INSTITUTE VISION

"To be a preferred institution in Engineering Education by achieving excellence in teaching and research and to remain as a source of pride for its commitment to holistic development of individual and society"

INSTITUTE MISSION

"To continuously strive for the overall development of students by educating them in a state-of-the-art- infrastructure, by retaining the best practices, faculties and inspire them to imbibe real-time problem-solving skills, leadership qualities, human values and societal commitments, so that they emerge as competent professionals".

DEPARTMENT VISION

"To be the centre of excellence in providing education in the field of Civil Engineering to produce technically competent and socially responsible engineering graduates."

DEPARTMENT MISSION

"Educating students to prepare them for professional competencies in the broader areas of the Civil Engineering field by inculcating analytical skills, research abilities and encouraging culture of continuous learning for solving real time problems using modern tools."

PROGRAM EDUCATIONAL OBJECTIVES (PEO's):

1. ***Pursue a successful career in various domains of Civil Engineering Profession by acquiring knowledge in mathematical, scientific and engineering fundamentals.***
2. ***Analyze and design Civil Engineering systems with social awareness and responsibility.***
3. ***Exhibit professionalism, ethical approach, communication skills & teamwork in their profession and adapt to modern trends by engaging in lifelong learning.***

PROGRAM OUTCOMES (PO's):

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, review research literature, and analyse 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 modelling 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, and 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.***

PROGRAM SPECIFIC OUTCOMES (PSO's):

PSO1: Inculcating in students practical knowledge and experimental skills to tackle Civil Engineering problems using technical and management skills, exhibiting professional ethics to meet the societal needs.

PSO2: Provide solutions related to Civil Engineering built environment through a multidisciplinary approach.

CONTENTS

1.0 Student Help Desk

Sl. No.	Purpose	Contact Person	
		Faculty	Instructor
01	HOD, Academics, Attestations, Exam forms signature	Prof. S.M.Chandrakanth	NA
02	Research Center Co-Ordinator,	Prof. S.M.Chandrakanth	NA
03	Industry-Institute-Interaction, Technical Magazine Coordinator (MoU, Ind. Visit etc.)	Prof. Shreedevi S B	NA
04	EMS / ED Cell coordinator, TP Cell officer	Prof. Preethi. R.Patil	NA
05	Project Coordinator, KSCST, IEEE coordinator, Smart India Hackathon, Scholarship, LIC	Prof. Preethi. R.Patil	NA
06	FACE / Website Coordinator	Prof. Sudarshan V Jore	NA
07	Civil/ IT Maintenance, Feedback / Publicity, Department News Letter, NSS, Student Welfare	Prof. Vishwanath I Patil	NA
08	GATE Coaching Coordinator	Prof. Sudarshan V Jore	NA
09	ISTE / E-Shikshana / E-learning / Internship	Prof. Vishwanath I Patil	NA
10	Women Empower cell, Conference, FDP, Workshop	Prof. Shreedevi S B	NA
11	IA Coordinator / Alumni coordinator	Prof. Shreedevi S B	NA

Institute Level

		Faculty	Contact
12	Student Welfare Convener	Sri. M. G. Huddar	8217056798
13	TP Cell Coordinator	Sri. Pramod. Patil	9731104059
14	Anti-Ragging Committee Member	Sri. K.M.Akkoli	9739114856
15	Anti Raging Squad Convener	Sri. K.M.Akkoli	9739114856
16	Internal Complaint Committee Convener	Smt. S. S. Kamte	9008696825
17	Grievance redressal Convener	Sri. S. S. Tabhaj	9901398134
18	Sports and Cultural / Extra-Curricular Activities Convener	Sri. S.B. Sarawadi	9739109383

2.0 Departmental Resources

*Department of Civil Engineering was established in the year 2020 and is housed in a total area of **858 Sq. Mtrs.***

2.1 Faculty Position

Sl.No.	Category	No. in Position	Average experience (in years)
01.	Teaching faculty	05	13
02.	Technical Supporting Staff	00	00
03.	Helper staff	02	21

2.2 Major Laboratories

Sl.No.	Name of the laboratory	Area in Sq. Mtrs	Amount Invested (Rs. in Lakhs)
01.	Computer Aided Building Planning & Drawing	66	14.37
02.	Building Materials Testing Laboratory	149	11.02
03.	Geology Laboratory	76	0.75
04.	Fluid Mechanics & Hydraulic Machines Laboratory	72	7.76
05	Surveying Practice	76	0.70
06	Concrete and Highway Materials Laboratory	72	1.30
07	Geotechnical Engineering Laboratory	73	0.70
08	Environmental Engineering Laboratory	200	New Setup Under Process

Total Investment in the Department **Rs. 36.60 Lakhs**

3.0 Teaching Faculty Details

Sl. No.	Name	Designation	Qualification	Specializ -ation	Professional Membership	Teaching Exp (In yrs.)	Phone No.
01	Prof. S.M.Chandrakanth	Asst. Prof./HOD	M. Tech. (PhD)	Highway Engineering	IAENG 220815	12	8867814854
02	Prof. Preethi R. Patil	Asst. Prof.	M. Tech.	Structures	--	04	9606557280
03	Prof. Vishwanath I Patil	Asst. Prof.	M. Tech	Structures	--	05	9975499979
04	Prof. Sudarshan V Jore	Asst. Prof.	M. Tech.	CT & M	--	02	9535459918
05	Prof. Shreedevi S B	Asst. Prof.	M. Tech.	WWMH&SE	--	02	7760429556

4.0 Institute Academic Calendar

S J P N Trust's
Hirasugar Institute of Technology, Nidasoshi.
Approved by AICTE, New Delhi, Permanently Affiliated to VTU, Belagavi
Recognized under 2(f) & 12B of UGC Act, 1956
Accredited at 'A' Grade by NAAC & Programmes Accredited by NBA:CSE & ECE

IQAC
File I-11
AY:2023-24 (Odd)
Rev: 01

ACADEMIC CALENDAR OF EVENTS-02 (CoE-02) OF III & V SEM FOR THE AY: 2023-24

Ref:
1. VTU CoE Notification No.: VTU/BGM/ACA/2023-24/3252, Dated 30th Sept. 2023
2. VTU CoE Notification No.: VTU/BGM/ACA/2023-24/2668, Dated 25th Aug. 2023
3. HSIT/NDS/HOD-Meeting-25/2022-23, Dated: 16th Oct. 2023

Calendar

October -2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November -2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December -2023

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

January -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

February -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29		

March -2024

Sun	Mon	Tue	Wed	Thu	Fri	Sat
31					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Date	Events & Holidays
28th Sept.2023	GH: Eid-Milad
2nd Oct. 2023	GH: Gandhi Jayanthi
14th Oct.2023	GH: Mahalaya Amavasya
17th Oct. 2023	Fresher's day: A Welcome Function for 1st year students
23rd -24th Oct. 2023	GH: Mahanavami, Ayudhapooja, Vijayadasami
25th Oct. 2023	Commencement of III Semester Classes
25th Oct to 23rd Nov. 2023	V Sem Innovation/Entrepreneurship / Societal Internship (2021 Scheme)
28th Oct. 2023	Valmiki Jayanti
1st Nov. 2023	GH: Kannada Rajyothsava
14th Nov. 2023	GH: Balipadyami, Deepavali
25th Nov. 2023	Commencement of V Semester Classes
30th Nov. 2023	GH: Kanakadasa Jayanti
4th-6th Dec.2023	1st IA Test for III Semester
6th Dec. 2023	1st Feedback on Teaching-Learning (III Sem.)
11th Dec. 2023	Display of 1st IA Test Marks (III Sem)
8th-9th Dec. 2023	International Conference
25th Dec. 2023	GH: Christmas
29th -30th Dec. 2023	Lab IA Test-I (III Sem. 2022 Scheme)
12th Jan. 2024	National Youth Day
26th Jan. 2024	Republic Day
8th-10th Jan.2024	2nd IA Test for III Sem. & 1st IA Test for V Sem.
10th Jan. 2024	2nd Feedback on Teaching-Learning (III Sem) & 1st Feedback on Teaching-Learning (V Sem)
15th Jan. 2024	Display of 1st (V Sem.) & 2nd IA Test Marks (III Sem.)
5th-7th Feb.2024	3rd IA Test for III Sem. & 2nd IA Test for V Sem.
7th Feb. 2024	2nd Feedback on Teaching-Learning (V Sem.)
8th -9th Feb. 2024	Lab IA Test-II (III Sem. 2022 Scheme) & Lab IA Test-I (V Sem. 2021 Scheme)
9th Feb. 2024	Display of 3rd & 2nd IA Test Marks (III & V Semesters)
10th Feb. 2024	Last Working Day of the III Semester
12th-22nd Feb. 2024	III Semester VTU Practical Examination
26th Feb.to15th March 23	III Semester VTU Theory Exams (SEE)
1st & 2nd March 2024	Lab IA Test-II (V Sem. 2021 Scheme)
5th -7th March 2024	3rd IA Test for V Sem
9th March 2024	Display of 3rd IA Test Marks
8th March 2024	Mahashivaratri
9th March 2024	Last Working Day of the V Semester
11th-20th March. 2024	V Semester Practical Examination
18th March 2024	Commencement of IV Semester
22nd March-20th April 24	V Semester VTU Theory Exams (SEE)
22nd April 2024	Commencement of VI Semester
29th March 2024	Good Friday

GH: General Holiday, LH: Local Holiday

Dr.S.N.Topannavar
IQAC Coordinator & Dean (Academics)

Dr.S.C.Kamate
Principal

Hirasugar Institute of Technology NIDASOSHI

Nidasoshi, Taq: Hukkeri, Dist: Belgaum, Karnataka - 591 236
Phone:+91-8333-278887, Fax:278886, Web:www.hsit.ac.in, Mail:principal@hsit.ac.in

5.0 Scheme of Teaching & Examination

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations 2021
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021 - 22)

V Semester **B.E: Civil Engineering**

SL No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CV51	Hydrology and Water Resources Engineering	TD: Civil Engg PSB: Civil Engg	3	0	0		03	50	50	100	3
2	IPCC 21CV52	Transportation Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	PCC 21CV53	Design of RC Structural Elements	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
4	PCC 21CV54	Geotechnical Engineering	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	PCC 21CVL55	Geotechnical Engineering Lab	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	AEC 21CV56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	1	2	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	0	2	0		1	50	50	100	1
8	AEC 21CV58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses: 0	2	0		01	50	50	100	1
				If offered as lab. courses: 0	0	2		02				
								Total	400	400	800	18

Ability Enhancement Course - V

21CV581	Data Analysis with Python	21CV584	Quality Control and Quality Assurance
21CV582	Software Applications	21CV585	Offshore Structures
21CV583	Gender Sensitization		

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.
L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCC can be 04 and its Teaching – Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (BE/B.Tech.) 2021-22 may be referred.

Subject Title	**HYDROLOGY AND WATER RESOURCE ENGINEERING**		
Subject Code	**21CV51**	**CIE Marks**	50
Number of Lecture Hrs / Week	(3:0:0)	**SEE Marks**	50
Total Number of Lecture Hrs	40	**Exam Hours**	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. V.I.Patil	**Designation:** Asst. Professor	**Experience: 5** Years
No. of times course taught: 01	**Specialization:** Structural Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Civil Engineering	III/IV	Fluid Mechanics
02	Civil Engineering	I/II	Elements of Civil Engineering

2.0 Course Objectives

Make the students to learn

1. Concept of hydrology, components of hydrologic cycle, hydrologic processes such as precipitation, infiltration, evaporation and transpiration.
2. Estimation of runoff and use the concept of unit hydrograph.
3. Systems and methods of irrigation, crop water requirement.
4. Canals, canal alignment, design methods of canals. Computation of reservoir capacity.
5. Concepts of floods and droughts, importance of water conservation and water management.

3.0 Course Outcomes

After studying this course, students will be able to:

	Course Outcome	RBT Level	POs
C301.1	Provide a background in the theory of hydrological processes and their	L1, L2,	1,2,3,5,
C301.2	Estimate runoff and develop unit hydrographs.	L1, L2, L3, L4	1,2,3,5, 6,8,12
C301.3	Find the water requirement and frequency of irrigation for various crops	L1, L2, L3, L4	1,2,3,5, 6,8,12
C301.4	Find the canal capacity and compute the reservoir capacity	L1, L2, L3, L4	1,2,3,5, 6,8,12
C301.5	Analyse floods and droughts. Emphasise on the importance of conservation of water and water bodies.	L1, L2, L3, L4	1,2,3,5, 6,8,12
	Total Hours of instruction		**40**

4.0 Course Content

Module-1

Hydrology: Introduction, Global distribution of water and Indian water availability. Hydrologic cycle (Horton's) qualitative and engineering representation.
Precipitation: Forms and types, measurement of rain fall using Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.
Losses from Precipitation: Evaporation process, factors affecting evaporation, measurement using IS class-A Pan, reservoir evaporation and control. Factors affecting Evapo-transpiration. Infiltration, Factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

Module-2

Runoff: Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis.
Hydrographs: Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.

Module-3

Irrigation: System of irrigation: surface and ground water, flow irrigation, lift irrigation. Methods of irrigation: surface, sprinkler and drip/micro irrigation.
Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.

Module-4

Canals: Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Regime channels, Design of canals by Lacey's and Kennedy's method (No numerical examples).
Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.

Module-5

Flood Management: Indian rivers and floods, Causes of floods, Alleviation, Levees and floodwalls, Flood ways, Channel improvement, Flood damage analysis.
Drought Management: Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning.
Water harvesting: rainwater collection, small dams, runoff enhancement, runoff collection, Restoration and rejuvenation of water bodies (ponds and lakes)

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VII	Design of Hydraulic Structures	Hydraulic Structures

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Design of components like Dams, Canals, Gates, Weirs, Notches, discharge & pressure calculation in industries
02	Analysis of hydrostatics & Dynamic forces
03	Design Pipes & Pipe networks using Hardy–Cross method

7.0 Gap Analysis and Mitigation

Sl No	Delivery Type	Details
01	Tutorial	Practicals should clubbed with theory for better understanding
02	NPTEL	https://twitter.com/hyrologyandirrigation.com https://youtu.be/A0BuHEqDm88

8.0 Books Used and Recommended to Students

Text Books
1. K. Subramanya, "Engineering Hydrology", Tata McGraw Hill Publishers, New Delhi.
2. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi.
3. Punmia and LalPandey, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.
Reference Books
1. H.M. Raghunath, "Hydrology", Wiley Eastern Publication, New Delhi.
2. Sharma R.K., "Irrigation Engineering and Hydraulics", Oxford & IBH Publishing Co., New Delhi.
3. VenTe Chow, "Applied Hydrology", Tata McGraw Hill Publishers, New Delhi.
4. Modi P.N "Water Resources and Water Power Engineering"-. Standard book house, Delhi.
5. Garg S.K, "Irrigation Engineering and Hydraulic Structures" Khanna publications, New Delhi.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
https://en.wikipedia.org/wiki/hydrology

10.0 Magazines/Journals used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	AEÜ - International Journal of hydrology and irrigations.	www.journals.elsevier.com/aeu

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together Continuous internal Examination (CIE) Three Tests (preferably in MCQ pattern with 20 questions) each of 20 Mark (duration 01hour)

1. First test at the end of 5th week of the semester 2. Second test at the end of the 10th week of the semester 3. Third test at the end of the 15th week of the semester Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester 2. Second assignment at the end of 9th week of the semester Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours) The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks Semester End Examinations (SEE) SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has tosecure minimum of 35% of the maximum marks meant for SEE.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
MODULE 1	01	**Hydrology:** Introductions.	20
	02	Importance of hydrology, Global distribution of water and Indian water availability. Practical application of hydrology. Hydrologic cycle (Horton's) qualitative and engineering representation	
	03	**Precipitation:** Definition, Forms and types of precipitation.	
	04	Measurement of rain fall using Symon's and Syphon type of rain gauges. Optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall.	
	05	Estimation of missing data presentation of precipitation data, Moving average curve, mass curve. Rainfall hyetographs	
	06	**Losses: Evaporation:** Introduction, Process, factors affecting evaporation Measurement using IS class-A Pan. Estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.	
	07	**Evapo-transpiration:** Introduction. Consumptive use, AET, PET, Factors affecting. Measurement, Estimation by Blaney-Criddle equation.	
	08	**Infiltration:** Introduction Factors affecting infiltration capacity. Measurement by double ring infiltrometer. Horton's infiltration equation, infiltration indices.	
MODULE 2	09	**Runoff:** Definition, concept of catchment.	20
	10	Factors affecting runoff.	
	11	Rainfall – runoff relationship using regression analysis.	
	12	**Hydrographs:** Definition.	
	13	Components of hydrograph.	
	14	Base flow separation, unit hydrograph.	
	15	Assumption application and limitations. Derivation from simple storm hydrographs.	
	16	S curve and its computations, Conversion of UH of different durations.	
MODULE 3	17	**Irrigation:** Definition and Introductions	20
	18	Benefits and ill effects of irrigation.	
	19	System of irrigation	
	20	Surface and ground water	
	21	Flow irrigation, lift irrigation, Bandhara irrigation.	
	22	**Water Requirements of Crops:** Duty, delta and base period.	
	23	Duty, Delta, Base period, relationship between them.	
	24	Factors affecting duty of water crops. Crop seasons in India, Irrigation efficiency, frequency of irrigation.	
MODULE 4	25	**Canals:** Types of canals.	20
	26	Alignment of canals.	
	27	Definition of gross command area.	
	28	Cultural command area intensity of irrigation, time factor, crop factor.	
	29	Unlined and lined canals. Standard sections.	

	30	Design of canals by Lacey's and Kennedy's method.	
	31	**Reservoirs:** Definition, investigation for reservoir site.	
	32	Storage zones determination of storage capacity using mass curves. Economical height of dam.	
MODULE 5	33	**Flood Management:** Indian rivers and floods,	20
	34	Causes of floods, Alleviation	
	35	Levees and floodwalls Flood ways, Channel improvement, Flood damage analysis	
	36	**Drought Management:** Definition of drought, Causes of drought,	
	37	Measures for water conservation and augmentation, drought contingency planning.	
	38	**Water harvesting:** rainwater collection, small dams	
	39	Runoff enhancement, runoff collection	
	40	Restoration and rejuvenation of water bodies (ponds and lakes)	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions on module 1	Students study of the basics of Hydrology and Precipitation. Losses,Evaporation, Evapo-transpiration, Infiltration	Module 1 of the syllabus	3	Individual Activity.	Text 1 & 2 Ref Book 2
2	Assignment 2: Questions on module 2	Students study of the Runoff Hydrographs	Module 2 of the syllabus	5	Individual Activity.	Text 1 & 2 Ref Book 2
3	Assignment 3: Questions on module 3	Students study of the. Irrigation and Water requirements of crops.	Module 3 of the syllabus	8	Individual Activity.	Text 1 & 2 Ref Book 2
4	Assignment 4: Questions on module 4	Students study of the Canals and reservoirs.	Module 4 of the syllabus	10	Individual Activity.	Text 1& 2 Ref Book 2
5	Assignment 5: Questions on module 5	Students Study of the Flood,drought Management Water harvesting	Module 5 of the syllabus	12	Individual Activity.	Text 1 & 2 Ref Book 2

14.0 QUESTION BANK

MODULE 1

1. Explain Horton's qualitative Hydrologic cycle?
2. Explain with a neat sketch Siphon's rain gauge?
3. Define precipitation. Explain various forms of precipitation?
4. Explain factors governing selection of site for rain gauge stations?
5. Explain types of recording raingauge?

6. Explain types of precipitation?

MODULE 2

1. Explain the factors affecting evaporation?
2. Define evaporation. With a neat sketch explain measurement of evaporation using "IS class A pan"?
3. Explain estimation of evaporation by Meyer's and Rohwer's empirical formulae?
4. What are the measures taken to reduce evaporation?
5. Enlist the factors affecting evapotranspiration?
6. Explain Blaney Criddle equation for estimating evapotranspiration?
7. What are the different methods of estimating evapotranspiration? Explain any two methods.
8. Explain the factors affecting infiltration capacity.
9. Describe the method of determining infiltration capacity using double ring infiltrometer.
10. Differentiate between:W-index & ϕ index (b) AET & PET (c) Infiltrometer & Lysimeter.
11. With a neat sketch explain Double mass technique

MODULE 3

1. Explain factors affecting Runoff?
2. Explain relation between rainfall & runoff using regression analysis.
3. With a neat sketch explain the fan and fern leaf catchment.
4. List out various methods for estimation of design flood. Explain rational method of flood estimation.
5. Explain typical single peaked hydrograph components with a neat sketch.
6. Define unit hydrograph. List the assumptions made in deriving unit hydrograph and its limitations.
7. Explain the procedure for drawing master depletion curve.
8. Explain the procedure for deriving a unit hydrograph from an isolated storm.
9. With a neat sketch explain S Hydrograph or summation hydrograph.

MODULE 4

1. Define irrigation? What is the necessity of irrigation?
2. Discuss in brief the benefit and ill effects of irrigation.With a neat sketch explain Bhandhara irrigation scheme.
3. Explain irrigation efficiencies.
4. Define duty? What are the factors affecting duty of water? Explain.
5. Explain consumptive use of water. List the factors affecting consumptive use of water.
6. Explain irrigation requirements of crops.
7. Explain the following:(a) Base period (b) crop period (c) Time factor
8. (d) Gross command area (e) Culturable command area
9. A water course has a culturable command area of 1200 hectares. The intensity of irrigation for crop A is 40 % and for B is 35%, both the crops being rabi crops. Crop A has a kor period of 20 days and crop B has kor period is 15 days. Calculate the discharge of the water course if the kor depth for crop A is 10cm and for it is 16cm.
10. The gross commanded area for a distributory is 20000 hectares, 75% of which can be irrigated. The intensity of irrigation for Rabi season is 40% that for Kharif season is 10%. If kor period is 4 weeks for rabi and 2.5 weeks for Kharif, determine the outlet discharge. Outlet factors for rabi and Kharif may be assumed as 1800 hectares/ cumec and 775 hectares/ cumec. Also calculate delta for each crop.

MODULE 5

1. What are the considerations made during alignment of canals?
2. Write a note on canal classification?
3. Write a short note on:(a) Critical velocity ratio (b) Regime Channel
4. Explain with neat sketch storage zones of reservoir.
5. Explain the different investigations conducted before selecting a reservoir site.
6. Explain the determination of storage capacity of reservoir by mass curves.

Prepared by	Checked by		
Prof:V.I.Patil	Prof:Preethi R.Patil	HOD	Principal

Subject Title	**TRANSPORTATION ENGINEERING**		
Subject Code	21CV52	**IA Marks**	50
Number of Lecture Hrs / Week	2:2:2:0	**Exam Marks**	50
Total Number of Lecture Hrs	50	**Exam Hours**	03
			Credits: 3

FACULTY DETAILS:		
Name: Prof. S. M. Chandrakanth	**Designation:** Asst. Prof. / HOD	**Experience:** 13 Years
No. of times course taught: 04		**Specialization:** Highway Engineering

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	General Science/Mathematics	I/II	Knowledge of Geometry, Engineering Mathematics and trigonometry.
02	Civil Engineering	I/II	Elements of Civil Engineering and Mechanics
03	Civil Engineering	III	Geodetic Engineering

2.0 Course Objectives

This course will enable students to;

1. Gain knowledge of different modes of transportation systems, history, development of highways and the organizations associated with research and development of the same in INDIA.
2. Understand Highway planning and development considering the essential criteria's (engineering and financial aspects, regulations and policies, socio economic impact).
3. Get insight to different aspects of geometric elements and train them to design geometric elements of a highway network.
4. Understand pavement and its components, pavement construction activities and its requirements.
5. Gain the skills of evaluating the highway economics by B/C, NPV, IRR methods and also introduce the students to highway financing concepts

3.0 Course Outcomes

Having successfully completed this course, the student will be able to.

CO	Course Outcome	Cognitive Level	POs
C405.1	Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.	L1, L2, L3, L4	1,2,3,4,6,8,12
C405.2	Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.	L1, L2, L3, L4	1,2,3,4,6,8,12
C405.3	Design road geometrics, structural components of pavement and drainage..	L1, L2, L3, L4,	1,2,3,4,6,8,12
C405.4	Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.	L1, L2, L3, L4	1,2,3,4,5,6,8,12
Total Hours of Instruction		**40**	

4.0 Course Content

Module-1

Principles of Transportation Engineering: Importance of transportation, Different modes of transportation. Characteristics of road transport, Importance of Roads in India, Current Road development Programmes in India.

Highway Development and Planning: Highway Development in India, Highway Planning, Planning Surveys and Interpretation, Highway Planning in India.

Highway Alignment and Project preparation: Highway Alignment, Engineering Surveys for Highway Alignment, Drawings and Reports, Highway Projects, Preparation of Detailed Project Report

Module-2

Highway Geometric Design of horizontal alignment elements: Cross sectional elements, Sight distance, Design of Horizontal alignment, Design of vertical alignment.

Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.

Module-3

Pavement Materials: Sub grade soilgrade soil -desirable properties-HRB soil classification determination of CBR and modulus of sub grade reaction with Problems. Aggregates - Desirable properties. Bituminous Binders & Mixes- Types, desirable properties. Pavement Quality concrete - Materials, Requirements.

Pavement Construction: General features, Embankment and Subgrade, Construction of Flexible pavements, Construction of CC pavements.

Module-4

Highway Drainage: Significance and requirements, Surface drainage system and Design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location.

Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis – annual Cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT

Module-5

Elements of Traffic Engineering – Traffic characteristics, Traffic Engineering Studies and Analysis, Traffic Regulation and Control.

Elements of Railways and Airport Engineering - Railways: Introduction, classification of routes; railway gauge, coning of wheels and canting of rails, train resistance and hauling power; track components: rails, sleepers, fastenings, ballast and formation.

Airports: Introduction, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications, - Site selection- regional Planning. Orientation of runway by using wind rose diagram with examples

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VI	Concrete Technology	Pavement Quality concrete - Materials, Requirements.
02	VI	Railways, Harbors, Tunneling and Airports.	Apply the basic principles of engineering surveying and measurements practices
03	VI	Remote Sensing & GIS	Basic concept of Remote sensing, Remote Sensing Platforms and Sensors, Geographic Information System, Data Models, Integrated Applications of Remote sensing and GIS.
04	VI	Traffic Engineering	Traffic engineering, scope and its importance, analyze traffic issues including safety, planning, design, operation and control.
05	VII	Quantity Survey and Contract Management	Estimations of road projects, specifications and tenders.
06	VII	Pavement Materials and Construction	Pavement Materials, which are used in pavement construction, impart knowledge about the engineering properties required
07	VII	Pavement Design	Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	To Involve in the design, construction and maintenance of highway systems.
02	To understand the principles & techniques of Highway Engineering.
03	To learn & implement the Standards of highway engineering
04	To analyse and design the highway cross section and alignment elements.
05	To prepare the highway geometric design
06	Students are able to understand future traffic flows, design of highway intersections/interchanges
07	In highway construction, highway pavement materials and design.
08	Understand the structural design of pavement thickness and pavement maintenance.
09	To learn the development of nations which have extensive highway networks
10	To investigate the highway drainage and Highway economics

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Demonstration to Theodolite & tachometer in Survey laboratory
02	NPTEL	Introduction to Surveying & Mapping, Advance and Higher Surveying

8.0 Books Used and Recommended to Students

Suggested Learning Resources: Books
1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. Subramaniam, "Transportation Engineering", SciTech Publications, Chennai.
5. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
6. Chandra S. and Agarwal M.M. "Railway Engineering", Oxford University Press India.
7. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nem Chand and Bros.
8. Khanna S.K. and Justo C.E.G. Highway Material Testing, Nem Chand & Bros
Other Reference Books
1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. Jotin Khisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.
Additional Study Material & e-Books
1. NPTEL notes, videos and courses
2. VTU online notes,
3. Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
01) https://nptel.ac.in/courses/105105107 02) https://archive.nptel.ac.in/courses/105/107/105107123/ 03) https://onlinecourses.nptel.ac.in/noc22_ce94/preview

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	Website
01	Transportation Geotechnics	https://www.sciencedirect.com/journal/transportation-geotechnics
02	Transportation Planning and Technology	https://www.tandfonline.com/journals/gtpt20
03	Transport	https://www.tandfonline.com/journals/tran20
04	Journal of Transportation Engineering, Part B: Pavements	https://ascelibrary.org/journal/jpeodx

11.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.

The minimum passing mark for the CIE is 40% of the maximum marks (20 marks).

A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject / course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together **CIE for the theory component of IPCC.**

Two Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of **5th week** of the semester
2. Second test at the end of the **10th week** of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of **4th week** of the semester
2. Second assignment at the end of **9th week** of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

1. On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
2. The **CIE marks** awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for **10 marks**. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
3. The laboratory test **(duration 02/03 hours)** at the end of the **15th week** of the semester /after completion of all the experiments (whichever is early) shall be conducted for **50 marks** and scaled down **to 05 marks.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC Theory SEE will be conducted by university as per the scheduled timetable, with common question papers for the course (**duration 03 hours**).

1. The question paper will have ten questions. Each question is set for **20 marks**. Marks scored shall be proportionally scaled down to **50 Marks**

2. There will be **2 questions from each module**. Each of the **two questions** under a module (with a maximum **of 3 sub-questions**), **should have a mix of topics** under that module.

3. The students have to answer **5 full questions**, selecting **one full question from each module**.

12.1 Course Delivery Plan (Theory)

Module	Lecture No.	Content of Lecture	% of portion
1	1	**Principles of Transportation Engineering:** Importance of transportation,	20%
	2	Different modes of transportation.	
	3	Characteristics of road transport, Importance of Roads in India,	
	4	Current Road development Programmes in India.	
	5	**Highway Development & Planning:** Highway Dvpt. in India, Highway Planning,	
	6	Planning Surveys and Interpretation, Highway Planning in India.	
	7	**Highway Alignment and Project preparation:** Highway Alignment,	
	8	Engineering Surveys for Highway Alignment,	
	9	Drawings and Reports, Highway Projects,	
	10	Preparation of Detailed Project Report	
2	11	**Highway Geometric Design of horizontal alignment elements:**	20%
	12	Cross sectional elements,	
	13	Sight distance,	
	14	Design of Horizontal alignment,	
	15	Design of vertical alignment.	
	16	**Pavement Design:** Pavement types,	
	17	component parts of flexible and	
	18	rigid pavements and their functions	
	19	ESWL and its determination (Graphical method only)-Examples.	
	20	ESWL and its determination (Graphical method only)-Examples.	
3	21	**Pavement Materials:** Subgrade soil - desirable properties.	20%
	22	HRB soil classification.	
	23	Determination of CBR and modulus of subgrade reaction with Problems.	
	24	Determination of CBR and modulus of subgrade reaction with Problems.	
	25	Aggregates- Desirable properties and tests.	
	26	Bituminous Binders & Mixes- Types, desirable properties.	
	27	Pavement Quality concrete- Materials, Requirements.	
	28	**Pavement Construction:** General features,	
	29	Embankment and Subgrade,	
	30	Construction of Flexible pavements, Construction of CC pavements.	
4	31	**Highway Drainage:** Significance and requirements.	20%
	32	Surface drainage system and design-Examples.	
	33	Sub surface drainage system.	
	34	Design of filter materials	
	35	Types of cross drainage structures, their choice and location	
	36	**Highway Economics:** Highway user benefits.	
	37	VOC using charts only-Examples.	
	38	Economic analysis - annual cost method.	
	39	Benefit Cost Ratio method-NPV-IRR methods- Examples.	
	40	Highway financing-BOT-BOOT concepts.	
5	41	**Elements of Traffic Engineering** – Traffic characteristics, Traffic	20%
	42	Engineering Studies and Analysis, Traffic Regulation and Control.	
	43	**Elements of Railways and Airport Engineering - Railways:** Introduction	
	44	classification of routes; railway gauge,	
	45	Coning of wheels and canting of rails,	
	46	Train resistance and hauling power;	
	47	Track components: rails, sleepers, fastenings, ballast and formation.	
	48	**Airports:** Introduction, Layout of an airport with component parts and functions of each,	
	49	Aircraft Characteristics – Airport Classifications, - Site selection- regional Planning.	
	50	Orientation of runway by using wind rose diagram with examples	

12.2 Course Delivery Plan (Laboratory Experiments)

Exp. No	Content of Lecture	% of portion
1	**1. Tests on Aggregates :** a. Aggregate Crushing value	10.0 %
2	b. Los Angeles abrasion test	10.0 %
3	c. Aggregate impact test	10.0 %
4	d. Aggregate shape tests (combined index and angularity number)	10.0 %
5	**2. Tests on Bituminous Materials :** a. Penetration test	10.0 %
6	b. Ductility test	10.0 %
7	c. Softening point test	10.0 %
8	d. Specific gravity test	10.0 %
9	**3. Tests on Soil :** a. Wet sieve analysis	10.0 %
10	b. CBR test	10.0 %
11	**4. Tests on Bituminous Mixes :** a. Marshall Method (Demo Experiment)	10.0 %

13.0 Internal Assessments, Assignments, Group Discussion, Seminars, Quiz, Mini Project.

Sl. No.	Title	Outcome expected	Allied study	Week No.	Max Marks	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions on module 1	Students study the topics and write the Answers. Get practice to solve numerical of university question papers.	Module 1 of syllabus	4	10	Individual Activity, Written solution expected.	Book 1, 2, 3 & notes, also 4-13 of reference list.
2	Internal Assessment - I	Students study the topics & write / reproduce the answers in blue books	Module 2 of syllabus	5	20	Individual Assessment, Blue Books as record	Book 1, 2, 3 & notes, also 4-13 of reference list.
3	Assignment 2: Questions on module 3	Students study the topics and write the Answers. Get practice to solve numerical of university question papers.	Module 3 of syllabus	9	10	Individual Activity, Written solution expected.	Book 1, 2, 3 & notes, also 4-13 of reference list.
4	Internal Assessment - II	Students study the topics & write / reproduce the answers in blue books	Module 4 of syllabus	10	20	Individual Assessment, Blue Books as record	Book 1, 2, 3 & notes, also 4-13 of reference list.
5	Internal Assessment - III	Students study the topics & write / reproduce the answers in blue books	Module5 of syllabus	15	20	Individual Assessment, Blue Books as record	Book 1, 2, 3 & notes, also 4-13 of reference list.

14.0 QUESTION BANK

MODULE – 1

1. Discuss the role of transportation in national development?
2. Explain various characteristics of road transport?
3. What are the different modes of transportation? Mention their advantages?
4. List & explain briefly the recommendations of Jayakar committee.
5. Discuss briefly the role of transportation in economic, social, political development of country?
6. Explain a) I R C b) C R F c) C R R I.
7. Explain the classification of roads as per Third 20-year road development plan.
8. What are the important policies mentioned in vision: 2021 document.
9. Define i) Master Plan ii) Saturation System
10. With a neat sketch explain: i) Rectangular or Block Pattern ii) Star & Grid Patter
11. List the salient features of i) PMGSY ii) KSHIP Projects.
12. With a neat sketch explain different road patterns.
13. What is saturation of road planning? How is it used to decide best proposal among several alternative proposals?
14. The area of certain backward district in India is 18400km2 & there are 15 towns as per 1981 census. Determine the length of different categories of road by third road development plan.
15. Explain the various types of survey to be carried out before planning a highway system for a given area.
16. What is the ideal requirement of highway alignment list & explain briefly?
17. Explain briefly the various factors governing the highway alignment?
18. Three new road links A, B & C are to be constructed during a five-year plan period. Suggest the order of priority for phasing road construction programme Used on maximum utility approach. Assume utility units of 0.5, 1.0 & 2.0 for three-year population ranges & 1 per 1000 tons of Agricultural & industrial Products respectively.

Road link	Length, km	No. of villages served with population Range			Productivity served, in 1000 tons	
		<500	501-1000	1001-2000	Agricultural	Industrial
A	500	100	150	40	250	20
B	600	200	250	68	320	25
C	700	270	350	82	500	35

19. Four new roads A, B, C & D are to be constructed in a district during a five-year plan period. Suggest the order of priority for phasing the development programme based on maximum utility approach. Assume utility units 0.5, 1.0, 2.0 & 4.0 for population ranges & 10.0 for 1000 T of agricultural & industrial products.

Road link	Length, km	No. of villages served with population Range				Productivity in tons	
		<500	500-1000	1000-2000	>2000	Agricultural	Industrial
A	65	40	12	14	14	5000	1000
B	55	22	9	6	6	8000	1200
C	45	32	8	9	9	6000	800
D	72	36	6	3	3	9000	2000

MODULE - 2

1. What are objects of highway geometric design? List various geometric elements to be considered in highway?
2. Enumerate the factors governing the width of carriageway. State the IRC Specification for width of carriageway for various classes of roads?
3. In a region with light rainfall a two-lane bituminous road is to be designed. Determine the height of the crown of parabolic camber. Draw the neat sketch?
4. Define right of way. Explain the factors affecting right of way?
5. Draw typical cross section of NH/SH in rural section in embankment & in cutting with dimensions?
6. Discuss importance of camber, skid resistance, unevenness of pavement surface?
7. In Mangalore district of Karnataka state, a VR of thin bituminous pavement 3.75m wide & a NH of bituminous concrete pavement 7m wide are to construct. What should be the height of crown with respect to edge in these two cases?
8. What is Camber? What are the objectives of providing camber to the pavement surface? Specify the values of camber recommended by the IRC for different types of road surfaces?
9. What are the steps to be followed while re -aligning an existing highway with poor alignment?
10. Explain briefly the various surveys to be conducted for the alignment of highway?
11. Define super elevation. Explain maximum & minimum super elevation. Enumerate the steps for practical design of super-elevation.
12. On a highway there is a horizontal curve of radius 400m & length 200m. Compute the setback distance required so as to provide stopping sight distance, for the design speed of 65kmph. The distance between the center line of the road & the center line of inner lane is 1.9m.
13. List the objects of providing extra widening of pavement at horizontal curves & super elevation.
14. Why vertical curves are required? Explain different types of vertical curve.
15. Two cars are approaching from opposite directions of a road with a gradient of two percent, with velocities of 90kmph & 75kmph respectively. Calculate the minimum sight distance required to avoid a head on collision of both the cars. Reaction time of the driver is 2.5sec & the coefficient of friction is 0.35.
16. Define SSD. Explain any one factor that restricts the SSD.
17. The speeds of overtaking & overtaken vehicles are 96kmph & 80kmph. Assuming an acceleration of 2.5 kmph/sec & Driver's reaction time of 2sec, find the OSD & draw a neat sketch of overtaking zone.
18. Explain with the help of a sketch the effect of centrifugal force on a vehicle negotiating a horizontal curve.
19. Explain briefly the attainment of designed super elevation in practice.
20. A summit curve is formed when an ascending gradient of 1 in 25 meets another ascending gradient of 1 in 100. Find the length or summit curve to provide the required SSD for a design speed of 80kmph.
21. List the factors Affecting SSD & OSD.
22. The design speed of overtaking vehicle is 60kmph. The rate of acceleration of the above vehicle is 3.6kmph/sec. The difference in speed between overtaking & overtaken vehicle is 20kmph. Calculate OSD as per IRC guidelines for a lane with two-way traffic.
23. Calculate the length of transition curve for a plain & rolling terrain for the following data: Design speed=80kmph, radius of curve=250m, road width=7.0m, maximum allowable rate of super elevation 1 in 150, super elevation maximum restricted to 0.07. Assume pavement is rotated with respect to center line.
24. Explain with neat sketch the 'PIEV' theory.
25. What is super elevation? Explain the steps for practical design of super elevation.
26. A valley curve is formed y a descending gradient of 1 in 25 meeting an ascending gradient of 1in30. Design the total length of valley curve, if the design speed is 100kmph so as to fulfil comfort conditions & head light sight distance for night driving assuming suitable details.

MODULE – 3

1. What are the desirable properties of soil as a highway material?
2. What are the desirable properties of aggregates? List the various tests on rod aggregates.
3. Differentiate between Bitumen and Tar. List the various tests on Bitumen.
4. Explain the following i) Bitumen emulsion ii) Cutback bitumen.
5. Explain HRB soil classification system.
6. Differentiate between Flexible and Rigid Pavement.
7. Explain CBR test procedure with neat sketch.
8. Compare Tar and Bitumen.
9. Define modulus of subgrade reaction. With the sketch explain the principal test for determining the K- value. How correction for K- value is made for different plate sizes.
10. Explain ESWL. How it is determined for dual wheel load assembly and what are its applications?
11. The properties of subgrade soil are given below:

Passing 0.074mm sieve=55% Liquid Limit= 50% Plastic Limit= 41%

a) classify the soil by revised PRA/HRB system.

b) discuss the suitability of the soil as a subgrade material.

12. The properties of subgrade soil are given below:

Passing 0.074mm sieve=32% Liquid Limit= 42.5 % Plastic Limit= 26.7 %

classify the soil by revised PRA/HRB system.

13. Calculate the GI of a sample of soil with the following data:

Passing 0.074mm sieve= 60% Liquid Limit= 30 % Plasticity index = 12

14. Explain procedure to find K –value (modulus of subgrade reaction)
15. A plate load test was conducted on a soaked subgrade during monsoon season using a plate diameter of 30cm. the load values corresponding to the mean settlement dial reading are given below. Determine the modulus of subgrade reaction for the standard plate.

Mean settlement value, mm	Load values, kg
0	0
0.24	460
0.52	900
0.76	1180
1.02	1360
1.23	1480
1.53	1590
1.76	1640

16. A plate load test was conducted in the field & the following are te readings obtained after the test. Determine the modulus of subgrade reaction if the radius of contact plate is 150mm.

Mean settlement value, mm	Load values, KN
0	0
0.05	1
0.2	5
0.6	10
0.8	15
1.05	20
1.15	25
1.30	30
1.40	35
1.50	40

17. The load penetration values of CBR tests conducted on two specimens of the soil samples are given below. Determine the CBR value of soil if 100 division of the load dial represents 190 kg of load in the Calibration chart of the proving ring.

Penetration of plunger,mm	Load dial readings, divisions	
	Specimen No. 1	Specimen No. 2
0	0	0
0.5	8	0.5
1.0	15	.5
1.5	23	2.5
2.0	29	6.0
2.5	34	13
3.0	37	20
4.0	43	30
5.0	48	38
7.5	57	50
10.0	63	58
12.5	67	63

18. Write down the construction steps for WMM base course.
19. Explain the construction steps for Dry lean concrete sub base.
20. Explain the construction steps for CC Roads.
21. What do you understand by Wet Mix Macadam? What are the materials used and its requirements?
22. Explain the construction procedure for bituminous road.
23. Write the construction steps for: a) Water bound macadam. b) CC pavement.

MODULE – 4

1. Explain the significance of highway drainage.
2. Indicate the different methods of subsurface drainage, with neat sketches.
3. With the help of a neat sketch, explain how the surface drainage system is provided to lower the
4. ground water table.
5. What are the quantifiable and non- quantifiable road user benefits due to construction of new highway or improvement of existing highway?
6. Briefly explain the three methods of economic evaluation of highway projects.
7. Briefly explain the various factors affecting the VOC.
8. Explain the concept of BOT and BOOT, in financing highway projects.
9. Explain the various benefits that a road user gets by the improvement of road.
10. Compare the annual cost of two types of pavement structures:

i) WBM with thin bituminous surface at total cost of Rs. 2.2 lakhs per km, life of 5 years, interest at 10%, salvage value of Rs. 0.9 lakhs after 5 years, annual average maintenance cost of Rs. 0.35 lakhs per km and ii) BM base and BC surface, total cost of Rs. 4.2 lakhs per km, life of 15 years, interest at 8%, salvage value of Rs. 2.0 lakhs at the end of 15 years, annual average maintenance cost of Rs. 0.25 lakhs per km.

11. Write a short note on: a) Annual cost method. b) Benefit cost ratio method. c) Alligator Cracking. d) Mud pumping.

MODULE - 5

1. What are the objectives of conning of wheels and tilting of rails? Explain with sketches.
2. What are gauges of track? Write the different values of gauge adopted on Indian Railways?
3. Draw a typical cross-section of a double track B.G. Railway on trunk route and briefly
4. Indicate the functions of each of the components – electrical railway.

5. Discuss the different type's causes of rail failures with relevant sketches.
6. Explain (a) Rail wear (b) Rail creep giving their causes & remedies.
7. What are different types of rail wear? How the wear of rail con be minimized.
8. What do you understand by the "creep of rail"? Explain any one of the theories to explain the occurrence of creep. How do you prevent the occurrence of creep?
9. Compare the different ballast materials with respect to merits, demerits and suitability of each material as ballast.
10. What are the requirements of good sleeper to be used in railway track? Mention the advantages and limitations of a wooden sleeper.
11. An 8° curve on BG track branches of from a 4V main curve in opposite direction of a BG yard. If the speed on main line is 60 kmph, determine the speed restriction on the branch line for a cant deficiency of 7.2 cm.
12. Explain briefly the different types of yards. With a neat sketch explain the functioning of marshalling yard.
13. What is healing divergence? What are its values adopted in Indian Railway.
14. What are the design details in a diamond crossing? Explain with sketches.
15. Explain different types of switches with the help of neat sketches?
16. With the help of a single line sketch label all the important parts of a right hand turn
17. List the types of track junctions. Explain the working principle of a diamond crossing by suitable sketch.
18. What are the factors to be kept in view for selecting the site for a railway station? Enumerate the classification and requirement of a station.
19. Compute the quantity of various materials required to construct one-kilometer length of BG track. Take the sleeper density of n=7.
20. Explain briefly the different aircraft characteristics that influence the design of airport.
21. Write a brief note on development of air transportation in India?
22. Draw a neat sketch of airport layout and mention the function of each component.
23. What are the factors to be considered in the selection of an airport site and explain them briefly?
24. What is basic length of runway and explain how it is determined?
25. What is wind rose? With a given set of wind data, explain how the wind rose diagram can be drawn on the principle of cross wind component.
26. Explain the construction of type II wind rose diagram for orientation of runway.
27. Draw a neat sketch of cross section of runway and indicate various geometrics.
28. Enumerate the assumptions made for designing the basic runway length.
29. Write short note on: (i) Calm period (ii) Wind Head (iii) Cross wind component (iv) Estimation of time of utilization of runway (v) wind coverage.
30. Explain briefly the various factors, which affect the layout of taxiway.
31. Draw the schematic diagram of Instrumentation Landing System (ILS) showing various components.
32. How visual aids are classified for airports? (Airport marking and airport lighting)
33. What are different control aids available for proper air trafficking at airports?
34. Determine the orientation of the runway from the observed wind data in % given below, starting from North direction in clock wise direction: 4.2, 1.3, 2.0, 4.9, 6.8, 11.2, 14.2, 7.5, 4.3, 1.2, 1.8, 3.4, 8.1, 9.9, 7.2, 2.6.

Prepared by	Checked by		
Prof. S.M.Chandrakanth	Prof. Preethi R Patil	HOD Civil Engineering S.J.P.N.T's.HIT, Nidasoshi	PRINCIPAL HIT, Nidasoshi

Subject Title	DESIGN OF RC STRUCTURAL ELEMENTS		
Subject Code	21CV53	CIE Marks	50
Number of Lecture Hrs / Week	(2:2:0)	SEE Marks	50
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. Preethi R. Patil	**Designation:** Asst. Professor	**Experience:** 5Years
No. of times course taught: 03	**Specialization:** Structural Engineer	

Sl.No	Branch	Semester	Subject
01	Civil Engineering	I	Elements of civil engineering
02	Civil Engineering	III	Strength of Materials

2.0 Course Objectives

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading
2. Follow a procedural knowledge in designing various structural RC elements.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to:

Sl.No	Course Outcome	RBT Level	POs
C303.1	Understand the design philosophy and principles.	L1,L2,L3,L4	1,2,3,5,6,8,12
C303.2	Solve engineering problems of RC elements subjected to flexure, shear and torsion	L1,L2,L3,L4	1,2,3,5,6,8,12
C303.3	Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.	L1,L2,L3,L4	1,2,3,5,6,8,12
C303.4	Understand the Design of cantilever, simply supported and one way continuous slab.	L1,L2,L3,L4	1,2,3,5,6,8,12
C303.5	Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments	L1,L2,L3,L4	1,2,3,5,6,8,12
	Total Hours of instruction		**40**

4.0 Course Content

Module-1

Introduction to working stress and limit State Design: Introduction to working stress method, Difference between Working stress and Limit State Method of design, Modular Ratio and Factor of Safety and evaluation of design constants for working stress method. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only. Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam. Side face reinforcement, slender limits of beams for stability.

Module-2

Limit State Analysis of Beams: Analysis of singly reinforced, doubly reinforced & flanged beams for flexure & shear

Module-3

Limit State Design of Beams: Design of singly and doubly reinforced beams, Design of flanged beams, design for combined bending, shear and torsion as per IS-456.

Module-4

Limit State Design of Slabs and Stairs: Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases. Importance of bond, anchorage length and lap length.

Module-5

Limit State Deign of Columns and Footings: Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load and also for axial load & moment.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
1.	V	Analysis of indeterminate structure	Structural analysis
2.	V	Design of reinforced concrete	Analysis of Beams
3.	VI	Design of steel structure	Analysis of Beams

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Load distribution on structure , deflection of beams

7.0 Gap Analysis and Mitigation

Sl No	Delivery Type	Details
01	Tutorial	Topic: Analysis of plane trusses

8.0 Books Used and Recommended to Students

Text Books

1. Unnikrishnan Pillai and Devdas Menon, " **Reinforced Concrete Design"** , McGraw Hill, New DelhI
2. Subramanian, " **Design of Concrete Structures"** , Oxford university Press
3. H J Shah, **"Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)"** , Charotar Publishing House Pvt. Ltd.

Reference Books

1. P C Varghese, "Limit State design of reinforced concrete" , PHI, New Delhi.
2. W H Mosley, R Husle, J H Bungey, "Reinforced Concrete Design", MacMillan Education, Palgrave publishers.
3. Kong and Evans, "Reinforced and Pre-Stressed Concrete", Springer Publications.
4. A W Beeby and Narayan R S, "Introduction to Design for Civil Engineers", CRC Press
5. Robert Park and Thomas Paulay, "Reinforced Concrete Structures", John Wiley & Sons, Inc.

Additional Study material & e-Books

Class notes and vtu notes

9.0 Relevant Websites (Reputed Universities & Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
https://en.m.wikipedia.org

10.0 Magazines/Journals used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	International Journal of MAT	www.matjournals.com

11.0 Examination Note

. Assessment Details both (CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing
mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied
the academic requirements and earned the credits allotted to each subject/ course if the student secures not less
than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of
100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

Two Unit Tests each of 30 Marks (duration 01 hour 30 Minutes)

- First test after the completion of 30-40 % (after the completion of first two modules) of the syllabus
- Second test after completion of 80-90% (after the completion of modules three and four) of the syllabus

One Improvement test before the closing of the academic term may be conducted if necessary. However best two
tests out of three shall be taken into consideration

Two assessments each of 20 Marks

The teacher has to plan the assignments and get them completed by the students well before the closing of the
term so that marks entry in the examination portal shall be done in time. Formative (Successive) Assessments include Assignments/Quizzes/Seminars/ Course projects/Field surveys/ Case studies/ Hands-on practice (experiments)/Group Discussions/ others. The Teachers shall choose the types of assessment depending on the requirement of the course and plan to attain the COs and POs. (to have a less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). CIE methods /test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

The sum of two tests, two assessments, will be out of 100 marks and will be scaled down to 50 marks

Semester End Examination(SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the
subject (**duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student

has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**

- There will be 2 questions from each module. Each of the two questions under a module (with a maximum **of 3 sub-questions),** should have a mix of topics **under that module.**

SCHEME OF EXAMINATION:

Question paper pattern:

1.The question paper will have **ten** full questions carrying equal marks.
2. Each full question consisting of **20** marks.
3. There will be **two** full questions (with a **maximum** of **four** sub questions) from each module.
4. Each full question will have sub question covering all the topics under a module.
5. The students will have to answer **five** full questions, selecting **one** full question from each module.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
Module 1	1	Introduction to working stress method	20
	2	Difference between Working stress and Limit State Method of design	
	3	Modular Ratio and Factor of Safety and evaluation of design constants for working stress method.	
	4	Philosophy and principle of limit state design with assumptions	
	5	Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.	
	6	concept of balanced section, under reinforced and over reinforced section.	
	7	Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only	
	8	Cracking in reinforced concrete members, calculation of crack width of singly reinforced beam.	
	9	Side face reinforcement, slender limits of beams for stability	
	10	Numerical problems	
Module 2	11	Analysis of singly reinforced,	20
	12	Analysis of doubly reinforced	
	13	Numerical problems	
	14	Analysis of flanged beams	
	15	Numerical problems Analysis of flexure	
	16	Analysis of flexure	
	17	Numerical problems	
	18	Analysis of shear	
	19	Numerical problems	
	20	Numerical problems	
Module 3	21	Design of singly reinforced beams	20
	22	Design of doubly reinforced beams	
	23	Numerical problems	
	24	Design of flanged beams	
	25	Numerical problems	
	26	design for combined bending	
	27	Numerical problems	
	28	Design for shear as per IS-456	
	29	Design for torsion as per IS-456	

	30	Numerical problems	
	31	Introduction to one way and two way slabs	
Module 4	32	Design of cantilever	20
	33	simply supported and one way continuous slab.	
	34	Design of two way slabs for different boundary conditions.	
	35	Design of dog legged	
	36	Design of open well staircases	
	37	Importance of bond	
	38	anchorage length.	
	39	lap length	
	40	Numerical problems	
Module 5	41	Analysis and design of short axially loaded RC column.	20
	42	Design of columns with uniaxia	
	43	Design of columns with biaxial moments	
	44	Design concepts of the footings	
	45	Design of Rectangular column footing	
	46	Design of square column footing	
	47	axial load & moment	
	48	Numerical problems	
	49	Numerical problems	
	50	Numerical problems	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl.No	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions on module 1	Understand the design philosophy and principles	Module 1 of the syllabus	3	Individual Activity.	Text 1 Ref Book 2
2	Assignment 2: Questions on module 2	Solve engineering problems of RC elements subjected to flexure, shear and torsion	Module 2 of the syllabus	5	Individual Activity.	Text 1 Ref Book 3
3	Assignment 3: Questions on module 3	Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings	Module 3 of the syllabus	8	Individual Activity.	Text 1 Ref Book 3
4	Assignment 4: Questions on module 4	Understand the Design of cantilever, simply supported and one way continuous slab	Module 4 of the syllabus	10	Individual Activity.	Text 1 Ref Book 3
5	Assignment 5: Questions on module 5	. Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments	Module 5 of the syllabus	12	Individual Activity.	Text 1 Ref Book 2

14.0 QUESTION BANK

MODULE 1

1. Explain the following a) Working stress method b) ultimate load method c) limit state method d) Modular ratio
2. Distinguish between a) working stress method & limit state method

b) under reinforced & over reinforced method

3. Derive the expressions for stress block parameters for compressive force Cu, Tensile force Tu, And Locate its depth y =0.42Xu from top.
4. A Singly reinforced rectangular beam 360mm x 580mm in section, is simply supported on a effective span of 5.25m. The steel reinforcement consists of 6-20dia, the beam supports a UDL of 25 KN/M. assume M20 concrete and Fe 415 steel. Check the design for short- and long-term deflections. Take Ultimate strain in concrete due to shrinkage as 0.0003 and coefficient of creep is unity. Effective cover may be taken as 40mm.
5. Obtain an expression for limiting percentage of steel for a rectangular RCC section with M15 concrete & Fe – 250 steels

MODULE 2

1. Difference between a) Analysis and design of an RCC structure b) Singly reinforced and doubly reinforced beams
2. Give steps for determining
a) Moment of resistance of a rectangular and T-beam
b) Shear reinforcement for rectangular beam
3. Determine the safe UDL the beam can carry for the simply supported beam of span 6m. The tension reinforcement consists of 4-20mm diameter, Size of beam is 250 x 600mm. Take fck – 25 N/mm^2 and fy=415 N/mm^2 and d' = 50mm
4. Calculate depth and area of steel at mid span of a simply supported beam over a clear span 5m. The beam is carrying all inclusive load 20KN/m. Assume 300mm bearings. Use M20 and Fe-500 Assume b = 1/2d
5. Determine the ultimate flexural strength of T-Beam having following sectional dimensions bf= 2500mm, bw=300mm, Df=125mm, d=800mm,D= 850mm, Area of tensions steel = 6-25mm dia bars ,Fck= 25N/mm^2 fy= 500 N/mm^2.

MODULE 3

1. Design a singly reinforced concrete beam to support a service live load of 5 KN/m over a Clear span of 5m.Adopt M25 Grade concrete and Fe 500 HYSD Bars. Assume Suitable data, if required.
2. A Beam of rectangular cross section of size 230 x 550 mm of effective span of 6.5m. Take live load as 4 KN/m,fck= 20N/mm^2, fy=415 N/mm^2, Design a beam for flexure and shear

3.A cantilever beam of 3m clear carries a load of 35KN/m. The width of the beam is 300mm. Design the beam for flexure and shear. Sketch the reinforcement details. Assume suitable data, if required

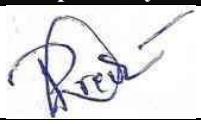
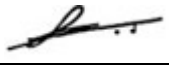
4.Design a rectangular RC beam section to carry a unfactored bending moment of 150 kN-m unfactored shear force of 75 KN and a unfactored torsional moment of 50 KN.m use M-25 grade concrete and Fe 415 grade steel.

MODULE 4

1. Difference between one way and two way slab
2. Under what conditions a slab is designed as a two way slab
3. Will the two way slab be thinner than one way slab for the same loading and dimension
4. Explain the structural action of one way and two way slabs with the help of sketches
5. Differential between Dog- legged and open well stair case
6. What is the importance of bond, anchorage length and lap length
7. Column of multi storied building is reinforced with 20mm diameter Fe- 415 bars. Calculate the lap lengthrequired .Use M20 grade concrete.

MODULE 5

1. Differentiate between short column and long column
2. Differentiate between uniaxial bending and biaxial bending
3. What are the assumptions made for limit state of collapse in compression
4. What is IS code guidelines for longitudinal and lateral reinforcement in column
5. Why does code require all columns to be able to resist a minimum eccentricity of loading
6. Explain the design steps for a) Axially loaded short column b) Axial load and uniaxial bending moment
7. Design the isolated rectangular footing of uniform depth for the column size 300 x 500 mm subjected to a dead load and live load. The column has an unsupported length of 3.5 m and effectively held in position and restrained against rotation at both ends. Use M25 grade concrete and Fe -415 steel.

Prepared by	Checked by		
			
Prof. Preethi.R.Patil	**Prof. V.I .Patil**	**HOD**	**Principal**

Subject Title	Basic Geotechnical Engineering		
Subject Code	21CV54	CIE Marks	50
Number of Lecture Hrs / Week	(2:2:0)	SEE Marks	50
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:		
Name: Prof. Sudarshan V Jore	**Designation:** Asst. Professor	**Experience: 01 year**
No. of times course taught: 02	**Specialization:** Construction Technology and Management	

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	Civil Engineering	III	Earth Resources and Engineering
02	Civil Engineering	IV	Engineering Geology

2.0 Course Objectives

1. Become familiar with geotechnical engineering problems.
2. Assess the improvement in mechanical behaviour by densification of soil.
3. Appreciate basic concepts of soil mechanics and comprehend basic engineering and mechanical properties of different types of soil.
4. Model and measure strength deformation characteristics and bearing capacity of soils.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to:

Sl.No	Course Outcome	RBT Level	POs
C504.1	Determine the index properties of soil and hence classify the soil.	L1,L2,L3	1,2,3,5,6,8,12
C504.2	Assess the compaction and consolidation characteristics of soil.	L1,L2,L3	1,2,3,5,6,8,12
C504.3	Determine the permeability of soils and assess the seepage in hydraulic structures.	L1,L2,L3	1,2,3,5,6,8,12
C504.4	Evaluate shear parameters of soil using shear tests.	L1,L2,L3	1,2,3,5,6,8,12
C504.5	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure	L1,L2,L3	1,2,3,5,6,8,12
	Total Hours of instruction		40

4.0 Course Content

Module-1

Introduction: Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships. Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis(sieve and Hydrometer analysis) Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

Module-2

Flow through soils: Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.

Seepage Analysis: Laplace equation, assumptions, limitation sand its derivation. Flow nets, characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreatic line (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.

Effective Stress Analysis: Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

Module-3

Compaction of Soils: Definition, Principle of compaction, Standard & Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-comp active effort & method of compaction, lift thickness & number of passes, Proctor's needle, Compacting equipment's & their suitability

Consolidation of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensional consolidationtheory-assumptionsandlimitations.GoverningdifferentialEquation and solution (No derivation). Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils

Module-4

Shear Strength of Soil: Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotropy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

Module-5

Bearing Capacity of Shallow Foundation: Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil: SPT and plate load test.

Foundation settlement: Types of settlement and importance, computation of immediate, consolidation and creep settlement, permissible, differential and total settlement.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VI	Applied Geotechnical Engineering	Soil Exploration, Drainage and Dewatering, Lateral Earth Pressure
02	VI	Ground Water Hydraulics	Darcy's law, Well hydraulics
03	VII	Advanced Geotechnical Engineering	Shallow Foundations, Pile Foundations
04	VII	Ground Improvement Techniques	Earthquake Geotechnical Engineering,

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Analysis of soil prior to any construction and methods to improve bearing capacity of soil

7.0 Gap Analysis and Mitigation

Sl No	Delivery Type	Details
01	Tutorial	Solving problems of GATE, Other University and previous year QP's
02	NPTEL	Introduction to Soil Mechanics

8.0 Books Used and Recommended to Students

Text Books

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi.
2. Punmia B C, Soil Mechanics and Foundation Engineering, Laxmi Publications co., New Delhi.
3. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
4. Braja, M. Das, Geotechnical Engineering; Thomson Business Information India (P) Ltd., India.

Reference Books

1. T.W. Lambe and R.V. Whitman, Soil Mechanics-, John Wiley & Sons.
2. Donald P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi.
3. Shashi K. Gulathi & Manoj Datta, Geotechnical Engineering-. , Tata McGraw Hill Publications.
4. Debashis Moitra, "Geotechnical Engineering", Universities Press.,
5. Malcolm D Bolton, "A Guide to soil mechanics", Universities Press.,
6. Bowles J E , Foundation analysis and design, McGraw- Hill Publications.

Additional Study material & e-Books

Class notes and vtu notes

9.0 Relevant Websites (Reputed Universities & Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References

https://en.m.wikipedia.org

10.0 Magazines/Journals used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	International Journal of MAT	www.matjournals.com

11.0 Examination Note

Scheme of Evaluation for CIE (50 Marks)

- **Internal Assessment:**
  Total of Three unit tests will be conducted for 20 Marks each.
  1. First at the end of 5th week of the semester.
  2. Second at the end of 10th week of the semester.
  3. Third at the end of 15th week of the semester.

- **Assignment:**
  Two assignments each of 10 Marks
  1. First at the end of 4th week of semester.
  2. Second at the end of 9th week of semester.
- **Quiz**
  Quiz of 20 marks
  1. At the end of 13th week of semester.

The sum of three tests, two assignment and quiz will be out of 100 and will be scaled down to 50 Marks.

SCHEME OF EXAMINATION: 100 Marks, scaled down to 60 in VTU result sheet.
The question paper will have ten questions.

- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of three sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
Module 1	1	Origin and formation of soil	20
	2	Regional soil deposits in India	
	3	Phase Diagram, phase relationships, definitions and their interrelationships	
	4	Numerical Problems	
	5	Determination of Index properties	
	6	Sieve analysis and Hydrometer analysis	
	7	Activity of clay, Field identification tests, Plasticity chart	
	8	Atterberg's Limits, consistency indices., BIS soil classification (IS: 1498-1970)	
Module 2	9	Flow through Soil, Darcy's law-assumption and validity	20
	10	Coefficient of permeability and its determination (laboratory and field)	
	11	Factors affecting permeability, permeability of stratified soils, seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.	
	12	Seepage Analysis, Laplace equation, assumptions, limitation sand its derivation. Flow nets, characteristics and applications	
	13	Flow nets for sheet piles and below the dam section	
	14	Unconfined flow, Phreaticline (Casagrande's method–with and without toe filter), flow through dams, design of dam filters	

	15	Effective Stress Analysis: Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress	
	16	Impact of the effective stress in construction of structures, quick sand phenomena.	
Module 3	17	Compaction of Soils: Definition, Principle of compaction, Standard and Modified proctor's compaction tests	20
	18	Factors affecting compaction, effect of compaction on soil properties, Consolidation of Soil, Definition, Mass-spring analogy.	
	19	Terzaghi's one dimensional consolidation theory-assumptions and limitations	
	20	Governing differential Equation and solution	
	21	Consolidation characteristics of soil (Cc, av, mv and Cv)	
	22	Laboratory one dimensional consolidation test	
	23	Characteristics of e-log (σ') curve	
	24	Pre-consolidation pressure and its determination by Casagrande's method, Over consolidation ratio, normally, under and over consolidated soils.	
Module 4	25	Shear Strength of Soil, Concept of shear strength	20
	26	Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion	
	27	Total and effective shear strength parameters	
	28	Factors affecting shear strength of soils. Thixotrophy and sensitivity	
	29	Measurement of shear strength parameters - Direct shear test, unconfined compression test	
	30	Triaxial compression test under different drainage conditions.	
	31	Field Vane shear test under different drainage conditions.	
	32	Numerical problems	
Module 5	33	Bearing Capacity of Shallow Foundation	20
	34	Determination of bearing capacity by Terzaghi's and BIS method	
	35	Modes of shear failure	
	36	Factors affecting Bearing capacity of soil, Effect of water table and Eccentricity on bearing capacity of soil	
	37	Field methods of determining bearing capacity of soil,SPT and plate load test	
	38	Foundation settlement and its types	
	39	Computation of immediate, consolidation and creepsettlements	
	40	Permissible, differential and total settlements	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl.No	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions on module 1 and module 2	Determine the index properties of soil and hence classify the soil., assess the compaction and consolidation characteristics of soil.	Module 1 and 2 of the syllabus	4	Individual Activity.	Text 1 Ref Book 2
2	Assignment 2: Questions on module 3, module 4 and module 5	Determine the permeability of soils and assess the seepage in hydraulic structures., evaluate shear parameters of soil using shear tests. and ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure	Module 3,4 and 5 of the syllabus	9	Individual Activity.	Text 1 Ref Book 3
3	Quiz	Basic knowledge of the geotechnical engineering covering entire syllabus of the course	Module 1,2,3,4 and 5 of the syllabus	13	Individual Activity.	Text 1 Ref Book 2

14.0 QUESTION BANK

MODULE 1

1. With the help of three phase diagram, explain
   Void ratio Porosity
   Water content Degree of saturation
2. With usual notation prove the relation between e , w, G, Sr
3. Determine dry density, void ratio, porosity and degree of saturation.
   Given bulk density- 26KN/m3, G 2.67 and w-16%
4. Define liquid limit, plastic limit and shrinkage limit.
5. Explain the Indian Standard Soil classification system.
6. A Fine-grained soil has a liquid limit 54% and a plastic 30%, Classify the soil as per IS classification.

MODULE 2

1. What is a flow net? What are the uses and characteristics of flow nets?
2. The porosity of certain sample of sand was 50% in the loose state and 34% in the dense state. The specific gravity is 2.70. Estimate the critical hydraulic gradient in loose and dense states.
3. Compute the quantity of water seeping under a weir per day for which the flow net has been satisfactly constructed. The coefficient of permeability is $2x10^{-2}$ mm/s
   Nf= 5 and Nd= 18. The difference in water level between upstream and downstream is 3.0 m. The length of the weir is 60m.
4. With the help of neat sketches, derive an equation to determine permeability by the following laboratory method and also state their suitability.
   i. Constant head permeability test
   ii. Falling head permeability method
5. What are the factors affecting permeability test.

MODULE 3

1. Following are the results of compaction test.

Weight of the soil with the mould (N)	29.25	30.95	31.50	31.25	30.70
Water content (%)	10	12	14.3	16.1	18.2

   Plot the compaction curve showing MDD and OMC, Given G = 2.70,
   Volume of mould = 1000cm^3, Weight of mould = 10N
2. Explain Electrical Diffuse double layer
3. Distinguish between Standard and modified compactor tests.
4. For constructing an embankment, the soil is transported from borrow area using truck which can carry 6m^3 of soil at a time. Determine the number of truck loads of soil required to obtain 100m^3 of compacted earth fill and the volume of borrow pit. Use the following details.

Property	Borrow area	Truck loose	Field compacted	Soil type
Bulk density (KN/m^3)	16.6	11.5	18.2	Well graded
Water Content (%)	8	6	14	

5. Explain with neat sketch, the mass spring analogy
6. Explain normally consolidated soil and over consolidated soil.
7. Explain with neat sketch, determination of Pre consolidation pressure by Casagrande's method.
8. Explain square root of time fitting method.
9. A 20mm thick isotropic clay stratum overlies an impervious rock. The coefficient of consolidation of soil is 5 x 10-2 mm2. Find the time required for 50% and 90% consolidation. Time factors are 0.2 and 0.85 for 50% and 90% consolidations respectively.

MODULE 4

1. Explain Mohr Coloumb failure theory of soil.
2. What are the factors affecting the shear strength of the soil?
3. In a shear test conducted on river sand, the following results were obtained.

Normal Force (N)	80	160	240	320	400	480
Shear force (N)	50	101	149	201	248	302

Determine 'e' and 'φ'

4. With the neat sketches, derive an equation to determine shear strength by vane shear test.
5. In a triaxial test on two identical soil samples the following data was obtained.

Test No	Cell pressure (KN/m2)	Maximum deviation stress (KN/m2)	Maximum principal stress (KN/m2)
01	50	120	
02	100		332

MODULE 5

1. Determine the bearing capacity of the soil by using plate load test as per IS : 1888 guidelines.
2. A square footing located at a depth of 1.3 m below ground has to carry a safe load of 800 kN. Predict the size of fooling which is safe against applied load. If the desired factor of safety is 3.0. Assume e = 0.55, Degree of Saturatm = 50%m G = 2.67, C = 8 kN/m2. Use Terzagh's analysis for general shear failure. Assume C= 30^0 , NC = 37.2, Nq = 22.5 and Nr = 19.7.
3. Generalize the assumptions made by Terzagh's bearing capacity theory for development of bearing capacity equation.
4. Determine the bearing capacity of the soil by using standard penetration test as per IS : 2131 guidelines.
5. Explain the types of shear failures with neat sketches.
6. With the help of neat sketches, explain the effect of water table and eccentric loading on bearing capacity of soils.
7. A square footing is to be constructed on a deep deposit of sand at a depth of 0.9m to carry a design load of 300 kN with a factor of safety 2.5. The ground water table may rise to the ground level during the rainy season. Design the plan dimension of footing given Υ_{sat} = 20.8 kN/m^3, Nc= 25, Nq= 34 and N_Υ = 32.
8. List the assumption and limitations made in Terzaghi's analysis.
9. With neat sketch plate load test.
10. A Square footing 2.8 x 2.8 m is built on a homogeneous bed of sand of density 18kN/m^3 and Ø = 36^0. If the depth of foundation is 1.8m. Determine the safe load on footing. Take F = 2.5. Also find safe allowable load.

Prepared by	Checked by		
Prof. Sudarshan V Jore	Prof. S.M.Chandrakanth	H O D	Principal

Subject Title	GEOTECHNICAL ENGINEERING LABORATORY		
Subject Code	21CVL55	CIE Marks	50
Number of Lecture Hrs /	0:0:2	SEE Marks	50
Total Number of Lecture Hrs	1	Exam Hours	03
CREDITS – 01			

FACULTY DETAILS:		
Name: Prof. S. V. Jore	**Designation:** Asst. Professor	**Experience:** 2 Years
No. of times course taught: 02	**Specialization:** Construction Technology and Management	

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	Civil Engineering	III	Earth Resource Engineering
02	Civil Engineering	V	Basic Geotechnical Engineering

2.0 Course Objectives

Course Learning Objectives:

This course will enable students to:

1. To carry out laboratory tests and to identify soil as per IS codal procedures
2. To perform laboratory tests to determine index properties of soil
3. To perform tests to determine shear strength and consolidation characteristics of soils

3.0 Course Outcomes

Having successfully completed this course, the student will be able to:

Sl.No	Course Outcome	RBT Level	POs
CO1	Physical and index properties of the soil	L1,L2,L3,L4	1,2,3,5,6,8,12
C02	Classify based on index properties and field identification	L1,L2,L3,L4	1,2,3,5,6,8,12
C03	To determine OMC and MDD, plan and assess field compaction program	L1,L2,L3,L4	1,2,3,5,6,8,12
CO4	Shear strength and consolidation parameters to assess strength and deformation characteristics	L1,L2,L3,L4	1,2,3,5,6,8,12
CO5	In-situ shear strength characteristics(SPT-Demonstration)	L1,L2,L3,L4	1,2,3,5,6,8,12

4.0 Course Content

1. Specific gravity test (pycnometer and density bottle method). Water content determination by oven drying and Pycnometer method, rapid moisture meter method.
2. Grain size analysis
    i. Sieve analysis
3. In-situ density tests
    i. Core-cutter method
    ii. Sand replacement method
4. Consistency limits
    i. Liquid limit test(by Casagrande's and cone penetration method)
    ii. Plastic limit test
    iii. Shrinkage limit test
5. Standard compaction test (light and heavy compaction)
6. Co-efficient of permeability test
    i. Constant head test
    ii. Variable head test
7. Shear strength tests
    i. Unconfined compression test
    ii. Direct shear test
    iii. Triaxial test (unconsolidated undrained test only)
8. Consolidation test: To determine pre consolidation pressure only (half an hour per loading-test).

Demonstration Experiments (For CIE)

9. Field identification of soil
10. Hydrometer Analysis
11. Rapid moisture meter method.
12. Shrinkage limit test.
13. Demonstration of Swell pressure test
14. Standard penetration test and boring equipment
15. Laboratory vane shear test

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
1.	VI	Applied Geotechnical Engineering	Geotechnical engineering, permeability , shear strength
2.	VII	Advanced Geotechnical Engineering	Geotechnical engineering, permeability , shear strength
3.	VII	Applied Geotechnical Engineering	Geotechnical engineering, permeability , shear strength
4.	VII	Earthquake Engineering	Geotechnical engineering, permeability , shear strength

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine

7.0 Books Used and Recommended to Students

Reference Books
• Punmia B C, Soil Mechanics and Foundation Engineering-(2017),16th Edition, Laxmi Publications co., New Delhi. • Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi. • Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press • BowlesJ.E.,"EngineeringPropertiesofSoilandTheirMeasurements",-McGrawHillBookCo.NewYork. Relevant BIS Codes of Practice: IS-2720 series
Additional Study material & e-Books
Class notes and vtu notes

8.0 Relevant Websites (Reputed Universities & Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
https://en.m.wikipedia.org

9.0 Magazines/Journals used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	International Journal of MAT	www.matjournals.com

10.0 Examination Note

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment to be evaluated for conduction with observation sheet and record writeup. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.

• Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.

• In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.

• The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book

• The average of 02 tests is scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

• All laboratory experiments are to be included for practical examination.

• (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer 08122023 script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

• Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

• Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

• General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

• Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book

11.0 Course Delivery Plan

Expt No	Name of the Experiment	% of Portion
1	Specific gravity test (pycnometer and density bottle method). Water content determination by oven drying and Pycnometer method, rapid moisture meter method.	10
2	Grain size analysis i. Sieve analysis	10
3	In-situ density tests i. Core-cutter method ii. Sand replacement method	10
4	Consistency limits i. Liquid limit test (by Casagrande's and cone penetration method) ii. Plastic limit test iii. Shrinkage limit test	10

5	Standard compaction test (light and heavy compaction)	10
6	Co-efficient of permeability test i. Constant head test ii. Variable head test	10
7	Shear strength tests i. Unconfined compression test ii. Direct shear test iii. Triaxial test (unconsolidated undrained test only)	10
8	Consolidation test :To determine pre consolidation pressure only(half an hour per loading-test)	10
	Demonstration Experiments	
9	Field identification of soil	-----
10	Hydrometer Analysis	-----
11	Rapid moisture meter method.	-----
12	Shrinkage limit test.	-----
13	Demonstration of Swell pressure test	-----
14	Standard penetration test and boring equipment	-----
15	Laboratory vane shear test	-----

12.0 QUESTION BANK

1) List 'k' values for different types of soils.
2) How permeability test is done in the field?
3) Mention other permeability tests that can be done in the lab.
4) What is the application of permeability of soils?
5) Derive the expression for 'k' by falling head method.
6) Is hydraulic gradient constant in variable head test? Why?
7) How will you reduce observed permeability to permeability at standard temperature?
8) What is the necessity of two methods for determination of 'k' in lab?
9) Estimate discharge velocity in constant head test conducted. What is seepage velocity?
10) Time interval for flow from h1 to h0 should be same as that from h0 to h2 Why?
11) Depth of hole made in field is limited to 15 cm.Why?
12) Explain core cutter method for determination of in-situ density of soil.
13) Explain the significance of in-situ density soil density determination.
14) What is the approximate value of degree of saturation at OMC?
15) How does amount of compaction affect maximum dry density and OMC?
16) What is the procedure for conducting modified proctor test?
17) What is the use of proctor's needle? How is it used for compaction control in the field?
18) Explain how soil compaction is achieved?
19) How correction for initial concavity is done in load-penetration curve?
20) What is the application of CBR test results?
21) Write the procedure to find expansion ratios for a soaked test.
22) What is the need for adding surcharge weights?
23) Draw plasticity chart and mark the soil tested and classify soil.
24) What is activity number?
25) Why clay exhibit plasticity while silt does not?
26) Indicate engineering uses of IP, IT, IL and IC
27) Is soil fully saturated at shrinkage limit?

28) Explain the one-point method for liquid limit determination.
29) If the plastic limit is greater than or equal to liquid limit, how will you report IP of thesoil?
30) If plastic limit can't be determined for sandy soil, how will you report plasticity index?
31) Whether oven drying of sample before test is permitted? If not, why?
32) Find compression index of given normally sensitive clay. What is the use of it?
33) How will you differentiate organic and inorganic soil using liquid limit test?
34) What is the use of Cv? When it is used?
35) Can permeability be determined from consolidation test indirectly?
36) Which type of permeability test can be done directly? Explain.
37) What result do you expect if a consolidation test is conducted on sand?
38) Suppose loading pad is placed such that it touches the sides of the ring. What willhappen?
39) If entrapped air is not removed completely, how will it affect the value of G of soilsolids?
40) Specify the range for the specific gravity of soil solids.
41) What is the practical application of specific gravity of soil solids?
42) What are the limitations of this test?
43) Draw mohr's circle for failure for a direct shear test and mark the failure plane, majorand minor principal plane.
44) If test is done under normal stress of 40 N/cm2, find the shear load at which this soil willfail.
45) What is the procedure for determination of shear strength parameters of clay usingdirect shear test?
46) Pour dry sand on horizontal surface and find angle of repose. Compare this angle withangle of shearing resistance.
47) What are the advantages of triaxial test over direct shear test?
48) What is the practical significance of cell pressure in this test?
49) Explain the changes to be incorporated for a drained test, in the procedure forundrained test.
50) Explain the stress conditions at the time of failure by drawing mohr's circle.
51) What do you mean by sensitivity of clay?
52) Draw mohr's circle for state of stress at failure in an unconfined compression test.
53) This test is used only for cohesive soils. Why?
54) Explain the relation between consistency and UCC value of clay.
55) Explain the terms sensitivity and thixotropy.
56) What type of soil yield dependable results by vane shear test? Why?
57) Why are different sizes of blades used in field vane shear test?
58) Why this test is an undrained test?
59) Is it possible to determine the effective shear strength parameters in vane shear test?

Prepared by	Checked by		
			
Prof S V Jore	Prof P R Patil	HOD	Principal

Subject Title	**ENVIRONMENTAL STUDIES**		
Subject Code	21CIV57	**IA Marks**	50
Number of Lecture Hrs /	01(L)+1(T)	**Exam Marks**	50
Total Number of Lecture Hrs	15	**Exam Hours**	01
CREDITS – 01			

FACULTY DETAILS:		
Name: Dr. M. S. Hanagadakar Dr. S. J. Walaki Dr. Tanuja S.B	Designation: i) Assoc. Professor ii) Asst. Professor iii) Asst. Professor	Experience: i) 18.0 ii) 6.0 iii)6.0
No. of times course taught: i) 08 ii) 03 iii)01	**Specialization:** i) Physical Chemistry ii) Organic Chemistry iii) Physical chemistry	

1.0 Prerequisite Subjects:

Fundamentals of Chemistry, Physics, Mathematics, Biology, Engineering, Anthropology, Sociology, (Social problems), Economics (production, consumption, and transfer of wealth), management, Ecology Knowledge are required.

2.0 Course Learning Objectives

1. Recognize major concepts in environmental sciences and demonstrate in-depth understanding of the environment.
2. Develop analytical skills, critical thinking, and demonstrate problem-solving skills using scientific techniques.
3. Demonstrate the knowledge and training for entering graduate or professional schools, or the job market.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to

Course Code	Course Outcome	RBT level	POs
C309.1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.	L1,L2	1,2,3,6,7,9 ,10,12
C309.2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.	L1, L2	1,2,3,6,7,9, 10,12
C309.3	Demonstrate ecology knowledge of a complex relationship between biotic and abiotic components.	L1, L2	1,2,3,6,7,9, 10,12
C309.4	Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.	L1, L2	1,2,3,6,7,9, 10,12
C309.5	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.	L1,L2	1,2,3,6,7,9, 10,12
Total Hours of instruction		**25**	

4.0 Course Content

Module-1

Ecosystems (Structure and Function): Forest, Desert, Wetlands, Riverine, Oceanic and Lake.

Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

Module -2

Advances in Energy Systems (Merits, Demerits, Global Status and Applications)**:** Hydrogen, Solar, OTEC, Tidal and Wind.
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.
Module -3
Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.
Waste Management & Public Health Aspects: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.
Module -4
Global Environmental Concerns:(Concept, policies and case-studies):Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.
Module -5
Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications): G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs.
Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be followed by understanding of process and its brief documentation.

5.0 Relevance to future subjects

Sl. No.	Semester	Subject	Topics
01	Common to all	Common to all engineering Subjects	Sustainable development, waste management, Pollution control, Energy systems, Environmental issues.

6.0 Relevance to Real World

Sl.No	Real World Mapping
01	All engineering applications / projects leading to the sustainable development, waste management, pollution control, to resolve global related issues.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL	http://nptel.ac.in/courses

8.0 Books Used and Recommended to Students

Text Books
1. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.
3. R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005,
4. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012.
Reference Books

1. Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005

2. P. Meenakshi, "Elements of Environmental Science and Engineering", Prentice Hall of India Private Limited, New Delhi, 2006

3. S.M. Prakash, "Environmental Studies", Elite Publishers Mangalore, 2007

4. Erach Bharucha, "Text Book of Environmental Studies", for UGC, University press, 2005

5. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Tenth Edition, Thomson Brooks /Cole, 2004

6. G.Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006

7. Dr.Pratiba Sing, Dr.AnoopSingh and Dr.Piyush Malaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
Web links and Video Lectures: https://nptel.ac.in/courses/120/108/120108005/ https://nptel.ac.in/courses/120/108/120108002/ https://nptel.ac.in/courses/120/108/120108004/ https://nptel.ac.in/courses/105/102/105102089/ https://www.my-mooc.com/en/categorie/environmental-science https://academicearth.org/environmental-studies/

10.0 Magazines/Journals Used and Recommended to Students

Sl.No	Magazines/Journals	website
1	Environmental-science	http://nlspub.ac.in/category/journals/journal-of-environmental-law-policy-and-development/
2	Environmental-research	https://www.journals.elsevier.com/environmental-research

11.0 Examination Note

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together
Continuous Internal Evaluation:
Three Unit Tests each of 20 Marks (duration 01 hour)
1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester
Two assignments each of 10 Marks
4. First assignment at the end of 4th week of the semester

5. Second assignment at the end of 9th week of the semester
Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)
6. At the end of the 13th week of the semester
The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks
(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.
Semester End Examination:
Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 01 hours)
Question paper pattern:
1. The Question paper will have 50 objective questions.
2. Each question will be for 01 marks
3. Students will have to answer all the questions on an OMR Sheet.
4. The Duration of the Exam will be 01 hour

12.0 Course Delivery Plan

Module No.	Lecture No.	Content of Lecturer	% of Portion
1	1	**Ecosystems** (Structure and Function):, Wetlands, Riverine	**20**
	2	Forest and Desert	
	3	Oceanic and Lake	
	4	**Biodiversity:** Types, Value; Hot-spots; Threats and Conservation of biodiversity.	
	5	Forest Wealth, and Deforestation	
2	6	**Advances in Energy Systems** (Merits, Demerits, Global Status and Applications)**:** Hydrogen,	**20**
	7	Solar and OTEC	
	8	Tidal and Wind.	
	9	**Natural Resource Management** (Concept and case-studies): Disaster Management.	
	10	Sustainable Mining, Cloud Seeding, and Carbon Trading.	
3	11	**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies)**:** Surface and Ground	**20**
	12	Water Pollution and Noise pollution	
	13	Soil Pollution and Air Pollution.	
	14	**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste	
	15	Hazardous wastes; E-wastes; Industrial and Municipal Sludge	
4	16	**Global Environmental Concerns:**(Concept, policies and case-studies):Ground water depletion/recharging.	**20**
	17	Climate Change; Acid Rain and Ozone Depletion	
	18	Radon and Fluoride problem in drinking water	
	19	Resettlement and rehabilitation of people	
	20	Environmental Toxicology.	
5	21	**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing.	**20**
	22	Environment Impact Assessment,	
	23	Environmental Management Systems, ISO14001, Environmental Stewardship-NGOs.	
	24	**Field work:** Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant.	

	25	Ought to be followed by understanding of process and its brief documentation.	

13.0 Assignments

Sl.No.	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 1 of the syllabus	2	Individual Activity.	Book 1, of the reference list. Website of the Reference list
2	Assignment 2: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 2 of the syllabus	4	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
3	Assignment 3: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 3 of the syllabus	6	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
4	Assignment 4: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 4 of the syllabus	8	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list
5	Assignment 5: University Questions/ Write up	Students study the Topics and write the Answers. Get practice to solve university questions.	Module 5 of the syllabus	10	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list

14.0 QUESTION BANK

Module-1

1. The term 'Environment' has been derived from the French word which means to encircle or surround
a) Environ b) Oikos c) geo d) Aqua
2. The objective of environmental education is
a) Raise consciousness about environmental conditions b) To teach environmentally appropriate behavior c) Create an environmental ethic d) All of the above
3. Which of the following conceptual spheres of the environment is having the least storage capacity for matter?
a) Atmosphere b) Lithosphere c) Hydrosphere d) Biosphere
4. Which of the following components of the environment are effective transporters of matter?
a) Atmosphere and Hydrosphere b) Atmosphere and Lithosphere
c) Hydrosphere and Lithosphere d) Biosphere and Lithosphere
5. Biosphere is
a) The solid shell of inorganic materials on the surface of the earth
b) The thin shell of organic matter on the surface of earth comprising of all the living things
c) The sphere which occupies the maximum volume of all of the spheres d) all of these.
6. Atmosphere consists of 79 per cent Nitrogen and 21 per cent Oxygen by
a) Volume b) weight c) Density d) All the three
7. Which of the following is a biotic component of an ecosystem?
a) Fungi b) solar light c) temperature d) humidity
8. In an ecosystem, the flow of energy is

a) Bi-directional b) Cyclic c) Unidirectional d) Multidirectional
9. Which Pyramid is always upright?
a) Energy b) biomass c) numbers d) food chain
10. In complex ecosystems the degree of species diversity is
a) Poor b) high c) medium d) none

Module-2

1. Which of the following is considered as an alternate fuel?
a) CNG b) Kerosene c) Coal d) Petrol
2. Solar radiation consists of
a) UV b) Visible light c) Infrared d) All of these
3. Reduction in usage of fuels cannot be brought about by
a) Using alternate fuels b) Changing lifestyles c) Reducing car taxes d) Both a) & b)
4. Which of the following is a hazard of a nuclear power plant?
a) Accident risk when tankers containing fuel cause spill
b) Radioactive waste of the power plant remains highly toxic for centuries
c) Release of toxic gases during processing d) All of these
5. The most important fuel used by nuclear power plant is
a) U – 235 b) U- 238 c) U – 245 d) U – 248
6. Biogas is produced by
a) Microbial activity b) Harvesting crop c) Both a) & b) d) None of these
7. Oil and Gas are preferred because of
a) Easy transportation b) Cheap c) Strong smell d) All of these
8. Biomass power generation uses
a) Crops b) Animal dung c) Wood d) All of these
9. Chernobyl nuclear disaster occurred in the year
a) 1984 b) 1952 c) 1986 d) 1987
10. Which of the following is not a renewable source of energy?
a) Fossil fuels b) Solar energy c) Tidal wave energy d) Wind energy

Module-3

1. Environmental pollution is due to
a) Rapid Urbanization b) deforestation c) Afforestation d) a & b
2. Which of the following are natural sources of air pollution?
a) Volcanic eruption b) solar flair c) earth quake d) all
3. Which of the following are biodegradable pollutants?
a) Plastics b) Domestic sewage c) detergent d) all
4. The liquid waste from baths and kitchens is called
a) Sullage b) Domestic sewage c) Storm waste d) Run off
5. Noise pollution can be minimized by
a) Urbanization b) Maintaining silence c) Reducing noise at source d) none
6. BOD Means
a) Biochemical oxygen demand b) chemical oxygen demand c) biophysical oxygen demand d) all
7. Which of the following industry generates colored waste?
a) Software industry b) Textile industry c) Biomedical industry d) none
8. Physical pollution of water is due to
a) Dissolved oxygen b) Turbidity c) pH d) none of these
9. Which of the following source is surface water?
a) Springs b) streams c) deep wells d) all
10. Deforestation can
a) Increase the rain fall b) Increase soil fertility c) Introduce silt in the rivers d) None of these
11. Which of the following is non point source of water pollution?
a) Factories b) Sewage treatment plant c) Urban and Sub-urban land d) all of the above

Module-4

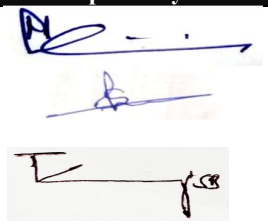
1. Acid rain can be controlled by
a) Reducing $SO_2$and NO_2emissions. b) Reducing oxygen emission.
c) Increasing number of lakes. c) Increasing the forest cover.
2. Atmospheric oxidation of $SO_2$to $SO_3$is influenced by
a) Sunlight. b) Humidity c) presence of hydrocarbons d) all of these
3. Reduction in brightness of the famous Taj Mahal is due to
a) Global warming. b) Air pollution c) Ozone depletion d) Afforestation.
27. The Effect of Acid rain

a) Reduces soil fertility. b) increases atmospheric temperature.
c) Causing respiratory problems d) skin cancer
4. The process of movement of nutrients from the soil by the Acid rain iscalled
a) Transpiration. b) Evapo transpiration c) Leaching d) Infiltration.
5. Ozone layer is present in
a) Troposphere b) Stratosphere c) Mesosphere d) Thermosphere
6. Which of the following statements about ozone is true?
a) Ozone is a major constituent of photochemical smog
b) Ozone protects us from the harmful uv radiation of sun
c) Ozone is highly reactive d) All of the above
7. Major compound responsible for the destruction of stratospheric ozone layer is
a) Oxygen b) CFC c) Carbon dioxide d) Methane
8. Ozone layer thickness is measured in
a) PPM b) PPB c) Decibels d) Dobson units
9. Normal average thickness of stratospheric ozone layer across the globe is around
a) 200 DU b) 300 DU c) 400 DU d) 500 DU
10. Chloro Fluro Carbon's (CFC) are
a) Non toxic b) Non flammable c) Non carcinogenic d) All these
11. Ozone layers absorbs
a) UV rays b) infra red rays c) Cosmic rays d) CO
12. Which of the following is not an ill effect of acid rain?
a) Results in killing fish b) causes stone leprosy. c) Leaches nutrients from the soil. d) Causes cataract.

13. Formation of ozone layer is explained by
a) Rosenmund reaction b) Henderson's reaction c) Chapman's reaction. d) Perkin's reaction
14. Each Chlorine free Radical can destroy the following number of ozone molecules.
a) 1000 b) 10,000 c) 1, 00, 000 d) 100
15. Which of the following statements about ozone is true?
a) Ozone is a major constituent of photochemical smog b) Ozone is highly reactive
c) Ozone protects us from the harmful UV radiation of sun. d) All of these

Module-5
1. Sustainable development means
a) Meeting present needs without compromising on the future needs b) Progress in human well beings
c) Balance between human needs and the ability of Earth to provide the resources d) All the above
2. The most important remedy to avoid negative impact due to industrialization is
a) Industry should be closed b) Don't allow new industrial units
c) Industry should treat all the wastes generated by it before disposal
d) Industries should be shifted far away from human habit tats.
3. Mining means
a) To conserve & preserve minerals b) To check pollution due to mineral resources
c) To extract minerals and ores d) None
4. E.I.A. can be expanded as
a) Environment & Industrial Act b) Environment & Impact Activities
c) Environmental Impact Assessment d) Environmentally Important Activity
5. E.I.A. is related to
a) Resource conservation b) Efficient equipment/process
c) Waste minimization d) All of the above
6. In order to protect the health of people living along the adjoining areas of roads, one should.
a) Plant trees alongside of the roads b) Not allow diesel driven vehicles
c) Shift them (people) to other places d) None of the above
7. The pollution caused by transportation/vehicular activities depends on
a) Type of the vehicle's engine b) Age of the vehicle
c) Traffic congestion d) All of the above
8. Sustainable development will not aim at
a) Social economic development which optimizes the economic and societal benefits available in the present, without spoiling the likely potential for similar benefits in the future
b) Reasonable and equitably distributed level of economic well being that can be perpetuated continually
c) Development that meets the needs of the present without compromising the ability of future generations
d) Maximizing the present day benefits through increased resource meet their own needs consumption
10. Which of the following is a key element of EIA?

a) Scoping b) Screening c) Identifying and evaluating alternatives d) all of these

Prepared by	Checked by		
			
Dr. M. S. Hanagadakar Dr. S. J. Walaki Dr. Tanuja. S.B	Dr. M. S. Hanagadakar	**HOD**	**Principal**

Subject Title	Quality Control and Quality Assurance		
Subject Code	21CV584	CIE Marks	50
Number of Lecture Hrs / Week	1:0:0:0	SEE Marks	50
Total Number of Lecture Hrs	15	Exam Hours	1
			CREDITS – 01

FACULTY DETAILS:		
Name: Prof.S.S Beesanakoppa	**Designation:** Asst. Professor	**Experience:** 2 Years
No. of times course taught: 01	**Specialization:** Quality Control and Quality Assurance	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Civil Engineering	II/III	Building Estimation

2.0 Course Objectives

1. Appreciate the concept of Quality
2. Articulate the Implication of Quality in construction
3. Implement QA & QC Programs
4. Realise the importance of QMS in Civil Engineering.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to:

	Course Outcome	RBT Level	POs
C308.1	Understand Quality History, Realize the importance of quality in construction	L1,L2,L3	1,2,3,5,6,8,12
C308.2	Apply SQC techniques in different aspects of construction	L1,L2,L3	1,2,3,5,6,8,12
C308.3	Implement QMS programs at different levels of construction	L1,L2,L3	1,2,3,5,6,8,12
C308.4	Frequency of material testing and reporting of basic construction materials	L1,L2,L3	1,2,3,5,6,8,12
C308.5	Conceptual Design, Preliminary Design, Detailed Design, Construction, Testing	L1,L2,L3	1,2,3,5,6,8,12
	Total Hours of instruction		**15**

4.0 Course Content

Module-1

Overview of Quality: Quality History, Quality Definition, Quality Inspection, Quality Control, Quality Assurance, Quality Engineering, Quality Management, Quality Gurus: Philip B. Crosby, W. Edwards Deming etc, PDCA Cycle, Costs associated with Quality, Reasons for Poor Quality

Module-2

Quality Management: Management Practices: TQM, Vision and Quality policy, Quality Function Deployment, Bench marking and performance evaluation, ISO 9000 Quality Management System, ISO 14000 Environmental Management System

Module-3

Statistical Quality Control: Importance of SQC in construction, Statistical parameters: sampling, population and sampling, measure of variability, measure of central tendency, Recommendations of IS 456:2000 on sampling, testing and acceptance criteria for concrete.

Module-4

QA and QC in Construction: Errors in concrete construction; Frequency of material testing and reporting of basic construction materials (cement, sand, coarse aggregate, bricks, steel), Norms for accepting and rejecting criteria of basic construction materials as per relevant IS codes.

Module-5

On-Site Quality: Achieving quality at different stages of construction: Conceptual Design, Preliminary Design, Detailed Design, Construction, Testing, Commissioning, and Handover. Quality assessment of concrete through NDT: rebound hammer and USPV tests and guidelines for accepting and rejecting.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	V	Construction projects	Achieving quality at different stages of construction

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Project Delivery planning, QA methodology

7.0 Gap Analysis and Mitigation

Sl No	Delivery Type	Details
01	NPTEL	Quality control and on site Quality

8.0 Books Used and Recommended to Students

Text Books
1. Juran J M and Gryna F M, Quality Planning and Analysis 2. Hutchins G, John L Ashford, The Management of Quality in Construction 3. Mohamed A. El-Reedy, "Concrete and Steel Construction, Quality Control and Assurance", CRC Press, Taylor and Francis Group 4. Amitava Mitra, Fundamentals of Quality Control and Improvement, WILEY Publications, 4th Edition 5. Abdul Razzak Rumane, Quality Management in Construction Projects, CRC Press, Taylor and Francis Group 6. M. S. Shetty, Concrete Technology, S Chand Publications 7. Relevant IS Codes
Reference Books
1. An introduction to fire dynamics -D.DRYSDALE 2. Structural fire protection Edt by T.T.LIE 3. Elevator technology - G.C.BARNEY 4. HEATING VENTILATING AND AIR CONDITIONING Analysis and Design - Faye C. McQuiston and Jerald D.

Parker.
5. Building Maintenance Management-R.LEE
6. Developments In Building Maintenance -I.EJ. GIBSON
7. Concrete Structures: materials, Maintenance And Repair D.CAMPBELL,ALLEN & H.ROPER

Additional Study material & e-Books

1. Online study material , You Tube videos

9.0 Relevant Websites (Reputed Universities and Others) for Notes/Animation/Videos Recommended

Website and Internet Contents References
https://en.wikipedia.org/wiki/transistor amplifier
https://en.wikipedia.org/wiki/oscillators

10.0 Magazines/Journals used and Recommended to Students

Sl.No	Magazines/Journals	Website
1	Elsevier journals	www.journals.elsevier.com/aeu

11.0 Examination Note

Scheme of Evaluation for CIE (50 Marks)

Three Tests (preferably in MCQ pattern with 20 questions) each of 20 Marks (duration 01 hour)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of 10 Marks

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours) The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks

SCHEME OF EXAMINATION: 100 Marks, scaled down to 50 in VTU result sheet.

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour. The student has to secure minimum of 35% of the maximum marks meant for SEE.

12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecturer	% of Portion
MODULE 1	1	Quality History, Quality Definition, Quality Inspection, Quality Control	20
	2	Quality Control, Quality Assurance, Quality Engineering, Quality Management	
	3	Gurus: Philip B. Crosby, W. Edwards Deming etc, PDCA Cycle, Costs associated with Quality, Reasons for Poor Quality	
MODULE 2	4	Management Practices: TQM, Vision and Quality policy,	20
	5	Quality Function Deployment, Bench marking and performance evaluation	
	6	ISO 9000 Quality Management System, ISO 14000 Environmental Management System	
MODULE 3	7	Importance of SQC in construction, Statistical parameters: sampling	20

	8	Population and sampling, measure of variability, measure of central tendency	
	9	Recommendations of IS 456:2000 on sampling, testing and acceptance criteria for concrete.	
MODULE 4	10	Errors in concrete construction; Frequency of material testing	20
	11	Reporting of basic construction materials	
	12	Norms for accepting and rejecting criteria of basic construction materials as per relevant IS codes.	
MODULE 5	13	Achieving quality at different stages of construction: Conceptual Design	20
	14	Preliminary Design, Detailed Design, Construction, Testing, Commissioning, and Handover.	
	15	Quality assessment of concrete through NDT: rebound hammer and USPV tests and guidelines for accepting and rejecting.	

13.0 Assignments, Pop Quiz, Mini Project, Seminars

Sl. No	Title	Outcome expected	Allied study	Week No.	Individual / Group activity	Reference: book/website /Paper
1	Assignment 1: Questions on module 1 & 2	Students study the Realize the importance of quality in construction	Module 1&2 of the syllabus	3	Individual Activity.	Text 1 & 2 Ref Book 1&2
2	Assignment 2: Questions on module 3 & 4	Students study the Apply SQC techniques in different aspects of construction Implement QMS programs at different levels of construction	Module 3&4 of the syllabus	5	Individual Activity.	Text 1 & 2 Ref Book 7 &8

14.0 QUESTION BANK

MODULE 1

1) Define Quality.
2) List objectives of Quality control.
3) State the meaning of Quality of Design.
4) State the meaning of Quality of Conformance.
5) State the meaning of Quality of Performance.
6) Define reliability.
7) List down advantages of Quality assurance.
8) List down objectives of Quality Circle.
9) List down advantages and disadvantages of Quality Circle.
10) List down objectives of Quality audit.
11) Define TQM and List down its principles.
12) List down objectives of TQM.
13) Explain the importance of TQM.

MODULE 2

1) Define Cost of quality and value of quality
2) List down advantages of Quality function deployment.
3) List down applications of Quality function deployment.
4) Define Frequency distribution.
5) State different SQC tools.
6) Define Inspection.
7) State the objectives of Inspection.

MODULE 3

1) Define Quality characteristics with two examples.
2) Define Quality specifications and state its types.
3) Define Quality and State quality of product and quality of services.
4) Differentiate between Quality control and Quality assurance
5) Explain Quality of Design, Quality of Conformance, Quality of Performance.
6) Define reliability and State factor considered for achieving reliable design
7) Explain working of Quality Circle.
8) Explain characteristics of Quality Circle.
9) Define Quality audit and state its purpose.
10) Define Quality audit and its types.

MODULE 4

1) State the step by step procedure in quality audit to implement it in manufacturing organisation.
2) State and explain concept of TQM.
3) Explain the TQM principles.
4) Explain PDCA.
5) Explain the advantages and limitation of ISO 9000.
6) Explain stepwise procedure to implement ISO 9000.
7) Explain any two Quality management principles of ISO.
8) State the importance if QS 14000 standard.
9) Explain the types of Inspection.
10) Explain the need of Inspection in industries.
11) Compare between Inspection and Quality control.
12) Compare between In process Inspection and Centralized Inspection.
13) Compare between Attribute Inspection and Variable Inspection.

MODULE 5

1) Define Statistical Quality Control and state its objectives.
2) State the benefits of statistical Quality Control.
3) Define assignable and chance causes.
4) Define Central tendency and Dispersion.
5) Define Median, mode, range.
6) Define Dispersion and Variance.
7) Define control charts.
8) Classify control charts.
9) Define defect and defective
10) Explain Single sampling plan
11) Enlist the types of sampling plan..

Prepared by	Checked by		
			
Prof. S.S.Bessanakoppa	Prof. Preeti. R.Patil	HOD	Principal