



S J P N Trust's

Hirasugar Institute of Technology, Nidasoshi.

Inculcating Values, Promoting Prosperity

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

Civil Engg. Dept

Academic
Course Plan

2022-23 (Even)

Rev: 00

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.*



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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.




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1.0	Student Help Desk
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Sl. No.	Purpose	Contact Person	
		Faculty	Instructor
01	HOD, Academics, Attestations, Exam forms signature	Prof. S.M.Chandrakanth	Mr.M. S. Badiger
02	Research Center Co-Ordinator,	Prof. S.M.Chandrakanth	Mr.M. S. Badiger
03	Industry-Institute-Interaction, Technical Magazine Coordinator (MoU, Ind. Visit etc.)	Prof. Shreedevi S B	Mr.M. S. Badiger
04	EMS / ED Cell coordinator, TP Cell officer	Prof. Preethi. R.Patil	Mr.M. S. Badiger
05	Project Coordinator, KSCST, IEEE coordinator, Smart India Hackathon, Scholarship, LIC	Prof. Preethi. R.Patil	Mr.M. S. Badiger
06	FACE / Website Coordinator	Prof. Sudarshan V Jore	Mr.M. S. Badiger
07	Civil/ IT Maintenance, Feedback / Publicity, Department News Letter, NSS, Student Welfare	Prof. Vishwanath I Patil	Mr.M. S. Badiger
08	GATE Coaching Coordinator	Prof. Sudarshan V Jore	Mr.M. S. Badiger
09	ISTE / E-Shikshana / E-learning / Internship	Prof. Vishwanath I Patil	Mr.M. S. Badiger
10	Women Empower cell, Conference, FDP, Workshop	Prof. Shreedevi S B	Mr.M. S. Badiger
11	IA Coordinator / Alumni coordinator	Prof. Shreedevi S B	Mr.M. S. Badiger
Institute Level			
		Faculty	Contact
12	Student Welfare Convener	Sri. M. G. Huddar	8217056798
13	TP Cell Coordinator	Sri. P. V. Patil	9731104059
14	Anti-Ragging Committee Member	Sri. S. M. Chandrakanth	8867814854
15	Anti Raging Squad Convener	Sri. Girish M. Zulpi	9480213587
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

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2.0 Departmental Resources

Department of Civil Engineering was established in the year 2020 and is housed in a total area of 785 Sq. Mtrs.

2.1 Faculty Position

Sl.No.	Category	No. in Position	Average experience (in years)
01.	Teaching faculty	05	12
02.	Technical Supporting Staff	01	05
03.	Helper staff	02	20

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

Total Investment in the Department

Rs. 21.53 Lakhs

3.0 Teaching Faculty Details

Sl. No.	Name	Designation	Qualification	Specialization	Professional Membership	Teaching Exp (In yrs.)	Phone No.
01	Prof. S.M.Chandrankanth	Asst. Prof./HOD	M. Tech. (PhD)	Highway Engineering	IAENG 220815	11	8867814854
02	Prof. Preethi R. Patil	Asst. Prof.	M. Tech.	Structures	--	05	9606557280
03	Prof. Vishwanath I Patil	Asst. Prof.	M. Tech	Structures	--	03	9975499979
04	Prof. Sudarshan V Jore	Asst. Prof.	M. Tech.	CT & M	--	02	9535459918
05	Prof. Shreedevi S B	Asst. Prof.	M. Tech.	CT & M	--	02	7760429556

4.0 Institute Academic Calendar

CALENDAR OF EVENTS OF VI SEM FOR THE ACADEMIC YEAR 2022-23 (Even)

Date	Events																																																																																																																																																																																																																																																																																																							
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20-04-2023 To 22-04-2023	First Internal Assessment for VI Semester & Feedback -I on Teaching-Learning																																																																																																																																																																																																																																																																																																							
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25-04-2023	Display & Submission of 1 st Internal Assessment Marks to Office																																																																																																																																																																																																																																																																																																							
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01-06-2023 To 03-06-2023	Second Internal Assessment for VI Semester & Feedback -II on Teaching-Learning																																																																																																																																																																																																																																																																																																							
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21-06-2023	International Yoga Day																																																																																																																																																																																																																																																																																																							
03-07-2023 To 05-07-2023	Third Internal Assessment for VI Semester																																																																																																																																																																																																																																																																																																							
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Note: Mahaveer Jayanti is on 4.04.2023 instead of 3.04.2023 as per Revised VTU list of Holidays

IQAC Coordinator
 Dr. R.R. Maggavi


Principal
 Dr. S. C. Kamate

Dr. B. V. Madiggond
 Dean (Academics)

Dr. S. C. Kamate
 Principal

	S J P N Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity</i> 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	Civil Engg. Dept Academic Course Plan 2022-23 (Even) Rev: 00
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5.0 Department Academic Calendar


	S J P N Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity</i> 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	Civil. Dept. Academic Calendar 2022-23 (Even) Rev: 00
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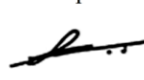
DEPARTMENT OF CIVIL ENGINEERING


CALENDAR OF EVENTS FOR THE ACADEMIC YEAR 2022-23 (Even Sem)

Date	Events																																																																																																																																																																																																																																																																																																							
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 Prof. Sudarshan V. Jore
 FACE Coordinator


 Prof. S.M.Chandrakanth
 HOD


 Dr. S. C. Kamate
 Principal




6.0 Scheme of Teaching & Examination

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examination 2018 – 19
Choice Based Credit System (CBCS) AND
Outcome Based Education (OBE) (Effective from the
academic year 2018 – 19)

VI SEM

B.E: Civil Engineering

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI CIVIL ENGINEERING Scheme of Teaching and Examination 2018 - 19 Outcome Based Education(OBE) and Choice Based Credit System (CBCS) (Effective from the academic year 2018 - 19)												
VI SEMESTER												
Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination			Credits	
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks		Total Marks
					L	T	P					
1	PCC	18CV61	Design of Steel Structural Elements	Civil Engg.	3	2	--	03	40	60	100	4
2	PCC	18CV62	Applied Geotechnical Engineering	Civil Engg.	3	2	--	03	40	60	100	4
3	PCC	18CV63	Hydrology and Irrigation Engineering	Civil Engg.	3	2	--	03	40	60	100	4
4	PEC	18CV64X	Professional Elective -1	Civil Engg.	3	--	--	03	40	60	100	3
5	OE	18CV65X	Open Elective -A	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL66	Software Application Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL67	Environmental Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	EP	18CVEP68	Extensive Survey project	Civil Engg.	--	2	2	03	40	60	100	2
9	Internship	--	Internship	To be carried out during the vacation/s of VI and VII semesters and /or VII and VIII semesters.								
TOTAL					15	12	06	24	320	480	800	24
Note: PCC: Professional core, PEC: Professional Elective, OE: Open Elective, MP: Mini-project.												
Professional Elective -1												
Course code under 18CV64X												
18CV641			Matrix Method of Structural Analysis									
18CV642			Solid Waste Management									
18CV643			Alternate Building Materials									
18CV644			Ground Improvement Techniques									
18CV645			Railway, Harbours, Tunnelling & Airports									
Open Elective -A												
Course code under 18CV65X												
18CV651			Remote Sensing & GIS									
18CV652			Traffic Engineering									
18CV653			Occupational Health & Safety									
18CV654			Sustainability Concepts in Civil Engineering									
18CV655			Intelligent Transportation Systems									
18CV656			Conservation of Natural Resources									
<p>Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department (Please refer to the list of open electives under 18XX65X).</p> <p>Selection of an open elective shall not be allowed if</p> <ul style="list-style-type: none"> The candidate has studied the same course during the previous semesters of the programme. The syllabus content of open elective is similar to that of the Departmental core courses or professional electives. A similar course, under any category, is prescribed in the higher semesters of the programme. <p>Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.</p> <p>Internship: All the students admitted to III year of BE/B. Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.</p>												
<p>AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.</p>												

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Subject Title	Design of steel structures		
Subject Code	18CV61	CIE Marks	40
Number of Lecture Hrs / Week	(3:2:0)	SEE Marks	60
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. Preethi R. Patil	Designation: Asst. Professor	Experience: 4 Years
No. of times course taught: 01	Specialization: Structural Engineer	

1.0 Prerequisite Subjects:

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. To recognize different forms of steel structures.
2. To understand the deflections of beams and trusses due to loads.

3.0 Course Outcomes

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

Sl.No	Course Outcome	RBT Level	POs
C601.1	Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code, provisions and plastic behaviour of structural steel.	L1,L2,L3,L4	1,2,3,5,6,8,12
C601.2	Understand the Concept of Bolted and Welded connections.	L1,L2,L3,L4	1,2,3,5,6,8,12
C601.3	Understand the Concept of Design of compression members, built-up columns and columns splices.	L1,L2,L3,L4	1,2,3,5,6,8,12
C601.4	Understand the Concept of Design of tension members, simple slab base and gusseted base.	L1,L2,L3,L4	1,2,3,5,6,8,12
C601.5	Understand the Concept of Design of laterally supported and unsupported steel beams.	L1,L2,L3,L4	1,2,3,5,6,8,12
Total Hours of instruction			50

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4.0 Course Content

Module-1

Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification.
 Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.

Module-2

Bolted Connections: Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) and bracket connections.
 Welded Connections: Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.

Module-3

Design of Compression Members: Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design of Laced and Battered Systems.

Module-4

Design of Tension Members: Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members and Lug angles, Splices, Gussets.
 Design of Column Bases: Design of Simple Slab Base and Gusseted Base.

Module-5

Design of Beams: Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.
 Beam to Beam Connections, Beam to Column Connection and Column Splices [No Numerical Problems].

5.0 Relevance to future subjects

SI 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


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

7.0 Gap Analysis and Mitigation

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

8.0 Books Used and Recommended to Students

Text Books
1. Reddy C S, Basic Structural Analysis, Tata McGraw Hill, New Delhi.
2. Muthu K U. etal, Basic Structural Analysis, 2nd edition, IK International Pvt. Ltd., NewDelhi,2015.

	S J P N Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity</i> Approved by AICTE, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi. Recognized Under Section 2(f) of UGC Act, 1956. Accredited at 'A' Grade by NAAC, Programmes Accredited by NBA: CSE, ECE,	Civil Engg. Dept Academic Course Plan 2022-23 (Even)
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3. Bhavikatti, Structural Analysis, Vikas Publishing House Pvt. Ltd, New Delhi,2002.
Reference Books
Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014.
Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi,2008
Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd, 2007.
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 (40 Marks)

➤ Internal Assessment: 30 Marks

Total of Three Internal Assessment tests will be conducted for 50 Marks each. Average of three tests is scaled down to 30 Marks.

➤ Assignment: 10 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	Advantages and Disadvantages of Steel Structures	20
	2	Limit state method Limit State of Strength	
	3	Structural Stability, Serviceability Limit states	
	4	Failure Criteria of steel, Design Consideration,	
	5	Loading and load combinations	
	6	IS code provisions, Specification and Section classification	
	7	Plastic Behavior of Structural Steel, Introduction	
	8	Plastic theory, Plastic Hinge Concept, Plastic collapse load,	
	9	load factor, Shape factor, Theorem of plastic collapse,	
	10	Methods of Plastic analysis, Plastic analysis of Continuous Beams.	
Module 2	11	Bolted Connections: Introduction	20
	12	Types of Bolts, Behavior of bolted joints,	
	13	Design of High Strength, friction Grip (HSFG) bolts	
	14	Design of Simple bolted Connections (Lap and Butt joints)and bracket connections.	
	15	Welded Connections: Introduction	
	16	Types and properties of welds, Effective areas of welds,	
	17	Weld Defects, Simple welded joints for truss member and bracket connections	
	18	Advantages and Disadvantages of Bolted	


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	19	Advantages and Disadvantages of Welded Connections	
	20	Numerical problem	
Module 3	21	Design of Compression Members: Introduction	20
	22	Failure modes of compression members	
	23	Behavior of compression members	
	24	Sections used for compression members	
	25	Effective length of compression members	
	26	Design of compression members	
	27	built up Compression members	
	28	Design of Laced systems	
	29	Design of Battened Systems	
	30	Numerical problem	
Module 4	31	Design of Tension Members Introduction	20
	32	Types of Tension members	
	33	Slenderness ratio, Modes of Failure	
	34	Factors affecting the strength of tension members,	
	35	Design of Tension members and Lug angles,	
	36	Design of Tension members Splices	
	37	Design of Tension members Gussets	
	38	Design of Column Bases	
	39	Design of Simple Slab Base	
	40	Design of Gusseted Base.	
Module 5	41	Design of Beams: Introduction,	20
	42	Beam types, Lateral Stability of beams	
	43	factors affecting lateral stability,	
	44	Behavior of Beams in Bending	
	45	Design strength of laterally supported beams in Bending	
	46	Design of Laterally unsupported Beams	
	47	Shear Strength of Steel Beams	
	48	Beam to Beam Connections	
	49	Beam to Column Connection	
	50	Column Splices	

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 concepts of steel structures	Module 1 of the syllabus	3	Individual Activity.	Text 1 Ref Book 2
2	Assignment 2: Questions on module 2	Understand the concept of bolted and welded connection	Module 2 of the syllabus	5	Individual Activity.	Text 1 Ref Book 3
3	Assignment 3: Questions on module 3	Understand the concept of design of compression members	Module 3 of the syllabus	8	Individual Activity.	Text 1 Ref Book 3
4	Assignment 4: Questions on module 4	Understand the concept of design of tension members	Module 4 of the syllabus	10	Individual Activity.	Text 1 Ref Book 3
5	Assignment 5: Questions on module 5	Understand the concept of design of laterally steel beams	Module 5 of the syllabus	12	Individual Activity.	Text 1 Ref Book 2

14.0 QUESTION BANK

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		Academic Course Plan
		2022-23 (Even)

MODULE 1

1. What are the advantages of steel structures ?
2. What are the disadvantages of steel structures?
3. What are the difference between limit state & working stress method?
4. What are the rolled steel section ?
5. Explain briefly with a neat sketch different rolled steel section?

MODULE 2

1. What are the advantages of bolted connection?
2. What are the advantages of welded connection?
3. What are the disadvantages of bolted connection?
4. What are the disadvantages of welded connection?
5. What are the common defects in welding?

MODULE 3





1. Explain different modes of failure of compression members
2. Design a built up column consisting of two channels section placed back to back to carry a load of 1000KN Over a length of 10m the ends of compression members are restrained in position but not in direction design Single lacing system use 20mm diameter bolts of property class 4.6 for connection.
3. Design compressive strength of [ISHB300@576.8N/m](#), Length of column is 3.5m and both ends are fixed.
4. Explain different modes of axially loaded column
5. Design a single angle discontinuous strut to carry a factored load of 65kN. The length of strut is 3m, between inter section


MODULE 4

1. Explain factor affecting strength of tension members
2. Explain different modes of failure of tension member with neat sketch
3. Explain slab base and gusseted base plate with neat sketch
4. Design a unequal single angle section to carry a load of 140KN use M20 bolts of grade 4.6 and the length of member is 3m.
5. Explain Lug angles and Column splices.

MODULE 5

1. Explain factor affecting lateral stability of beam
2. Explain with neat sketch beam to beam connection
3. Explain with neat sketch beam to column connection
4. Calculate the load carrying capacity of laterally restrained simply supported beam with ISMB 500 @86.9 Kg/m section for an effective span of 6m.

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

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Subject Title	APPLIED GEOTECHNICAL ENGINEERING		
Subject Code	18CV62	CIE Marks	40
Number of Lecture Hrs / Week	(3:2:0)	SEE Marks	60
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. Sudarshan V Jore	Designation: Asst. Professor	Experience: 06 months
No. of times course taught: 01	Specialization: Construction Technology and Management	

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	Civil Engineering	I	Elements of civil engineering
02	Civil Engineering	III	Engineering Geology
03	Civil Engineering	V	Basic Geotechnical Engineering

2.0 Course Objectives

1. To comprehend concepts of Geotechnical investigations and soil mechanics.
2. To assess stability of slopes and earth pressure on rigid retaining structures.
3. To Estimate internal stresses in the soil mass.

3.0 Course Outcomes

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

Sl.No	Course Outcome	RBT Level	POs
C602.1	Learn concepts of Geotechnical investigations for civil engineering projects	L1,L2	1,2,3,5,6,8,12
C602.2	Analyze the stresses in soils using various theories.	L1,L2,L3,L4	1,2,3,5,6,8,12
C602.3	Exhibit the knowledge to lateral earth pressure and stability of slopes.	L1,L2,L3,L4	1,2,3,5,6,8,12
C602.4	Understand the bearing capacity of shallow foundations.	L1,L2,L3,L4	1,2,3,5,6,8,12
C602.5	Comprehend the concepts of pile foundations.	L1,L2,L3,L4	1,2,3,5,6,8,12
Total Hours of instruction			50



4.0 Course Content

Module-1

Soil Exploration: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, Geophysical methods, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, Geophysical exploration and Bore hole log. Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method).

Module-2

Stress in Soils: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure, Newmark's chart. Foundation Settlement: Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

Module-3

Lateral Earth Pressure: Active, Passive and earth pressure at rest, Rankine's theory for cohesionless and cohesive soils, Coulomb's theory, Rebhann's and Culmann's graphical construction. Stability of Slopes :Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C- ϕ (Method of slices) soils, Felineous method for critical slip circle, use of Taylor's stability charts.

Module-4

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.

Module-5


Pile Foundations: Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

5.0 Relevance to future subjects

SI No	Semester	Subject	Topics
1.	VII	Geotechnical Engineering Laboratory	Soil investigations.
2.	VII	Reinforced Earth structure	Stresses in soils.
3.	VII	Earthquake engineering	Bearing capacity of soils & soil investigation.
4.	VIII	Bridge Engineering	Bearing capacity of soils & soil investigation.
5.	VIII	Advanced Foundation Engineering	Bearing capacity of soils & soil investigation.

6.0 Relevance to Real World

SI No	Real World Mapping
01	Insitu soil investigation using appropriate methods for respective soil type.

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02	Determination of stresses, lateral earth pressure and bearing capacity of soils.
03	Assessment of bearing capacity of various pile foundations.

7.0 Gap Analysis and Mitigation

SI No	Delivery Type	Details
01	Tutorial & Site visit	Insitu experience of soil stabilization and laying out foundation

8.0 Books Used and Recommended to Students

Text Books
1. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engg, UBS Publishers and Distributors, NewDelhi.
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publisher Distributors, New Delhi.
3. P C Varghese, Foundation Engineering, PHI India Learning Private Limited, New Delhi.
4. Punmia B C, Soil Mechanics and Foundation Engg-(2017), 16thEdition, Laxmi Publications co., New Delhi.
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.
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 (40 Marks)

➤ Internal Assessment: 30 Marks

Total of Three Internal Assessment tests will be conducted for 50 Marks each. Average of three tests is scaled down to 30 Marks.

➤ Assignment: 10 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	Introduction to soil exploration	20
	2	Objectives and importance of soil exploration	
	3	Stages of soil exploration.	
	4	Methods of soil exploration.	

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	5	Geophysical methods	
	6	stabilization of boreholes	
	7	Sampling techniques.	
	8	Geophysical exploration and Bore hole log	
	9	Drainage and Dewatering methods.	
	10	estimation of depth of GWT (Hvorslev's method).	
Module 2	11	Introduction to stresses in soils.	20
	12	Boussinesq's and Westergaard's theory for concentrated load	
	13	Boussinesq's and Westergaard's theory for circular load	
	14	Boussinesq's and Westergaard's theory for rectangular load	
	15	Equivalent point load method	
	16	Pressure distribution diagrams and contact pressure	
	17	Newmark's chart	
	18	Types of settlements and importance	
	19	Computation of immediate and consolidation settlement,	
	20	Permissible differential and total settlements	
Module 3	21	Introduction to lateral earth pressure.	20
	22	Active and Passive earth pressure at rest	
	23	Rankine's theory for cohesion less and cohesive soils	
	24	Coulomb's theory	
	25	Rebhann's and Culmann's graphical construction	
	26	Stability of Slopes, Assumptions, infinite and finite slopes	
	27	Swedish slip circle method for C and C- ϕ (Method of slices) soils	
	28	Fellineous method for critical slip circle	
	29	Taylor's stability charts	
	30	Numerical problems.	
Module 4	31	Bearing Capacity of Shallow Foundation	20
	32	Types of foundations	
	33	Determination of bearing capacity by Terzaghi's and BIS method	
	34	Modes of shear failure	
	35	Case study	
	36	Factors affecting Bearing capacity of soil	
	37	Effect of water table	
	38	Eccentricity on bearing capacity of soil	
	39	Field methods of determining bearing capacity of soil	
	40	SPT and plate load test	
Module 5	41	Pile Foundations	20
	42	Types and classification of piles	
	43	Single loaded pile capacity in cohesion less by static and Dynamic formulas.	
	44	Single loaded pile capacity in cohesive soils by static and Dynamic formulas.	
	45	Efficiency of Pile group	
	46	Group capacity of piles in cohesion less and cohesive soils	
	47	Negative skin friction, pile load tests	
	48	Settlement of piles	
	49	Under reamed piles	
	50	Case study	

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	Understanding of Basic concepts of soil mechanics & Geotechnical insitu investigations.	Module 1 of the syllabus	3	Individual Activity.	Text 1 Ref Book 2

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		Academic Course Plan
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2	Assignment 2: Questions on module 2	Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils	Module 2 of the syllabus	5	Individual Activity.	Text 1 Ref Book 3
3	Assignment 3: Questions on module 3	Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures	Module 3 of the syllabus	8	Individual Activity.	Text 1 Ref Book 3
4	Assignment 4: Questions on module 4	Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure	Module 4 of the syllabus	10	Individual Activity.	Text 1 Ref Book 3
5	Assignment 5: Questions on module 5	Capable of estimating load carrying capacity of single and group of piles	Module 5 of the syllabus	12	Individual Activity.	Text 1 Ref Book 2

14.0 QUESTION BANK

MODULE 1

- Define sub surface exploration. Explain the objectives of soil exploration.
- With the neat sketch explain seismic refraction method.
- Determine the area ratios for the following soil sampler and comment the nature of sample obtained in each samplers.
 - Core cutter 185 mm OD 135mm ID
 - Split Barrel 51mm OD 45mm ID
 - Shelby tube 51mm OD 49mm ID
 Which one you recommend to be used for getting good qualifier samples?
- List the methods of dewatering technique used in the field and explain vaccum method.
- List and explain different types of samples of soil.
- Estimate the position of ground water table with following data by Hyorselve,s method. Depth upto which water is bailed out= 10.5m.

Water Rise in 1st day : 0.63m
 2nd day : 0.57m
 3rd day : 0.51m
- Describe with neat sketch wash boring technique to explore soil.
- Explain with neat sketch, electrical resistivity method of soil exploration.
- Predict the Ground water table given the following data: Depth upto which water is boiled out 18 m, Water rise in I day = 0.95 m, II day = 0.86 m and III day = 0.78 m, use the Hvorslev's method for predicting ground water table.
- The following sizes of sampling tubes are available in market.

Sample NO	I	II	III
Outer dia (mm)	75	110	50
Inner dia (mm)	72	107	35
Length (mm)	600	600	600

Out of these which one would you select for obtaining undistributed Soil sample from a base hole, Apply appropriate technique to get best undisturbed sample.

MODULE 2

- Compare Boussinesq's theory with Westergaard's theory with a logical graph analysis.
- Find intensity of vertical pressure at a point 3 m directly below 25 kN point load acting on a horizontal ground surface. What will be the vertical pressure at a point 2 m horizontally away from the axis of loading and at same depth of 3 m? Use Boussinesq's equation.



3. Explain components of settlements.
4. A reinforced concrete foundation of dimensions $1.8\text{m} \times 3.6\text{m}$ exerts a uniform pressure of 180 kN/m^2 on a soil mass, with E -value 45 MN/m^2 . Determine the value of Immediate settlement under the foundation. Take $\mu = 0.3$ and $I_f = 1.0$
5. Explain contact pressure distribution of soil.
6. A Circular area 6m in dia carries uniformly distributed load of 10 KN/m^3 Determine the vertical stress at a depth of 2m , 4m , and 8m . Plot the variation of vertical stress with depth.
7. Explain pressure bulb.
8. Explain distribution on Horizontal plane.
9. Explain pressure distribution on vertical plane.
10. What are the different types of settlements?

MODULE 3


1. With neat sketches, explain types of earth pressure.
2. Describe Rebann's graphical method of determining the active earth pressure on retaining wall.
3. A retaining wall 7.5m high retains cohesionless, horizontal backfill. The top 3m of fill has a unit weight of 18 KN/m^3 and $\phi = 30^\circ$ and the rest has a unit weight of 24 kN/m^3 and $\phi = 20^\circ$. Determine using Rankine's theory, the distribution of active earth pressure and total active earth thrust.
4. With the neat sketches, explain different types of slope failures.
5. Explain Swedish circle method of stability analysis of slopes for c - ϕ soils.
6. An embankment is to be constructed with $C = 20 \text{ kN/m}^2$, $\phi = 20^\circ$, $\gamma = 18 \text{ kN/m}^3$, $FS = 1.25$ and height is 10m . Estimate side slope required. Taylor's stability numbers are as follows below table. Also find the factor of safety, if the slope is $1v : 2H$ given $\phi = 20^\circ$.

Slope angle	90	75	60	45	30	20	10
Sn	0.182	0.134	0.097	0.062	0.025	0.005	0

7. Compare Coulomb's Earth pressure theory over Rankin's Earth pressure theory.
8. Determine the active earth pressure using Rebhann's graphical method.
9. Explain the procedure for determination of factor of safety using method of slices for C - ϕ soil.
10. An Embankment is inclined at an angle 35° and its height is 15 m . The angle of shearing resistance is 15° and the cohesion intercept is 40 kN/m^2 . The unit weight of soil is 18 kN/m^3 . Examine the factor of safety with respect to cohesion. Consider Taylor's stability number = 0.06 .





MODULE 4


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 footing which is safe against applied load. If the desired factor of safety is 3.0 . Assume $e = 0.55$, Degree of Saturation = 50% , $G = 2.67$, $C = 8 \text{ kN/m}^2$. Use Terzaghi's analysis for general shear failure. Assume $C = 30^\circ$, $N_C = 37.2$, $N_q = 22.5$ and $N_r = 19.7$.
3. Generalize the assumptions made by Terzaghi'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 $\gamma_{\text{sat}} = 20.8 \text{ kN/m}^3$, $N_c = 25$, $N_q = 34$ and $N_r = 32$.
8. List the assumption and limitations made in Terzaghi's analysis.
9. With neat sketch plate load test.
10. A Square footing $2.8 \times 2.8 \text{ m}$ is built on a homogeneous bed of sand of density 18 kN/m^3 and $\phi = 36^\circ$. If the depth of foundation is 1.8m . Determine the safe load on footing. Take $F = 2.5$. Also find safe allowable load.

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MODULE 5

1. Explain the classification of pile based on the material and function.
2. Mention the situation where the pile foundation is necessary.
3. In a group of 16 pile dia is 450mm and centre to centre spacing of the square group is 1.5m. If $C = 50\text{kN/m}^2$, determine whether the failure would occur with the pile acting individually, or as a group? Neglect bearing at the tip of the pile. All piles are 10m long. Take adhesion factor as 2 and factor of safety 2.5. Also find safe allowable load.
4. Write a short note on Group capacity of piles.
5. Write a short note on negative skin friction.
6. Write a short note on under reamed piles.
7. Write short note on settlement of piles.
8. Classify the various type of Piles based on material and function.
9. Explain negative skin friction in pile foundation.
10. Explain with a neat sketch the construction and working of under reamed pile.
11. Justify with a neat sketch, how static formula summarize the load transfer mechanism in pile foundations.

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

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Subject Title	HYDROLOGY AND IRRIGATION ENGINEERING		
Subject Code	18CV63	CIE Marks	40
Number of Lecture Hrs / Week	(3:0:0)	SEE Marks	60
Total Number of Lecture Hrs	50	Exam Hours	03
CREDITS – 04			

FACULTY DETAILS:		
Name: Prof. V.I.Patil	Designation: Asst. Professor	Experience: 4 Years
No. of times course taught: 00	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


This course will enable students to:

1. Understand the concept of hydrology and components of hydrologic cycle such as precipitation, infiltration, evaporation and transpiration.
2. Quantify runoff and use concept of unit hydrograph.
3. Demonstrate different methods of irrigation, methods of application of water and irrigation procedure.
4. Design canals and canal network based on the water requirement of various crops.
5. Determine the reservoir capacity.

3.0 Course Outcomes

After studying this course, students will be able to:

	Course Outcome	RBT Level	POs
C603.1	Understand the importance of hydrology and its components.	L1, L2,	1,2,3,5,
C603.2	Measure precipitation and analyze the data and analyze the losses in precipitation.	L1, L2, L3, L4	1,2,3,5, 6,8,12
C603.3	Estimate runoff and develop unit hydrographs.	L1, L2, L3, L4	1,2,3,5, 6,8,12
C603.4	Find the quantity of irrigation water and frequency of irrigation for various crops.	L1, L2, L3, L4	1,2,3,5, 6,8,12
C603.5	Find the canal capacity, design the canal and compute the reservoir capacity.	L1, L2, L3, L4	1,2,3,5, 6,8,12
Total Hours of instruction			50

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		Academic Course Plan
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4.0

Course Content

Module-1

Hydrology: Introduction, Importance of hydrology, Global distribution of water and Indian water Availability, Practical application of hydrology, Hydrologic cycle (Horton's) qualitative and engineering representation.

Precipitation: Definition, Forms and types of precipitation, measurement of rain fall using Symon's and Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs.

Module-2

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.

Evapo-transpiration: Introduction, Consumptive use, AET, PET, Factors affecting, Measurement, Estimation by Blaney-Criddle equation.

Infiltration: Introduction, factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.

Module-3

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-4


Irrigation: Definition. Benefits and ill effects of irrigation. System of irrigation: surface and ground water, Flow irrigation, lift irrigation, Bandhara 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-5

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. Design of Canals by Lacey's and Kennedy's method.

Reservoirs: Definition, investigation for reservoir site, storage zones determination of storage capacity Using mass curves, economical height of dam.

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5.0 Relevance to future subjects

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

6.0 Relevance to Real World


SI 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

SI No	Delivery Type	Details
01	Tutorial	Practicals should clubbed with theory for better understanding
02	NPTEL	https://twitter.com/hydrologyandirrigation.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.

	S J P N Trust's Hirasugar Institute of Technology, Nidasoshi. <i>Inculcating Values, Promoting Prosperity</i> Approved by AICTE, Recognized by Govt. of Karnataka and Affiliated to VTU Belagavi. Recognized Under Section 2(f) of UGC Act, 1956. Accredited at 'A' Grade by NAAC, Programmes Accredited by NBA: CSE, ECE,	Civil Engg. Dept Academic Course Plan 2022-23 (Even)

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

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

11.0	Examination Note
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Scheme of Evaluation for CIE (40 Marks)

➤ **Internal Assessment: 30 Marks**

Total of Three Internal Assessment tests will be conducted for 50 Marks each. Average of three tests is scaled down to 30 Marks.

➤ **Assignment: 10 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	01	Hydrology: Introductions.	20
	02	Importance of hydrology, Global distribution of water and Indian water availability.	
	03	Practical application of hydrology.	
	04	Hydrologic cycle (Horton's) qualitative and engineering representation.	
	05	Precipitation: Definition, Forms and types of precipitation.	
	06	Measurement of rain fall using Symon's and Syphon type of rain gauges.	
	07	Optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall.	
	08	Estimation of missing data presentation of precipitation data,	
	09	Moving average curve, mass curve.	
	10	Rainfall hyetographs.	
MODULE 2	11	Losses: Evaporation: Introduction, Process, factors affecting evaporation.	20
	12	Measurement using IS class-A Pan.	
	13	Estimation using empirical formulae (Meyer's and Rohwer's equations) Reservoir evaporation and control.	
	14	Evapo-transpiration: Introduction.	
	15	Consumptive use, AET, PET, Factors affecting.	
	16	Measurement, Estimation by Blaney-Criddle equation.	
	17	Infiltration: Introduction	
	18	Factors affecting infiltration capacity.	
	19	Measurement by double ring infiltrometer.	
	20	Horton's infiltration equation, infiltration indices.	
MODULE 3	21	Runoff: Definition, concept of catchment.	20
	22	Factors affecting runoff.	
	23	Rainfall – runoff relationship using regression analysis.	
	24	Hydrographs: Definition.	
	25	Components of hydrograph.	
	26	Base flow separation, unit hydrograph.	
	27	Assumption application and limitations.	
	28	Derivation from simple storm hydrographs.	
	29	S curve and its computations,	
	30	Conversion of UH of different durations.	
MODULE 4	31	Irrigation: Definition and Introductions	20
	32	Benefits and ill effects of irrigation.	
	33	System of irrigation	
	34	Surface and ground water	
	35	Flow irrigation, lift irrigation, Bandhara irrigation.	
	36	Water Requirements of Crops: Duty, delta and base period.	
	37	Duty, Delta, Base period, relationship between them.	
	38	Factors affecting duty of water crops.	
	39	Crop seasons in India,	
	40	Irrigation efficiency, frequency of irrigation.	
MODULE 5	41	Canals: Types of canals.	20
	42	Alignment of canals.	
	43	Definition of gross command area.	
	44	Cultural command area intensity of irrigation, time factor, crop factor.	
	45	Unlined and lined canals. Standard sections.	
	46	Design of canals by Lacey's and Kennedy's method.	
	47	Reservoirs: Definition, investigation for reservoir site.	
	48	Storage zones determination of storage capacity using mass curves.	
	49	Economical height of dam.	
	50	Problems.	

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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.	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 Losses, Evaporation, Evapo-transpiration, Infiltration.	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 Runoff Hydrographs.	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 Irrigation and Water requirements of crops.	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 Canals and reservoirs.	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) Infiltrimeter & 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.

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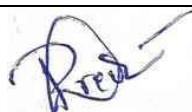


3. With a neat sketch explain the fan and fern leaf catchment.
4. List out various methods for estimation of design flood. Explain rational method of flood estimation.
5. Explain typical single peaked hydrograph components with a neat sketch.
6. Define unit hydrograph. List the assumptions made in deriving 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

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Subject Title	ALTERNATE BUILDING MATERIALS		
Subject Code	18CV56	IA Marks	40
Number of Lecture Hrs / Week	3:0:0	Exam Marks	60
Total Number of Lecture Hrs	40	Exam Hours	03
			Credits: 3

FACULTY DETAILS:		
Name: Prof. S.M.Chandrakanth	Designation: Asst. Prof. / HOD	Experience: 12 Years
No. of times course taught: 04		Specialization: Highway Engineering

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	Civil Engineering	I/II	Elements of Civil Engineering and Mechanics
02	Civil Engineering	III	Building Materials and Construction
03	Civil Engineering	III	Engineering Geology
04	Civil Engineering	IV	Concrete Technology

2.0 Course Objectives


This course will enable students to;

1. Understand environmental issues due to building materials and the energy consumption in manufacturing building materials
2. Study the various masonry blocks, masonry mortar and structural behaviour of masonry under compression.
3. Study the alternative building materials in the present context.
4. Understand the alternative building technologies which are followed in present construction field.
5. Understand the equipment's used in the production of alternative building materials with current technologies by cost effective analysis, techniques and case studies.

3.0 Course Outcomes

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

CO	Course Outcome	Cognitive Level	POs
C604.1	Solve the problems of Environmental issues concerned to building materials and cost-effective building technologies	L1, L2, L3	1,2,3,4,6,8,12
C604.2	Identify appropriate type of masonry unit and mortar, design of structural masonry under axial compression.	L1, L2, L3	1,2,3,4,6,8,12
C604.3	Identify the various alternative building materials and suggest agro and industrial wastes in manufacturing of building	L1, L2, L3	1,2,3,4,6,8,12
C604.4	Recommend various types of alternative building technologies and design of energy efficient building by considering local climatic condition and building material.	L1, L2, L3	1,2,3,4,5,6,8,12
C604.5	Identify new technologies for manufacture of alternative building materials and suggest basic cost saving techniques in planning, design and construction.	L1, L2, L3	1,2,3,4,5,6,8,12
Total Hours of Instruction		40	

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4.0 Course Content

Module-1

Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.

Module-2

Elements of Structural Masonry: Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks.

Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.

Module-3

Alternate Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.

Module-4

Alternate Building Technologies: Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top-down construction, Mivan Construction Technique.

Alternate Roofing Systems: Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.

Module-5


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

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
01	VII	Masonry Structures	Masonry Units, Materials, types and masonry construction Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, Load considerations and design of Masonry subjected to axial loads, Design of walls subjected to concentrated axial and eccentric loads, Design of Laterally and transversely loaded walls

6.0 Relevance to Real World

Sl. No	Real World Mapping
01	To understand environmental issues due to building materials.
02	To understand energy consumption in manufacturing building materials
03	To learn various masonry blocks, masonry mortar & structural behavior of masonry under compression.
04	To analyse and design the construction strength and stability of axially loaded masonry walls.
05	To prepare alternative building materials in the present context.
06	Students are able to understand effect of unit strength, mortar strength, joint thickness, Load considerations and design of Masonry subjected to axial loads,
07	Understand the structural design of walls subjected to concentrated axial and eccentric loads, Design of Laterally and transversely loaded walls
08	To learn the development of nations which have extensive building construction
09	To investigate the alternative building technologies which are followed in present construction field.
10	To understand equipment's used in the production of alternative building materials with current technologies by cost effective analysis, techniques and case studies.

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7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	Tutorial	Topic: Demonstration to building blocks in Basic Material Testing laboratory
02	NPTEL	Building materials and Construction
03	NPTEL	NOC: Sustainable Materials and Green Buildings

8.0 Books Used and Recommended to Students

Text Books

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International pub.
2. Arnold W Hendry, "Structural Masonry", Macmillan Publishers.

Reference Books

1. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
2. LEED India, Green Building Rating System, IGBC pub.
3. IGBC Green Homes Rating System, CII pub.
4. Relevant IS Codes.

Additional Study Material & e-Books

1. NPTEL notes and Videos
2. VTU online notes.

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

Website and Internet Contents References

- 01) <https://www.digimat.in/nptel/courses/video/105102088/L01.html>
- 02) <https://www.digimat.in/nptel/courses/video/105102195/L01.html>

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	Website
01	Construction and Building Materials	https://www.sciencedirect.com/journal/construction-and-building-materials
02	Materials and Structures	https://www.springer.com/journal/11527
03	Journal of Materials in Civil Engineering	https://www.scimagojr.com/journalsearch.php?q=16299&tip=sid&clean=0

11.0 Examination Note

Scheme of Evaluation for CIE (40 Marks)

Internal Assessment: 30 Marks

Total of Three Internal Assessment tests will be conducted for 50 Marks each.

Average of three tests is scaled down to 30 Marks.

Assignment: 10 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.



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Civil Engg. Dept


Academic
Course Plan

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12.0 Course Delivery Plan

Module	Lecture No.	Content of Lecture	% of portion
1	1	Introduction: Energy in building materials,	20%
	2	Environmental issues concerned to building materials,	
	3	Embodied energy & life-cycle energy,	
	4	Global warming and construction industry, green concepts in buildings,	
	5	Green building ratings – IGBC and LEED manuals – mandatory requirements, (contd...)	
	6	Rainwater harvesting & solar passive architecture	
	7	Environmental friendly and cost-effective building technologies,	
	8	Requirements for buildings of different climatic regions	
2	9	Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks,	20%
	10	stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks	
	11	Structural Masonry Mortars: Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS,	
	12	characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding,	
	13	Compressive strength of masonry elements, Factors affecting compressive strength,	
	14	Strength of Prisms/wallets and walls, Effect of brick bond on strength,	
	15	Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry,	
	16	Design of masonry compression elements subjected to axial load.	
3	17	Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process,	20%
	18	Properties and uses. Fibers- metal and synthetic, Properties and applications.	
	19	Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties & applications.	
	20	Building materials from agro and industrial wastes ,Types of agro wastes,	
	21	Types of industrial and mine wastes,	
	22	Properties and applications of industrial waste	
	23	Masonry blocks using industrial wastes.	
	24	Construction and demolition wastes	
4	25	Alternative Building Technologies: Use of arches in foundation, alternatives for wall constructions,	20%
	26	composite masonry, confined masonry,	
	27	cavity walls, rammed earth	
	28	Ferro cement and ferroconcrete building components,	
	29	Materials and specifications, Properties, Construction methods, Applications. Top down construction,	
	30	Mivan Construction Technique.	
	31	Alternative Roofing Systems: Concepts, Filler slabs	
	32	Composite beam panel roofs, Masonry vaults and domes	
5	33	Equipment for Production of Alternative Materials: Machines for manufacture of concrete	20%
	34	Equipment's for production of stabilized blocks,	
	35	Moulds and methods of production of precast elements,	
	36	Cost concepts in buildings,	
	37	Cost saving techniques in planning, design and construction, (contd...)	
	38	Cost saving techniques in planning, design and construction,	
	39	Cost analysis: Case studies using alternatives (contd...)	
	40	Cost analysis: Case studies using alternatives	

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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 the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 1 of the syllabus	3	Individual Activity. Printed solution expected.	Book 1, 2 & 1, 2, 3, 4 & 5 of the reference list.
2	Assignment 2: Questions on module 2	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 2 of the syllabus	5	Individual Activity. Printed solution expected.	Book 1, 2 & 1, 2, 3, 4 & 5 of the reference list.
3	Assignment 3: Questions on module 3	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 3 of the syllabus	8	Individual Activity. Printed solution expected.	Book 1, 2 & 1, 2, 3, 4 & 5 of the reference list.
4	Assignment 4: Questions on module 4	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 4 of the syllabus	10	Individual Activity. Printed solution expected.	Book 1, 2 & 1, 2, 3, 4 & 5 of the reference list.
5	Assignment 5: Questions on module 5	Students study the Topics and write the Answers. Get practice to solve numerical of university question papers.	Module 5 of the syllabus	12	Individual Activity. Printed solution expected.	Book 1, 2 & 1, 2, 3, 4 & 5 of the reference list.


14.0 QUESTION BANK

MODULE – 1

1. Explain energy in building materials
2. Describe the life cycle of embodied energy.
3. Explain global warming and effect of construction Industry on global warming?
4. Explain concept of green building?
5. State the requirements of green buildings with reference to IGBC and LEED
6. Explain rain water harvesting and solar passive architecture.
7. Explain environmental friendly and cost effective building technology buildings?
8. List out the requirements of buildings in different climatic regions.

MODULE – 2

1. Explain elements of structural masonry and its materials.
2. State the requirements of masonry units.
3. Explain the characteristics of bricks, stones, clay blocks, stone boulders and concrete blocks.
4. Explain the characteristics of laterite blocks, Fal – G blocks?
5. Explain the manufacturing of stabilizes mud blocks?

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MODULE – 3





1. Explain the manufacturing process of lime and pozzolana cements
2. Explain the properties and uses of lime and pozzolana
3. State the properties and applications of metal fibers, synthetic fibers
4. State the properties and applications of fiber reinforced plastics, matrix materials.
5. State the properties and applications of organic and synthetic fibers.
6. State the properties and applications of agro and industrial wastes.
7. Explain types of agro wastes, industrial and mine waste
8. Understand the wastes generated from construction and demolitions of building. What are the factors influencing creep?


MODULE - 4

1. Explain the uses of arches in foundation for alternatives wall construction.
2. Explain the use of composite masonry and confined masonry for alternative wall construction.
3. Explain the application and properties of Ferro cement.
4. Explain the application and properties of Ferro concrete building components.
5. Explain the concept of mivan construction.
6. Explain the concept of filler slabs
7. Explain the construction techniques of masonry vaults
8. Explain the construction techniques of domes

MODULE -5

1. Explain the machines used in manufacturing of concrete
2. Explain the equipments for production of stabilized blocks
3. Explain the moulds used in production of pre cast elements
4. Explain the concept of cost saving in building.
5. Explain the cost saving techniques in planning
6. Explain the cost saving design and construction
7. Explain the case studies of building using alternative materials
8. Write short note on RMC manufacturing and construction

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

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Subject Title	NON-CONVENTIONAL ENERGY SOURCES		
Subject Code	18ME651	IA Marks(30)+Assignments(10)	40
Number of Lecture Hrs / Week	3+0 hrs	Exam Marks(appearing for)	60 (100)
Total Number of Lecture Hrs	40	Exam Hours	03
CREDITS – 03			

FACULTY DETAILS:

Name: Dr. M. M. Shivashimpi	Designation: Associate Professor	Experience: 15 Years
No. of times course taught: 01	Specialization: Thermal Power Engineering	

1.0 Prerequisite Subjects:

Sl. No	Branch	Semester	Subject
01	Students should have the knowledge of basic subjects	I/II	Mathematics, Physics and chemistry, EME

2.0 Course Objectives

Students belonging to all branches of Engineering are made to learn certain fundamental topics related to energy sources and conversion systems. So that they will have a minimum understanding and working of energy systems, equipment and process.

3.0 Course Outcomes

Having successfully completed this course, the student will be able to understand construction and working mechanical systems.


CO'S	Course Outcome	Cognitive	POs
C317.1	Describe the environmental aspects of non-conventional energy resources.	L2	PO1,PO7, P12
C317.2	Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation, drying, cooking etc.	L3	PO1,PO2,PO3, PO6 PO7,PO12
C317.3	Understand The Performance Analysis Of Liquid Flat Plate Collectors	L3	PO1,PO2,PO3, PO6 PO7,PO12
C317.4	Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications. Acquire the knowledge of tidal power and Ocean Thermal Energy Conversion principles and applications.	L3	PO1,PO2,PO3, PO6 PO7,PO12
C317.5	Acquire the knowledge of fuel cells and geothermal principles and applications. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications	L3	PO1, PO3, PO5,PO6,PO7, PO12
Total Hours of instruction			40

4.0 Course Content

Module - 1

Introduction: Energy source, India's production and reserves of commercial energy sources, need for non-conventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind biomass, ocean temperature difference, tidal and waves, geothermal, tar sands and oil shale, nuclear (Brief descriptions); advantages and disadvantages, comparison (Qualitative and Quantitative).

Solar Radiation: Extra-Terrestrial radiation, spectral distribution of extra terrestrial radiation, solar constant,

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solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data. Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.

Module- 2

Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, and zenith angle, solar altitude angle expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sun, day length, numerical examples. Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation, expression for flux on tilted surface (no derivations) numerical examples.

Solar Thermal Conversion: Collection and storage, thermal collection devices, liquid flat plate collectors, solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis); sensible heat storage, latent heat storage, application of solar energy water heating. Space heating and cooling, active and passive systems, power generation, and refrigeration. Distillation (Qualitative analysis) solar pond, principle of working, operational problems.

Module- 3

Performance Analysis of Liquid Flat Plate Collectors: General description, collector geometry, selective surface (qualitative discussion) basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity-absorptivity product, numerical examples. The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided). Temperature distribution between the collector tubes, collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided). Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.

Photovoltaic Conversion: Description, principle of working and characteristics, application.

Module- 4

Wind Energy : Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills, elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples.

Tidal Power: Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, limitations.

Ocean Thermal Energy Conversion: Principle of working, Rankine cycle, OTEC power stations in the world, problems associated with OTEC.

Module- 5


Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world, problems associated with geothermal conversion, scope of geothermal energy.

Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation, description of bio-gas plants, transportation of bio-gas, problems involved with bio-gas production, application of bio-gas, application of bio-gas in engines, advantages.

Hydrogen Energy: Properties of Hydrogen with respect to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermo chemical production bio-chemical production.

5.0 Relevance to future subjects

Sl. No	Semester	Subject	Topics
01	VIII	Project work	Fundamental concepts
02	V/VI	Design of Machine Elements I/II	Fasteners, Keys and Joints, Rivets and Assembly drawings
03	III/IV	Power plant engineering, I C Engines, Energy	Internal combustion engines, gas cycles,

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Engineering.	Turbines, Refrigeration & air conditioning.
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6.0 Relevance to Real World

SL.No	Real World Mapping
01	Electricity generation, Energy harnessing.
02	Working and operation of wind, solar, biomass, geothermal, OTEC, Tidal power plants
03	Fuel cells and hydrogen energy.

7.0 Gap Analysis and Mitigation

Sl. No	Delivery Type	Details
01	NPTEL Tutorial	Topic: Non Conventional Energy resources, Renewable Energy, Environmental pollution.

8.0 Books Used and Recommended to Students


Text Books	
1.	Non-Convention EnergyResources, B H Khan, McGraw Hill Education(India) Pvt. Ltd. 3 rd Edition.
2.	Solar energy, Subhas P Sukhatme, Tata McGraw Hill, 2 nd Edition,1996.
3.	Non-Conventional EnergySources, G.D Rai, Khanna Publishers, 2003.
Reference Books	
1.	Renewable Energy Sources andConversion Technology, N.K.Bansal, Manfred Kleeman&MechaelMeliss, Tata McGraw Hill. 2004
2.	Renewable EnergyTechnologies , Ramesh R & Kumar K U, Narosa Publishing HouseNew Delhi.
3.	Conventional Energy Systems, K M, Non, Wheeler Publishing Co.Ltd., New Delhi, 2003.
4.	Non-Conventional Energy, Ashok V Desai, Wiley Eastern Ltd, NewDelhi,2003.
Additional Study material & e-Books	
NPTEL Videos, E- Books	

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

Website and Internet Contents References	
1)	https://nptel.ac.in/courses/121/106/121106014/
2)	https://nptel.ac.in/content/storage/121/106/121106014/MP4/mod03lec08.mp4
3)	https://onlinecourses.nptel.ac.in/noc20_ph14/preview
4)	https://www.youtube.com/watch?v=GExTwRNkQBg https://www.youtube.com/watch?v=F2YsrxpQPwE https://www.youtube.com/watch?v=DD0Y6Snxpdk
5)	https://nptel.ac.in/content/storage2/courses/121106014/Week9/lecture27.pdf https://nptel.ac.in/content/storage2/courses/108108078/pdf/chap7/teach_slides07.pdf https://www.youtube.com/watch?v=-yYrc1-thxQ

10.0 Magazines/Journals Used and Recommended to Students

Sl. No	Magazines/Journals	website
1	Elsevier	https://www.journals.elsevier.com
2	Journal of Composite Materials	http://journals.sagepub.com
4	International Journal of Renewable Energy Research (IJRER)	http://www.ijrer.org

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11.0 Examination Note

Internal Assessment (30 Marks)

Questions shall be answered in Internal Assessment books (blue book). Internal assessment book shall be submitted.

Scheme of Evaluation for Internal Assessment (30 Marks)

Internal Assessment test in the same pattern as that of the main examination (Better of the three Tests): 30 marks.


Assignments/Quiz (10 Marks)

Assignments for each module are to be submitted and evaluated for 10 marks for each. Average of five modules is to be considered.

SCHEME OF EXAMINATION: Two full questions (with a maximum of four sub questions) of twenty mark each to be set from each module. Each question should cover all the contents of the respective module. Students have to answer five full questions choosing one full question from each module. From each module out of two full questions one full question to be answered and each carries 20 Marks. Five full question to be answered $5 \times 20 = 100$ Marks. Later after evaluation total marks are reduced to 60 marks.

12.0 Course Delivery Plan


Module	Lecture No.	Content of Lecturer	% of Portion
1	1	Introduction: Energy source, India's production and reserves of commercial energy sources,	20%
	2	Need for non- conventional energy sources, energy alternatives, solar, thermal, photovoltaic.	
	3	Water power, wind biomass, ocean temperature difference, tidal and waves,	
	4	geothermal, tar sands and oil shale, nuclear (Brief descriptions);	
	5	advantages and disadvantages, comparison (Qualitative and Quantitative).	
	6	Solar Radiation: Extra-Terrestrial radiation, spectral distribution of extra terrestrial radiation, solar constant,	
	7	Solar radiation at the earth's surface, beam, diffuse and global radiation, solar radiation data.	
	8	Measurement of Solar Radiation: Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working.	
2	9	Solar Radiation Geometry: Flux on a plane surface, latitude, declination angle, surface azimuth angle, hour angle, zenith angle, solar altitude angle	40%
	10	expression for the angle between the incident beam and the normal to a plane surface (No derivation) local apparent time. Apparent motion of sun, day length, numerical examples.	
	11	Radiation Flux on a Tilted Surface: Beam, diffuse and reflected radiation, expression for flux on a tilted surface (no derivations) numerical examples.	
	12	Solar Thermal Conversion: Collection and storage, thermal collection devices, liquid flat plate collectors,	
	13	solar air heaters concentrating collectors (cylindrical, parabolic, paraboloid) (Quantitative analysis);	
	14	sensible heat storage, latent heat storage, application of solar energy water heating.	
	15	Space heating and cooling, active and passive systems, power generation, refrigeration.	
	16	Distillation (Qualitative analysis) solar pond, principle of working, operational problems.	
3	17	Performance Analysis of Liquid Flat Plate Collectors: General description,	60%
	18	collector geometry, selective surface (qualitative discussion)	
	19	basic energy-balance equation, stagnation temperature, transmissivity of the cover system, transmissivity – absorptivity product, numerical examples.	
	20	The overall loss coefficient, correlation for the top loss coefficient, bottom and side loss coefficient, problems (all correlations to be provided).	
	21	Temperature distribution between the collector tubes,	
	22	collector heat removal factor, collector efficiency factor and collector flow factor, mean plate temperature, instantaneous efficiency (all expressions to be provided).	
	23	Effect of various parameters on the collector performance; collector orientation, selective surface, fluid inlet temperature, number covers, dust.	

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	24	Photovoltaic Conversion: Description, principle of working and characteristics, application.	
4	25	Wind Energy : Properties of wind, availability of wind energy in India, wind velocity and power from wind;	80%
	26	major problems associated with wind power, wind machines; Types of wind machines and their characteristics, horizontal and vertical axis wind mills,	
	27	elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design, numerical examples.	
	28	Tidal Power: Tides and waves as energy suppliers and their mechanics;	
	29	fundamental characteristics of tidal power, harnessing tidal energy,	
	30	limitations.	
	31	Ocean Thermal Energy Conversion: Principle of working, Rankine cycle,	
	32	OTEC power stations in the world, problems associated with OTEC.	
5	33	Geothermal Energy Conversion: Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world,	100%
	34	problems associated with geothermal conversion, scope of geothermal energy	
	35	Energy from Bio Mass: Photosynthesis, photosynthetic oxygen production, energy plantation, bio gas production from organic wastes by anaerobic fermentation,	
	36	description of bio-gas plants, transportation of bio- gas, problems involved with bio-gas production,	
	37	application of bio-gas, application of bio-gas in engines, advantages.	
	38	Hydrogen Energy: Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen,	
	39	production of hydrogen, electrolysis of water, thermal decomposition of water,	
	40	thermo chemical production bio-chemical production.	

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: University Questions on Energy Resources	Students study the Topics and prepare the multiple choice questioner with answer.	Module -1 of the syllabus	2	Group Activity. Each group should prepare minimum 05 questions expected.	Book 1, 2 of the reference list. Website of the Reference list
2	Assignment 2: University Questions on Solar Energy	Students study the Topics and explain solar energy.	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 on Solar energy	Students study the Topics and explain solar energy.	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 on Wind, Tidal and OTEC energy.	Students study the Topics and explain Wind, Tidal and OTEC energy.	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 on Geothermal, Biomass and Hydrogen energy.	Students study the Topics and explain Geothermal, Biomass and Hydrogen energy.	Module -5 of the syllabus	10	Individual Activity.	Book 1, 2 of the reference list. Website of the Reference list

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15.0

QUESTION BANK


Sample Questions	Questions
1.	Module 1 1. What are the limitations of conventional energy sources? 2. What are the prospects of non conventional energy sources in India? 3. What are the renewable energy sources? Write its advantages and obstacles to implement these sources. 4. What are the methods of direct energy conversion? Describe in brief. 5. What are limitations of renewable energy sources? 6. Show on a map, wind power plants, solar power plants, tidal power plants, nuclear power plants hydro power plants and thermal power plants. 7. What are the convention and non-conventional sources? Write advantages of non-conventional energy sources. 8. What is need of renewable energy?
2.	Module 2 9. Write a note on solar radiation on tilted surfaces. 10. Briefly explain different type of instruments used to measure solar radiation. 11. What is extraterrestrial , terrestrial radiation, solar radiation and solar flux 12. What are the challenges associated in the use of solar energy and give the Remedies and possible solutions. 13. Discuss energy requirement of rural consumers and state the possible alternative source of energy to meet the demand 14. Briefly describe Renewable Energy Scenario in India and world. 15. What is Environmental Aspects of Energy Utilization in renewable and non- renewable energy sources? 16. Enumerate the different types of concentrating type collectors.
3.	Module 3 17. Enumerate the different types of concentrating type collectors. 18. With the help of a neat sketch describe a solar heating system using water heating solar collectors and state the advantages and disadvantages of this method. 19. How is the performance of flat plate collector evaluated? 20. Explain the construction and uses of evacuated tube collectors? 21. What are the factors effected on performance of solar flat plate collector? 22. What is solar cell, and applications of PV system? 23. Explain working principle of solar PV cells? What are the materials used for PV cells? 24. What are the various methods to store solar energy? Discuss in detail any two processes? 25. Draw neatly solar pond and explain each zone operation and how it is store energy? 26. What are the different types of photovoltaic cell? Explain each one?
4.	Module 4 27. What is wind power explain briefly? 28. Describe with a neat sketch the working of wind energy system with main components 29. How power extracted by wind turbine? 30. List out type of wind turbine and what are the wind power plants are grouped 31. Discuss the advantages and disadvantages of horizontal and vertical axis wind mill. What methods are used to overcome the fluctuate power generation of wind mill? 32. What are the rules for site selection of wind turbine and advantages and disadvantages of wind turbine? 33. How performance of the wind turbine is determined? Explain its operational characteristics. 34. What is tide? Explain tidal energy and its conversion with neat diagram 35. Explain the basic components of a tidal thermal power plant and state their advantages and disadvantages.. 36. What is the nature of tidal power extracted from single basin arrangement and double basin arrangement? 37. What are the wave energy conversion machines, explain any one conversion methods. 38. What is the basic principle of ocean thermal energy conversion ? What are the main types of OTEC power plants? Describe their working in brief.

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5.	Module 5 39. What are the geothermal power plants, explain binary cycle power plant with neat diagram 40. Draw schematic diagram of an alkaline water electrolytic hydrogen cell and explain 41. With a neat sketch explain biomass gasification? 42. What is biomass, bio-fuel, bio energy and biogas? 43. What are the methods used for biomass conversion to energy? Explain in brief? 44. What are the factors affecting the generation of bio gas? 45. What are the constituents of biomass materials? Explain proximate and ultimate analysis. 46. What is fermentation, aerobic and anaerobic, hydrolysis explain each. 47. Compare fixed dome and float drum type bio digesters.
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16.0 University Result

Prepared by	Checked by		
Dr. M. M. Shivashimpi	Dr. K. M. Akkoli	HOD	Principal

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Subject Title	SOFTWARE APPLICATION LABORATORY		
Subject Code	18CVL66	CIE Marks	40
Number of Lecture Hrs / Week	(0:2:2)	SEE Marks	60
Total Number of Lecture Hrs	2	Exam Hours	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Prof. P.R.Patil	Designation: Asst. Professor	Experience: 4Years
No. of times course taught: 02	Specialization: Structural engineering	

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	Civil Engineering	III	Computer aided engineering drawing

2.0 Course Objectives

- 1 Use industry standard software in a professional set up.
2. Understand the elements of finite element modeling, specification of loads and boundary condition, performing analysis and interpretation of results for final design.

3.0 Course Outcomes

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

Sl.No	Course Outcome	RBT Level	POs
CO1	use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work	L1,L2,L3,L4	1,2,3,5,6,8,12


4.0 Course Content

Module -1

Use of civil engineering software's: Use of software's for: 1. Analysis of plane trusses, continuous beams, portal frames. 2. 3D analysis of multistoried frame structures.

Module -2 .

Project Management- Exercise on Project planning and scheduling of a building project using any project management software: a. Understanding basic features of Project management software b. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software. c. Identification of Predecessor and Successor activities with constrain d. Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Otherton Critical paths, Project duration, Floats. e. Study on various View options available f. Basic understanding about Resource Creation and allocation g. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project 1. **GIS applications using open source software:** a. To create shape files for point, line and polygon features with a map as reference. b. To create decision maps for specific purpose.

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Module -3

Use of EXCEL spread sheets: Design of singly reinforced and doubly reinforced rectangular beams, design of one way and two way slabs, computation of earthwork, Design of horizontal curve by offset method, Design of super elevation.

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
1.	VII	Computer Aided Drawing	Building planning

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Building planning design and load combination

7.0 Books Used and Recommended to Students

Reference Books
1. IS code 800 2. IS Code 875 part 1 – 5 3. IS code -456
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

Scheme of Evaluation for CIE (40 Marks)

CIE marks:


Theoretical aspects as well as relevant circuits should be drawn neatly for questions asked in Internal Assessment.

Scheme of Evaluation for CIE (40 Marks)

- Continuous Assessment: **24 marks**
- Internal Assessment test in the same pattern as that of the main examination: **16 marks.**
 - Write up- 4 marks
 - Conduction and Result- 10 marks
 - Viva Voce- 2 marks

Conduct of Practical SEE:

- Students can pick one experiment from the questions lot prepared by the examiners.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.





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11.0 Course Delivery Plan

Expt No	Name of the Experiment	% of Portion
1	Analysis of plane trusses, continuous beams, portal frames.	6
2	3D analysis of multistoried frame structures	7
3	Project Management- Exercise on Project planning and scheduling of a building project using any project management software: a. Understanding basic features of Project management software	7
4	Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.	7
5	Identification of Predecessor and Successor activities with constrain	7
6	Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and Other non Critical paths, Project duration, Floats.	7
7	Study on various View options available	7
8	Basic understanding about Resource Creation and allocation	8
9	Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project	8
10	GIS applications using open source software: a. To create shape files for point, line and polygon features with a map as reference.	8
11	To create decision maps for specific purpose	7
12	design of singly reinforced	7
13	design of doubly reinforced rectangular	7
14	Design of column	7

12.0 QUESTION BANK

1. Types of trusses
2. Advantages of software
3. Future scope of software
4. Who introduced Bentley?
5. Full form of Staad Pro
6. Advantages over ETABS software
7. What is single reinforced beam?
8. What is doubly reinforced beam?
9. What is effective cover of beam?
10. What is the effective cover of column?

Prepared by	Checked by		
			
Prof. Preeti. R.Patil	Prof.Sudarshan V. Jore	HOD	Principal

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Subject Title	ENVIRONMENTAL ENGINEERING LABORATORY		
Subject Code	18CVL67	CIE Marks	40
Number of Lecture Hrs / Week	(0:2:2)	SEE Marks	60
Total Number of Lecture Hrs	2	Exam Hours	03
CREDITS – 02			

FACULTY DETAILS:		
Name: Prof. S.S Beesanakoppa	Designation: Asst. Professor	Experience: 1Years
No. of times course taught: 00	Specialization: waste water management	

1.0 Prerequisite Subjects:

Sl.No	Branch	Semester	Subject
01	Civil Engineering	III	Municipal wastewater engineering
02	Civil Engineering	III	chemistry

2.0 Course Objectives

- 1.To learn different methods of water & waste water quality
2. To conduct experiments to determine the concentrations of water and waste water
3. To determine the degree and type of treatment
4. To understand the environmental significance and application in environmental engineering practice


3.0 Course Outcomes

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

Sl.No	Course Outcome	RBT Level	POs
CO1	Acquire capability to conduct experiments and estimate the concentration of different parameters	L1,L2,L3,L4	1,2,3,5,6,8,12
C02	Compare the result with standards and discuss based on the purpose of analysis.	L1,L2,L3,L4	1,2,3,5,6,8,12
C03	Determine type of treatment, degree of treatment for water and waste water.	L1,L2,L3,L4	1,2,3,5,6,8,12
C04	Identify the parameter to be analyzed for the student project work in environmental stream.	L1,L2,L3,L4	1,2,3,5,6,8,12

4.0 Course Content

1. Preparation chemical solutions required for analysis and sampling methodologies
2. Determination of pH, Conductivity, TDS and Turbidity.
3. Determination of Acidity and Alkalinity

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4. Determination of Calcium, Magnesium and Total Hardness.
5. Determination of Dissolved Oxygen
6. Determination of BOD.
7. Determination of Chlorides
8. Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.
9. Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids.
10. Determination of optimum coagulant dosage using Jar test apparatus.
11. Determination Nitrates and Iron by spectrophotometer
12. Determination of COD(Demonstration)
13. Air Quality Monitoring (Demonstration)
14. Determination of Sound by Sound level meter at different locations (Demonstration)

5.0 Relevance to future subjects

Sl No	Semester	Subject	Topics
1.	VII	Environmental protection and management	Environmental audit, Environmental quality objectives

6.0 Relevance to Real World

Sl No	Real World Mapping
01	Comprehend the concepts of Environmental Engineering For sustainable development.

7.0 Books Used and Recommended to Students

Reference Books
1. IS codes-3025 series
2. Standard method for examination of water and waste water, APHA, 20th edition
3. Clair Sawyer and Perry McCarty and Gene Parkin, "Chemistry for Environmental Engineering and Science", McGraw-Hill Series in Civil and Environmental Engineering.
Additional Study material & e-Books
Class notes and vtu notes
1.Environmental studies P.C.Verges


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

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		Academic Course Plan
		2022-23 (Even)

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- (a) Continuous Assessment: **24 marks**
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Conduct of Practical SEE:

- Students can pick one experiment from the questions lot prepared by the examiners.
- Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

11.0 Course Delivery Plan

Expt No	Name of the Experiment	% of Portion
1	Preparation chemical solutions required for analysis and sampling methodologies	6
2	Determination of pH, Conductivity, TDS and Turbidity.	7
3	Determination of Acidity and Alkalinity	7
4	Determination of Calcium, Magnesium and Total Hardness.	7
5	Determination of Dissolved Oxygen	7
6	Determination of BOD.	7
7	Determination of Chlorides	7
8	Determination of percentage of % of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.	8
9	Determination of Solids in Sewage: i) Total Solids, ii) Suspended Solids, iii) Dissolved Solids, iv) Volatile Solids, Fixed Solids v) Settleable Solids.	8
10	Determination of optimum coagulant dosage using Jar test apparatus.	8
11	Determination Nitrates and Iron by spectrophotometer	7
12	Determination of COD(Demonstration)	7
13	Air Quality Monitoring (Demonstration)	7
14	Determination of Sound by Sound level meter at different locations (Demonstration)	7

12.0 QUESTION BANK


Viva Questions

pH

- What is the relationship between (a) pH and hydrogen ion concentration (b) pH and hydroxide ion concentration?
- What is the principle involved in pH meter?
- What is meant by pH index.
- pH is one of the most important controlling factors for treatment and chemical analysis of water and wastewater. explain
- What is the standard limit of pH in the drinking water?
- What is the electrode used in the determination of the pH?

Acidity

- What is meant by acidity in water and wastewater? What are the effects of the acidity?
- Explain the principle involved in the determination of acidity?

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3. What are the sources of mineral acidity in water?
4. What are the constituents that cause acidity in water?
5. Acidity in water is removed by neutralization with
6. Acid water are of concern because of theircharacteristics.
7. The permissible limit of total acidity as CaCO₃ in water used for RCC works should not be more thanmg/L
8. What are the treatment techniques adopted for the reduction of acidity?
9. What are the treatment techniques adopted for the reduction of acidity?
10. Can you tell what are the effects of acidity in building construction activity/ concrete?

Alkalinity

11. What is meant by alkalinity in water and wastewater?
12. What are the constituents that cause alkalinity in water ?
13. At what pH range the alkalinity is present in water ?
14. How is alkalinity removed from water?
15. The permissible limit of alkalinity in water to be used for RCC works is less than.....mg/L
16. What are the principle ions responsible for the cause of alkalinity?
17. Explain the effects of alkalinity on water bodies ?
18. How does alkalinity affects on plants?

Hardness

19. Define hardness with respect to water?
20. What are the different types of hardwater?
21. What is Pseudo-hardness ?
22. What are the salts that cause permanent hardness in water ?
23. What are the methods to be used for removal of temporary hardness ?
24. What are the methods to be used for removal of permanent hardness ?
25. What are the principal anions and cations responsible for causing of hardness of a water?
26. What are the effects of the hardwater in domestic as well as the industrial usages.
27. Explain the principle for the determination of the hardness using EDTA?
28. What is the standard limit of the hard water?
29. If the ground water is found to be saltier in taste then what sort of conclusion you come across it?
30. Among finished drinking water, raw wastewater and de-ionized water, which water is expected to have the highest
 1. carbonate hardness and why?
31. A sample has 50mg/L Ca²⁺, 150 mg/L Mg²⁺, 50 mg/L Na⁺, 20 mg/L Cl⁻ and 100 mg/L glucose.
32. Calculate its total hardness, carbonate and non-carbonate hardness?
 2. Dissolved Oxygen
33. What is the limit for the Dissolved oxygen present in the water?
34. What are the factors affecting the D.O?
35. How can you determine the presence or absence of DO in the given samples?
36. How can you relate the DO with BOD in what way it can be used to assess in wastewater treatment.?
37. An sugarcane industry is letting out the effluent which contains BOD of 600mg/L . then in what way the DO will be affected?
38. How does the DO Concentration varies in lakes and rivers?
39. What is the minimum DO required for survival of aquatic life?
40. What processes affect the DO content in the water?
41. When do you say the water is polluted ?

BOD

42. What is meant by BOD ?
43. Why do you take 203 ml of the sample from the BOD Bottle?
44. What is the difference between seeded and unseeded BOD samples?
45. Why was the 5 day incubation period been selected for BOD determination?
46. List five requirements which must be complied with in order to obtain reliable BOD data.



47. What should be the composition of 'good dilution water' for BOD determination?
48. Light must be excluded from the incubator in BOD test. Why ?

Chlorides


49. What are the reasons for non-salty taste of water, even chlorides concentration more than 1000 mg/L ?
50. What happens if the Sodium chloride concentration increases in the uptake of plants?
51. What is the effect of temperature on the determination of chlorides?
52. What process is to be used to remove excess chlorides in water?
Percentage of available chlorine in bleaching powder, Residual Chlorine
53. What are the different forms of chlorination?
54. What is the difference between disinfection and sterilization?
55. Justify how can you treat the water contaminated with the microorganisms at home?
56. Define available chlorine and residual chlorine and chlorine demand
57. What is the chemical name of bleaching powder? And how much bleaching powder concentration must be present in the treated water?
58. Why do you determine residual chlorine in water treatment practice and water supply mains?
59. Hundred percentage pathogen bacteria is removed in water treatment plant. However 0.1 to 0.2 mg/L residual chlorine is maintained in water distribution main. Why?
60. Free available chlorine is more effective than combined available chlorine. Why?
61. Give the chemical formula for bleaching powder
62. What is the percentage of active chlorine available in bleaching powder?
63. Name any three disinfectant which can commercially be employed in water treatment.
Solids
64. Define Solids with reference to water
65. What is the permissible and tolerable total dissolved solids in drinking water as per Indian standards?
66. What are the different types of solids that you come across in your laboratory?
67. The permissible total dissolved solids for drinking water according to Indian Standards ismg/L and tolerable
68. limit ismg/L.
69. What is the significance of determining settleable solids in water and wastewater by Imhoff cone?
70. A domestic wastewater contains 400 mg/L of suspended solids. Primary sedimentation facilities to remove 65%.
71. Approximately how many litres of wastewater settled ?
72. The residue and container must be cooled in dessicators after drying or ignition operation. Why ?
73. What is the best available methods for removal of dissolved organic solids from water and Wastewater ?

Turbidity

72. How the turbidity does affects the disinfection process?
73. Explain the principle in the determination of the turbidity.
74. Explain how turbidity of the water is caused?
75. Mention the standards for the turbidity.
76. What are the causes of turbidity in water?
77. What units are generally used for measuring turbidity?
78. What is the difference between visual method and instrument method in turbidity measurement?
79. Turbidity is not a direct quantitative measurement of suspended solids. Why?
80. What limit is fixed on turbidity for drinking water by various organizations?
81. What is the general coagulant used for removal of turbidity in water?

Jar test

82. What is the purpose of rapid mixing in jar test?
83. What is the importance of slow mixing in jar test?
84. What is the difference between coagulation and flocculation?
85. Specify the advantages of using a coagulant in water treatment.
86. What do you understand by liquid alum?
87. What is flocculent aid?





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Nitrates

88. What is the significance of the presence of the following compounds in water?
 89. What is the effect on public health due to excess nitrate present in drinking water?

COD

90. What is meant by COD of wastewater?
 91. The wastewater samples have higher BOD than COD. Can you interpret?
 92. What organic compounds are not oxidized in COD test?
 93. What are the major limitations are the COD test?
 94. Why do COD analysis and BOD analysis usually give different results for the same wastewater?
 95. If COD concentration in the industrial wastewater is found to be 5000mg/L. can you suggest the treatment techniques adopted for the removal of the COD?
 96. What are the differences between BOD and COD?
 97. What is the permissible limit of COD for inland sewers and surface water bodies?

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