

1. Explain working principle and usage of different types of modern surveying instruments.[PO1,PSO1]
2. Determine area and contouring using total station.[PO1,PSO2]
3. Employ effectively field procedures required for a professional surveyor.[PO12]
4. Compute necessary data for setting out profile survey using total station.[PO1,PSO1]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)											Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	Analyze 2D structural systems including Continuous beams, Frames using STAAD pro software.	3	2			3								2	3	3	3
	Explain working principle and usage of different types of modern surveying instruments	3															3
3	Employ effectively field procedures required for a professional surveyor													2			
4	Compute necessary data for setting out profile survey using total station.	2													1		



Course Title : Technical Skills – I (Proficiency in Civil Engineering)			
Course Code : P18CV591	Semester : V	L-T-P : H : 0-2-0 :02	Credits :01
Contact Period : 26 Hrs	Exam Hours :3 Hrs	Weight age:CIE:50%,SEE : 50%	
Prerequisites: Civil Engineering Core Subjects Studied from I to V semester.			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Develop Technical skills in Structural Engineering.
2	Develop Technical skills in Water Resources Engineering.
3	Develop Technical skills in Geomatics Engineering.
4	Develop Technical skills in Transportation Engineering.
5	Develop Technical skills in Construction Management.

<u>Course content</u>	
Part –A : <i>Structural Engineering</i>	
Engineering Mechanics: System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Friction and its applications; Kinematics of point mass and rigid body; Centre of mass; Euler’s equations of motion; Impulse-momentum; Energy methods; Principles of virtual work.	
Structural Analysis: Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.	
Construction Materials: Construction Materials: Structural steel – composition, material properties and behaviour; Concrete – constituents, mix design, short-term and long-term properties; Bricks and mortar; Timber; Bitumen.	
Concrete Structures: Working stress, Limit state and Ultimate load design concepts; Design of beams, slabs, columns; Bond and development length; Prestressed concrete; Analysis of beam sections at transfer and service loads.	
10 Hrs	
Part -B : <i>Water Resources Engineering</i>	
Fluid Mechanics: Properties of fluids, fluid statics; Continuity, momentum, energy and corresponding equations; Potential flow, applications of momentum and energy equations; Laminar and turbulent flow; Flow in pipes, pipe networks; Concept of boundary layer and its growth.	
Hydraulics: Forces on immersed bodies; Flow measurement in channels and pipes; Dimensional analysis and hydraulic similitude; Kinematics of flow, velocity triangles; Basics of hydraulic machines,	



Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

specific speed of pumps and turbines; Channel Hydraulics – Energy-depth relationships, specific energy, critical flow, slope profile, hydraulic jump, uniform flow and gradually varied flow.

Hydrology:

Hydrologic cycle, precipitation, evaporation, evapo-transpiration, watershed, infiltration, unit hydrographs, hydrograph analysis, flood estimation and routing, reservoir capacity, reservoir and channel routing, surface run-off models, ground water hydrology – steady state well hydraulics and aquifers; Application of Darcy’s laws.

Irrigation:

Duty, delta, estimation of evapo-transpiration; Crop water requirements; Design of lined and unlined canals, head works, gravity dams and spillways; Design of weirs on permeable foundation; Types of irrigation systems, irrigation methods; Water logging and drainage; Canal regulatory works, cross-drainage structures, outlets and escapes.

Water Supply and Treatment:

Quality standards, basic unit processes and operations for water treatment. Drinking water standards, water requirements, basic unit operations and unit processes for surface water treatment, distribution of water.

08 Hrs

Part -C : Geomatics, Transportation Engineering and Construction Management

Geomatics Engineering :

Principles of surveying; Errors and their adjustment; Maps - scale, coordinate system; Distance and angle measurement - Levelling and trigonometric levelling; Traversing and triangulation survey; Total station; Horizontal and vertical curves. Photogrammetry - scale, flying height; Remote sensing - basics, platform and sensors, visual image interpretation; Basics of Geographical information system (GIS) and Geographical Positioning system (GPS).

Transportation Engineering:

Highway alignment and engineering surveys; Geometric design of highways - cross-sectional elements, sight distances, horizontal and vertical alignments; Geometric design of railway track; components of railway track, Highway drainage. Airport runway length, taxiway and exit taxiway design. Highway Pavements: Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes; Design factors for flexible and rigid pavements; Design of flexible pavement using IRC: 37-2012; Design of rigid pavements using IRC: 58-2011; Distresses in concrete pavements.

Construction Management:

Construction Management: Types of construction projects; Tendering and construction contracts; Rate analysis and standard specifications; Cost estimation; Project planning and network analysis – PERT and CPM.

08 Hrs

Text Books :

1	Basic Structural Analysis , – Reddy C.S. – Second Edition, Tata McGraw Hill Publication Company Ltd.
2	Environmental Engineering-I – B.C. Punmia & Ashok Jain, Lakshmi Publications (P) Ltd.
3	Construction Engineering and Management , by S. Seetharaman, Umesh publications, New



	Delhi
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Reference Books :	
1	Indeterminate Structural Analysis , – J. Sterling Kinney, Oxford and IBH Publishing Co.
2	Construction Planning Equipment's and Methods , by Peurifoy, R. L. Mc, Graw Hill publication

Course Outcomes

After learning all the units of the course, the student is able to

1. Understand the principles and analysis of elements in structural engineering. [PO1, PO2,PO3]
2. Understand the principles and application of Water Resources Engineering. [PO1, PO2,PO3]
3. Understand the principles and usage of Geomatics engineering and Transportation Engineering. [PO1, PO2, PO3]
4. Understand the principles and perceive Construction Management. [PO1, PO2, PO3]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	Understand the principles and analysis of elements in structural engineering.	2	3	2										2			
2	Understand the principles and analysis of elements in Water Resources Engineering.	2	3	2										2			
3	Understand the principles and analysis of elements in Geomatics engineering and Transportation Engineering.	2	3	2										2			
4	Understand the principles and analysis of elements in Construction Management.	2	3	2										2			



Course Title : WASTE WATER COLLECTION AND TREATMENT			
Course Code: P18CV61	Semester: VI	L-T-P-H:4-0-0: 0 4	Credits:04
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age : CIE :50%,SEE : 50%	
Prerequisites: Water Supply Treatment.			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	To understand wastewater generation characteristics and need for waste water treatment.
2	To study design different unit operations and unit process in involved in wastewater treatment process.
3	To impart knowledge on the various biological treatment processes used in waste water treatment plant.
4	To describe different methods for wastewater disposal and environmental effects of wastewater.
5	To grasp the microbiological processes in the activated sludge process.

<u>Course content</u>	
UNIT -I	
INTRODUCTION: Necessity of sanitation, Systems of sanitation and disposal, types of sewerage systems and their suitability. Dry weather flow (DWF) - factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow. Wet weather flow (WWF) - estimation of storm flow by rational method and empirical formulae, Time of concentration. Problems on DWF & WWF. HYDRAULIC DESIGN OF SEWERS: Hydraulic formulae for velocity, effects of flow variations on velocity, self-cleansing and non-scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full (No derivations). Problems on design of sewers.	
12 Hrs	
Self Study Component: Problems on time of concentration, Design formula to calculate WWF, Nomograms.	
UNIT -II	
MATERIALS OF SEWERS: Sewer materials, Selection criteria, shape of sewers, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers. SEWER APPURTENANCES: Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps. PUMPING OF SEWAGE: Need, types of pump, problems on power of pumps and rising mains. HOUSE DRAINAGE- Typical layout plan showing house drainage connections, maintenance of house drainage.	
10 Hrs	
Self Study Component: Loads on sewer, precaution to be taken before entry into Manhole, Drop Manhole.	



UNIT -III	
WASTEWATER CHARACTERIZATION: Physical, Chemical and Biological characteristics, typical wastewater characteristics, and Biological treatment process-Aerobic and Anaerobic, CNS cycles. BOD and COD - their significance & problems on BOD. DISPOSAL OF SEWAGE: Disposal by dilution-self-purification phenomenon. Oxygen sag curve, Zones of purification, Sewage farming, sewage sickness, Effluent standards for Disposal on to land & in to surface waters.	
10 Hrs	
<i>Self Study Component:</i> Typical composition of Domestic waste water, population equivalent, Problem on Oxygen sag curve.	
UNIT -IV	
TREATMENT OF SEWAGE: Importance of treatment, methods of treatment, Flow diagram of conventional municipal sewage treatment plant. PRIMARY TREATMENT: Screening, grit chambers, skimming tanks and primary sedimentation tanks, Design criteria & Design examples of PST. SECONDARY TREATMENT: Advantages of biological treatment system, Suspended growth and attached growth system. Trickling filter – theory, operation, types, operational problems & design problems.	
10 Hrs	
<i>Self Study Component:</i> Preliminary primary & unit operation, unit process.	
UNIT -V	
ACTIVATED SLUDGE PROCESS- Principle, flow diagram, Modifications of ASP, F/M ratio, Design problems. ANAEROBIC SLUDGE DIGESTION- Sludge digestion tanks, Design of Sludge drying beds, low cost. WASTE TREATMENT METHOD- Septic tank, Oxidation Pond and Oxidation ditches.	
10 Hrs	
<i>Self Study Component:</i> UASB.	

Text Books :	
1	Environmental Engineering–II, – B.C. Punmia & Ashok Jain, Lakshmi Publications.
2	Wastewater Treatments, – S.K. Garg, Khanna publications.

Reference Books :	
1	Manual on Waste Water Treatment: CPHEEO, Ministry of Urban Development, NewDelhi.
2	Water & Wastewater Engineering Vol-II, - Fair, Geyer and Okun: John Willey Publishers,New York.
3	Waste Water Treatment, Disposal and Reuse, Metcalf and Eddy Inc: Tata McGrawHill

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

After learning all the units of the course, the student is able to

- 1 Apply knowledge of mathematics and science to estimate sewage and storm water flow in community.[PO1,PSO1]
- 2 Apply knowledge of basic science for testing and analyze the sewage characteristics and to compare with legal standards. [PO1,PO2,PSO1,PSO2]
- 3 Hydraulic design of sewers and various sewage treatment units to remove selected impurities to meet disposal standards.[PO3,PSO2]
- 4 To understand the impact of different waste water disposal methods of sewage for sustainable environment.[PO7,PSO3]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
01	Apply knowledge of mathematics and science to estimate sewage and storm water flow in community.	2														2		
02	Apply knowledge of basic science for testing and analyze the sewage characteristics and to compare with legal standards.	2	3													2	3	
03	Hydraulic design of sewers and various sewage treatment units to remove selected impurities to meet disposal standards.			3													2	
04	To understand the impact of different waste water disposal methods of sewage for sustainable environment.								3									3



Course Title : Geotechnical Engineering.-I			
Course Code : P18CV62	Semester : VI	L-T-P : H : 4-0-0 :04	Credits :04
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age : CIE : 50%, SEE :50%	
Prerequisites : NIL			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	History of soil mechanics, origin and formation of soil.
2	Clay mineralogy and soil structure, soil as three phase system and inter relationship.
3	Index properties and their determination, classification of soil.
4	Flow of water through soils, effective stress concept, compaction of soil
5	Consolidation of soil and shear strength of soil.

<u>Course content</u>	
UNIT -I	
INTRODUCTION: History of soil mechanics, origin and formation of soil.	
CLAY MINERALOGY AND SOIL STRUCTURE- Primary and Secondary valence forces, clay mineral structure, common clay minerals in soils – Kaolinite, Illite and Montmorillonite, soil water interaction – diffuse double layer and double layer repulsion; structure of coarse grained soils – single grained structure, structure of fine grained soil – flocculent and dispersed structure and honeycomb structure.	
SOIL AS A THREE-PHASE SYSTEM- Phase Diagram, Basic definitions and inter relationship.	
12 Hrs	
Self Study Component: Isomorphism substitution, Specific surface, cation exchange capacity of soil	
UNIT -II	
INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION: Water content, specific gravity of soils and their determination, Particle size distribution, (Sieve analysis) Consistency limits- liquid limit by Casagrande's' method, plastic limit, Shrinkage limit and indices, Insitu density-Core cutter and Sand replacement method, Activity of clay.	
CLASSIFICATION OF SOILS: Purpose of soil classification, Particle size classification–IS classification, unified soil classification, Plasticity chart and its importance, Field identification of soils.	
10 Hrs	
Self Study Component: Particle size distribution by Hydrometer analysis. Determination of liquid limit by fall cone methods.	
UNIT -III	



FLOW OF WATER THROUGH SOILS: Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory tests), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation.

COMPACTION OF SOILS: Definition, Principle of compaction, Standard and Modified proctor's compaction, factors affecting compaction, Effect of compaction on soil properties Field compaction control, and Proctor needle

10 Hrs

Self Study Component: Determination of coefficient of permeability by field method, Compacting equipments.

UNIT -IV

EFFECTIVE STRESS CONCEPT – Total and effective stresses, Pore water pressure, Terzaghi's effective stress equation and its limitations, Capillary phenomena, Quick sand phenomena.

CONSOLIDATION OF SOILS :Definition, spring analogy for normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by-Casagrande's method, Consolidation characteristics of soil (C_c , a_v , m_v and C_v),Terzaghi's one-Dimensional consolidation theory (Assumptions and limitations only) Laboratory 1-D consolidation test to determine the consolidation characteristics of soil, determination of coefficient of consolidation by square root of time fitting method, logarithmic time fitting method.

10 Hrs

Self Study Component: Determination of pre consolidation pressure by Log- log method, Determination of Coefficient of consolidation by Rectangular hyperbola method.

UNIT -V

SHEAR STRENGTH OF SOILS: Concept of shear strength, Mohr's-coulomb theory, conventional and modified failure envelopes, Total and effective shear strength parameters, Laboratory determination of shear strength of soils – Direct shear test, Triaxial compression test, Unconfined compression test and vane shear test, Test under different drainage conditions, sensitivity and Thixotropy of clay

10 Hrs

Self Study Component: Concept of pore pressure, factors affecting shear strength of soils.

Text Books :

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|---|---|
| 1 | Soil Mechanics and Foundation Engg , Punmia B.C, Laxmi Publications Co. , New Delhi. |
| 2 | Soil Mechanics and Foundation Engineering , Murthy V.N.S. 4th Edition, UBS Publishers and Distributors, New Age International Pvt Ltd Publishers |



3	Geotechnical Engineering , C. Venkatramaiah , 3rd edition , New Age International Pvt Ltd Publishers, New Delhi.
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Reference Books :	
1	Foundation Analysis and Design , Bowles J.E. 5th Edition, McGraw Hill Pub. Co. New York.
2	Basic and Applied Soil Mechanics , Gopal Ranjan and Rao A.S.R., New Age International (P) Ltd., New Delhi.
3	Soil Mechanics and Foundation Engineering , K R Arora, STANDARD PUBLISHER DIST, New Delhi.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of chemistry & Geology to distinguish structural arrangements of soils. [PO1, PSO1]
2. Examine and evaluate index properties of soils [PO2, PSO2]
3. Implement compaction and consolidation characteristics of ground modification for sustainable developments [PO7, PSO3]
4. Examine and evaluate the shear strength of soil. [PO2, PSO2]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
1	Apply the knowledge of chemistry & Geology to distinguish structural Arrangements of soils.	2															2		
2	Examine and evaluate index properties of soils		3														3		
3	Implement compaction and consolidation characteristics of ground modification for sustainable developments.							3										2	
4	Examine and evaluate the shear strength of soil		2														2		



Course Title : Advanced Design of RC Structures			
Course Code : P18CV63	Semester : VI	L-T-P : H : 4-0-0:04	Credits :04
Contact Period : 52Hrs	Exam Hours : 3 Hrs	Weight age : CIE : 50 , SEE 50:	
Prerequisites : Design of RC Structural Elements			

<u>Course Learning Objectives (CLO's)</u>	
1	Understand, analyse and design reinforced concrete grid floors and yield line analysis of slabs.
2	Understand, analyse and design reinforced concrete flat slabs.
3	Understand, analyse and design reinforced circular overhead water tank.
4	Understand, analyze and design reinforced concrete Silo and roof shells.

<u>Course content</u>	
UNIT –I	
Design of grid floors: Introduction, Analysis of the Slabs for Moment and Shears by Rankine’s method and Design of floors. Yield line analysis of slabs: Introduction, characteristics, analysis of slabs by Equilibrium method and design for shear and deflection.	
12 Hrs	
Self Study Component: Location, advantages and disadvantages of yield line, sign conventions, yield line patterns.	
UNIT -II	
Design of flat slabs: Introduction, Proportioning of flat slab, Direct design method- Limitations of Direct design method, Distribution of moments in column strips and middle strip- Shear in Flat slabs. Analysis and design of flat slab with and without drop and column head (interior panel).	
16 Hrs	
Self Study Component: Analysis of exterior panel of flat slab.	
UNIT -III	
Design of RCC overhead circular water tanks –Introduction, design requirements as per IS:1343, Analysis and Design of top dome, top ring beam, side walls of water tank and bottom slab with bottom ring beam at the outer periphery only.	
12 Hrs	
Self Study Component : Analysis of bottom ring beam	
UNIT -IV	
Design of silos: Design of silos with circular cross sections using Janssen’s method and Airy’s method.	
12 Hrs	



Self Study Component : Different types of shells, their forms and structural behavior

Text Books :

1	Advanced Reinforced Concrete Design , Krishnaraju N., CBI Publishers, New Delhi
2	Advance R.C.C. Design , S.S.Bhavikatti ., NEW AGE Publishers, New Delhi
3	Limit State Design of Reinforced Concrete , B.C. Punmia, Ashok Kumar Jain & Arun kumar Jain, Laxmi Publication, New Delhi, India.

Reference Books :

1	Reinforced Concrete Design , Unnikrishna Pillai and Devadas Menon, Tata McGraw Hill Publishing Company Limited, New Delhi.
2	Reinforced Concrete Structures , Shah H.J., Charotar Publishers, Anand.
3	BIS codes , IS: 456:2000, IS:3370, IS:4995, IS:2210.
4	SP16:1980 , Design Aids for Reinforced Concrete to IS: 456-1978, Bureau of Indian Standards, New Delhi, 1992

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Analyze, design and to prepare detailing of grid floors and yield line analysis of slabs in line with IS codal provisions. [PO1,PO3,PO4,PO8,PO12,PSO1,PSO12]
2. Analyze, design and to prepare detailing of flat slabs in line with IS codal provisions. [PO1,PO3,PO4,PO8,PO12,PSO1,PSO12]
3. Analyze, design and to prepare detailing of overhead circular water tanks in line with IS codal provisions. [PO1,PO3,PO4,PO8,PO12,PSO1,PSO12]
4. Distinguish between Janssen's theory and Airy's theory, application of the theory in the Design of silos and analysis of shell roofs in line with IS codal provisions. [PO1,PO3,PO4,PO8,PO12,PSO1,PSO12]



Course Articulation Matrix (CAM)

Sl.No.	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Analyze, design and to prepare detailing of grid floors and yield line analysis of slabs in line with IS codal provisions.	2		2	1				2				1	1	2	
2	Analyze, design and to prepare detailing of flat slabs in line with IS codal provisions.	2		2	1				2				1	1	2	
3	Analyze, design and to prepare detailing of overhead circular water tanks in line with IS codal provisions.	2		2	1				2				1	1	2	
4	Distinguish between Janssen's theory and Airy's theory, application of the theory in the Design of silos and analysis of shell roofs in line with IS codal provisions.	2		2	1				2				1	1	2	



Professional Elective -II			
Course Title : Alternative Building Materials and Masonry Structures			
Course Code : P18CV641	Semester : VI	L-T-P : H :2-2-0: 4	Credits :3
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age:CIE:50%,SEE: 50%	
Prerequisites : NIL			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Know the significance of Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, and Environmental friendly and cost effective building technologies.
2	Study the characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks.
3	Study the possible causes of defects in masonry, factors affecting strength of masonry, and permissible stresses in masonry
4	Design masonry buildings up to three floors, for both axial and eccentric load as per IS codes

<u>Course content</u>	
UNIT –I	
Introduction: Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods and vernacular architecture	
Energy calculations: Embodied energy calculation for concrete.	
10 Hrs	
Self Study Component: Basics for the Assessment of Embodied Energy and Embodied GHG Emissions for Building Construction.	
UNIT –II	
Alternative Building Materials: Characteristics of building blocks for walls, Stones and Laterite blocks and hollow clay blocks, Concrete blocks, Stabilized mud blocks, Steam cured blocks, Fal-G Blocks stone masonry block.	
Lime-pozzolana cements: Raw materials, Manufacturing process, Properties and uses, Fibre reinforced cement composite: Matrix materials, reinforcing materials : metallic, polymeric, mineral and natural fibers, Properties and applications,	
Building materials from agro waste, Types of agro wastes and Industrial wastes, properties and applications	
10 Hrs	
Self Study Component : Fibre reinforced polymer composites: Matrix materials, Fibers,	



Properties and applications
UNIT -III
Alternative Building Technologies: Alternative for wall construction, Types, Construction method. Masonry mortars: introduction, Cementitious materials, sand, types of mortar, Properties and requirements of mortar, selection of mortar. Ferro cement and ferro concrete: Materials and specifications, Properties, Construction methods, durability and applications. Alternative roofing systems, Concepts, Filler slabs, Composite beam panel roofs
10 Hrs
Self Study Component : Ferroconcrete
UNIT -IV
STRENGTH AND STABILITY: Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. PERMISSIBLE STRESSES: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.
10 Hrs
Self Study Component : strength formulae
UNIT -V
Design and Load considerations for masonry: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, design of load bearing masonry for building up to 3 storey's using IS : 1905 and SP : 20 procedure. Load considerations: Wall carrying axial load, eccentric loaded elements with different eccentricity ratios, walls with openings, free standing wall, Application.
12 Hrs
Self Study Component: Arching action, lintels and load dispersion. Composite wall-beam elements and infilled frames.

Text Books :	
1	Alternative Building Materials and Technologies , Jagadish.K.S, Venkatarama Reddy.B.V and Nanjunda Rao.K.S. New Age Int. Pub. New Delhi (Ch.1 to 8)
2	Structural Masonry , Hendry A.W., 2nd Ed., Palgrave Macmillan Publishers, (Ch.7 & 8)
3	Brick and Reinforced Brick Structures , Dayaratnam P, Oxford & IBH
Reference Books :	
1	“Proceedings of workshop on Alternative Building Material and Technology” 19th – 20th Dec 2003 @ BVB College of Engineering & Tech, Hubli.(Ch.3,4 & 5)
2	Relevant BIS codes , IS 2250 : 1985, IS 3466 : 1999, IS 4098 : 1999, IS 2116 :1998, IS 1095 : 1998
3	Design of Reinforced and Prestressed Masonry , Curtin, - Thomas Telford

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

After learning all the units of the course, the student is able to

1. Understand significance of Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry.[PO1,PO7]
2. Understand the characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks.[PO1,PO7]
3. Study the possible causes of defects in masonry, factors affecting strength of masonry, and permissible stresses in masonry.[PO2,PO4,PO7,PO12]
4. Design masonry buildings up to three floors, design of walls subject to both axial and eccentric load as per IS relevant codes.[PO3,PSO1,PSO2,PSO3]

Course Articulation Matrix (CAM)

Sl. no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Understand significance of Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry	3						2								
2	Understand the characteristics of building blocks for walls, Stones and Laterite blocks, Bricks and hollow clay blocks	3						2								
3	Study the possible causes of defects in masonry, factors affecting strength of masonry, and permissible stresses in masonry.		3		2			2					2			
4	Design masonry buildings up to three floors, design of walls subject to both axial and eccentric load as per IS relevant codes			3										2	2	2



Professional Elective -II			
Course Title : Reinforced Earth Structures			
Course Code : P18CV642	Semester : VI	L-T-P : H : 2-2-0 :04	Credits : 3
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age : CIE : 50 , SEE : 50	
Prerequisites : Basics Geotechnical engineering and Applied Geotechnical engineering			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Create an understanding of the latest technique such as reinforcing the soil.
2	Analyze the concept of RE so as to ascertain stability of RE structures
3	Understand the different reinforcing materials that can be used efficiently in soils.
4	Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed

<u>Course content</u>	
UNIT -I	
Basics of Reinforced Earth Construction: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.	
Geosynthetics and Their Functions: Historical developments, Recent developments, manufacturing process woven & non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics. Properties and Tests on Materials Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements.	
12 Hrs	
Self Study Component : Testing & Evaluation of properties of Geosynthetics.	
UNIT -II	
Design of Reinforced Earth Retaining Walls: Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems	
Soil Nailing Techniques: Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system,	
10 Hrs	
Self Study Component: Design aspects and precautions to be taken for Reinforced earth retaining wall.	
UNIT -III	
Design of Reinforced Earth Foundations: Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.	
10 Hrs	
Self Study Component : Modes of failure of foundation	



UNIT -IV	
Geosynthetics for Roads and Slopes: Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes	
10 Hrs	
Self Study Component: Causes for slope failure.	
UNIT -V	
GEOSYNTHETICS - FILTER, DRAIN AND LANDFILLS: Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, properties, Design criteria – soil retention, Geosynthetic permeability, anticlogging, survivability and durability (No Numerical Problems) Landfills – Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems)	
10 Hrs	
Self Study Component: Drain and filter.	

Text Books :	
1	Design with Geosynthetics , Koerner. R.M, Prince Hall Publications
2	Construction and Geotechnical Engineering using synthetic fabrics ,Koerner. R.M. & Wesh, J.P, Wiley Inter Science, New York,
3	An introduction to Soil Reinforcement and Geosynthetics , Sivakumar Babu G. L Universities Press, Hyderabad
4	Reinforced Soil and its Engineering Applications , Swami Saran, I. K. International Pvt. Ltd, New Delhi
5	Engineering with Geosynthetics , Venkattappa Rao, G., & Suryanarayana Raju., G. V.S, Tata McGraw Hill publishing Company Limited., New Delhi.

Reference Books :	
1	Earth reinforcement and Soil structure ,Jones, CJEP Butterworths, London
2	Geotextile Hand Book , Ingold, T.S. & Millar, K.S, Thomas, Telford, London
3	Earth Reinforcement Practices , Hidetoshi Octial, Shigenori Hayshi & Jen Otani, Vol. I, A.A. Balkema, Rotterdam
4	Ground Engineer's reference Book , Bell F.G, Butterworths, London
5	Reinforced Earth , Ingold, T.S, Thomas, Telford, London.
6	Geosynthetics in Civil Engineering , Sarsby R W- Editor, Woodhead Publishing Ltd & CRC Press, 2007

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

After learning all the units of the course, the student is able to

1. Identify, formulate reinforced earth techniques that are suitable for different soils and in different structures.[PO1,PO2,PSO1,PSO2]
2. Understand the laboratory testing concepts of Geosynthetics.[PO1,PO2,PO3,PSO1,PSO2]
3. Design RE retaining structures and Soil Nailing concepts. [PO1,PO2,PO3,PSO1,PSO2]
4. Determine the load carrying capacity of Foundations resting on RE soil bed. [PO1,PO2,PSO1,PSO2]
5. Asses the use of Geosynthetics in drainage requirements and landfill designs.[PO2,PO3,PSO1,PSO2]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
1	Identify, formulate reinforced earth techniques that are suitable for different soils and in different structures	1	2													1	2	
2	understand the laboratory testing concepts of Geosynthetics.	1	2	1												1	2	
3	design RE retaining structures and Soil Nailing concepts.	1	2	1												1	1	
4	Determine the load carrying capacity of Foundations resting on RE soil bed.	1	2													1	2	
5	Asses the use of Geosynthetics in drainage requirements and landfill designs		1	2												1	1	



Professional Elective -II			
Course Title : SOLID WASTE MANAGEMENT			
Course Code: P18CV643	Semester: VI	L–T–P– H : 2– 2 – 0 : 04	Credits: 03
Contact Period : 52 Hrs	Exam Hours : 3 Hrs	Weight age :CIE:50%,SEE: 50%	
Prerequisites: Waste water management.			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	To understand material flow and different elements of solid waste management from generation of solid waste to disposal.
2	To Study the different methods of solid waste management system in par with statutory rules.
3	To Analyze different processing technologies of conversion of municipal solid waste to compost or biogas.
4	To Evaluate landfill site and to study the sanitary landfill reactions.

<u>Course content</u>	
UNIT –I	
INTRODUCTION: Definition, scope and importance of solid waste management, Material flow and waste generation functional elements of solid waste management. Sources: Classification and characteristics – Municipal, commercial & industrial, Methods of quantification.	
12 Hrs	
Self Study Component: Types of Solid waste and factor affecting generation rates.	
UNIT –II	
COLLECTION AND TRANSPORTATION: Systems of collection, collection equipment, transfer stations – bailing and compacting, route optimization techniques and problems on moisture content and Energy content. TREATMENT / PROCESSING TECHNIQUES: Components separation, volume reduction, size reduction	
10 Hrs	
Self Study Component: Chemical reduction and biological processing.	
UNIT -III	
INCINERATION: Process – 3 T's, factors affecting incineration process, incinerators – pyrolysis, design criteria for incineration. COMPOSTING: Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore composting methods, mechanical and semi mechanical composting processes, Vermi-composting.	
10 Hrs	
Self Study Component: Prevention of air pollution due to incinerators.	



UNIT –IV
SANITARY LAND FILLING: Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, leachate & gas collection and control methods.
10 Hrs
Self Study Component: Prevention of land pollution, geosynthetic fabric and lining in sanitary landfill.
UNIT –V
DISPOSAL METHODS: Land pollution due to Open dumping – selection of site, ocean disposal, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, biomedical wastes. RECYCLE AND REUSE: Material and energy recovery operations, plastic wastes, environmental significance and reuse.
10 Hrs
Self Study Component: Ploughing into fields, feeding to hogs and reuse of material in other industry.

Text Books :	
1	Integrated Solid Waste Management: Tchobanoglous: M/c GrawHill.
2	Solid Waste Management in developing countries. Bhide and Sunderashan, Indian National Scientific, Documentation Centre.

Reference Books :	
1	Hand book on Solid Waste Disposal.: Pavoni J.L., Published by Van Nost. Reinhold,1975.
2	Environmental Engineering, Howard S. Peavy, George Tchobanoglous and Donald R. Rowe's Environmental Engineering, published by Tata McGraw-Hill Education Donald R. Rowe's Environmental Engineering, published by Tata McGraw-Hill Education.
3	Environmental Engineering – Vol II: S.K. Garg, Khanna publishers.

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

Student will be able to,

1. Understand the importance, source, classification of solid waste [PO2,PSO1]
2. Learn different methods of collection, transportation and management of solid waste [PO2, PO3, PO4, PSO1]
3. Learn different methods of treatment of solid waste like incineration composing, sanitary land filling and design of sanitary land fill. [PO1, PO3,PSO1]
4. Learn different disposal methods of solid waste, recycling and reusing of solid waste. [PO2,PSO2]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Understand the importance, source, classification of solid waste.		2											2		
02	Learn different methods of collection, transportation and management of solid waste.		1	2	2									2		
03	Learn different methods of treatment of solid waste like incineration composing, sanitary land filling and design of sanitary landfill.	1		3										2		
04	Learn different disposal methods of solid waste, recycling and reusing of solid waste.		2												2	



Professional Elective -II			
Course Title : TRAFFIC ENGINEERING			
Course Code : P18CV644	Semester : VI	L-T-P : H : 2-2-0: 4	Credits : 03
Contact Period : 52 Hrs	Exam Hours : 03 Hrs	Weight age : CIE : 50% , SEE : 50%	
Prerequisites: Transportation Engineering.			

Course Learning Objectives (CLO's)	
This Course aims to,	
1	Understand fundamental knowledge of traffic engineering, scope and its importance.
2	Describe basic techniques for collecting and analyzing traffic data, diagnosing problems, designing appropriate remedial treatment.
3	Under the concept of traffic signal design and importance of pedestrian facilities
4	Understand and analyse the effect of traffic on environment and remedial measures.
5	Apply intelligent transport system and its applications in the present traffic scenario and traffic management techniques.

Course content	
UNIT -I	
Traffic Planning and Characteristics: Definition and scope of traffic engineering, Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India and remedies, Sustainable approach- land use and transport.	
10 Hrs	
Self Study Component: Integrated planning, modal integration.	
UNIT -II	
Traffic Surveys: Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Level of service-Concept.	
12 Hrs	
Self Study Component: Statistical applications in traffic studies and traffic forecasting.	
UNIT -III	
Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS, Significant roles of traffic control personnel, Networking pedestrian facilities and cycle tracks, road side development.	
10 Hrs	
Self Study Component: Road markings, Design of bus bay.	



UNIT -IV	
Traffic Safety and Environment: Road accidents: Causes, effect, prevention and cost; Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.	
10 Hrs	
<i>Self Study Component:</i> Street lighting.	
UNIT -V	
Traffic Management: Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.	
10 Hrs	
<i>Self Study Component:</i> Congestion and parking pricing.	

Text Books :	
1	Traffic Engineering and Transport Planning , Kadiyali. L.R. Khanna Publishers, Delhi.
2	Highway Engineering , – S.K. Khanna, C.E.G Justo, and A.Veeraragavan, Nem Chand and Bros, Roorkee, Revised 10th Edition.
3	Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management
4	Highway Traffic Analysis and design , Salter. R.I and Hounsell N.B, “Macmillan PressLtd..

Reference Books :	
1	Principles of Highway Engineering and Traffic Analysis , Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, Wiley India Pvt. Ltd., New Delhi.
2	Principles of Traffic and Highway Engineering , Garber and Hoel, “CENGAGE Learning, New Delhi.
3	Guidelines on Low-cost Traffic Management Techniques , SP: 43-1994, IRC Specification, for Urban Areas.
4	Traffic Management Planning, Operations and control , John E Tyworth, “Addison Wesley Publishing Company.
5	Traffic Planning and Engineering , Hobbs. F. D.,University of Brimingham, Peragamon Press Ltd.

Note: Self study is for 5 marks only in CIE and not in SEE



Course Outcomes

After learning all the units of the course, the student is able to

1. Understand the human factors and vehicular factors in traffic engineering design. [PO1, PO7, PSO1]
2. Conduct different types of traffic surveys and analysis of collected data. [PO3, PO4, PSO2]
3. Understand the concept of traffic signal design and influence of traffic on environment. [PO3, PO7, PSO2]
4. Understand the basic knowledge of transportation management and ITS.[PO4, PO5, PO11,PSO3]

Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)			
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	Understand the human factors and vehicular factors in traffic engineering design	1						2							1		
2	Conduct different types of traffic surveys and analysis of collected data			1	2											1	
3	Understand the concept of traffic signal design and influence of traffic on environment			2				1								2	
4	Understand the basic knowledge of transportation management and ITS.				2	2							2				2



Open Elective -I			
Course Title : BUILDING SCIENCE AND ENGINEERING			
Course Code : P18CVO651	Semester : VI	L-T-P : H : 3-0-0: 3	Credits : 03
Contact Period : 52 Hrs	Exam Hours : 03 Hrs	Weight age : CIE : 50% , SEE : 50%	
Prerequisites : NIL			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Understand the basic materials in civil engineering
2	Analyse the types of foundation, have an insight to different types of doors, windows
3	Gain the knowledge of bylaws for the planning of a public/private building
4	Understand the different methods and materials of interiors for building
5	Understand the concept of landscaping

<u>Course content</u>	
UNIT -I	
MATERIALS FOR CONSTRUCTION: Cement concrete: introduction, ingredients of cement, grade of concrete, properties. Steel :definition , types of steel, uses of steel, market forms of steel used in construction Doors and windows : location of doors and windows, types of doors, types of windows, Stairs : requirements of good stairs.	
12 Hrs	
<i>Self Study Component:</i> Types of stairs.	
UNIT -II	
FOUNDATION AND STRUCTURAL MEMBERS: selection of site, substructure, objectives of foundation, site inspection, soils, loads on foundations, essential requirements of good foundation, types of foundation, failure of foundation and remedial measures. Structural members: columns, lintels, roofing (flat roof and sloped roof), flooring (types of floors and floor covering), damp proofing.	
10 Hrs	
<i>Self Study Component:</i> Painting and Varnish	
UNIT -III	
BUILDING PLANNING AND MAINTAINENCE: plan, section and elevation .Introduction, classification of buildings, components of buildings, building By-Laws, orientation of buildings, ventilation, acoustic requirements, Super structure: introduction, brick masonry, stone masonry and R.C.C. Building maintenance Deterioration of concrete, deterioration of masonry works, prevention of cracks and leaks, cost effective construction	
10 Hrs	
<i>Self Study Component:</i> Anti termite treatment in building	



UNIT -IV	
INTERIOR DESIGN: Functional requirement of interior designer, basic elements of interior design, design problems :Interior design for spacious rooms, comfortable rooms, theme rooms, living area, cooking area, drinking area dining area, home offices, sleeping area.	
10 Hrs	
<i>Self Study Component:</i> Interior design for bathrooms, public/private buildings	
UNIT -V	
LANDSCAPING: Elements of Landscape architecture, specialization in landscape, landscape products, landscape materials, design guidelines for interior landscape.	
10 Hrs	
<i>Self Study Component:</i> Water efficient landscaping	

Text Books :	
1	Basic civil engineering: M.S.palanichamy fourth edition Tata mcgraw hill limited.
2	Basic civil engineering: sateesh gopi, Pearson.

Reference Books :	
1	Basic civil engineering : Dr.B.C.Punmia, Ashok kumar jain, Arun kumar jain Laxmi publications year of publication.
2	Basic civil engineering : S.S.Bhavikatti New Age International Limited.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes:

1. Apply the knowledge of engineering fundamentals to understand, the characteristics of basic civil engineering materials. [PO1, PSO1]
2. Apply the knowledge of engineering fundamentals and analyze the types of foundation.[PO2, PSO2]
3. Develop plan, section and apply bylaws and investigate causes and remedies for cracks, have an insight to cost effective construction.[PO1, PO2, PO3, PO4, PO6, PO8, PO10, PSO2]
4. Understand, design and work in a team and develop the interiors and landscaping for buildings as per design guidelines.[PO3, PO6, PO9, PO11]



Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of engineering fundamentals to understand, the characteristics of basic civil engineering materials	3												1		
2	Apply the knowledge of engineering fundamentals and analyze the types of foundation		1												1	
3	Develop plan, section and apply bylaws and investigate causes and remedies for cracks , have an insight to cost effective construction	1	2			1		2		1			1		1	
4	Understand, design and work in a team and develop the interiors and landscaping for buildings as per design guidelines.			2		2			1			1				



Open Elective -I			
Course Title : BASIC TRANSPORTATION ENGINEERING			
Course Code : P18CVO652	Semester: VI	L-T-P : H : 3-0-0: 3	Credits : 03
Contact Period : 52 Hrs	Exam Hours : 03 Hrs	Weightage: CIE: 50% ; SEE : 50%	
Prerequisites : NIL			

<u>Course Learning Objectives (CLO's)</u>	
This Course aims to,	
1	Understand the knowledge of different modes of transportation and its importance
2	Understand the importance of Highway cross elements and different types of pavements.
3	Understand the importance of Railway components and its role.
4	Understand the importance of Airport engineering and components of harbor.
5	Understand the basic concept of advance transportation system and role of public transport.

<u>Course content</u>	
UNIT -I	
Introduction: Importance of transportation, Different modes of transportation and comparison, Characteristics of road transport, Jayakar committee recommendations and implementation – Central Road Fund, Indian Roads Congress, Central Road Research Institute, Classification of roads as per Nagpur road plan, Scope of highway engineering.	
10 Hrs	
Self Study Component: KSHIP and KRIDL	
UNIT -II	
Highway Engineering: Ideal Alignment, Factors affecting the alignment, obligatory points, Importance of geometric design, design control and criteria, highway cross section elements - cross slope or camber, medians, carriageway, kerbs, road margins, cross section details, Object of highway pavements, requirements of highway pavements, types of pavement structures and comparisons & their limitations, flexible/rigid pavements – components and their functions.	
10 Hrs	
Self Study Component : Road patterns, NHDP & PMGSY	
UNIT -III	
Railway Engineering: Permanent Way, Requirements of an ideal permanent way, Gauges in Railway Track, Selection of Gauges, Functions of Rails, Requirements, Types of Rail Sections, Rail Joints, Requirements, types of joints, Welding of Rails, Sleepers-function and requirements, Classification of Sleepers, Spacing of Sleepers and Sleeper Density, Ballast- Functions, requirements and types.	
12 Hrs	
Self Study Component: Comparison of Different types of sleepers, Comparison of Rail sections.	



UNIT -IV	
Airport Engineering: Introduction to airport engineering, Airport site selection Runway Design - Orientation of runway by using wind rose diagram - Basic runway length, Corrections for Elevation, Temperature and Gradient to runway length by ICAO and FAA specification - runway cross sections problems on above.	
Harbors Engineering: Introductions, classifications, natural phenomenon affecting the design of harbor viz. wind, wave, tide and currents. Harbor layout with component parts.	
10 Hrs	
<i>Self Study Component :</i> Regional planning, exit taxiway	
UNIT -V	
Advanced Transportation System: Introduction to ITS- definition, objectives, benefits and historical background, data collection techniques employed in ITS, Promotion and integration of public transportation, Promotion of non-motorized transport, role of metro rail.	
10 Hrs	
<i>Self Study Component:</i> Fly bus technology, MAGLEV Train technology.	

Text Books :	
1	Highway Engineering , – S.K. Khanna, C.E.G Justo, and A.Veeraragavan, Nem Chand and Bros, Roorkee, Revised 10th Edition.
2	Railway Engineering , - Saxena and Arora, Dhanpat Rai and Sons, New Delhi.
3	Airport Planning and Design , Khanna, Arora and Jain – Nemchand Roorkee.
4	Dock & Tunnel Engineering , Srinivasan R Harbour, Charotar Publishing House.

Reference Books :	
1	Highway Engineering , Kadiyali, L.R., Khanna Publishers, New Delhi
2	Railway Engineering , Satish Chandra and Agarwal, M.M., Oxford University Press, New Delhi

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of science and engineering to acquire the fundamentals of basic modes of transportation (PO1, PO12, PSO1)
2. Study of different cross section elements of highway and different types of pavements (PO1, PO2, PO12, PSO2)
3. Identify different components of railway track, design of airport runway and to understand the components of harbor (PO1, PO4, PO12, PSO2)
4. To understand the advanced developments in transportation systems (PO4, PO12, PSO3)



Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Apply the knowledge of science and engineering to acquire the fundamentals of basic modes of transportation.	1											2	1		
2	Study of different cross section elements of highway and different types of pavements.	3	3										2		2	
3	Identify different components of railway track; design of airport runway and to understand the components of harbor.	2			2								2		2	
4	To understand the advanced developments in transportation systems.				1								2			2



Open Elective -I			
Course Title : OCCUPATIONAL HEALTH AND SAFETY			
Course Code : P18CVO653	Semester : VI	L-T-P : H : 3-0-0: 03	Credits : 03
Contact Period : 52 Hrs	Exam Hours : 03 Hrs	Weight age : CIE : 50% , SEE : 50%	
Prerequisites : NIL			

<u>Course learning objectives (CLO's)</u>	
This course aims to,	
1	Gain an historical, economic, and organizational perspective of occupational safety and health.
2	Investigate current occupational safety and health problems and solutions.
3	Identify the forces that influence occupational safety and health.
4	Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

<u>Course content</u>	
UNIT -I	
Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan.	
10 Hrs	
Self-Study Component: Methods of acquiring accident facts, Supervisory role in accident investigation.	
UNIT -II	
Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis.	
12 Hrs	
Self-Study Component: Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.	
UNIT -III	
Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.	
10 Hrs	
Self-Study Component: Electrical Safety, Product Safety: Technical Requirements of Product safety.	
UNIT -IV	
Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and	



advantages, effects of exposure and treatment for engineering industries, municipal solid waste.
10 Hrs
Self-Study Component: Environment management plans (EMP) for safety and sustainability
UNIT -V
Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites.
10 Hrs
Self-Study Component: Policies, roles and responsibilities of workers, managers and supervisors

Text Books :	
1	Goetsch D.L., (1999), “Occupational Safety and Health for Technologists, Engineers and Managers”, Prentice Hall.
2	Heinrich H.W., (2007), “Industrial Accident Prevention - A Scientific Approach”, McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),
3	“Industrial Safety and Pollution Control Handbook

Reference Books :	
1	Colling D.A., (1990), “Industrial Safety Management and Technology”, Prentice Hall, New Delhi.
2	Della D.E., and Giustina, (1996), “Safety and Environmental Management”, Van Nostrand Reinhold International Thomson Publishing Inc.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.[PO1,PO7,PO8]
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.[PO1,PO6]
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.[PO6,PO7,PO9,PO12]
4. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.[PO1,PO7,PO8,PSO2]



Course Articulation Matrix (CAM)

Sl.no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.	2						2	2							
2	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard	2					2									
3	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.						2	2		2			2			
4	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.	2						2	2						2	



Course Title : GEOTECHNICAL ENGINEERING LABORATORY			
Course Code: P18CVL66	Semester: VI	L-T-P : H : 0-0-3: 03	Credits : 1.5
Contact Period : 39 Hrs	Exam Hours : 03 Hrs	Weightage: CIE: 50% ; SEE : 50%	
Prerequisites: Geotechnical Engineering.			

Course Learning Objectives (CLO's)	
This Course aims to,	
1	Determine the specific gravity of different types of soil using density bottle and pycnometer method. Determine moisture content present in the soil by different methods.
2	Classify the soil as per IS classification by sieve analysis. Determine the density of soil in the field by core cutter and sand replacement method.
3	Determine maximum dry density and optimum moisture content of soil by light and heavy compaction test.
4	Calculate the co-efficient of permeability of soil by constant and variable head method. Calculate the shear parameters, major and minor principal stress of soil by direct shear test.
5	Calculate the unconfined compressive strength and cohesion of the soil by unconfined compression test

LIST OF EXPERIMENTS TO BE CONDUCTED:

1.	Tests for determination of specific gravity and moisture content	3 Hrs
2.	Grain size analysis of soil sample (sieve analysis)	3 Hrs
3.	In situ density by core cutter and sand replacement methods.	3 Hrs
4	Consistency Limits – Liquid Limit (Casagrande and cone penetration method), plastic limit and shrinkage limit	3 Hrs
5.	IS Light Compaction Test and IS Heavy Compaction Test	3 Hrs
6.	Coefficient of permeability by constant head and variable head methods	3 Hrs
7.	Strength Test	
a.	Unconfined Compression Test	3 Hrs
b.	Direct Shear Test	3 Hrs
c.	Triaxial Compression Test (Unconsolidated & Untrained)	3 Hrs
8.	Consolidation Test – Determination of compression index and coefficient of consolidation	3 Hrs
9.	Laboratory vane shear test	2 Hrs
10.	Determination of free Swell index of soils	2 Hrs
11.	Demonstration of miscellaneous equipment such as Augers, Samplers, Rapid Moisture meter, Proctor's needle	
a.	Demonstration of Hydrometer Test	2Hrs
b.	Demonstration of Swelling Pressure	2Hrs
c.	Demonstration of determination of relative density of sands	1Hrs



Reference Books :	
1	Soil Testing for Engineers – Lambe T.W., - Wiley Eastern Ltd., NewDelhi.
2	Manual of Soil Laboratory Testing–Head K.H.,(1986)–Vol I, II, III, Princeton Press, London
3	Engineering Properties of Soil and Their Measurements – Bowles J.E (1988), - Mc Graw Hill Book Co. NewYork.
4	BIS CODES of Practice: IS 2720 (Part-3/sec.1) – 1987; IS 2720 (Part-2)-1973; IS 2720 (Part – 4)-1985; IS 2720 (Part – 5)-1985; IS 2720 (Part-6) – 1972; IS 2720 (Part – 7) - 1980; IS 2720 (Part -8)-1983; IS 2720(Part -17) – 1986; IS 2720 (Part -10)- 1973; IS 2720 (Part-13)-1986; IS 2720 (Part-11)-1971; IS 2720 (Part -15)-1986; IS 2720 (Part30)- 1987

Course outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of Geotechnical engineering to evaluate index properties of soils.[PO1,PSO1]
2. Conduct shear test, permeability test and consolidation test to evaluate various soil parameters. [PO2,PSO2]
3. Carryout investigations on different soils to provide sustainable solutions for design of foundations.[PO3,PSO2]
4. Interpret permeability data for seepage analysis, shear strength data for evaluate bearing capacity and consolidation data for settlement analysis.[PO4,PSO2]

Course Articulation Matrix (CAM)

Sl. no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
1	Apply the knowledge of Geotechnical engineering to evaluate index properties of soils	2															2		
2	Conduct shear test, permeability test and consolidation test to evaluate various soil parameters		2															3	
3	Carryout investigations on different soils to provide sustainable solutions for design of foundations			3														2	
4	Interpret permeability data for seepage analysis, shear strength data for evaluate bearing capacity and consolidation data for settlement analysis.				2													2	



Course Title : EXTENSIVE SURVEY			
Course Code: P18CVL67	Semester: VI	L-T-P : H : 0-0-03: 03	Credits : 1.5
Contact Period : 39 Hrs	Exam Hours : 03 Hrs	Weightage: CIE:50%;SEE : 50%	
Prerequisites : Basic surveying, Hydrology and irrigation Engineering, Transportation Engineering			

Course Learning Objectives (CLO's)	
This Course aims to,	
1	Gain skills to handle conventional & modern surveying equipments for location of objects and setting outworks.
2	Learn how to Capture data, interpret and analyze data to prepare drawings and reports of engineering projects like water supply, highway and irrigation.
3	Understand the technical difficulties at site and managerial skills to tackling them in completing the assigned survey work.
4	Function as a team member imparting networking, communicating effectively in gaining lifelong learning process.

Course content	
UNIT –I	
i)	General instructions, reconnaissance of sites and fly leveling to establish benchmarks. 03 Hrs
1.	NEW TANK PROJECTS: The work shall consist of i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the centerline. ii) Capacity surveys. iii) Details at Waste weir and sluice points. iv) Canal alignment. 10 Hrs
2.	RESTORATION OF OLD TANK PROJECTS: The work shall consist of i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the centerline. ii) Capacity surveys. iii) Details at Waste weir and sluice points. 09 Hrs



Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

3. **WATER SUPPLY AND SANITARY PROJECT:** Examination of sources of water supply, Calculation of quantity of water based on existing and projected population. Preparation of village map by any suitable methods of surveying (like plane tabling). Location of sites for ground level and overhead tanks, underground drainage system surveys for laying the sewers.

09 Hrs

4. **HIGHWAY PROJECT:** Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) 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.

08 Hrs

Note:

- i) All projects should be conducted in field using Total station and plotting should be done using E- survey software.
- ii) All drawings should be plotted by using Auto Cad software.

Course outcomes

After learning all the units of the course, the student is able to

1. Apply skills to handle conventional & modern surveying equipments for location of objects and setting out works [PO1,PO5,PSO2,PSO3]
2. Capture data, interpret and analyze data to prepare drawings and reports of engineering projects like water supply, highway and irrigation.[PO2, PO4, PSO2, PSO3]
3. Understand the technical difficulties at site and managerial skills to tackling them in completing the assigned survey work[PO9, PO11, PSO1]
4. Function as a team member imparting networking, communicating effectively in gaining lifelong learning process.[PO9, PO10, PO12, PSO2]



Course Articulation Matrix (CAM)

Sl. no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)					
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			
1	Apply skills to handle conventional & modern surveying equipments for location of objects and setting out works	2				3												2	1
2	Capture data, interpret and analyze data to prepare drawings and reports of engineering projects like water supply, highway and irrigation.		2		2													2	2
3	Understand the technical difficulties at site and managerial skills to tackling them in completing the assigned survey work									2		2					2		
4	Function as a team Member imparting networking, communicating effectively in gaining lifelong learning process.									2	2			1				2	



Course Title :Skill Oriented Laboratory – II (Competence in Project Management & Mapping, Spatial analysis in Hydrology)			
Course Code : P18CVL68	Semester : VI	L-T-P : H : 0-0-2 :02	Credits : 01
Contact Period : 26 Hrs	Exam Hours : 3Hrs	Weight age : CIE : 50 , SEE : 50	
Prerequisites: Construction Management, Knowledge of Hydrology.			

Course Learning Objectives (CLO's)	
This Course aims to,	
1	Use industry standard software in a professional set up.
2	Create WBS, Activities, and tasks and Computation Time using Excel and transferring the same to Project management software.
3	Understand the basic concept of Resource Creation and allocation
4	Learn to generate various thematic maps.
5	Calculate area of catchment, length of river, longest flow path of various catchments.

Course content	
PART-A	
Project Management- Exercise on Project planning and scheduling of a building project using relevent software: a. Understanding basic features of Project management software. b. Constructing Project: Create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software. c. Identification of Predecessor and Successor activities with constraint. d. Constructing Network diagram and analyzing for Critical path, Critical activities and Project duration. e. Basic understanding about Resource Creation and allocation.	
16 Hrs	
Self Study Component: Understanding about Splitting the activity, Linking multiple activities, Creating Baseline Project.	
PART-B	
Arc GIS a. Introduction to software, coordinate system, download DEM from various websites. b. Mosaicking of DEM. c. Edit features. d. Map generation with patterns and legends. e. Terrain analysis (Development of slope, hill shade map, contour map). f. Catchment delineation using arc hydro tool with calculation of area of catchment, length of river, longest flow path of river using attribute table.	
10 Hrs	
Self Study Component: Export shape file from Arc GIS application software to google earth.	



Text books:	
1	Construction Engineering and Management by S. Seetharaman, Umesh publications, New Delhi
2	Lillisand T.M and Kiefer R.W., Remote sensing and image Interpretation, John Wiley and sons, 2008
3	Training manuals and User manuals and Relevant course reference books

Course Outcomes

After learning all the units of the course, the student is able to

1. Understanding the basic concept of Microsoft project software with respect to the construction management.[PO1,PO5,PO11,PSO2]
2. Construct Network diagram and analyze Critical path, Critical activities and Project duration.[PO3,PO5,PO11,PSO3]
3. Gain basic experience in the hands on application of remote sensing data through visual interpretation and digital image processing and various thematic maps.[PO1,PO5,PSO1]
4. Work in team and demonstrate the work carried out professionally using Microsoft project and ArcGis and pursue lifelong learning for professional advancement.[PO9,Pso2,PSO3]

Course Articulation Matrix (CAM)

Sl. no	Course Outcomes (CO's)	Program outcomes (PO's)												Program Specific outcomes (PSO's)				
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
1	Understanding the basic concept of Microsoft project software with respect to the construction management.	2				3							2				2	
2	Construct Network diagram and analyze Critical path, Critical activities and Project duration.			1		3							2					1
3	Gain basic experience in the hands on application of remote sensing data through visual interpretation and digital image processing and various thematic maps.	2				3											2	
4	Work in team and demonstrate the work carried out professionally using Microsoft project and Arc Gis and pursue lifelong learning for professional advancement.													2			3	



Course Title : Internals of C Programming (Technical Skills – II)			
Course Code : P18HU693	Semester : VI	L-T-P:H : 0-2-0: 02	Credits : 01
Contact Period : 26Hrs	Exam Hours : 3 Hrs	Weight age :CIE: 50% ,SEE : 50%	
Prerequisites : -			

COURSE OUTCOME:

To enable students to:

- Strengthen their understanding of **Introduction to Computer Science, C, and Data Structures**
- Write effective codes on **C Programming**

OVERALL SYLLABUS BREAKUP:

Sl. No.	Module name	Classroom (Hours)	Lab (Hours)	Total duration (Hours)
1.	Introduction to Computer Science	2	0	2
2.	C Programming	0	14	14
3.	Introduction to Data Structures	4	6	10
Total Hours		6	20	26

LEARNING OUTCOMES

- After undergoing training in this course, the students will be in a position to –
 - Write complete program based on the requirements and to debug.
 - Frame effective programs using C programming and Data Structures.

ASSESSMENTS

- Each of the modules (C and Data Structures) will have two types of assessments -
 - Multiple-choice assessment for programming logic, concepts and debugging
 - Coding



COURSE PLAN:

C Programming

Sl. No.	Topics covered	Learning outcome	Type of learning	Duration
1.	Introduction to Computer Science: Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance– Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. • Operating System - An Introduction: Definition and functions of operating systems. Discussion on evolution of operating systems and different structures of operating systems.	<ul style="list-style-type: none">● Understand the basics of computer structure and operation of computers and their peripherals and need of Operating System.	Class - 2	2
2.	C Programming Language: • Basic level of Snippets for <ul style="list-style-type: none">○ Understanding basic syntax○ If - else statement○ Switch case○ Struck○ For loop○ While and do - while loop○ Array○ Strings○ Pointers○ Function○ String○ File handling○ Pre-processing	<ul style="list-style-type: none">● Understand the concepts of snippets in a programming term for a small region of re-usable source code, machine code, or text. In C it could be part of the program - A Function, typed or a part of the algorithm or code.● Understand the concepts of programs as sequences or machine instructions.	Lab - 14	14
3.	Introduction to Data Structures: Data Structures Basics: Structure and Problem Solving, Data structures, Data structure Operations, Algorithm: complexity, Time- space tradeoff. <ul style="list-style-type: none">○ Linked List○ Stack and Queue○ Searching and Sorting Techniques	<ul style="list-style-type: none">● Understand common data structures and the algorithms that build and manipulate them including various sorting and searching algorithms. Data structures include arrays, linked lists, stacks, queues, Features, properties, applications, enumerators, and performance issues.	Class – 4 Lab - 6	10