

## VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

## B.E. in Civil Engineering

## Scheme of Teaching and Examinations 2022

## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER													
Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	BCV301	Strength of Materials	TD: CVPSB: CV	3	0	0		03	50	50	100	3
2	IPCC	BCV302	Engineering Survey	TD: CVPSB: CV	3	0	2		03	50	50	100	4
3	IPCC	BCV303	Engineering Geology	TD- Geology/CV PSB-Geology/CV	3	0	2		03	50	50	100	4
4	PCC	BCV304	Water Supply and Waste water Engineering	TD: CV PSB: CV	3	0	0		03	50	50	100	3
5	PCCL	BCV305	Computer Aided Building Planning and Drawing	TD: CV PSB: CV	0	0	2		03	50	50	100	1
6	ESC	BCV306x	ESC/ETC/PLC	PSB: CV	3	0	0		03	50	50	100	3
7	UHV	BSCK307	Social Connect and Responsibility	Any Department	0	0	2		01	100	---	100	1
8	AEC/ SEC	BCV358x	Ability Enhancement Course/Skill Enhancement Course - III		If the course is a Theory				01	50	50	100	1
					1	0	0						
					If a course is a laboratory				02				
					0	0	2						
9	MC	BNSK359	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK359	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK359	Yoga	Yoga Teacher									
Total									550	350	900	20	

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

### Engineering Science Course (ESC/ETC/PLC)

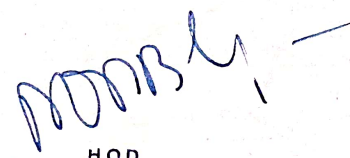
BCV306A	Rural, Urban Planning and Architecture	BCV306C	Sustainable Design Concept for Building Services
BCV306B	Geospatial Techniques in Practice	BCV306D	Fire Safety in Buildings

### Ability Enhancement Course – III

BCVL358A	Data analytics with Excel (0:0:1)	BCVL358C	Problem Solving with PYTHON
BCV358B	Smart Urban Infrastructure	BCV358D	Personality Development for Civil Engineers

**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching-Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

**National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

  
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STRENGTH OF MATERIALS		Semester	III
Course Code	BCV301	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3+0+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3 Hrs.
Examination type (SEE)	Theory		

**Course Learning objectives:** This course will enable students to

- Understand the simple stresses, strains, and compound stresses in various structural components.
- Understand the bending moments and shear forces in different types of beams under various loading conditions
- Know the bending stress, shear stress, and torsional stress in beams and shafts with different cross sections
- Understand the deflection in beams and the stability of columns under different loading conditions.
- Understand the behaviour and strength of structural elements subjected to compound stresses and stresses in thin and thick cylinders.

#### Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills

#### Module-1

**Simple Stresses and Strains:** Introduction, Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress – Strain Diagram for structural steel, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections. Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants. Thermal stresses and strains, Compound bars subjected to thermal stresses, state of simple shear. (L1, L2, L3)

#### Module-2

**Bending moment and shear force diagrams in beams:** Introduction to types of beams, supports and loadings. Definition of shear force and bending moment, sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, development of Shear Force Diagram(SFD) and Bending Moment Diagram (BMD) with salient values for cantilever, simply supported and overhanging beams for point loads, UDL (Uniformly Distributed Load), UVL (Uniformly Varying Load), Couple and their combinations (L1,L2,L3)

#### Module-3

**Bending and Shear Stresses in Beams:** Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections.  
**Torsion in Circular Shaft:** Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft. (L1, L2, L3)

#### Module-4

**Deflection of Beams:** Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment- curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.  
**Columns and Struts:** Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns. (L1,L2,L3)

#### Module-5

##### Compound Stresses:

Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses

##### Thin and Thick Cylinders:

Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lamé's equation, radial and hoop stress distribution. (L1,L2,L3)



### Course outcome (Course Skill Set)

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

1. Evaluate the simple stresses, strains and compound stresses
2. Calculate the Bending moments, shear force and draw BMD, SFD for various types of beams and loadings
3. Analyse the bending stress, shear stress and torsional stress in beams and shafts with different cross sections
4. Evaluate the deflection in beams and determine the stability of the columns.
5. Evaluate the behaviour and strength of structural elements under the action of compound stresses and strains in thin and thick cylinders.

### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

#### Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

#### Semester-End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks



**Suggested Learning Resources:****Text Books**

- B.C Punmia Ashok Jain, Arun Jain, "Strength of Materials", Laxmi - 2018-22 Publications, 10th Edition-2018
- R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
- S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013).
- Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.
- R.K. Rajput, "Strength of materials" S. Chand Publishing (6th Edition)
- S S Bhavikatti, "Strength of Materials" Vikas Publishing (5th Edition)
- B.S. Basavarajaiah, P. Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010

**Web links and Video Lectures (e-Resources):**

- 1.Strength of Materials web course by IIT Roorkee <https://nptel.ac.in/courses/112107146/>
- 2.Strength of Materials video course by IIT Kharagpur <https://nptel.ac.in/courses/105105108/>
- 3.Strength of Materials video course by IIT Roorkee <https://nptel.ac.in/courses/112107147/18>
- 4.All contents organized <http://www.nptelvideos.in/2012/11/strengthof-materials-prof.html>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Quiz (To assist in GATE Preparations)
- Demonstrations in Lab
- Virtual Lab Experiments

**CO & PSO - PO Mapping (Individual Teacher has to fill)****Mapping of Course Outcomes and Program specific outcomes to Program Outcomes**

Course outcomes	Program outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

Note: Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.

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<b>Engineering Survey</b>		Semester	3
Course Code	BCV302	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	3
Examination nature (SEE)	Theory		

**Course Learning objectives:** This course will enable students to

- Ability to understand principles of both traditional and modern surveying applying knowledge of mathematics.
- Ability to handle surveying equipment's and software tools to carry out field surveying, plot topographical Drawings and construction drawing
- Ability to use Total station for data capture, data storage, data transfer.
- Ability to prepare construction drawing and setting out

### Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

### MODULE-1

**Engineering surveying** – Definition & importance of surveying for Civil Engineers. Surveying types- Control survey, Topographical surveying, Construction Survey, Cadastral survey, Hydrographic survey and Underground Survey. Surveying through the ages- Chain surveying, Compass surveying and Plane Table Surveying (concepts and limitations only).  
**Measurement of Distance**- Various types of tapes, Laser distance meter, Distance measuring wheel, Electronic Distance measurement, GPS.

L1,L2,L3

## MODULE-2

**Vertical Control-** Concepts of various types of Datum – Mean Sea level, Bench marks – Temporary and Permanent.

**Levelling-** Terms used in levelling, Setting up of Dumpy level. Differential levelling by plane of collimation method using Dumpy level.

**Theodolite Surveying** – Terms used in Theodolite surveying. Setting up a Theodolite. Measurement of horizontal and vertical angles with Theodolite.

**Total Station Surveying** – Features, parts, accessories and advantages of Total Station. Surveying with total station – Measurement of Horizontal angle, vertical angle, distance, slope, vertical distance, multiple angles with Total station. Using Total station for Area measurement and Volume calculation. L1,L2,L3

## MODULE-3

**Contours** - Definition, terms used, characteristics of contours and applications of contours in civil engineering practice. Contouring using level, theodolite and total station. Plotting of contours in CAD.

**Longitudinal and cross sectioning** – Definition, importance of L/S & C/S. L/S & C/S using level, theodolite and Total station. Plotting of L/S & C/S in CAD.

**Coordinate survey with Total station** - Measurement of coordinates using total station. Creating Job files, importance of back sight data, coordinate data recording. Data transferring, data refinement and plotting in CAD. L1,L2,L3

## MODULE-4

**Curves** –Types of Curves- Application of curves in civil engineering. Setting out of Horizontal curve by Theodolite (Rankine's method) and using Total Station. Components of Compound, Reverse curve. Transition Curve and Combined curve. Various types of vertical curves and its applications.

**Areas and Volumes-** Methods of determining areas by trapezoidal and Simpsons' rule. Measurement of volume by prismoidal and trapezoidal formula. Earthwork volume calculations from spot levels and from contour maps; Earthwork calculation in Embankments.

**Construction Surveying** - Setting out works using Total Station, Setting out buildings by Centre line method. L1, L2, L3, L4

## MODULE-5

**GPS Surveying** – Introduction. Overview of GPS system- space, control and user segments. Reference co- ordinate systems. Absolute and Differential positioning with GPS. Gagan system in India. Types of GPS Receivers. Engineering survey using Differential GPS.

**Surveying with Drone** – Introduction, applications and advantages. Features of photogrammetric mapping method. Drone surveying requirements- Drone platform, Flight planning software, Sensor DGPS equipment and Image processing software. Types of drones and sensors. Process of drone surveying – flight planning, DGPS markers, capturing images, post processing of images using photogrammetry software and output maps.

Application and uses of Remote sensing and GIS in engineering surveying. L1, L2, L3, L4

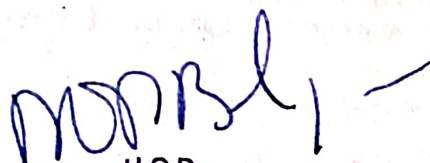


# **CO & PSO - PO Mapping (Individual Teacher has to fill)**

Mapping of Course Outcomes and Program specific outcomes to Program Outcomes													Program Specific Outcomes			
Course outcomes	Program outcomes															
	PO 1	PO 2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

**Note:** Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.



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ENGINEERING GEOLOGY		Semester	3
Course Code	BCV303	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	
Examination nature (SEE)	Theory		
<b>Course objectives:</b> <ol style="list-style-type: none"><li>1. To inculcate the importance of earth's interior and application of Geology in civil engineering in Geo Hazard mitigation and management</li><li>2. To create awareness among Civil engineers regarding the resources of earth</li><li>3. To provide knowledge on dynamic Geology and its importance in modifying the physical character of rocks which cause rocks suitable or unsuitable in different civil engineering projects such as Dams, bridges, tunnels and highways.</li><li>4. To educate the ground water management regarding diversified geological formations, . To highlight the concept of rain water harvesting.</li><li>5. To understand the application of Remote Sensing and GIS, Natural disaster and management and environmental awareness. To understand the subsurface using geospatial data</li><li>6. To provide decision support on the nature of the basic raw materials used in construction. To provide decision support on Lithological characters and subsurface conditions</li><li>7. To describe various geological maps and interpretation of geological data for mining and subsurface investigations.</li></ol>			
<b>Teaching-Learning Process (General Instructions)</b> <p>These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.</p> <ul style="list-style-type: none"><li>• Chalk and Talk method.</li><li>• Show Video/animation films to explain earth dynamics and influence of geology in prime civil constructions</li><li>• Encourage collaborative (Group Learning) Learning in the class</li><li>• Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.</li><li>• Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking process such as the ability to evaluate, generalize, and analyse information rather than simply recall it.</li><li>• Topics will be introduced in a multiple representation.</li><li>• Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.</li><li>• Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.</li></ul>			
MODULE-1		7 hrs	
<b>Introduction, the scope of earth science in Engineering.</b> <p>Earth's internal structure and composition, internal dynamics and Plate tectonics, Earthquakes - types, causes, so-seismic lines, seismic zonation, seismic proof structures. Volcanic eruption - types, causes. Landslides-causes types, preventive measures; Tsunami – causes, consequences, mitigation. Cyclones - causes and management.</p>			
MODULE-2		5 hrs	
<b>Earth Materials in Construction</b> <p>Minerals -Industrial, rock-forming and ore minerals. Physical properties, composition. Rocks Types, structure/Texture, mineral composition occurrence, properties. Decorative (facing/polishing), railway ballast, rocks for masonry work, monumental/architecture, Dressing of stones, Requirement of good building stones.</p>			
MODULE-3		7hrs	



- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

#### **CIE for the practical component of the IPCC**

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

#### **SEE for IPCC**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

**The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.**

#### **Suggested Learning Resources:**

##### **Books**

1. Punmia BC, & Jain Ashok Kumar. (2016). *Surveying* (17th ed., Vol. 1). Laxmi Publications.
2. Dr. K.R. Arora. (2019). *Surveying* (17th ed., Vol. 1). Standard Book House.
3. Charles D. Ghilani. (2012) (13<sup>th</sup> ed.). Prentice Hall

##### **Web links and Video Lectures (e-Resources):**

1. <https://enterprise.dji.com/surveying/land-surveying>
2. <https://www.gps.gov/applications/survey/>
3. <https://www.constructionplacements.com/total-station-in-surveying-types-uses-and-applications/>
4. <https://www.youtube.com/watch?v=bbs5AEPstl4>
5. [https://www.youtube.com/watch?v=KHI4TEeexuM&list=PLLy\\_2iUCG87DwNVc3Mz1yYIRA42jSQ1tB&index=28](https://www.youtube.com/watch?v=KHI4TEeexuM&list=PLLy_2iUCG87DwNVc3Mz1yYIRA42jSQ1tB&index=28)
6. [https://www.youtube.com/watch?v=lu9vrE48\\_I4&list=PLLy\\_2iUCG87DwNVc3Mz1yYIRA42jSQ1tB&index=30](https://www.youtube.com/watch?v=lu9vrE48_I4&list=PLLy_2iUCG87DwNVc3Mz1yYIRA42jSQ1tB&index=30)
7. <https://www.youtube.com/watch?v=RXUi2cX4CkU>
8. <https://www.youtube.com/watch?v=SVa66vO08So>

##### **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

1. Hand on use of various surveying instruments
2. Surveying Civil engineering block and plotting with instruments of student's choice
3. Setting out a single bedroom house plan in field



## PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Use of Various types of tapes, Laser distance meter, Distance measuring wheel.
2	Differential levelling by Dumpy level by plane of collimation method
3	Measurement of horizontal and vertical angles by Theodolite. Method of repetition
4	Setting out simple curve using Rankine's method using Theodolite
5	Setting out central line of a small residential building.
6	Setting up of Total station. Features and components of Total station
7	Measurement of Distance, slope, vertical distance, horizontal and vertical angles using Total station
8	Coordinate measurement with Total station
9	Longitudinal sectioning and cross sectioning using Total station
10	Contouring and plotting with Total station
11	Demonstration of Equipment's used for chain, compass and plane table surveying
12	Visit to railway station/ large construction site to understand the importance of datum and benchmark.

### Course outcomes (Course Skill Set):

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

- Summarize various types of surveying and carry out distance measurement using various equipment's
- Illustrate the use and applications of levelling and theodolite
- Plot contours, longitudinal and cross sections for construction projects.
- Set curves for construction works and carry out estimation of areas and volumes.
- Demonstrate the necessary skills to carry out GPS and DRONE Surveying

### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

### Suggested Learning Resources:

#### Books

1. Engineering Geology, by Parthasarathy et al, Wiley publications
2. A textbook of Engineering Geology by ChennaKesavulu, Mac Millan India Ltd
3. Principle of Engineering Geology, by K.M. Bangar, Standard publishers
4. Physical and Engineering Geology, by S.K. Garg, Khanna publishers
5. Principles of Engineering Geology, by KVGK Gokhale, BS Publications

#### Reference Books

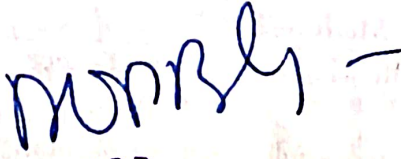
1. Introduction to Environmental Geology by Edward A Keller, Pearson publications.
2. Engineering Geology and Rock Mechanics B. P. Verma, Khanna publishers
3. Principles of Engineering Geology and Geotechnics, Krynine and Judd, CBS Publications

#### Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=aTVDiRtRook&list=PLDF5162B475DD915F>
- <https://www.youtube.com/watch?v=EBiLLjAxBuU&index=2&list=PLDF5162B475DD915F>
- <https://www.youtube.com/watch?v=sTY-ao4RZck&list=PLDF5162B475DD915F&index=3>
- <https://nptel.ac.in/courses>
- <https://youtu.be/fvoYHzAhvVM>
- <https://youtu.be/aTVDiRtRook>
- [https://serc.carleton.edu/NAGTWorkshops/hazards/events/12262004.html?serc\\_source=recommendation](https://serc.carleton.edu/NAGTWorkshops/hazards/events/12262004.html?serc_source=recommendation)
- <https://serc.carleton.edu/NAGTWorkshops/visualization/examples/CBezanson.html?sercsource=recommendation>
- <https://serc.carleton.edu/NAGTWorkshops/coursedesign/goalsdb/14712.html>
- <https://www.earthsciweek.org/classroom-activities>
- NPTEL materials

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Field Visits
- Quiz/Assignments/Open book test to develop skills
- Encourage collaborative learning in the class
- Demonstration of Geological models and animations
- Hands on experiments with Rock and Minerals

  
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WATER SUPPLY AND WASTEWATER ENGINEERING		Semester	III
Course Code	BCV304	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3+0+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	
Examination type (SEE)	Theory		

**Course Learning objectives:** This Course will enable the students to

1. Analyze the variation of water demand and to estimate water requirement for a community.
2. Study drinking water quality standards and to illustrate qualitative analysis of water.
3. Analysis of physical and chemical characteristics of water and wastewater.
4. Understand and design of different unit operations and unit process involved in water and wastewater treatment process
5. Design various oxidation processes.

#### Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills

#### Module-1

**Introduction:** Water: Need for protected water supply, Demand of Water: Types of water demands - domestic demand, industrial, institutional and commercial demand, public use and fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor.

Design period and factors governing design period. Methods of population forecasting and numerical problems. Physico chemical characteristics of water Sampling. **L1, L2, L3**

#### Module-2

**Water Treatment:** Objectives, Unit flow diagrams – Significance of each unit, Aeration process Limitations and types.

**Sedimentation** - Theory, settling tanks, types and design with numerical, Coagulation and flocculation, types of coagulants.

**Filtration:** Mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation and cleaning. Design of slow and rapid sand filter without under drainage system, Numerical. **L1, L2,**

#### Module-3



the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

#### **CIE for the theory component of the IPCC (maximum marks 50)**

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

#### **CIE for the practical component of the IPCC**

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

#### **SEE for IPCC**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

**The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.**

**Note: Subject to be taught by Geologist with qualification M. Sc Geology/MPhil/ Ph. D in Geology**

**Earth Surface process and Resources**

Weathering, type, causes, soil insitu, drifted soil, soil profile, soil mineralogy, structure, types of soil, Black cotton soil v/s Lateritic soil; effects of weathering on monumental rocks. Soil Horizon, Soil Classification by Grain Size.

**MODULE-4 7 hrs****Surface and sub Investigation for deep foundation**

Dip and strike, and outcrop problems(numerical problem geometrical/ simple trigonometry based), Borehole data(and problems), Faults, folds, unconformity, joints, types, recognition and their significance in Civil engineering projects like tunnel project, dam project, Reservoir site,.

**MODULE-5 5 hrs****Modern Tools and geophysical methods**

Rocks as aquifers, water-bearing properties igneous, sedimentary and metamorphic rocks , coefficient of permeability, factors affecting permeability, Electrical Resistivity meter, depth of water table, (numerical problems), seismic studies.

**PRACTICAL COMPONENT OF IPCC (May cover all / major modules)**

Sl.NO	Experiments 8 hrs
1	Identification of common minerals based on Physical Properties
2	Identification of rocks used in building construction based on Physical properties
3	Solving Geological maps for suitability for aqua duct
4	Geological maps with inclined beds, suitability for tunnels/ Dams
5	Geological maps with folds, in tunnels/ Dams
6	Geological maps with unconformity , in tunnel/dam project
7	Geological maps with faults in Dams/tunnels project
8	One Day Nearest Field Visit Investigation.

**Course outcomes (Course Skill Set):**

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

- Apply geological knowledge in different civil engineering practice.
- Acquire knowledge on durability and competence of foundation rocks, and will be able to use the best building materials.
- Students will become competent enough for the safety, stability, economy and life of the structures that they construct
- Able to solve various issues related to ground water exploration, build up dams, bridges, tunnels which are often confronted with ground water problems
- Students will become Intelligent enough to apply GIS, GPS and remote sensing as a latest tool in different civil engineering for safe and solid construction.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for



Lecture 25 : Water Treatment Units Screening and Aeration

[https://youtu.be/QsWp\\_HIZqPs](https://youtu.be/QsWp_HIZqPs)

Lecture 26 : Water Treatment Units Sedimentation <https://youtu.be/T1M4Eciwq7Q>

Lecture 27 : Practice Problems On Sedimentation <https://youtu.be/Zlh2mpOjIMU>

Lecture 28: Coagulation and Flocculation: Theory <https://youtu.be/aAo2bBaF0yU>

Lecture 29: Coagulation and Flocculation: Selection and Application <https://youtu.be/44p0IN31ogo>

Lecture 30: Coagulation and Flocculation: Design Operation and Process Control [https://youtu.be/v0TDfCz\\_iLU](https://youtu.be/v0TDfCz_iLU)

Lecture 31: Filtration Theory and Slow Sand Filters [https://youtu.be/nuJQe9F\\_2zI](https://youtu.be/nuJQe9F_2zI)

Lecture 32: Rapid Sand Filter: Filter Media and Components <https://youtu.be/3qw3sKcuQIY>

Lecture 33: Rapid Sand Filters and Pressure Filters [https://youtu.be/PEX\\_0DebrSQ](https://youtu.be/PEX_0DebrSQ)

Lecture 34: Practice Problems Coagulation Flocculation and Filtration <https://youtu.be/73jxsBCDuq4>

Lecture 35: Disinfection Basic <https://youtu.be/d4UG9Xivulk>

Lecture 36: Chlorination <https://youtu.be/L3eSkeOU3iY>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

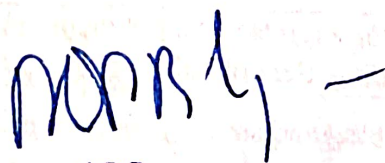
- Activity Based Learning (Suggested Activities in Class)/ Practical Based learning <http://nptel.ac.in>
- <https://swayam.gov.in>
- <https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham>

### CO & PSO - PO Mapping (Individual Teacher has to fill)

Mapping of Course Outcomes and Program specific outcomes to Program Outcomes																
Course outcomes	Program outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

Note: Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.



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COMPUTER AIDED BUILDING PLANNING AND DRAWING		Semester	3
Course Code	BCV305	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	practical		
<b>Course objectives:</b> <ul style="list-style-type: none"><li>Gain skill set to prepare Computer Aided Engineering Drawings using a software</li><li>Understanding the details of construction of different building elements</li><li>Visualize the completed form of the building and the intricacies of construction based on the engineering drawings</li><li>Get familiarization of practices used in Industry.</li></ul>			
Sl.NO	Experiments		
1	<b>Drawing Basics:</b> Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS:962.		
2	<b>Drawing Tools:</b> Lines Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet,		
3	<b>Using Text:</b> Single line text, Multiline text, Spelling, Edit text		
4	<b>Special Features:</b> View tools, Layers concept, Dimension tools, Hatching, Customizing Toolbars, Working with multiple drawings.		
5	<b>Drawings of Different Building Elements:</b> Refer NBC before practice <ul style="list-style-type: none"><li>a&gt; Footing/ Foundation – Foundation dimension for Isolated, combined footing, Standard dimension and cross section of footing</li><li>b&gt; Size stone Masonry – Size of single and double bond stone, Sections at wall foundation</li><li>c&gt; Brick Masonry – Size of standard Burnt Brick, Solid Cement Block, Hollow Cement block, Other bricks used in current practice</li></ul>		
6	Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.		
7	Draw a building plan for single and double bed room accommodation for a given site dimension. Students have to go through Building Bye Laws and regulations		
8	Prepare the centre line drawing for marking the single and double bedroom house as in exercise 6		
9	Prepare a complete sanction plan for the exercise 6 as per the bye law. Also study the requirements to plan Residential Building, School building, Hospital Building, Offices		
10	Drawing of plan with electrical, plumbing and sanitary services using CAD software		
11	Drawing standard sections for Lintel and chajja, RCC Slabs, Columns and beams.		
12	Drawing different types of staircases – Dog legged, Open well – plan and section		



**Disinfection:** Methods of disinfection with merits and demerits. Breakpoint chlorination, Softening: Lime soda and Zeolite process.  
**Wastewater: Introduction:** Need for sanitation, methods of sewage disposal, types of sewerage systems, Treatment of municipal waste water: Waste water characteristics sampling, significance and techniques, physical, chemical and biological characteristics, Numerical on BOD.

L1, L2

#### Module-4

**Treatment Process:** flow diagram for municipal waste water Treatment unit operations and process Screens: types, disposal. Grit chamber, oil and grease removal. Primary and secondary settling tanks, **Suspended growth system** - conventional activated sludge process and its modifications, numerical.

L1, L2, L3

#### Module-5

**Attached growth system** – Trickling filter, numerical on Trickling filters, bio-towers and rotating biological contactors. Principle of stabilization ponds, oxidation ditch. Sludge digesters (aerobic and anaerobic), Equalization. Thickeners and drying beds.

L1, L2, L3

#### Course outcome (Course Skill Set)

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

1. Estimate the average and peak water demand for a community.
2. Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
3. Design the different units of water treatment plant.
4. Design the various units of wastewater treatment plant.
5. Design of various AOPs and low cost treatment units.

#### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

#### Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment



shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

**Internal Assessment Test** question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

**Semester-End Examination:**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

**Suggested Learning Resources:**

**Text books**

- Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering" - Tata McGraw Hill, New York, Indian Edition, 2013
- S. K. Garg, Environmental Engineering Volume-I, Water supply Engineering – M/s Khanna Publishers, New Delhi 2010
- B.C. Punmia and Ashok Jain, Environmental Engineering I-Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi 2010.
- B C Punmia, "Environmental Engineering volume-II", Laxmi Publications 2nd, 2016
- Karia G.L., and Christian R.A, "Wastewater Treatment Concepts and Design Approach", Prentice Hall of India Pvt. Ltd., New Delhi. 3rd, Edition, 2017
- S.K.Garg, "Environmental Engineering vol-II, Water supply Engineering", Khanna Publishers, – New Delhi, 28th edition and 2017
- CPHEEO Manual on water supply and treatment engineering, Ministry of Urban Development, Government of India, New Delhi.
- Mark.J Hammer, Water & Waste Water Technology, John Wiley & Sons Inc., New York, 2008

**Web links and Video Lectures (e-Resources):**

Lecture 01: Background and Course Introduction <https://youtu.be/yDnrv-oGSBc>

Lecture 02: Water Sources and Availability <https://youtu.be/K4Vty0cmvbl>

Lecture 03: Water Uses <https://youtu.be/9H7dPkW0sJA>

Lecture 04: Water Supply Key Issues and Concerns <https://youtu.be/JueYGPbsflw>

Lecture 05: Urban water services and water supply systems <https://youtu.be/bCKm9KkcQtw>

Lecture 06: Urban water services and water supply systems <https://youtu.be/s0hy0ZIM1bA>

Lecture 07: Components of Water Demand <https://youtu.be/mVmErXpIp64>

Lecture 08: Fluctuations in Water Demand <https://youtu.be/qXUwy5OnX9Q>

Lecture 09: "Concept of Design Period and Design Population Need to Forecast Population Population Forecasting Methods [https://youtu.be/QvLdA\\_qhUog](https://youtu.be/QvLdA_qhUog) Lecture 10: Demand Forecasting and Design Capacities <https://youtu.be/rKTWjvx7E8A>

Lecture 11: Water Sources and Collection of Water <https://youtu.be/TvEGgZw1El4>

Lecture 12: Surface Water Intakes <https://youtu.be/GcQOyAdG5OM>

Lecture 13: Surface Water Intakes Systems [https://youtu.be/r1oJtm\\_SXz4](https://youtu.be/r1oJtm_SXz4)

Lecture 14: Groundwater Intake <https://youtu.be/Zo1p7uRDEmM>

Lecture 15: Well Interferences, Well losses and Efficiency [https://youtu.be/dRU5M\\_WICU0](https://youtu.be/dRU5M_WICU0) Lecture 16: Raw water Conveyance and Pumping <https://youtu.be/iQwEoEhujTc>

Lecture 17: Practice Problems <https://youtu.be/e5bduQiz5NY> Lecture 18 : Raw Water Storage <https://youtu.be/WZII7kWoUjE>

Lecture 19 : Treated Water Storage <https://youtu.be/BuZ48afjd04>

Lecture 20 : Placement, Design and Construction of Storage Reservoirs <https://youtu.be/nOCZbXaBb1o>



**Course outcomes (Course Skill Set):**

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

- Prepare, read and interpret the drawings in a professional set up.
- Know the procedures of submission of drawings and Develop working and submission drawings for building.
- Plan of residential or public building as per the given requirements..

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are 50 Marks.

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted

between the schedule mentioned in the academic calendar of the University.

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

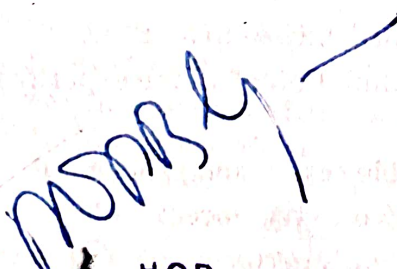
General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by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

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

**Suggested Learning Resources:**

- MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing co. Ltd, New Delhi.
- Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
- Malik RS and a Meo GS, "Civil Engineering Drawing", Asian Publishers/Computech Publication Pvt Ltd

  
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<b>Fire Safety in Buildings</b>		<b>Semester</b>	<b>3</b>
<b>Course Code</b>	<b>BCV306D</b>	<b>CIE Marks</b>	<b>50</b>
<b>Teaching Hours/Week (L: T:P: S)</b>	<b>3:0:0:0</b>	<b>SEE Marks</b>	<b>50</b>
<b>Total Hours of Pedagogy</b>	<b>40</b>	<b>Total Marks</b>	<b>100</b>
<b>Credits</b>	<b>03</b>	<b>Exam Hours</b>	<b>03</b>
<b>Examination type (SEE)</b>	<b>Theory</b>		

**Course objectives:**

- To understand the importance fire safety
- To learn various techniques involved in fire safety
- To design fire resistant buildings using proper materials and methods

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The online courses available should be shared with students
2. YouTube videos
3. Power point presentations
4. Visit to fire stations and understand various fire accidents.

**Module-1**

Fire: Introduction, Basic concepts of fire protection, Fire as a process of combustion, planning for fire protection, fire resistance Ventilation and fuel controlled fire, process of combustion: flashover condition, effect of fire on construction material, design of fire resistance steel structure, concrete structure

**Module-2**

Fire safety: urban planning, escape and refuge, internal planning, detection and suppression Introduction to lift design, design of lift system, expected stop and floor of reversal, different cases, simulation, arrangements and escalators

**Module-3**

Introduction to flow system: water supply, constant demand, variable demand and diversity factor, control systems Flow in pipe networks and fixture units, design of water supply distribution system, flow in waste water pipes

**Module-4**

Introduction to HVAC: governing equations to HVAC process, numerical problem on HVAC system, psychometric chart, equation based approach Electrical systems: design of electrical systems, intelligent building, life cycle cost and basics of building maintenance, stages of maintenance management, planning for building maintenance, periodicity of maintenance management, estimation of repair cycle, cost profile of maintenance, lamp replacement, building inspection, planned and Ad-hoc maintenance

**Module-5**

Condition survey and health evaluation of buildings, diagnosis of building by visual survey, case studies of visual survey, effect of corrosion and alkali aggregate reaction, sampling and choice of test location Non-destructive testing, core strength test, carbonation and chloride measurement, electrical method of progress measurement Repair, rehabilitation, retrofit, periodicity and economics of condition survey, interpretation of test results

11. Concept of building fire safety - D. EGAN.
12. Design of fire resisting structures - H.L. MALHOTRA.

**List of reference materials/books/**

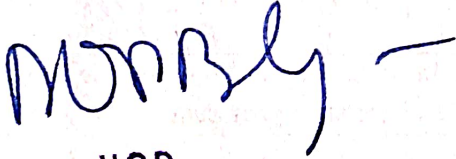
1. An introduction to fire dynamics - D. DRYSDALE
2. Structural fire protection Edt by T.T. LIE
3. Elevator technology - G.C. BARNEY
4. HEATING VENTILATING AND AIR CONDITIONING Analysis and Design - Faye C. McQuiston and Jerald D. Parker.
5. Building Maintenance Management - R. LEE
6. Developments In Building Maintenance - I.EJ. GIBSON
7. Concrete Structures: materials, Maintenance And Repair D.CAMPBELL, ALLEN & H. ROPER

**Web links and Video Lectures (e-Resources):**

- <https://archive.nptel.ac.in/courses/105/102/105102176/>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Assignment students: A case study of fire hazard in building and restoration procedure adopted

  
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<b>BSCK307 – Social Connect &amp; Responsibility 2022 Scheme &amp; syllabus for 3<sup>rd</sup> sem</b>		Semester	3 <sup>rd</sup>
Course Code	<b>BSCK307</b>	CIE Marks	<b>100</b>
Teaching Hours/Week (L:T:P: S)	0:0:3:1	SEE Marks	-----
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	<b>100</b>
Examination nature (No SEE – Only CIE)	For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.		
Credits	<b>01 - Credit</b>		

**Course objectives:** The course will enable the students to:

1. Provide a formal platform for students to communicate and connect to the surrounding.
2. create a responsible connection with the society.
3. Understand the community in general in which they work.
4. Identify the needs and problems of the community and involve them in problem –solving.
5. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
6. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

#### **General Instructions - Pedagogy :**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

#### **Contents :**

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

### **Social Connect & Responsibility - Contents**

#### **Part I:**

##### **Plantation and adoption of a tree:**

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE)

They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature. -- Objectives, Visit, case study, report, outcomes.

#### **Part II :**

##### **Heritage walk and crafts corner:**

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms -- Objectives, Visit, case study, report, outcomes.

#### **Part III :**

##### **Organic farming and waste management:**

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus --

Objectives, Visit, case study, report, outcomes.

#### **Part IV:**

##### **Water conservation:**

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

#### **Part V :**

##### **Food walk:**

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

#### **Course outcomes (Course Skill Set):**

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

CO1: Communicate and connect to the surrounding.

CO2: Create a responsible connection with the society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

#### **Activities:**

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

#### **PEDAGOGY:**

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersion with NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

#### **COURSE TOPICS:**

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversational will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

#### **Duration :**

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

#### **Guideline for Assessment Process:**

##### **Continuous Internal Evaluation (CIE):**

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall



be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

**Excellent** : 80 to 100

**Good** : 60 to 79

**Satisfactory** : 40 to 59

**Unsatisfactory and fail** : <39

**Special Note :**

**NO SEE – Semester End Exam – Completely Practical and activities based evaluation**

**Pedagogy – Guidelines :**

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	<b>Plantation and adoption of a tree:</b>	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	<b>Heritage walk and crafts corner:</b>	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	<b>Organic farming and waste management:</b>	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc.....	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	<b>Water conservation: &amp; conservation techniques</b>	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc.....	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	<b>Food walk: Practices in society</b>	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

## Plan of Action (Execution of Activities )

Sl.NO	Practice Session Description
1	Lecture session in field to start activities
2	Students Presentation on Ideas
3	Commencement of activity and its progress
4	Execution of Activity
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Case study based Assessment, Individual performance
9	Sector/ Team wise study and its consolidation
10	Video based seminar for 10 minutes by each student At the end of semester with Report.

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1<sup>st</sup> to 5<sup>th</sup>, compiled report should be submitted as per the instructions and scheme.

### Assessment Details for CIE (both CIE and SEE)

Assessment Details for CIE (both CIE and SEE)		<ul style="list-style-type: none"><li>• Implementation strategies of the project (NSS work).</li><li>• The last report should be signed by NSS Officer, the HOD and principal.</li><li>• At last report should be evaluated by the NSS officer of the institute.</li><li>• Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.</li></ul>
Weightage	CIE – 100%	
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. <b>Activities 1 to 5, 5*5 = 25</b>	25 Marks	
<b>Total marks for the course in each semester</b>	<b>100 Marks</b>	
<b>For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.</b>		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.		

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Data analytics with Excel		Semester	3
Course Code	BCV358A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	100
Examination type (SEE)	practical		
<b>Course objectives:</b> <ul style="list-style-type: none"><li>Understand the use of Spreadsheet for data collection and analysis.</li><li>Evaluate the equations using Excel functions</li><li>Learn the data quality and consistency of data</li></ul>			
<b>Sl.NO</b>	<b>Experiments</b>		
1	Introduction to Data Analysis Using Spreadsheets: Fundamentals of spreadsheet applications, Excel interface, and learn how to navigate around a worksheet and workbook.		
2	Using Excel Spreadsheets: Perform basic spreadsheet tasks, such as viewing, entering and editing data, and moving, copying and filling data. Learn about the fundamentals of formulas, and learn about the most common functions used by a data analyst. Finally, you will learn how to reference data in formulas.		
3	Cleaning & Wrangling Data Using Spreadsheets: Importance of data quality, how to import file data in to Excel, fundamentals of data privacy, remove duplicate and inaccurate data, and how to remove empty rows in your data..		
4	How to deal with inconsistencies in your data and how to use the Flash Fill and Text to Columns features to help you manipulate and standardize your data		
5	Analyzing Data Using Spreadsheets: Fundamentals of analyzing data using a spreadsheet, and learn how to filter and sort data. Learn how to use some of the most useful functions for a data analyst		
6	How to use the VLOOKUP and HLOOKUP reference functions. In addition, learn how to create pivot tables in Excel, and use several pivot table features		
7	Final Project: In this final module, you will be introduced to a hands-on lab where you will complete a graded assignment for cleaning and preparing data, and then analyzing data using an Excel spreadsheet.		
8	Submission of report for final assessment		
<b>Course outcomes (Course Skill Set):</b> At the end of the course the student will be able to: <ul style="list-style-type: none"><li>Prepare the data sets and perform the analysis.</li><li>Analyse and perform repetitive calculations using several functions</li><li>Design and apply solutions to verify the data sets</li></ul>			

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.



- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

**Suggested Learning Resources:**

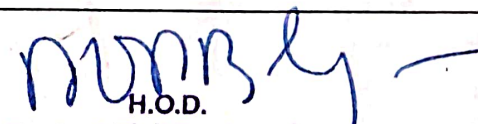
- <https://www.coursera.org/learn/excel-basics-data-analysis-ibm>
- Any online platform with the above course content like YouTube videos and NPTEL courses

## Physical Education (Sports and Athletics) syllabus

Semester: III				
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I				
Course Code	:	BPEK359	CIE	: 100 Marks
Credits: L:T:P	:	0:0:1		
Total Hours	:	24 P		
<p><b>Course Outcomes:</b> At the end of the course, the student will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness</li> <li>2. Familiarization of health-related Exercises, Sports for overall growth and development</li> <li>3. Create a foundation for the professionals in Physical Education and Sports</li> <li>4. Participate in the competition at regional/state / national / international levels.</li> <li>5. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.</li> <li>6. Understand and practice of Traditional Games</li> </ol>				
<p><b>Module I : Orientation</b></p> <ol style="list-style-type: none"> <li>A. Lifestyle</li> <li>B. Health &amp; Wellness</li> <li>C. Pre-Fitness test.</li> </ol>			<b>4 Hours</b>	
<p><b>Module II: General Fitness &amp; Components of Fitness</b></p> <ol style="list-style-type: none"> <li>A. Warming up (Free Hand exercises)</li> <li>B. Strength – Push-up / Pull-ups</li> <li>C. Speed – 30 Mtr Dash</li> </ol>			<b>4 Hours</b>	
<p><b>Module III : Specific games (Any one to be selected by the student)</b></p> <ol style="list-style-type: none"> <li>1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.</li> <li>2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.</li> </ol>			<b>16 Hours</b>	

### Scheme and Assessment for auditing the course and Grades:

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

  
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## VARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

## B.E. in Civil Engineering

## Scheme of Teaching and Examinations 2022

## Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

## IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self-Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	PCC	BCV401	Analysis of Structures	TD: CV PSB: CV	3	0	0		03	50	50	100	3
2	IPCC	BCV402	Fluid Mechanics and Hydraulics	TD: CV PSB: CV	3	0	2		03	50	50	100	4
3	IPCC	BCV403	Transportation Engineering	TD: CV PSB: CV	3	0	2		03	50	50	100	4
4	PCCL	BCVL404	Building Materials Testing Lab	TD: CV PSB: CV	0	0	2		03	50	50	100	1
5	ESC	BCV405x	ESC/ETC/PLC		3	0	0		03	50	50	100	3
6	AEC/ SEC	BCV456x	Ability Enhancement Course/Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	BBOK407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	3
8	UHV	BUHK408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	MC	BNSK459	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		BPEK459	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		BYOK459	Yoga	Yoga Teacher									
Total									500	400	900	20	

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K: This letter in the course code indicates common to all the stream of engineering.

**Ability Enhancement Course / Skill Enhancement Course - IV**

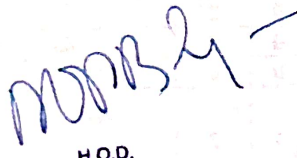
BCVL456A	Building Information Modelling in Civil Engineering – Basics (0:0:2)	BCV456C	Electronic Waste Management - Issues and Challenges
BCV456B	GIS with Quantum GIS	BCV456D	Technical Writing Skills

**Engineering Science Course (ESC/ETC/PLC)**

BCV405A	Finance for Professionals	BCV405C	Concreting Techniques & Practices
BCV405B	Construction Equipment, Plants and Machinery	BCV405D	Watershed Management

**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching-Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

**National Service Scheme /Physical Education/Yoga:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of Degree.

  
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Analysis of Structures		Semester	IV
Course Code	SCV401	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	03	SEE Marks	50
Total Hours of Pedagogy	3:0:0:0	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory/practical/Viva-Voce /Term-work/Others		

**Course Learning objectives:** This course will enable students to

- Understand the Different Forms of Structural Systems.
- Determine the Strain Energy and Slope and Deflection of Beams, Trusses and Frames.
- Analyse arches and cable structures.
- Analyse different types of beams and frames using slope deflection method.
- Analyse different types of beams and frames using moment distribution method.

### Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills

### Module-1

**Introduction and Analysis of Plane Trusses:** Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and nonlinear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.  
L1,L2,L3

### Module-2

**DEFLECTION OF BEAMS: Moment area method:** Derivation, Mohr's theorems, sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts.

**Strain Energy:** Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion (No numerical). Castigliano's theorems, application of Castigliano's theorems to calculate deflection of beams, trusses and frames (No numerical on unit load method).

#### Module-3

**Arches and Cable Structures:** Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.  
L1,L2,L3

#### Module-4

**Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3  
L1,L2,L3,L4

#### Module-5

**Moment Distribution Method:** Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3  
L1,L2,L3,L4

#### Course outcome (Course Skill Set)

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

1. identify the different forms of structural systems and analyse the trusses.
2. Evaluate the slope and deflections in beams, frames and trusses by using moment area method and energy principle.
3. Analyse and determine the stress resultants in arches and cables.
4. Analyse the indeterminate structures and construct BMD AND SFD using slope deflection methods.
5. Analyse the indeterminate structures and construct BMD AND SFD using Moment Distribution Method.



### **Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

### **Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

### **Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

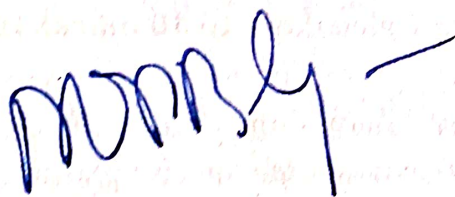
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Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

#### **Suggested Learning Resources:**

- <https://www.coursera.org/learn/excel-basics-data-analysis-ibm>
- Any online platform with the above course content like YouTube videos and NPTEL courses



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Dept. of Civil Engineering  
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Mijar, Moodbidri - 574 225



FLUID MECHANICS AND HYDRAULICS			
Course Code	BCV402	Semester	IV
Teaching Hours/Week (L:T:P: S)	3:0:2:0	CIE Marks	50
Total Hours of Pedagogy	40 + 8-10 Lab slots	SEE Marks	50
Credits	04	Total Marks	100
Examination nature (SEE)	Theory/Practical	Exam Hours	3

**Course Learning objectives:** This course will enable students to

- Understand the Fundamentals of properties of fluids, fluid pressure measurement and hydrostatic law
- Learn the Principles of kinematics, hydrodynamics and its applications
- Study the Flow measurements and design of pipes
- Understand the design of open channels and energy concepts
- Understand the Working principles of hydraulic turbines and pumps

### Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

### MODULE-1

Fluids and their properties – compressibility, surface tension, capillarity, Pascal's law, hydrostatic law, fluid pressure measurement using simple and differential manometers, Total pressure and center of pressure on vertical and inclined plane surfaces. L2,L3

### MODULE-2

Kinematics- Types of flow, continuity equation in Cartesian coordinates, velocity potential, stream function, flow nets, Dynamics-Euler's equation of motion, Bernoulli's equation, Application- Venturimeter, Orifice meter, Pitot tube. L2,L4

### MODULE-3

Classification of orifice and mouthpiece, hydraulic coefficients, discharge over rectangular, triangular and Cipoletti notch, Flow through pipes- major and minor losses, pipes in series and parallel, equivalent pipe, concept of water hammer and surge tanks. L2,L4

### MODULE-4



Open channel hydraulics- classification of flow, Most economical channel sections-rectangular, triangular, trapezoidal, circular, Uniform flow, specific energy-rectangular channels, on-uniform flow, hydraulic jump-equation and applications, GVF equation-types. **L2,L4**

#### MODULE-5

Momentum equation, impact of jet on stationary and moving curved vanes Turbines-types, Pelton wheel-working proportions, velocity triangles Francis turbine- working proportions, velocity triangles Centrifugal pumps-work done, efficiency, multi-stage pumps. **L2,L4**

#### PRACTICAL COMPONENT OF IPCC (May cover all / major modules)

Sl.NO	Experiments	
1	Verification of Bernoulli's equation	L1,L2
2	Calibration of Venturimeter/Orifice meter	L1,L2
3	Determination of hydraulic coefficients of small vertical orifice	L1,L2
4	Calibration of triangular notch	L1,L2
5	Determination of Cd for Cipoletti notch	L1,L2
6	Determination of major losses in pipes	L1,L2
7	Determination of Cd for ogee/broad crested weir	L1,L2
8	Determination of efficiency of jet on flat and curved vanes	L1,L2
9	Determination of Cd of Venturiflume	L1,L2
10	Demo of determination of efficiency of centrifugal pump	L1,L2
11	Demo of determination of efficiency of Francis/Kaplan turbine	L1,L2
12	Demo of determination of efficiency of Pelton wheel	L1,L2

#### Course outcomes (Course Skill Set):

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

- Explain the fundamental properties of fluids and solve problems on fluid pressure and hydrostatics.
- Apply the principles of kinematics and dynamics of fluid flow to solve problems on velocity and pressure.
- Compute the discharge through pipes, notches and weirs.
- Design the turbines and open channels of different sections and to estimate the energy loss in hydraulic jump.
- Able to interpret the experimental results of discharge, efficiency based on the test conducted in the laboratory.



### **Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### **CIE for the theory component of the IPCC (maximum marks 50)**

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.
- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for 25 marks).
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

### **CIE for the practical component of the IPCC**

- 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

### **SEE for IPCC**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.



**Suggested Learning Resources:****Books:****Text Books:**

1. P.N. Modi and S.M. Seth-Hydraulics and Fluid Mechanics, including Hydraulic machines, standard Book House, New Delhi
2. K Subramanya- Fluid Mechanics and Hydraulic Machines, Tata McGraw-Hill, New Delhi
3. R.K. Bansal- A text book of Fluid Mechanics and Hydraulic Machines- Laxmi Publications, New Delhi
4. Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford- Fluid Mechanics, Tata McGraw Hill publishing Co Ltd, New Delhi
5. J.F. Douglas. M. Gastric, John Warfield, Lynne Jack – Fluid Mechanics, Pearson, Fifth edition.
6. K. Subramanya- Fluid Mechanics and Hydraulic Machines, Problems and Solutions, Tata McGrawhill, New Delhi.
7. S K SOM and G.Bis was – “ introduction to Fluid Mechanics and Fluid Machines, Tata Mcg raw Hill, New Delhi.

**Web links and Video Lectures (e-Resources):**

- YouTube Videos

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning:**

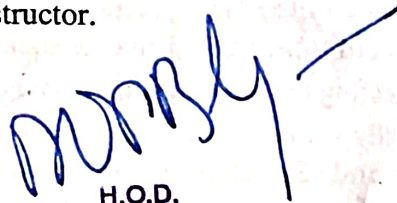
- Visit to hydro- electric power plant
- Visit to sites to visualise the flow measuring devices, viz., weirs, spillways, etc.

**CO & PSO - PO Mapping (Individual Teacher has to fill)**

Mapping of Course Outcomes and Program specific outcomes to Program Outcomes																
Course outcomes	Program outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

Note: Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.

  
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TRANSPORTATION ENGINEERING		Semester	
Course Code	BCV403	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	
Examination nature (SEE)	Theory		

**Course Learning objectives:** This course will enable students to

- Gain knowledge of different modes of transportation systems and to learn the introductory concepts on Highway Engineering.
- Get insight to different highway materials and pavement design elements of a highway network.
- Realize the significance of road safety by incorporating the concepts of Traffic Engineering.
- Understand to different aspects of geometric elements of railway system and evaluate the material quantity required for track laying
- Gain knowledge about various components of an Airport and its runway design.

#### Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Arrange field visits to give brief information about the water and wastewater treatment plant.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking and enhance the knowledge of treatment processes.
5. Adopt Problem Based Learning (PBL), which fosters students, Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills

#### MODULE-1

**TRANSPORTATION ENGINEERING:** Introduction, Different Modes of Transportation, M R Jayakar Committee recommendations, Road Classifications and Road Patterns.

**Highway Alignment:** Factors affecting highway alignment, Engineering surveys for alignment-conventional and modern methods.

**Highway Geometric Design:** Factors affecting geometric design of roads, Cross Sectional Elements, Sight distances, Horizontal alignment- Transition curve, superelevation, Extrawidening, Vertical alignment-gradients, summit and valley curves. (*No derivations*)

***Problems on Sight distance, Super elevation, extra widening of curves, Length of transition curve, Length of summit and valley curve.*** (L1, L2)

#### **MODULE-2**

**HIGHWAY MATERIALS AND PAVEMENTS:** Desirable properties of aggregates, soil subgrade & Bitumen, Application of bituminous emulsion, Desirable properties of Bituminous Mixes  
**Pavement Design:** Factors Controlling design of highway pavements, Pavement types, component parts of pavements and their functions; types of joints used in rigid pavement. Critical stresses in flexible and rigid pavement.  
**Highway Drainage:** Significance and requirements, Surface drainage system and design-Examples, sub surface drainage system, Types of cross drainage structures their choice and location.  
***Problems on design of Longitudinal drain.*** (L2, L3)

#### **MODULE-3**

**TRAFFIC ENGINEERING:** Objectives and scope of Traffic Engineering. Traffic Characteristics: Road user characteristics, vehicular characteristics – static and dynamic characteristics, Reaction time of driver and PIEV theory, Types of traffic engineering studies-volume, spot speed, speed and delay, parking, accident, origin & destination, objectives of studies and data collection, method of study, analysis. PCU concept, factors affecting and PCU at different locations and applications. Traffic signs, Signal design by IRC method; Types of intersections.  
***Problems on Spot speed studies, Speed and delay studies, accident studies, Signal design by IRC method.*** (L2, L3)

#### **MODULE-4**

**RAILWAY ENGINEERING:** Permanent way and its requirements, Gauges and types, Typical cross sections single and double-line BG track, Coning of wheels and tilting of rails, Rails-Functions-requirements, types and defects of rails. Sleepers and Ballast: Functions, requirements, Track fitting and fasteners, Calculation of quantity of materials required for laying a track, Points & crossings, Railway Station and Yards. Metro train & high speed train- Design factors considered.  
***Problem on Quantity calculation for laying railway track. Super-elevation*** (L1, L2)

#### **MODULE-5**

**AIRPORT ENGINEERING:** Layout of an airport with component parts and functions, Site selection for airport, Aircraft characteristics affecting the design and planning of airport, Airport classification, Runway orientation using wind rose with examples.  
**RUNWAY-**Basic runway length-Corrections and examples, Runway geometrics, Taxiway-Factors affecting the layout - geometrics of taxiway-Comparison between Runway and Highway, Design of exit taxiway with examples.  
***Problems on Runway orientation, Basic Runway length, Exit taxiway design.*** (L2, L3)



**PRACTICAL COMPONENT OF IPCC (May cover all / major modules)****Experiments (8-10 Lab slots)**

Sl. NO		
1	Tests on Aggregates a. Crushing Strength Test b. Los Angeles abrasion test c. Impact test d. Shape tests (combined index and angularity number)	(L1, L2)
2	Tests on Bituminous Materials a. Penetration test b. Ductility test c. Softening point test d. Specific gravity test e. Viscosity test by tar viscometer f. Flash and fire point test	(L1, L2)
3	Tests on Soil a. Wet sieve analysis b. CBR Test on soil	(L1, L2)
4	Design of flexible pavement as per IRC 37-2018	(L2, L4)
5	Design of Rigid pavement as per IRC 58-2015	(L3, L4)
6	Bituminous Mix Design by Marshall Method (Demonstration only)	(L1, L2)
7	Traffic Engineering studies	(L3, L4)

**Course outcomes (Course Skill Set):**

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

1. Explain the basic principles of geometric design in the context of transportation engineering and planning.
2. Select the appropriate pavement materials for construction and design the pavement as per standard practices.
3. Conduct traffic studies and analyse traffic data for practical applications.
4. Identify the Components parts of Railway Track and design the suitable runway for an Airport.
5. Able to interpret the experimental results of highway materials based on laboratory tests and design the pavement as per IRC guidelines.

**Assessment Details (both CIE and SEE)**

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**CIE for the theory component of the IPCC (maximum marks 50)**

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- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks**).
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#### **CIE for the practical component of the IPCC**

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test (**duration 02/03 hours**) after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks**.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

#### **SEE for IPCC**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

**The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.**

#### **Suggested Learning Resources:**

##### **Books**

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. "A Text Book of Railway Engineering" by S C Saxena and S P Arora
4. "Airport Engineering" by S C Rangwala
5. "Airport Planning and Design" by Khanna Arora and Jain, Nem Chand Bros, Roorke.
6. "Roads, Railways, Bridges, Tunnels and Harbour Dock Engineering by B L Gupta, Amit Gupta.
7. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual", Nem Chand Bros, Roorkee.



**Web links and Video Lectures (e-Resources):**

1. <https://nptel.ac.in/courses/105101087>
2. [https://onlinemanuals.txdot.gov/txdotmanuals/rdw/horizontal\\_alignment.htm#BGBHGECC](https://onlinemanuals.txdot.gov/txdotmanuals/rdw/horizontal_alignment.htm#BGBHGECC)
3. [www.civil.itb.ac.in/tvm/1111\\_nptel/567\\_Grade/plain/plain.html](http://www.civil.itb.ac.in/tvm/1111_nptel/567_Grade/plain/plain.html)
4. <https://www.pavementinteractive.org/>
5. <https://www.eng.auburn.edu/research/centers/ncat/research/other-publications.html>
6. <https://nptel.ac.in/courses/105/106/105106203/>
7. <https://nptel.ac.in/courses/105/101/105101008>
8. <https://nptel.ac.in/courses/105/104/105104098>
9. <https://www.classcentral.com/course/edx-intro-to-traffic-flow-modeling-and-intelligenttransport-systems-12728>
10. <https://www.aai.aero/>
11. <https://www.faa.gov/>
12. <https://www.icao.int>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Visit to a road construction project

**CO & PSO - PO Mapping (Individual Teacher has to fill)**

Mapping of Course Outcomes and Program specific outcomes to Program Outcomes																
Course outcomes	Program outcomes												Program Specific Outcomes			
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

Note: Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.

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BUILDING MATERIALS TESTING LABORATORY		Semester	4
Course Code	BCVL404	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Total Marks	100
		Exam Hours	02
Examination type (SEE)	Practical		

**Course objectives:**

- Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
- Ability to function on multi-disciplinary teams in the area of material testing.
- Ability to use the techniques, skills and modern engineering tools necessary for engineering.
- Understanding of professional and ethical responsibility in the areas of material testing.
- Ability to communicate effectively the mechanical properties of materials..

Sl.NO	Experiments
1	Tests on Bricks, Tiles, Cement Concrete blocks (Weight & Dimensionality, Water Absorption, Strength)(L1, L2, L3, L4)
2	Tests on Fine aggregates - Sieve Analysis, Moisture content, Specific gravity, Bulk density, Bulking and Silt Content (L1, L2, L3, L4)
3	Tests on Coarse aggregates- Sieve Analysis, Water absorption, Moisture content, specific gravity and Bulk density(L1, L2, L3, L4)
4	Compression test on mild steel, cast iron and wood.(L1, L2, L3, L4)
5	Tension test on mild steel and HYSD bars (L2, L3, L4)
6	Torsion test on mild steel circular sections. (L1, L2, L3, L4)
7	Bending Test on Wood Under two-point loading. (L1, L2, L3, L4)
8	Shear Test on Mild steel- single and double shear. (L1, L2, L3, L4)
9	Impact test on Mild Steel (Charpy&Izod). (L1, L2, L3, L4)
10	Hardness tests on ferrous and non-ferrous metals- Brinell's, Rockwell and Vicker's. (L1, L2, L3, L4)
11	Demonstration of Strain gauges and Strain indicators. (L1, L2, L3, L4)

**NOTE: All tests to be carried out as per relevant latest BIS Codes**

**Course outcomes (Course Skill Set):**

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

- Analyze the physical characteristics, and behavior of common building materials.
- Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion for steel .
- Evaluate the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to unsuitable materials.
- Recognize the importance of ethical conduct, integrity, and accuracy in materials testing and



reporting..

### **Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### **Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

### **Semester End Evaluation (SEE):**

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement

evaluation rubrics shall be decided jointly by examiners.

- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

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

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

#### Suggested Learning Resources:

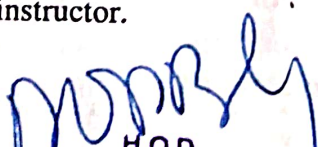
- Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.
- M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education (India) Pvt. Ltd., 2014.
- Fenner, "Mechanical Testing of Materials", George Newnes Ltd. London.
- Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.
- Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd. New Delhi.
- Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors 1996.
- Relevant latest IS Codes.

#### CO & PSO - PO Mapping (Individual Teacher has to fill)

Mapping of Course Outcomes and Program specific outcomes to Program Outcomes																
Course outcomes	Program outcomes												Program Specific Outcomes			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1																
CO2																
CO3																
CO4																
CO5																
Total																
Average																

Level 0: Not Mapped, 1: Low Mapped, 2: Moderately Mapped 3: Highly Mapped

Note: Depending on the Assessment tool used, higher order POs Can be identified by the concerned course instructor.

  
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Watershed Management		Semester	4
Course Code	BCV405D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory/practical/Viva-Voce /Term-work/Others		

**Course objectives:**

- To understand Watershed Hydrology
- To estimate water demand and learn, water conservation methods
- To understand application of Remote Sensing and GIS in watershed management
- Sustainable measures for watershed management

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Power point Presentation, video
- Video tube, NPTEL materials
- Quiz/Assignments/Open book test to develop skills
- Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

**Module-1**

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

**Module-2**

**Water resources systems:** Integrated water resources system, river basins-morphometric analysis of watersheds for watershed management, watershed management practices in arid and semi-arid regions, watershed management through wells, management of water supply, short term and long-term strategic planning.

**Module-3**

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

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

**Module-4**

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

**Module-5**

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

### Course outcome (Course Skill Set)

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

- Discuss surface and ground water resources system and, human influences.
- Integrate water resources system in arid and semi-arid regions and explain watershed aquifer for management.
- Analyse water resources related issues for conservation and synthesize augmentation of water resources.
- Design integrated watershed management system.
- Apply modern tools in watershed management.

### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

#### Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered.
- Any two assignment methods mentioned in the 220B2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

#### Semester-End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

**Note: Subject to be taught by Geologist with qualification M. Sc Geology/MPhil/ Ph. D in Geology or Faculty of Civil Engineering**

#### Suggested Learning Resources:

##### Books

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

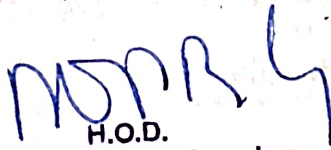


**Web links and Video Lectures (e-Resources):**

- <https://www.youtube.com/watch?v=wkPu4LwRKro>
- <https://youtu.be/wkPu4LwRKro>
- <https://youtu.be/wkPu4LwRKro>
- <https://youtu.be/wkPu4LwRKro>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Discussion of case studies
- Field visits to construction sites



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GIS with Quantum GIS		Semester	4
Course Code	BCV456B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:2:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	1
Examination type (SEE)	Theory (MCQ)		

**Course objectives:**

- Learning the open source QGIS software for Civil Engineering applications
- Understand raster and vector data
- Creation of base map and thematic maps for specific application

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Demonstration of open source software for GIS
2. YouTube videos to learn GIS software
3. Power Point presentations.

**Module-1**

QGIS Introduction: Definition of GIS and its use. Introduction to a free and open source desktop geographic information system software. Types of data (vector and raster formats), web services, useful commands and utilities for geo-processing, extending its capabilities to digital satellite image processing and analysis

**Module-2**

INTRODUCTION IN QGIS About QGIS Characteristics of QGIS Start using QGIS. QGIS TOOLS QGIS Configuration, General tools, Working with projections QGIS Browser. WORKING WITH RASTER DATA Introduction, Display raster data, Raster calculator, Working with images, Practical exercises: Working with raster data and operations with

**Module-3**

QGIS PLUGINS Additional modules of QGIS or “plugins” Description of Plugins incorporated in QGIS Operations through “plugins” Practical exercises: Different QGIS “plugins” and their applications: GDAL library tool, georeferencing, coordinate capture, format converter.

**Module-4**

CREATE MAPS AND RELATED PRODUCTS: Creation tools, Graphic elements, Atlases generation, and Graphic output creations. Practical exercises: Map creation with QGIS.

**Module-5**

RELATIONAL DATABASE MANAGEMENT SYSTEMS AND SPATIAL DATA. Database design, Database connections, Table joins Spatial joins, generate new statistics and new data using table and spatial data information. Practical exercises: Creation of thematic maps like population data of taluk, Watershed map with drainage and water bodies, Highway with other 2 road intersection details



**Course outcome (Course Skill Set)**

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

1. Use open source software for civil engineering applications
2. Various tools in QGIS software
3. Create thematic layers with attribute data
4. Generate maps for decision making

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Examination (CIE)**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 220B2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

**Semester End Examinations (SEE)**

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

**Suggested Learning Resources:****Books**

1. Geographic Information System-An Introduction, Tor Bernharadsen, 2009, 3rd Edition, Wiley India Pvt. Ltd. New Delhi, ISBN - 9788126511389.
2. Principles of Remote sensing and Image Interpretation, Lillesand and Kiefer, 2011, 6th Edition, John Wiley Publishers, New Delhi, ISBN – 8126532238.

**Web links and Video Lectures (e-Resources):**

- YouTube videos
- <https://docs.qgis.org/3.16/pdf/en/QGIS-3.16-DesktopUserGuide-en.pdf> for QGIS manual
- NPTEL Lectures.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Prepare the thematic maps using google earth images for various applications

Universal Human Values (UHV)		Semester	3 <sup>rd</sup>
Course Code	BUHK408	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:1	SEE Marks	50
Total Hours of Pedagogy	15 hour Theory Session +15 hour Self study	Total Marks	100
Credits	01	Exam Hours	01 Hour
Examination type (SEE)	SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is <b>MCQ (multiple choice questions)</b> .		

**Course objectives:**

This course is intended to:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
- This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
7. Encourage the students for group work to improve their creative and analytical skills.

**Module-1****Introduction to Value Education****(3 hours)**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations

**Module-2**



**Harmony in the Human Being :**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

**Module-3****Harmony in the Family and Society :**

(3 hours)

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

**Module-4****Harmony in the Nature/Existence :**

(3 hours)

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

**Module-5****Implications of the Holistic Understanding – a Look at Professional Ethics :**

(3 hours)

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

**Course outcome (Course Skill Set)**

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

1. Ethical human conduct
2. Socially responsible behaviour
3. Holistic vision of life
4. Environmentally responsible work
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

**Continuous Internal Examination (CIE)**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

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

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examinations (SEE)**

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

**Suggested Learning Resources:**

**Books for READING:**

Text Book and Teachers Manual

- a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
- b. The Teacher's Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews



7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Susan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
23. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

**Web links and Video Lectures (e-Resources):**

- Value Education websites,
- <https://www.uhv.org.in/uhv-ii>,
- <http://uhv.ac.in>,
- <http://www.uptu.ac.in>
- Story of Stuff,
- <http://www.storyofstuff.com>
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- [https://www.youtube.com/channel/UCQxWr5QB\\_eZUnwxSwxXEkQw](https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw)
- [https://fdp-si.aicte-india.org/8dayUHV\\_download.php](https://fdp-si.aicte-india.org/8dayUHV_download.php)
- <https://www.youtube.com/watch?v=8ovkLRYXlJE>
- <https://www.youtube.com/watch?v=OgdNx0X923I>
- <https://www.youtube.com/watch?v=nGRcbRpvGoU>
- <https://www.youtube.com/watch?v=sDxGXOgYEKM>



BIOLOGY FOR ENGINEERS		Semester	IV
Course Code	BBOK407	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

**Course objectives:**

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

**Teaching-Learning Process (General Instructions)**  
These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
- Instructions with interactions in classroom lectures (physical/hybrid).
- Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
- Flipped classroom sessions (~10% of the classes).
- Industrial visits, Guests talks and competitions for learning beyond the syllabus.
- Students' participation through audio-video based content creation for the syllabus (as assignments).
- Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
- Students' seminars (in solo or group) /oral presentations.

**Module-1 (8 Hours)**

**INTRODUCTION TO BIOLOGY:**  
The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each), Properties and functions), vitamins and hormones.

**Module-2(8 Hours)**

**BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):**  
Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).

**Module-3(8 Hours)**

**HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):**  
Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).



#### Module-4 (8 Hours)

#### NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):

Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train), Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).

#### Module-5(8 Hours)

#### TRENDS IN BIOENGINEERING (QUALITATIVE):

Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).

#### Course outcome (Course Skill Set)

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

1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

#### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

#### Continuous Internal Evaluation:

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- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

#### Semester-End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 2 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks



### **Suggested Learning Resources:**

#### **Books**

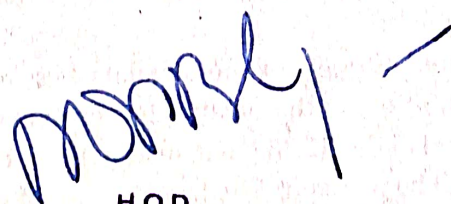
- Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
- Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
- Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
- Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
- Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
- Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
- Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
- Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
- Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
- 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
- Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

#### **Web links and Video Lectures (e-Resources):**

- <https://nptel.ac.in/courses/121106008>
- <https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists>
- <https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009>
- <https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006>
- <https://www.coursera.org/courses?query=biology>
- [https://onlinecourses.nptel.ac.in/noc19\\_ge31/preview](https://onlinecourses.nptel.ac.in/noc19_ge31/preview)
- <https://www.classcentral.com/subject/biology>
- <https://www.futurelearn.com/courses/biology-basic-concepts>

#### **Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Group Discussion of Case studies
- Model Making and seminar/poster presentations
- Design of novel device/equipment like Cellulose-based water filters, Filtration system



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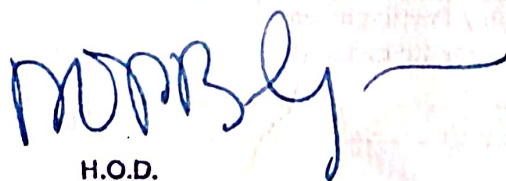


## Physical Education (Sports and Athletics) syllabus

Semester: IV						
PHIISICAL EDUCATION (SPORTS & ATHLETICS) – II						
Course Code	:	BPEK459		CIE	:	100 Marks
Credits: L:T:P	:	0:0:1				
Total Hours	:	24 P				
<b>Course Outcomes:</b> At the end of the course, the student will be able to						
1. Understand the ethics and moral values in sports and athletics						
2. Perform in the selected sports or athletics of student's choice.						
3. Understand the roles and responsibilities of organisation and administration of sports and games.						
<b>Module I : Ethics and Moral Values</b> 4 Hours						
A. Ethics in Sports						
B. Moral Values in Sports and Games						
<b>Module II : Specific Games (Any one to be selected by the student)</b> 16 Hours						
A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.						
B. Athletics (Track Events) – Any event as per availability of Ground.						
<b>Module III: Role of Organisation and administration</b> 4 Hours						

### Scheme and Assessment for auditing the course and Grades:

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



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@# 16092024

## VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

## B.E. In Civil Engineering

Scheme of Teaching and Examinations 2021

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 - 22)

## V SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration In hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
1	BSC 21CV51	Hydrology and Water Resources Engineering	TD: Civil Engg PSB: Civil Engg	3	0	0		03	50	50	100	3
2	IPCC 21CV52	Transportation Engineering	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	PCC 21CV53	Design of RC Structural Elements	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
4	PCC 21CV54	Geotechnical Engineering	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
5	PCC 21CVL55	Geotechnical Engineering Lab	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
6	AEC 21RMI56	Research Methodology & Intellectual Property Rights	TD: Any Department PSB: As identified by University	1	2	0		02	50	50	100	2
7	HSMC 21CIV57	Environmental Studies	TD: Civil/ Environmental /Chemistry/ Biotech. PSB: Civil Engg	0	2	0		1	50	50	100	1
8	AEC 21CV58X	Ability Enhancement Course-V	Concerned Board	If offered as Theory courses				01	50	50	100	1
				0	2	0						
				If offered as lab. courses				02				
				0	0	2						
Total								400	400	800	18	

## Ability Enhancement Course - V

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

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, HSMC: Humanity and Social Science & Management Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

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

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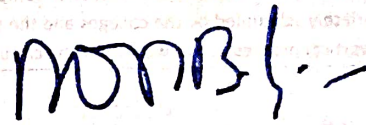
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**V Semester**

Hydrology and Water Resource Engineering			
Course Code	21CV51	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3+0+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3
<b>Course objectives: Make the students to learn</b> 1. Concept of hydrology, components of hydrologic cycle, hydrologic processes such as precipitation, infiltration, evaporation and transpiration. 2. Estimation of runoff and use the concept of unit hydrograph. 3. Systems and methods of irrigation, crop water requirement. 4. Canals, canal alignment, design methods of canals. Computation of reservoir capacity. 5. Concepts of floods and droughts, importance of water conservation and water management.			
<b>Teaching-Learning Process (General Instructions)</b> These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. 1. Power point Presentation 2. Video tube, NPTEL materials 3. Quiz/Assignments/Open book test to develop skills 4. Adopt problem based learning (PBL)to develop analytical and thinking skills 5. Encourage collaborative learning, site visits related to subject and impart practical knowledge 6. Mini projects			
<b>Module-1</b>			
<b>Hydrology:</b> Introduction, Global distribution of water and Indian water availability. Hydrologic cycle (Horton's) qualitative and engineering representation. <b>Precipitation:</b> Forms and types, measurement of rain fall using Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs. <b>Losses from Precipitation:</b> Evaporation process, factors affecting evaporation, measurement using IS class-A Pan, reservoir evaporation and control. Factors affecting Evapo-transpiration. Infiltration, Factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.			8 hours
<b>Teaching-Learning Process</b>		Chalk and talk, Power Point Presentation& PBL	
<b>Module-2</b>			
<b>Runoff:</b> Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. <b>Hydrographs:</b> 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.			8 hours
<b>Teaching-Learning Process</b>		Chalk and talk, Power Point Presentation & PBL	
<b>Module-3</b>			
<b>Irrigation:</b> System of irrigation: surface and ground water, flow irrigation, lift irrigation. Methods of irrigation: surface, sprinkler and drip/micro irrigation. <b>Water Requirements of Crops:</b> Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.			8 hours
<b>Teaching-Learning Process</b>		Chalk and talk, PowerPoint Presentation and Model preparation	
<b>Module-4</b>			

<b>Canals:</b> Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Regime channels, Design of canals by Lacey's and Kennedy's method (No numerical examples). <b>Reservoirs:</b> Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam.		8 hours
<b>Teaching-Learning Process</b>	Chalk and talk, Power Point Presentation and Field visits.	
<b>Module-5</b>		
<b>Flood Management:</b> Indian rivers and floods, Causes of floods, Alleviation, Levees and floodwalls, Flood ways, Channel improvement, Flood damage analysis. <b>Drought Management:</b> Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning. <b>Water Management:</b> Definition of water management, small dams, runoff enhancement, runoff collection, Restoration and rejuvenation of water bodies ( ponds and lakes)		8 hours
<b>Teaching-Learning Process</b>	Chalk and talk, Power Point Presentation and Mini-projects	
<b>Course outcome (Course Skill Set)</b>		
At the end of the course the student will be able to :		
<ol style="list-style-type: none"><li>1. Provide a background in the theory of hydrological processes and their measurement</li><li>2. Estimate runoff and develop unit hydrographs.</li><li>3. Find the water requirement and frequency of irrigation for various crops.</li><li>4. Find the canal capacity and compute the reservoir capacity.</li><li>5. Analyse floods and droughts. Emphasise on the importance of conservation of water and water bodies.</li></ol>		

  
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## TRANSPORTATION ENGINEERING

Course Code	21CV52	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(32:02:02:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	04	Exam Hours	03

**Course objectives:**

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

**Teaching-Learning Process (General Instructions)**

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

**Module-1**

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

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

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

<b>Teaching-Learning Process</b>	1.Blackboard teaching/PowerPoint presentations (if needed)
	2.Regular review of students by asking questions based on topics covered in the class.

**Module-2**

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

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

<b>Teaching-Learning Process</b>	1.Blackboard teaching/PowerPoint presentations (if needed)
	2.Regular review of students by asking questions based on topics covered in the class.

**Module-3**

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

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

<b>Teaching-Learning Process</b>	1.Blackboard teaching/PowerPoint presentations (if needed)
	2.Regular review of students by asking questions based on topics covered in the class.
	3. Compliment the understanding of Pavement materials with Lab demos.
	4. Plan for site visits for students, where pavement construction is going on.

**Module-4**



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

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

**Teaching-Learning Process**

- 1.Blackboard teaching/PowerPoint presentations (if needed)
- 2.Regular review of students by asking questions based on topics covered in the class.

**Module-5**

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

**Elements of Railways and Airport Engineering - Railways:** Introduction, classification of routes; railway gauge, coning of wheels and canting of rails, train resistance and hauling power; track components: rails, sleepers, fastenings, ballast and formation. **Airports:** Introduction, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications, - Site selection- regional Planning. Orientation of runway by using wind rose diagram with examples

**Teaching-Learning Process**

- 1.Blackboard teaching/PowerPoint presentations (if needed)
- 2.Regular review of students by asking questions based on topics covered in the class.
3. Conduction of Basic traffic studies by students in the field.

**PRACTICAL COMPONENT OF IPCC**

**Experiments**

1. Tests on Aggregates
  - a. Aggregate Crushing value
  - b. Los Angeles abrasion test
  - c. Aggregate impact test
  - d. Aggregate shape tests (combined index and angularity number)
2. Tests on Bituminous Materials
  - a. Penetration test
  - b. Ductility test
  - c. Softening point test
  - d. Specific gravity test
3. Tests on Soil
  - a. Wet sieve analysis
  - b. CBR test
4. Tests on Bituminous Mixes
  - a. Marshall Method (Demo Experiment)

**Course outcome (Course Skill Set)**

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

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

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### Assessment Details (both CIE and SEE)

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

#### CIE for the theory component of IPCC

Two Tests each of 20 Marks (duration 01 hour)

- First test at the end of 5<sup>th</sup> week of the semester
- Second test at the end of the 10<sup>th</sup> week of the semester

Two assignments each of 10 Marks

- First assignment at the end of 4<sup>th</sup> week of the semester
- Second assignment at the end of 9<sup>th</sup> week of the semester

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

#### CIE for the practical component of IPCC

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

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

#### SEE for IPCC

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

#### Suggested Learning Resources:

##### Text Books

1. S K Khanna and C E G Justo, "Highway Engineering", Nem Chand Bros, Roorkee.
2. L R Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, "Highway Engineering", University Press.
4. K. Subramaniam, "Transportation Engineering", SciTech Publications, Chennai.
5. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
6. Chandra S. and Agarwal M.M. "Railway Engineering", Oxford University Press India.



7. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nem Chand and Bros.
8. Khanna S.K. and Justo C.E.G. Highway Material Testing, Nem Chand & Bros

#### Reference Books:

1. Relevant IRC Codes.
2. Specifications for Roads and Bridges-MoRT&H, IRC, New Delhi.
3. C. Jotin Khisty, B. Kentlal, "Transportation Engineering", PHI Learning Pvt. Ltd. New Delhi.

#### Web links and Video Lectures (e-Resources):

<https://nptel.ac.in/courses/105101087>

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Demonstrations in Lab
- Self-Study on simple topics
- Simple problems solving using Excel
- Discussion of case studies
- Virtual Lab experiments

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**DESIGN OF RC STRUCTURAL ELEMENTS**

Course Code	21CV53	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

**Course objectives:**

This course will enable students to

1. Identify, formulate and solve engineering problems of RC elements subjected to different kinds of loading.
2. Follow a procedural knowledge in designing various structural RC elements.
3. Impart the usage of codes for strength, serviceability and durability.
4. Acquire knowledge in analysis and design of RC elements.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge.

**Module-1**

**Introduction to working stress and limit State Design:** Introduction to working stress method, Difference between Working stress and Limit State Method of design.

Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section.

Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only.

**Teaching-Learning Process**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module-2****Limit State Analysis of Beams:**

Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.

**Teaching-Learning Process**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module-3**

**Limit State Design of Beams:** Design of singly reinforced beams with check for shear, check for development length and other checks. Design of doubly reinforced beams and flanged sections without checks.

**Teaching-Learning Process**

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

**Module-4**



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

<b>Teaching-Learning Process</b>	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.
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#### Module-5

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

<b>Teaching-Learning Process</b>	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.
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#### Course outcome (Course Skill Set)

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

1. Understand the design philosophy and principles.
2. Solve engineering problems of RC elements subjected to flexure, shear and torsion.
3. Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns and footings.
4. Owns professional and ethical responsibility.

#### Assessment Details (both CIE and SEE)

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

#### Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

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

Two assignments each of 10 Marks

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

#### Semester End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

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



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

#### Reference Books:

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

#### Web links and Video Lectures (e-Resources):

1. <https://nptel.ac.in/courses/105105105>

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students are asked to prepare the models showing the reinforcement details in singly reinforced, doubly reinforced beams, Columns, Staircases and footings.

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## GEOTECHNICAL ENGINEERING

Course Code	21CV54	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

**Course objectives:**

This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assess the improvement in mechanical behavior by densification of soil deposits using compaction.
5. Model and measure strength-deformation characteristics and bearing capacity of soils

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills
3. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

**Module-1**

**Introduction :** Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis, Atterberg's Limits, consistency indices. Activity of clay, Field identification of soils, Plasticity chart, BIS soil classification. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-2**

**Permeability:** Darcy's law- assumption, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation  
**Effective Stress** Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-3**

**Compaction:** Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties.  
**Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption, Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $C_v$ ). Laboratory one dimensional consolidation test, characteristics of  $e$ -log ( $\sigma'$ ) curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-4**

**Shear Strength:** Concept of shear strength, Mohr-Coulomb Failure Criterion, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotropy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test, Tests under different drainage conditions. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-5**



**Bearing Capacity of Soil:** Determination of bearing capacity by Terzaghi's and BIS method (IS:6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effects of water table and eccentricity on bearing capacity of soil.  
**Foundation Settlement:** Types of settlements and importance, Computation of Immediate, consolidation and creep settlements, permissible, differential and total settlements. (08 Hrs)

<b>Teaching-Learning Process</b>	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites
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#### Course outcome (Course Skill Set)

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

1. Determine the index properties of soil and hence classify the soil
2. Assess the compaction and consolidation characteristics of soil
3. Determine the permeability of soils and assess the seepage in hydraulic structures
4. Evaluate shear parameters of the soil using shear tests
5. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure

#### Assessment Details (both CIE and SEE)

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

##### Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

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

Two assignments each of 10 Marks

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

##### Semester End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

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

#### Suggested Learning Resources:

##### Text Books

1. Punmia B.C., "Soil Mechanics and Foundation Engineering, Laxmi Publications Co., India.
2. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York

##### Reference Books:



1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India.
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India.
4. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

#### Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of field equipment's to learn the onsite field test of soil
- Visit to a site and learn importance of soil investigation

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CREDIT DISTRIBUTION SCHEME: UG AUTONOMOUS BT. COURSE - 2021												
Sl. No.	COURSE CODE	SEMESTER							AUTONOMOUS UG SCHEME	YII REG. LATIO	YII	TOTAL
		I	II	III	IV	V	VI	VI				
01	ESL 101	3	3	3	3	3	3	3	12	25	12	39
02	ESL 102	3	3	3	3	3	3	3	12	25	12	39
03	ESL 103	3	3	3	3	3	3	3	12	25	12	39
04	ESL 104	3	3	3	3	3	3	3	12	25	12	39
05	ESL 105	3	3	3	3	3	3	3	12	25	12	39
06	ESL 106	3	3	3	3	3	3	3	12	25	12	39
07	ESL 107	3	3	3	3	3	3	3	12	25	12	39
08	ESL 108	3	3	3	3	3	3	3	12	25	12	39
09	ESL 109	3	3	3	3	3	3	3	12	25	12	39
10	ESL 110	3	3	3	3	3	3	3	12	25	12	39
11	ESL 111	3	3	3	3	3	3	3	12	25	12	39
12	ESL 112	3	3	3	3	3	3	3	12	25	12	39
13	ESL 113	3	3	3	3	3	3	3	12	25	12	39
14	ESL 114	3	3	3	3	3	3	3	12	25	12	39
15	ESL 115	3	3	3	3	3	3	3	12	25	12	39
16	ESL 116	3	3	3	3	3	3	3	12	25	12	39
17	ESL 117	3	3	3	3	3	3	3	12	25	12	39
18	ESL 118	3	3	3	3	3	3	3	12	25	12	39
19	ESL 119	3	3	3	3	3	3	3	12	25	12	39
20	ESL 120	3	3	3	3	3	3	3	12	25	12	39
21	ESL 121	3	3	3	3	3	3	3	12	25	12	39
22	ESL 122	3	3	3	3	3	3	3	12	25	12	39
23	ESL 123	3	3	3	3	3	3	3	12	25	12	39
24	ESL 124	3	3	3	3	3	3	3	12	25	12	39
25	ESL 125	3	3	3	3	3	3	3	12	25	12	39
26	ESL 126	3	3	3	3	3	3	3	12	25	12	39
27	ESL 127	3	3	3	3	3	3	3	12	25	12	39
28	ESL 128	3	3	3	3	3	3	3	12	25	12	39
29	ESL 129	3	3	3	3	3	3	3	12	25	12	39
30	ESL 130	3	3	3	3	3	3	3	12	25	12	39
31	ESL 131	3	3	3	3	3	3	3	12	25	12	39
32	ESL 132	3	3	3	3	3	3	3	12	25	12	39
33	ESL 133	3	3	3	3	3	3	3	12	25	12	39
34	ESL 134	3	3	3	3	3	3	3	12	25	12	39
35	ESL 135	3	3	3	3	3	3	3	12	25	12	39
36	ESL 136	3	3	3	3	3	3	3	12	25	12	39
37	ESL 137	3	3	3	3	3	3	3	12	25	12	39
38	ESL 138	3	3	3	3	3	3	3	12	25	12	39
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61	ESL 161	3	3	3	3	3	3	3	12	25	12	39
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64	ESL 164	3	3	3	3	3	3	3	12	25	12	39
65	ESL 165	3	3	3	3	3	3	3	12	25	12	39
66	ESL 166	3	3	3	3	3	3	3	12	25	12	39
67	ESL 167	3	3	3	3	3	3	3	12	25	12	39
68	ESL 168	3	3	3	3	3	3	3	12	25	12	39
69	ESL 169	3	3	3	3	3	3	3	12	25	12	39
70	ESL 170	3	3	3	3	3	3	3	12	25	12	39
71	ESL 171	3	3	3	3	3	3	3	12	25	12	39
72	ESL 172	3	3	3	3	3	3	3	12	25	12	39
73	ESL 173	3	3	3	3	3	3	3	12	25	12	39
74	ESL 174	3	3	3	3	3	3	3	12	25	12	39
75	ESL 175	3	3	3	3	3	3	3	12	25	12	39
76	ESL 176	3	3	3	3	3	3	3	12	25	12	39
77	ESL 177	3	3	3	3	3	3	3	12	25	12	39
78	ESL 178	3	3	3	3	3	3	3	12	25	12	39
79	ESL 179	3	3	3	3	3	3	3	12	25	12	39
80	ESL 180	3	3	3	3	3	3	3	12	25	12	39
81	ESL 181	3	3	3	3	3	3	3	12	25	12	39
82	ESL 182	3	3	3	3	3	3	3	12	25	12	39
83	ESL 183	3	3	3	3	3	3	3	12	25	12	39
84	ESL 184	3	3	3	3	3	3	3	12	25	12	39
85	ESL 185	3	3	3	3	3	3	3	12	25	12	39
86	ESL 186	3	3	3	3	3	3	3	12	25	12	39
87	ESL 187	3	3	3	3	3	3	3	12	25	12	39
88	ESL 188	3	3	3	3	3	3	3	12	25	12	39
89	ESL 189	3	3	3	3	3	3	3	12	25	12	39
90	ESL 190	3	3	3	3	3	3	3	12	25	12	39
91	ESL 191	3	3	3	3	3	3	3	12	25	12	39
92	ESL 192	3	3	3	3	3	3	3	12	25	12	39
93	ESL 193	3	3	3	3	3	3	3	12	25	12	39
94	ESL 194	3	3	3	3	3	3	3	12	25	12	39
95	ESL 195	3	3	3	3	3	3	3	12	25	12	39
96	ESL 196	3	3	3	3	3	3	3	12	25	12	39
97	ESL 197	3	3	3	3	3	3	3	12	25	12	39
98	ESL 198	3	3	3	3	3	3	3	12	25	12	39
99	ESL 199	3	3	3	3	3	3	3	12	25	12	39
100	ESL 200	3	3	3	3	3	3	3	12	25	12	39



GEOTECHNICAL ENGINEERING LABORATORY			
Course Code	21CVL55	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0+0+2	SEE Marks	50
Credits	1	Exam Hours	3
<b>Course objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. To carry out laboratory tests and to identify soil as per IS codal procedures</li> <li>2. To perform laboratory tests to determine index properties of soil</li> <li>3. To perform tests to determine shear strength and consolidation characteristics of soils</li> </ol>			
Sl.NO	Experiments		
1	Specific gravity test(pycnometer and density bottle method).Water content determination by oven drying method		
2	Grain Size Analysis Sieve Analysis		
3	In-situ density tests Core-cutter method Sand replacement method		
4	Consistency limits Liquid limit test (by casagrande's and cone penetration method) Plastic limit test		
5	Standard compaction test(light and heavy compaction)		
6	Co-efficient of permeability test Constant head test Variable head test		
7	Shear strength tests Unconfined compression test Direct shear test Triaxial test (unconsolidated undrained test only)		
8	Consolidation test: to determine preconsolidation pressure only(half an hour perloading-test).		
	<b>Demonstration Experiments ( For CIE )</b>		
9	Field identification of soil		
10	Hydrometer analysis,		
11	Rapid moisturemeter method.		
12	Shrinkage limit test,		
13	Swell pressure test,		
14	Standard penetration test and boring equipment		
15	laboratory vane shear test		



**Course outcomes (Course Skill Set):**

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

1. Physical and index properties of the soil
2. Classify based on index properties and field identification
3. To determine OMC and MDD, plan and assess field compaction program
4. Shear strength and consolidation parameters to assess strength and deformation characteristics
5. In-situ shear strength characteristics(SPT-Demonstration)

**Assessment Details (both CIE and SEE)**

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

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8<sup>th</sup> week of the semester and the second test shall be conducted after the 14<sup>th</sup> week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

**Semester End Evaluation (SEE):**

SEE marks for the practical course is **50 Marks**.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer



script to be strictly adhered to by the examiners. OR based on the course requirement evaluation rubrics shall be decided jointly by examiners.

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

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

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

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

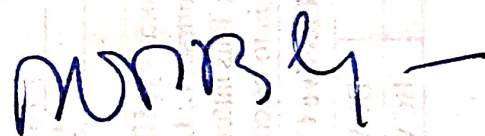
The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

**Suggested Learning Resources:**

**ReferenceBooks:**

1. PunmiaBC, Soil Mechanics and Foundation Engineering- (2017), 16<sup>th</sup> Edition, Laxmi Publications co., New Delhi.
2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.
3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press
4. Bowles J.E., "Engineering Properties of Soil and Their Measurements", - McGraw Hill Book Co. New York.
5. Relevant BIS Codes of Practice: IS-2720 series



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# SAMPLE TEMPLATE

## V Semester

Environmental Studies			
Course Code	21CIV57	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0+2+0+0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02

**Course objectives:**

- To create the environmental awareness among the students.
- To gain the knowledge on different types of pollution in the environment.

**Teaching-Learning Process (General Instructions)**  
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
- Environmental awareness programme for the in house campus
- Encourage collaborative (Group Learning) Learning in the class.
- Seminars, surprise tests and Quizzes may be arranged for students in respective subjects to develop skills.

**Module-1**

Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.

<b>Teaching-Learning Process</b>	Chalk and talk, powerpoint presentation and animation tools
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**Module-2**

Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind.  
Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining, Cloud Seeding, and Carbon Trading.

<b>Teaching-Learning Process</b>	Chalk and talk, powerpoint presentation and animation tools
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**Module-3**

**Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution.  
**Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.

<b>Teaching-Learning Process</b>	Chalk and talk, powerpoint presentation and animation tools
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**Module-4**



# SAMPLE TEMPLATE

**Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.

<b>Teaching-Learning Process</b>	Chalk and talk, powerpoint presentation and animation tools
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## Module-5

**Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.

<b>Teaching-Learning Process</b>	Chalk and talk, powerpoint presentation and animation tools
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## Course outcome (Course Skill Set)

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

- CO1: Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
- CO2: Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
- CO3: Demonstrate ecology knowledge of a complex relationship between biotic and a biotic components.
- CO4: Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

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**Assessment Details (both CIE and SEE)**

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**Continuous Internal Evaluation:**

Three Unit Tests each of **20 Marks (duration 01 hour)**

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

Two assignments each of **10 Marks**

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester End Examination:**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

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

**Question paper pattern:**

1. The Question paper will have 100 objective questions.
2. Each question will be for 01 marks
3. Student will have to answer all the questions in an OMR Sheet.
4. The Duration of Exam will be 2 hours

**Suggested Learning Resources:****Books**

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2<sup>nd</sup> edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3<sup>rd</sup> edition-2018

**Reference Books:-**

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2<sup>nd</sup> edition 2009
2. M.Ayi Reddy Text book of environmental science and Technology, BS publications 2007

Dr. B.S Chauhan, Environmental studies, university of science press 1<sup>st</sup> edition

**Web links and Video Lectures (e-Resources):**



# SAMPLE TEMPLATE

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

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## Semester V

Software Applications			
Course Code	21CV582	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0::2:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	1 hr

**Course objectives:**

- To understand the types of trusses
- Modelling and analysis of trusses adopting codal provisions
- Analysis and design of multi-storied structures

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills

**Module-1**

Categorization of structures based on number of dimensions, types of member connectivity, type of elements (1D truss/beam element, 2D plane stress/plane strain, and plate elements, 3D solid elements), structure degrees of freedom, boundary conditions, stiffness matrix, load vector, displacements, stiffness equation, degree of freedom numbering for a structure.

Global or structure coordinate system, Local or element coordinate system, element degrees of freedom, Element forces and Material properties for different types of elements.

**Teaching-Learning Process**

Chalk and talk, PPT, You Tube video lectures

**Module-2**

Modeling 2D and 3D skeletal structures (truss and frame) in software: Node coordinates, member connectivity, supports. Representing slabs using rigid diaphragms and/or master and slave nodes.

Nodal loads and element loads, Independent load cases, Load combinations, self weight of structural elements, calculation and verification of gravity loads including self weight

**Teaching-Learning Process**

Chalk and talk, PPT, You Tube video lectures.

**Module-3**

Analysis and interpretation of results by studying support reactions, bending moment and shear force diagrams of elements.

Identifying critical cross-sections for design of beam and column elements, Grouping of elements based on structural behaviour and similarity of geometry and member design forces

**Teaching-Learning Process**

Chalk and talk, PPT, You Tube video lectures

**Module-4**

Modelling 2D plane trusses with Indian Standard steel sections, analysis for gravity and wind loads as per Indian Standard codes, design check for selected cross-section as per IS 800:2007, identifying failed elements and revising cross-section to make element safe.

Modelling simple 3D frame structures up to 4 storeys with reinforced concrete cross-sections, analysis for gravity and wind loads as per Indian Standard codes, verification of weight of building by



hand calculation with reactions obtained from analysis, load combinations, interpretation of results, grouping of elements, design of typical elements and foundation as per IS 456:2000.

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures
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#### Module-5

Modelling steel gabled frames for industrial structures with Indian Standard steel sections, analysis for gravity and wind loads as per Indian Standard codes, design check for selected cross-section as per IS 800:2007, identifying failed elements and revising cross-section to make element safe.

Teaching-Learning Process	Chalk and talk, PPT, You Tube video lectures
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#### Course outcome (Course Skill Set)

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

1. Determine the forces in the truss members
2. Analyse and design the truss
3. Analyse and design industrial structures

#### Assessment Details (both CIE and SEE)

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

#### Continuous internal Examination (CIE)

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

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

Two assignments each of 10 Marks

1. First assignment at the end of 4<sup>th</sup> week of the semester
2. Second assignment at the end of 9<sup>th</sup> week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be scaled down to 50 marks

#### Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is

MCQ (multiple choice questions). The time allotted for SEE is **01 hour**. The student has to secure minimum of 35% of the maximum marks meant for SEE.

**Suggested Learning Resources:**

**Books**

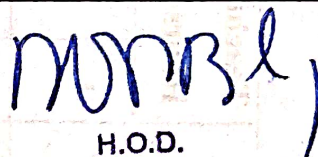
1. IS 875 Parts 1, 2 and 3: 1987
2. IS 456:2000
3. IS 800:2007
4. STAAD Pro v8i user manual
5. SAP2000 user manual

**Web links and Video Lectures (e-Resources):**

- Online study material
- NPTEL video lectures.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Assignment to students to design an industrial roof truss



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## VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

## B.E. In Civil Engineering

Scheme of Teaching and Examinations 2021

Outcome-Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2021 - 22)

## VI SEMESTER

Sl. No	Course and Course Code	Course Title	Teaching Department (TD) and Question and Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
1	HSMC 21CV61	Construction Management and Entrepreneurship	TD: Civil Engg PSB: Civil Engg	L	T	P	S	03	50	50	100	3
2	IPCC 21CV62	Concrete Technology	TD: Civil Engg PSB: Civil Engg	2	2	2		03	50	50	100	4
3	PCC 21CV63	Design of Steel structure	TD: Civil Engg PSB: Civil Engg	2	2	0		03	50	50	100	3
4	PEC 21CV64x	Professional Elective Course-I	TD: Civil Engg PSB: Civil Engg					03	50	50	100	3
5	OEC 21CV65x	Open Elective Course-I	Concerned Department					03	50	50	100	3
6	PCC 21CVL66	Computer Aided Detailing of Structure	TD: Civil Engg PSB: Civil Engg	0	0	2		03	50	50	100	1
7	MP 21CVMP67	Mini Project	TD: Civil Engg PSB: Civil Engg	Two contact hours /week for interaction between the faculty and students.				--	100	--	100	2
8	INT 21INT68	Innovation/Entrepreneurship /Societal Internship	Completed during the intervening period of IV and V semesters.				--	100	--	100	3	
Total								500	300	800	22	

## Professional Elective - I

21CV641	Design of Prestressed Concrete Structures	21CV644	Design Concept in Building Services
21CV642	Applied Geotechnical Engineering	21CV645	Ground Water Hydraulics
21CV643	Railways, Harbors, Tunneling and Airports	21CV646	Alternative Building Materials

## Open Electives – I offered by the Department to other Department students

21CV651	Remote Sensing and GIS	21CV653	Occupational Health and Safety
21CV652	Traffic Engineering	21CV654	Conservation of Natural Resources

**Note:** HSMC: Humanity and Social Science & Management Courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PEC: Professional Elective Courses, OEC–Open Elective Course, MP –Mini Project, INT –Internship.  
L –Lecture, T – Tutorial, P - Practical / Drawing, S – Self Study Component, CIE: Continuous Internal Evaluation, SEE: Semester End Examination.

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

## Professional Elective Courses(PEC):

A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

## Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program,
- The syllabus content of open electives 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 program.



In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams such as Law, Business (MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college. The minimum students' strength for offering open electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than 10.

**Mini-project work:** Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

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

**CIE procedure for Mini-project:**

(i) **Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) **Interdisciplinary:** Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**No SEE component for Mini-Project.**

### VII semester Class work and Research Internship /Industry Internship (21INT82)

#### Swapping Facility

Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/ industry internship after the VI semester.

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

#### Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes. The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

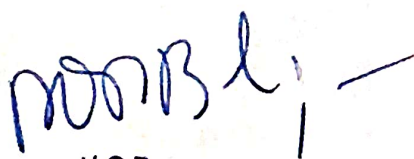
#### INT21INT82 Research Internship/ Industry Internship/Rural Internship

**Research internship:** A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

**Industry internship:** Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the students' internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of internship.



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## VI Semester

VI Semester

CONSTRUCTION MANAGEMENT AND ENTPRENEURSHIP			
Course Code	21CV61	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3+0+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03
<b>Course objectives:</b> This course will enable students to 1. Understand the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction project. 2. Inculcate Human values to grow as responsible human beings with proper personality. 3. Keep up ethical conduct and discharge professional duties 4. Develop an entrepreneurial outlook and mind set along with critical skills and knowledge to , manage risks associated with entrepreneurs.			
<b>Teaching-Learning Process (General Instructions)</b> These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. 1. Blackboard teaching/PowerPoint presentations (if needed) 2. Regular review of students by asking questions based on topics covered in the class.			
<b>Module-1</b>			
<b>Management:</b> Characteristics of management, functions of management, importance and purpose of planning process, types of plans. <b>Construction Project Formulation:</b> Introduction to construction management, project organization, management functions, management styles. <b>Construction Planning and Scheduling:</b> Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path critical path method, PERT method, concept of activity on arrow and activity on node.			
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.		
<b>Module-2</b>			
<b>Resource Management:</b> Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity. <b>Construction Equipments:</b> classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipments. Selection of construction equipment and basic concept on equipment maintenance <b>Materials:</b> material management functions, inventory management.			
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.		
<b>Module-3</b>			
<b>Construction Quality , safety and Human Values:</b> Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management HSE: Introduction to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. <b>Ethics :</b> Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.			
Teaching-Learning	1.Blackboard teaching/PowerPoint presentations (if needed)		



Process	2.Regular review of students by asking questions based on topics covered in the class.
<b>Module-4</b>	
<p><b>Introduction: Principles of Engineering Economy, Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy.</b></p> <p><b>Interest and Interest Factors:</b> Interest rate, Simple interest, Compound interest, Cash- flow diagrams, Exercises and Discussion.</p> <p><b>Comparison of alternatives:</b> Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.</p> <p><b>Replacement Analysis:</b> Replacement studies, replacement due to deterioration, obsolescence, inadequacy, economic life for cyclic replacements, Exercises, Problems. Break- Even Analysis: Basic concepts, Linear Break- Even analysis, Exercises, Problems.</p> <p><b>Depreciation:</b> Causes of Depreciation, Basic methods of computing depreciation charges, Exercises, Problems.</p>	
Teaching-Learning Process	<p>1.Blackboard teaching/PowerPoint presentations (if needed)</p> <p>2.Regular review of students by asking questions based on topics covered in the class.</p>
<b>Module-5</b>	
<p><b>Introduction to Entrepreneurship –</b> Learn how entrepreneurship has changed the world. Identify six entrepreneurial myths and uncover the true facts. Explore E-cells on Campus <b>Listen to Some Success Stories:</b> - Global legends Understand how ordinary people become successful global entrepreneurs, their journeys, their challenges, and their success stories. Understand how ordinary people from their own countries have become successful entrepreneurs.</p> <p><b>Characteristics of a Successful Entrepreneur</b> Understand the entrepreneurial journey and learn the concept of different entrepreneurial styles. Identify your own entrepreneurship style based on your personality traits, strengths, and weaknesses. Learn about the 5M Model, each of the five entrepreneurial styles in the model, and how they differ from each other. <b>Communicate Effectively:</b> Learn how incorrect assumptions and limiting our opinions about people can negatively impact our communication. Identify the barriers which cause communication breakdown, such as miscommunication and poor listening, and learn how to overcome them.</p> <p><b>Business Planning Process:</b> Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.</p>	
Teaching-Learning Process	<p>1.Blackboard teaching/PowerPoint presentations (if needed)</p> <p>2.Regular review of students by asking questions based on topics covered in the class.</p>
<p><b>Course outcome (Course Skill Set)</b></p> <p>At the end of the course the student will be able to :</p> <ol style="list-style-type: none"> <li>1.Understand various management principles of construction industry (L2)</li> <li>2.Use planning, organizing, scheduling, monitoring and controlling techniques for managing construction activity (L4)</li> <li>3.Understand importance of quality control and safety in construction.(L2)</li> <li>4. Understand managing data pertaining to construction project. (L4)</li> <li>5. Evaluate alternatives and develop capital budget for different scenarios.</li> </ol>	



### Assessment Details (both CIE and SEE)

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

#### Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

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

Two assignments each of 10 Marks

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

#### Semester End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

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

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education
2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw Hill Publishing Company, New Delhi.
3. Poornima M. Charantimath, "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education
4. Dr. U.K. Shrivastava "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1)- 1974 : Recommendations for labour output constant for building works:
5. Engineering Economy, Riggs J.L., 5th Edition, Tata McGraw Hill, ISBN 0-07-058670-5
6. Engineering Economics, R Panneerselvam, Eastern Economy Edition 2001, PHI, ISBN – 81- 203-1743-2.
7. Cost Accounting, Khan M Y, 2nd Edition, 2000, Tata McGraw-Hill, ISBN 0070402248
8. Mechanical Estimating & Costing, T.R.Banga, S.C.Sharma, 16th Edition, 2011, Khanna Publishers, ISBN 8174091009

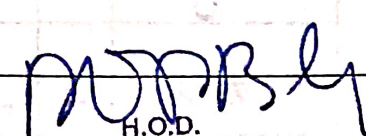
#### Web links and Video Lectures (e-Resources):

- Online study material
- You Tube video lectures

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quizz(To assist in GATE Preparations)
- Self Study on simple topics
- Case Study Presentation

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**CONCRETE TECHNOLOGY**

Course Code	21CV62	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	4	Exam Hours	3

**Course objectives:**

1. To recognize material characterization of ingredients of concrete and its influence on properties of concrete
2. Proportion ingredients of Concrete to arrive at most desirable mechanical properties of Concrete.
3. Ascertain and measure engineering properties of concrete in fresh and hardened state which meet the requirement of real time structures.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

**MODULE-1****CEMENT AND AGGREGATES**

Cement, Chemical composition, Physical and chemical properties, Other Cementitious materials and composition -GGBS, Fly ash rice Husk ash, Silica fume, Hydration of cement, Factors influencing and affecting Hydration of cement, Types of cement. Fine aggregate - grading, analysis, Specify gravity, bulking, moisture content, deleterious materials.  
Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. Codal Provisions.

**Teaching-Learning Process**

- 1.Blackboard teaching/PowerPoint presentations (if needed)
- 2.Regular review of students by asking questions based on topics covered in the class.

**MODULE-2****FRESH PROPERTIES OF CONCRETE**

Workability - Process of manufactures of concrete: Batching, Mixing, Assessment of Workability of Concrete, Factors affecting workability, Measurement of workability – slump test, flow test, Compaction factor test and Vee-Bee Consistometer tests, Segregation and bleeding, Transporting, Placing, Compaction, Curing, need and Types of curing, accelerated curing.

**Teaching-Learning Process**

- 1.Blackboard teaching/PowerPoint presentations (if needed)
- 2.Regular review of students by asking questions based on topics covered in the class.

**MODULE-3**

**ADMIXTURES:** Classification, effect on fresh and hardened concrete, retention time, Dosage and their effects, Influence on properties of paste, mortar, and concrete Types of concrete (in brief).  
**MIX DESIGN PROCEDURE:** Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design as per IS 10262-2019, Numerical examples of Mix Design. Highlights of Other methods of Mix Design as per other codes.



Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.
<b>MODULE-4</b>	
<b>HARDENED CONCRETE:</b> Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, assessment of compressive strength, flexural strength, tensile strength, bond strength and modulus of elasticity, aggregate - cement bond strength, factors influencing strength and codal provisions, Relation between modulus of elasticity and strength, factors affecting modulus of elasticity, Poisson Ratio.	
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.
<b>MODULE 5</b>	
<b>Durability</b> - definition, significance, short term and long-term durability. Shrinkage - plastic shrinkage and drying shrinkage, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, Factors affecting shrinkage, Effect of creep. Measurement of creep, factors influencing creep. Permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Construction joints and Expansion joints, Thermal effect of concrete. Codal Provisions.	
Teaching-Learning Process	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.

#### PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Testing of cement: Consistency, fineness, setting time, Specific Gravity, Soundness and strength.
2	Testing of fine aggregate: Specific Gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content.
3	Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index, elongation index, water absorption & moisture content, soundness of aggregate.
4	Concrete Mix design by ACI 211.1-91 method, IS code method as per 10262- 2019 & 456-2000, DOE method
5	Tests on Concrete- Workability tests – Slump cone test, compaction factor test, Vee-bee consistometer test, flow table test, strength tests- compressive strength, flexural strength, split tensile strength
6	Effects of Admixture - Accelerator, Retarder, Super Plasticizer
7	Non-destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test
<b>Course outcomes (Course Skill Set):</b> At the end of the course the student will be able to: 1. Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications (L2) 2. Design the concrete mix for the given materials as per IS:10262-2019 provisions (L4) 3. Understand the manufacturing process and assess the quality of green (L2)	



4. Describe the properties of fresh and hardened concrete – Strength and Durability aspects (L3)  
5. Examine and Evaluate properties of Cement and Concrete

### **Assessment Details (both CIE and SEE)**

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

### **CIE for the theory component of IPCC**

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

- First test at the end of 5<sup>th</sup> week of the semester
- Second test at the end of the 10<sup>th</sup> week of the semester

**Two assignments each of 10 Marks**

- First assignment at the end of 4<sup>th</sup> week of the semester
- Second assignment at the end of 9<sup>th</sup> week of the semester

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

### **CIE for the practical component of IPCC**

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

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

### **SEE for IPCC**

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from



the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

**Suggested Learning Resources:**

**Books**

- 1.M.S.Shetty , "Concrete Technology" - Theory and Practice, , S.Chand and Company, New Delhi, 2002.
2. Concrete Technology (Trade, Technology & Industry), George White, Delmar Pu
- 3.Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta , Paulo J. M. Monteiro, McGraw-Hill Education
- 4.Neville, A.M. , Properties of Concrete": , ELBS, London
- 5.A.R.Santakumar , "Concrete Technology" -. Oxford University Press (2007)'
- 6.Advanced Concrete Technology, Zongjin Li, Wiley; 1 edition
- 7.GambhirDhanpatRai&Sons , "Concrete Manual" -, New Delhi
- 8.N.KrishnaRaju, "Concrete Mix Design" -, Sehgal - publishers
- 9.IS:10262-2016 , "Recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi

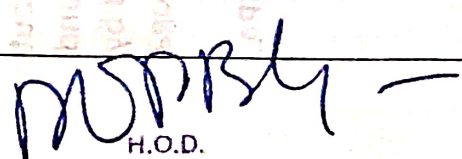
**Web links and Video Lectures (e-Resources):**

- Cement <https://nptel.ac.in/courses/105102012/1>  
Aggregates <https://nptel.ac.in/courses/105102012/6>  
Mineral admixtures<https://nptel.ac.in/courses/105102012/11>  
Chemical admixtures <https://nptel.ac.in/courses/105102012/9>  
<https://nptel.ac.in/courses/105102012/10>  
Concrete mix design <https://nptel.ac.in/courses/105102012/14>  
Concrete production & fresh concrete <https://nptel.ac.in/courses/105102012/19>  
Engineering properties of concrete<https://nptel.ac.in/courses/105102012/23>  
Dimensional stability & durability <https://nptel.ac.in/courses/105102012/27>  
Durability of concrete <https://nptel.ac.in/courses/105102012/31>  
Special concretes <https://nptel.ac.in/courses/105102012/36>

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Seminars/Quizz(To assist in GATE Preparations
- Demonstrations in Lab
- Self Study on simple topics
- Simple problems solving using Excel
- Virtual Lab Experiments

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# VI Semester

## DESIGN OF STEEL STRUCTURAL ELEMENTS

Course Code	21CV63	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

### Course objectives:

This course will enable students to

1. Understand advantages and disadvantages of steel structures, steel code provisions, and plastic behaviour of structural steel.
2. Learn Bolted connections and Welded connections.
3. Design of compression members, built-up columns and columns splices.
4. Design of tension members, simple slab base and gusseted base.
5. Design of laterally supported and un-supported steel beams.

### Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching
2. Power point Presentation
3. Videos , NPTEL materials
4. Quiz/Assignments/Open book test to develop skills
5. Adopt problem based learning (PBL) to develop analytical and thinking skills
6. Encourage collaborative learning, site visits related to subject and impart practical knowledge

### 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.

### Teaching-Learning Process

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

### 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.

### Teaching-Learning Process

Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.

### 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 concept of Laced and Battered Systems.



Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.
<b>Module-4</b>	
<b>Design of Tension Members:</b> Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members. Concept of Lug angles, Splices and Gussets. <b>Design of Column Bases:</b> Design of Simple Slab Base and Gusseted Base.	
Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.
<b>Module-5</b>	
<b>Design of Beams:</b> 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.	
Teaching-Learning Process	Chalk & Talk, PPT presentation, Youtube videos, Nearby construction site visits.
<b>Course outcome (Course Skill Set)</b> At the end of the course the student will be able to : <ol style="list-style-type: none"> <li>1. Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.</li> <li>2. Understand the Concept of Bolted and Welded connections.</li> <li>3. Understand the Concept of Design of compression members, built-up columns and columns splices</li> <li>4. Understand the Concept of Design of tension members, simple slab base and gusseted base.</li> <li>5. Understand the Concept of Design of laterally supported and un-supported steel beams.</li> </ol>	
<b>Assessment Details (both CIE and SEE)</b> The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% ( 18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together <b>Continuous Internal Evaluation:</b> Three Unit Tests each of <b>20 Marks (duration 01 hour)</b> <ol style="list-style-type: none"> <li>1. First test at the end of 5<sup>th</sup> week of the semester</li> <li>2. Second test at the end of the 10<sup>th</sup> week of the semester</li> <li>3. Third test at the end of the 15<sup>th</sup> week of the semester</li> </ol> Two assignments each of <b>10 Marks</b> <ol style="list-style-type: none"> <li>4. First assignment at the end of 4<sup>th</sup> week of the semester</li> <li>5. Second assignment at the end of 9<sup>th</sup> week of the semester</li> </ol> Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for <b>20 Marks (duration 01 hours)</b> <ol style="list-style-type: none"> <li>6. At the end of the 13<sup>th</sup> week of the semester</li> </ol> The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be <b>scaled down to 50 marks</b> (to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course). <b>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</b> <b>Semester End Examination:</b>	

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

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

#### Suggested Learning Resources:

##### Text Books

1. N Subramanian., "Design of Steel Structures" (2016), Oxford University Press, New Delhi.
2. Duggal S K., "Limit State Method of Design of Steel Structures", Tata McGraw Hill, New Delhi

##### Reference Books:

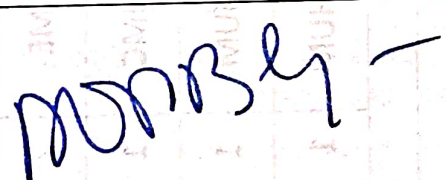
1. Dayarathnam P, "Design of Steel Structures", Scientific International Pvt. Ltd.
2. Kazim S M A and Jindal R S, "Design of Steel Structures", Prentice Hall of India, New Delhi.
3. IS 800-2007: General Construction in Steel Code Practice (Third revision), Bureau of Indian Standards, New Delhi.

##### Web links and Video Lectures (e-Resources):

- Video Lectures <https://nptel.ac.in/courses/105105162>
- Lecture Notes <https://nptel.ac.in/courses/105106112>.

##### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students are asked to prepare models of different connections, compression members, built-up columns, column bases.
- Students are asked to prepare a report after visiting the industrial structure construction site.

  
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# VI Semester

## RAILWAYS, HARBOUR, TUNNELING AND AIRPORTS

Course Code	21CV643	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	(3:0:0)	SEE Marks	50
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	03

### Course objectives:

- Understand the history and development, role of railways, railway planning and development based on essential criteria.
- Learn different types of structural components, engineering properties of the materials, to calculate the material quantities required for construction.
- Understand various aspects of geometrical elements, points and crossings, significance of maintenance of tracks.
- Design and plan airport layout, design facilities required for runway, taxiway and impart knowledge about visual aids.
- Apply design features of tunnels, harbors, dock and necessary navigational aids; also expose them to various methods of tunneling and tunnel accessories.

### Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

### Module-1

**Railway Planning:** Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability  
 – Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails  
 Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only).

### Teaching-Learning Process

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

### Module-2

**Railway Construction and Maintenance:** Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construction & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.

### Teaching-Learning Process

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

### Module-3

**Harbour and Tunnel Engineering:** Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities, Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works.  
 Tunneling: Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.

### Teaching-Learning Process

1. Blackboard teaching/PowerPoint presentations (if needed)
2. Regular review of students by asking questions based on topics covered in the class.

### Module-4



**Airport Planning:** Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.

<b>Teaching-Learning Process</b>	1.Blackboard teaching/PowerPoint presentations (If needed) 2.Regular review of students by asking questions based on topics covered in the class.
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#### Module-5

**Airport Design:** Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.

<b>Teaching-Learning Process</b>	1.Blackboard teaching/PowerPoint presentations (if needed) 2.Regular review of students by asking questions based on topics covered in the class.
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#### Course outcome (Course Skill Set)

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

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunnelling activities.

#### Assessment Details (both CIE and SEE)

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

##### Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour)**

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

Two assignments each of **10 Marks**

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks (duration 01 hours)**

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

**CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

##### Semester End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3



sub-questions), should have a mix of topics under that module.

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

#### Suggested Learning Resources:

##### Books

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M. M, "Railway Engineering", 2<sup>nd</sup> Edition, Oxford University Press, New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemch and Brothers, Roorkee.
4. C Venkatramiah, "Transportation Engineering", Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press.
5. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

#### Web links and Video Lectures (e-Resources):

- <https://nptel.ac.in/courses/105107123>

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Seminars/Quiz (To assist in GATE Preparations)
- Self-Study on simple topics
- Simple problems solving using Excel

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## CONSERVATION OF NATURAL RESOURCES

Course Code	21CV654	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

**Course objectives: Make the students to learn**

1. Learn types of land forms, soil conservation and sustainable land use planning.
2. Apprehend water resources, types, distribution, planning and conservation. Water pollution and types of uses.
3. Know the types of minerals and rocks.
4. Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control.
5. Apprehend basics of biodiversity and ecosystems.

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Power point Presentation
2. Video tube, NPTEL materials
3. Quiz/Assignments/Open book test to develop skills
4. Adopt problem based learning (PBL) to develop analytical and thinking skills
5. Encourage collaborative learning, site visits related to subject and impart practical knowledge
6. Mini projects

**Module-1**

**Land:** Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes. Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security, need for soil conservation, sustainable land use planning.

<b>Teaching-Learning Process</b>	Chalk and talk, PowerPoint Presentation & PBL
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**Module-2**

**Water:** Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India, equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved. Ground water, its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.

<b>Teaching-Learning Process</b>	Chalk and talk, PowerPoint Presentation & PBL
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**Module-3**

**Air:** Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index, effects of air pollution on human health. Economic effects of air pollution. Control of air pollution by equipment, smoke and its control. Ozone depletion –impacts, photochemical changes.

<b>Teaching-Learning Process</b>	Chalk and talk, PowerPoint Presentation and Model preparation
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**Module-4**

**Biodiversity:** Introduction, Flora and Fauna, Importance of biodiversity, Economic values-medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss. Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry. Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of ecosystem.

<b>Teaching-Learning Process</b>	Chalk and talk, PowerPoint Presentation and Field visits.
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**Module-5**

**Global warming:** concept, indicators, factor and effects. Global climate change-indicators, health impacts, effect on biodiversity. Introduction to global efforts in conservation of biodiversity. EIA regulations in India, status of EIA in India, list of projects needing environmental clearance under EIA notifications. Case study of hydro power/ thermal power projects

<b>Teaching-Learning Process</b>	Chalk and talk, PowerPoint Presentation and Mini-projects
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### Course outcome (Course Skill Set)

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

1. Apprehend various components of land as a natural resource and land use planning.
2. Know availability and demand for water resources as applied to India.
3. Analyse the components of air as resource and its pollution.
4. Discuss biodiversity & its role in ecosystem functioning.
5. Critically appreciate the environmental concerns of today.

### Assessment Details (both CIE and SEE)

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

#### Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

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

Two assignments each of 10 Marks

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz/mini project, any one of these suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

#### Semester End Examination:

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

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

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

### Suggested Learning Resources:

#### Books

1. Modi, P.N., "Irrigation Water Resources and Water Power Engineering". Standard Book House, New Delhi. 10<sup>th</sup> Edition 2019.
2. Raghunath, H.M., "Groundwater", 3<sup>rd</sup> Edition, New Age International Publishers, New Delhi, 2007.
3. Krishnan, M.S., "Geology of India & Burma". CBS publishers, New Delhi, 2017.
4. P.Jaya Rami Reddy, "A Textbook of Hydrology", University Science Press, New Delhi, 2011.
5. M N Rao and H V N Rao, "Air pollution", McGraw Hill Publications 2017.
6. Krishnamurthy K.V., "An advanced textbook of Biodiversity- principle & practices." Oxford and IBH publications Co.Pvt ltd, New Delhi. 2004.

#### Reference Books :

1. Odum, E.P., "Fundamentals of Ecology", W.B sounders, Philadelphia, USA, 1971
2. Singh J.S, Singh S.P & Gupta, S.R., "Ecology, environment and resource conservation", Anamaya publications, 2006.
3. Edmond A. Mathez & Jason E.Smerdon, "Climate Change: The science of Global warming and our energy feature", Columbia University Press, 2009.
4. National Council of Applied Economic Research, "Economic Impact of Interlinking of Rivers Program", Revised Final Report, April 2008.
6. <http://nwda.gov.in/content>.
7. Madhav Gadgil, "Biodiversity and Indias degraded lands", Indian Academy of Sciences, Volume 22- No

**Web links and Video Lectures (e-Resources):**

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

- Seminars /Quiz ( to assist in GATE preparations)
- Demonstrations in lab
- Self-Study on simple topics
- Simple problems solving by Excel, C+
- Virtual lab experiments

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

**Programme: CIVIL ENGINEERING**

**VII SEMESTER**

VII 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	18CV71	Quality Surveying and Contract Management	Civil Engg.	3	--	--	03	40	60	100	3
2	PCC	18CV72	Design of RCC and Steel Structures	Civil Engg.	3	--	--	03	40	60	100	3
3	PEC	18CV73X	Professional Elective - 2	Civil Engg.	3	--	--	03	40	60	100	3
4	PEC	18CV74X	Professional Elective - 3	Civil Engg.	3	--	--	03	40	60	100	3
5	OEC	18CV75X	Open Elective -B	Civil Engg.	3	--	--	03	40	60	100	3
6	PCC	18CVL76	Computer Aided Detailing of Structures	Civil Engg.	--	2	2	03	40	60	100	2
7	PCC	18CVL77	Geotechnical Engineering Laboratory	Civil Engg.	--	2	2	03	40	60	100	2
8	Project	18CVP78	Project Work Phase - 1		--	--	2	--	100	--	100	1
9	Internship	--	Internship	(If not completed during the vacation of VI and VII semesters, it shall be carried out during the vacation of VII and VIII semesters )								
TOTAL					15	04	06	21	380	420	00	20

**Note:** PCC: Professional core, PEC: Professional Elective.


**Professional Elective - 2**

Course code under 18CV73X	Course Title
18CV731	Theory of Elasticity
18CV732	Air Pollution and Control
18CV733	Pavement Materials & Construction
18CV734	Ground Water Hydraulics
18CV735	Masonry Structures

**Professional Electives - 3**

Course code under 18CV74X	Course Title
18CV741	Earthquake Engineering
18CV742	Design Concepts of Building Services
18CV743	Reinforced Earth Structures

18CV744	Design of Hydraulic Structures
18CV745	Urban Transport Planning
<b>Open Elective -B</b>	
<b>Course code under 18CV75X</b>	<b>Course Title</b>
18CV751	Finite Element Method
18CV752	Numerical Methods and Applications
18CV753	Environmental Protection and Management
<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 18XX75X).</p> <p>Selection of an open elective shall not be allowed if,</p> <ul style="list-style-type: none"> <li>• The candidate has studied the same course during the previous semesters of the programme.</li> <li>• The syllabus content of open elective is similar to that of the Departmental core courses or professional electives.</li> <li>• A similar course, under any category, is prescribed in the higher semesters of the programme.</li> </ul> <p>Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.</p>	
<p><b>Project work:</b> Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.</p> <p><b>CIE procedure for Project Work Phase - 1:</b> (i) <b>Single discipline:</b> The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.</p> <p>(ii) <b>Interdisciplinary:</b> Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.</p> <p><b>Internship:</b> 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><b>AICTE activity Points:</b> 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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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b>			
<b>QUANTITY SURVEYING AND CONTRACT MANAGEMENT</b>			
Course Code	<b>18CV71</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to; <ol style="list-style-type: none"> <li>1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project</li> <li>2. Understand and apply the concept of Valuation for Properties</li> <li>3. Understand, Apply and Create the Tender and Contract document.</li> </ol>			
<b>Module -1</b>			
<b>Quantity Estimation for Building:</b> study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates. Estimation of building by Short wall and long wall method - centre line method. Estimate of R.C.C structures including Slab, beam, column, footings.			
<b>Module -2</b>			
Estimate of Steel truss, manhole and septic tanks and slab culvert. <b>Quantity Estimation for Roads:</b> Computation of volume of earthwork fully in banking, cutting, partly cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods.			
<b>Module -3</b>			
<b>Specification for Civil Engineering Works:</b> Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads. <b>Analysis of Rates :</b> Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.			
<b>Module-4</b>			
<b>Contract Management-Tender and its Process:</b> Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process. Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture. <b>Contract Forms:</b> FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC.			
<b>Module -5</b>			
<b>Contract Management-Post award :</b> Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, <b>Disputes &amp; its resolution mechanism</b> , Contract management and administration. <b>Valuation:</b> Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.			
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.</li> <li>2. Prepare detailed and abstract estimates for various road works, structural works and water supply and sanitary works.</li> <li>3. Prepare the specifications and analyze the rates for various items of work.</li> <li>4. Assess contract and tender documents for various construction works.</li> <li>5. Prepare valuation reports of buildings.</li> </ol>			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> </ul>			

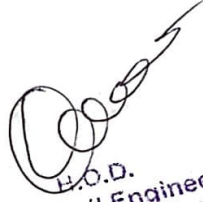
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborti; "Estimation, Costing and Specifications", Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.

**Reference Books:**

1. Kohli D.D and Kohli R.C, "Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
2. Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge , "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy , Garold D. Oberlender , " Estimating Construction Costs" – 5ed , Tata McGraw-Hill , New Delhi.
7. David Pratt, "Fundamentals of Construction Estimating" – 3ed, Edition.
8. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms.
9. B.S. Ramaswamy "Contracts and their Management" 3ed, Lexis Nexis(a division of Reed Elsevier India Pvt Ltd).

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b>			
<b>DESIGN OF RCC AND STEEL STRUCTURES</b>			
Course Code	18CV72	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to <ol style="list-style-type: none"> <li>1. Provide basic knowledge in the areas of limit state method and concept of design of RC and Steel structures</li> <li>2. Identify, formulate and solve engineering problems in RC and Steel Structures</li> <li>3. Give procedural knowledge to design a system, component or process as per needs and specifications of RC Structures like Retaining wall, Footing, Water tanks, Portal Frames and Steel Structures like Roof Truss, Plate Girder and Gantry Girder.</li> <li>4. Imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design of RC and Steel Structures.</li> <li>5. Provide factual knowledge on analysis and design of RC Structural elements, who can participate and succeed in competitive examinations.</li> </ol>			
<b>Module -1</b>			
<b>Footings:</b> Design of rectangular slab, slab-beam type combined footing. <b>Retaining Walls:</b> Design of cantilever Retaining wall and counter fort retaining wall. <b>Water Tanks:</b> Design of circular water tanks resting on ground (Rigid and Flexible base). Design of rectangular water tanks resting on ground. <b>As per IS: 3370 (Part IV).</b> Design of portal frames with fixed and hinged based supports.			
<b>Module -2</b>			
<b>Roof Truss:</b> Design of roof truss for different cases of loading, forces in members to given. <b>Plate Girder:</b> Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks <b>Gantry Girder:</b> Design of gantry girder with all necessary checks.			
<b>Course Outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Students will acquire the basic knowledge in design of RCC and Steel Structures.</li> <li>2. Students will have the ability to follow design procedures as per codal provisions and skills to arrive at structurally safe RC and Steel members.</li> </ol>			
<b>Question Paper Pattern:</b> <ul style="list-style-type: none"> <li>• Two questions shall be asked from each module. There can be maximum of three subdivisions in each question, if necessary.</li> <li>• One full question should be answered from each module.</li> <li>• Each question carries 50 marks.</li> <li>• Code books – IS 456, IS 800, IS 3370 (Part IV), SP-16, SP (6) – Steel Tables, shall be referred for designing. The same will be provided during examination.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. N Krishna Raju, “Structural Design and Drawing of Reinforced Concrete and Steel”, University Press</li> <li>2. Subramanian N, “Design of Steel Structures”, Oxford university Press, New Delhi</li> <li>3. K S Duggal, “Design of Steel Structures”, Tata McGraw Hill, New Delhi</li> </ol>			
<b>Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. Charles E Salman, Johnson &amp; Mathas, “Steel Structure Design and Behavior”, Pearson Publications</li> <li>2. Nether Cot, et.al, “Behavior and Design of Steel Structures to EC -III”, CRC Press</li> <li>3. P C Verghese, “Limit State Design of Reinforced Concrete”, PHI Publications, New Delhi</li> <li>4. S N Sinha, “Reinforced Concrete Design”, McGraw Hill Publication</li> </ol>			

  
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**B. E. CIVIL ENGINEERING**  
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**SEMESTER - VII**

**THEORY OF ELASTICITY**

Course Code	18CV731	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

- Course Learning Objectives:** This course will enable students to
1. This course advances students from the one-dimensional and linear problems conventionally treated in courses of strength of materials in to more general, two and three-dimensional problems.
  2. The student will be introduced to rectangular and polar coordinate systems to describe stress and strain of a continuous body.
  3. Introduction to the stress-strain relationship, basic principles and mathematical expressions involved in continuum mechanics. Also solution of problems in 2-dimensional linear elasticity.

**Module-1**

Rigid and deformable bodies, body and surface forces, concept of stress, state of stress at a point, Cartesian stress components, Cauchy's stress formula, stress transformation, principal stresses and principal planes, stress invariants, equations of equilibrium in 2D and 3D (Cartesian coordinates).

**Module-2**

Types of strain, strain displacement relations, state of strain at a point, strain tensor, strain transformation, strain along a linear element, principal strains, strain invariants, octahedral strains, spherical and deviatoric strains.

**Module-3**

Generalized Hooke's Law, Stress-strain relationships, Equilibrium equations in terms of displacements and Compatibility equations in terms of stresses, Plane stress and plane strain problems, St. Venant's principle, Principle of superposition, Uniqueness theorem, Airy's stress function, Stress polynomials (Two Dimensional cases only). Equations of equilibrium in polar coordinate, compatibility equation, stress function.

**Module-4**

Axisymmetric stress distribution - Rotating discs, Lamé's equation for thick cylinder, Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

**Module-5**

**Torsion:** Inverse and Semi-inverse methods, stress function, torsion of circular, elliptical, triangular sections.

**Course outcomes:** After studying this course, students will be able to:

1. Ability to apply knowledge of mechanics and mathematics to model elastic bodies as continuum.
2. Ability to formulate boundary value problems; and calculate stresses and strains.
3. Ability to comprehend constitutive relations for elastic solids and compatibility constraints.
4. Ability to solve two-dimensional problems (plane stress and plane strain) using the concept of stress function.

**Question paper pattern:**

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

**Textbooks:**

1. S P Timoshenko and J N Goodier, "Theory of Elasticity", McGraw-Hill International Edition, 1970.
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 2012.
3. S Valliappan, "Continuum Mechanics - Fundamentals", Oxford & IBH Pub. Co. Ltd., 1981.
4. L S Srinath, "Advanced Mechanics of Solids", Tata - McGraw-Hill Pub., New Delhi, 2003.

**Reference Books:**

1. C. T. Wang, "Applied Elasticity", Mc-Graw Hill Book Company, New York, 1953.
2. G. W. Housner and T. Vreeland, Jr., "The Analysis of Stress and Deformation", California Institute of Tech., CA, 2012. [Download as per user policy from <http://resolver.caltech.edu/CaltechBOOK:1965.001>].
3. A. C. Ugural and Saul K. Fenster, "Advanced Strength and Applied Elasticity", Prentice Hall, 2003.
4. Abdel-Rahman Ragab and Salah Eldinin Bayoumi, "Engineering Solid Mechanics: Fundamentals and Applications", CRC Press, 1998.



<p align="center"><b>B. E. CIVIL ENGINEERING</b>  <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b>  <b>SEMESTER - VII</b></p>			
<b>AIR POLLUTION AND CONTROL</b>			
Course Code	<b>18CV732</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<p><b>Course Learning Objectives:</b> This course will enable students to</p> <ol style="list-style-type: none"> <li>1. Study the sources and effects of air pollution</li> <li>2. Learn the meteorological factors influencing air pollution.</li> <li>3. Analyze air pollutant dispersion models</li> <li>4. Illustrate particular and gaseous pollution control methods.</li> </ol>			
<b>Module-1</b>			
<b>Introduction:</b> Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Types of inversion, photochemical smog.			
<b>Module-2</b>			
<b>Meteorology:</b> Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths.			
<b>Module-3</b>			
<b>Sampling:</b> Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants (PM <sub>2.5</sub> , PM <sub>10</sub> , SO <sub>x</sub> , NO <sub>x</sub> , CO, NH <sub>3</sub> ). Development of air quality models-Gaussian dispersion model-Including Numerical problems.			
<b>Module-4</b>			
<b>Control Techniques:</b> Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP - Including Numerical problems. Site selection for industrial plant location.			
<b>Module-5</b>			
Air pollution due to automobiles, standards and control methods. Noise pollution- causes, effects and control, noise standards. Environmental issues, global episodes. Environmental laws and acts.			
<p><b>Course outcomes:</b> After studying this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Identify the major sources of air pollution and understand their effects on health and environment.</li> <li>2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.</li> <li>3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants.</li> <li>4. Choose and design control techniques for particulate and gaseous emissions.</li> </ol>			
<p><b>Question paper pattern:</b></p> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.</li> <li>2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication.</li> <li>3. Mackenzie Davis and David Cornwell, "Introduction t o Environmental Engineering" McGraw-Hill Co.</li> </ol>			
<b>Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. Noel De Nevers, "Air Pollution Control Engineering", Waveland Pr Inc.</li> <li>2. Anjaneyulu Y, "Text book of Air Pollution and Control Technologies", Allied Publishers.</li> </ol>			

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VII**

**PAVEMENT MATERIALS AND CONSTRUCTION**

Course Code	18CV733	CIE Marks	40
Teaching Hours/Week	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:**

1. Expose students to different materials which are used in pavement construction, impart knowledge about the engineering properties required.
2. To train students to perform various types of bituminous mix designs as per the guidelines (MORTH).
3. Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field scenarios.
4. Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).
5. To introduce students to possible improvisation in various layers of pavement to increase the structural strength by the use of non basic materials (DLC, polythene sheets).

**Module-1**

**Pavement Materials**

**Aggregates-** Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification.  
**Bitumen and Tar-** Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements.

**Module-2**

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

**Module-3**

**Bituminous mixes:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveemstabilo meter and Hubbar- field tests) bituminous mixes, Design methods using Rothfutch's method only and specification, Marshall mix design criteria, voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Problems on above.

**Module-4**

**Equipments in highway construction:** Various types of equipments for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.

**Sub grade:** Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests.

**Module-5**

**Flexible Pavements:** Specifications of materials, Construction method and field control checks for various types of flexible pavement layers.

**Cement Concrete Pavements:** Specifications and method of cement concrete pavement construction (PQC, importance of providing DLC as sub base and polythene thin layer between PQC and sub base). Quality control tests, Construction of various types of joints.

**Course outcomes:** At the end of the course the student will be able to:

1. Students will be able to evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
2. Students will be able to formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
3. Students will be competent to adapt suitable modern technique and equipment for speedy and economic construction.
4. Student will be able to execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.



**Question paper pattern:**

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

**Textbooks:**

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G.: Nem Chand and Bros. Roorkee.
2. Construction Equipment and its Management- Sharma, S.C.:Khanna Publishers.
3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland.

**Reference Books**

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT& H specifications.

**Web links and Video Lectures:**

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. VTU EDUSAT PROGRAMME - 20

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b>			
<b>GROUND WATER HYDRAULICS</b>			
Course Code	18CV734	IA Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	Exam Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students <ol style="list-style-type: none"> <li>1. To characterize the properties of ground water and aquifers.</li> <li>2. To quantify the ground water flow.</li> <li>3. To locate occurrence of ground water and augment ground water resources.</li> <li>4. To synthesize ground water development methods.</li> </ol>			
<b>Module -1</b>			
<b>Introduction:</b> Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers.			
<b>Module -2</b>			
<b>Fundamentals of Ground Water Flow:</b> Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, derivation of the expression, Darcy's law, hydraulic conductivity, coefficient of permeability and intrinsic permeability, transmissibility, permeability in isotropic, anisotropic layered soils.			
<b>Module -3</b>			
<b>Well Hydraulics:</b> Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, derivation; theis method, Cooper and Jacob method, Chow's method, solution of unsteady flow equations, leakyaquifers (only introduction), interference of well, image well theory.			
<b>Module -4</b>			
<b>Ground Water Exploration:</b> Seismic method, electrical resistivity method, Geo-physical techniques, electrical logging, radioactive logging, induction logging, sonic and fluid logging.			
<b>Module -5</b>			
<b>Ground Water Development:</b> Types of wells, methods of construction, tube well design, dug wells, pumps for lifting water, working principles, power requirement, Conjunctive use, necessity, techniques and economics.			
<b>Ground Water Recharge:</b> Artificial recharge, Rainwater harvesting for ground water recharge.			
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Find the characteristics of aquifers.</li> <li>2. Estimate the quantity of ground water by various methods.</li> <li>3. Locate the zones of ground water resources.</li> <li>4. Select particular type of well and augment the ground water storage.</li> </ol>			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. H.M. Raghunath, "Ground Water", Wiley Eastern Publication, New Delhi.</li> <li>2. K. Todd, "Ground Water Hydrology", Wiley and Sons, New Delhi.</li> <li>3. Bower. H., "Ground Water Hydrology" McGraw Hill, New Delhi.</li> </ol>			
<b>Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. GargSatyaPrakash, "Ground Water and Tube Wells", Oxford and IBH, New Delhi.</li> <li>2. W. C. Walton, "Ground Water Resources and Evaluation" McGraw Hill, Delhi.</li> <li>3. Michel, D. M., Khepar, S. D., Sondhi, S. K., "Water Wells and Pumps" McGraw Hill, Delhi.</li> </ol>			

  
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**B. E. CIVIL ENGINEERING**  
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**SEMESTER - VII**

**MASONRY STRUCTURES**

Course Code	18CV735	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Understand properties of masonry units, strength and factors affecting strength.
2. Understand design criteria of various types of wall subjected to different load system.
3. Impart the culture of following the codes for strength, serviceability and durability as an ethics.
4. Provide knowledge in analysis and design of masonry elements for the success in competitive examinations.

**Module-1**

**Masonry Units, Materials, types and masonry construction:** Bricks, Stone and Block masonry units-strength, modulus of elasticity and water absorption of masonry materials-classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks.

**Strength and Stability:** Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.

**Module-2**

**Permissible stresses:** Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

**Design Considerations:** Effective height of wall and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.

**Module-3**

**Load considerations and design of Masonry subjected to axial loads:** Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

**Module-4**

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

**Design of walls subjected to eccentric loads:** Design criteria – stress distribution under eccentric loads –Problems on centrally loaded solid walls, cavity walls, walls with piers.

**Module-5**

**Design of Laterally and transversely loaded walls:** Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls.

Introduction to reinforced brick masonry, lintels and slabs.


**In-filled frames:** Types – modes of failures – design criteria of masonry retaining walls.

**Course outcomes:** After studying this course, students will be able to:

1. Select suitable material for masonry construction by understanding engineering properties.
2. Compute loads, load combinations and analyze the stresses in masonry.
3. Design masonry under compression (Axial load) for various requirements and conditions.
4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
5. Assess the behavior of shear wall and reinforced masonry.

**Question paper pattern:**

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

  
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**Textbooks:**

1. Dayaratnam P, "Brick and Reinforced Brick Structures", Scientific International Pvt. Ltd.
2. M. L. Gambhir, "Building and Construction Materials", McGraw Hill education Pvt. Ltd.

**Reference Books:**

1. Henry, A.W., "Structural Masonry", Macmillan Education Ltd., 1990.
2. IS 1905-1987 "Code of practice for structural use of un-reinforced masonry- (3rd revision) BIS, New Delhi.
3. SP20(S&T)-1991, "Hand book on masonry design and construction (1<sup>st</sup> revision) BIS, New Delhi.



**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VII**

**EARTHQUAKE ENGINEERING**

Course Code	18CV741	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to learn about

1. Fundamentals of engineering seismology
2. Irregularities in building which are detrimental to its earthquake performance
3. Different methods of computation seismic lateral forces for framed and masonry structures
4. Earthquake resistant design requirements for RCC and Masonry structures
5. Relevant clauses of IS codes of practice pertinent to earthquake resistant design of structures

**Module -1**

**Engineering Seismology:** Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India; (Problems on computation of wave velocities. Location of epicenter, Magnitude of earthquake).

**Module -2**

**Response Spectrum:** Basics of structural dynamics; Free and forced vibration of SDOF system; Effect of frequency of input motion and Resonance; Numerical evaluation of response of SDOF system (Linear acceleration method), Earthquake Response spectrum: Definition, construction, Characteristics and application; Elastic design spectrum.

**Module -3**

**Seismic Performance of Buildings and Over View of IS-1893 (Part-1):** Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy; Structural modeling; Code based seismic design methods.

**Module -4**

**Determination of Design Lateral Forces:** Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 storeys and without infill walls).

**Module -5**

**Earthquake Resistant Analysis and Design of RC Buildings:** Typical failures of RC frame structures, Ductility in Reinforced Concrete, Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column, Concept of weak beam-strong column, Detailing of Beam-Column Joints to enhance ductility, Detailing as per IS-13920. Retrofitting of RC buildings

**Earthquake Resistant Design of Masonry Buildings:** Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

**Course outcomes:** After studying this course, students will be able to:

1. Acquire basic knowledge of engineering seismology.
2. Develop response spectra for a given earthquake time history and its implementation to estimate response of a given structure.
3. Understanding of causes and types of damages to civil engineering structures during different earthquake scenarios.
4. Analyze multi-storied structures modeled as shear frames and determine lateral force distribution due to earthquake input motion using IS-1893 procedures.
5. Comprehend planning and design requirements of earthquake resistant features of RCC and Masonry

  
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structures thorough exposure to different IS-codes of practices.

**Question paper pattern:**

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

**Textbooks:**

1. Pankaj Agarwal and Manish Shrikande, "Earthquake resistant design of structures", PHI India.
2. S.K. Duggal, "Earthquake Resistant Design of Structures", Oxford University Press
3. Anil K. Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, Inc.
4. T. K. Datta, "Seismic Analysis of Structures", John Wiley & Sons (Asia) Ltd.

**Reference Books:**

1. David Dowrick, "Earthquake resistant design and risk reduction", John Wiley and Sons Ltd.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan & Vipul V. Mehta, "Some Concepts in Earthquake Behaviour of Buildings", Published by Gujarat State Disaster Management Authority, Government of Gujarat.
3. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
4. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
5. IS- 4326 – 2013, Earthquake Resistant Design and Construction of Buildings, BIS, New Delhi.
6. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
7. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VII**

**DESIGN CONCEPT OF BUILDING SERVICES**

Course Code	18CV742	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Learn the importance of sanitation, domestic water supply, and plumbing and fire services.
2. Understand the concepts of heat, ventilation and air conditioning.
3. Develop technical and practical knowledge in Building Services.

**Module -1**

**Water Supply and its Services.**

Water requirements for different types of buildings, simple method of removal of impurities, water saving practices and their potential Service connection from mains, sump and storage tank, types and sizes of pipes, special installation in multistoried buildings. Material, types of fixtures and fitting for a contemporary bathroom—taps –quarter turn, half turn, ceramic, foam flow etc, hot water mixer, hand shower Rainwater harvesting to include roof top harvesting, type of spouts, sizes of rainwater pipes and typical detail of a water harvesting pit.

**Module -2**

**Heat Ventilation and Air Conditioning (HVAC):**

Behaviour of heat propagation, thermal insulating materials and their co-efficient of thermal conductivity. General methods of thermal insulation: Thermal insulation of roofs, exposed walls. Ventilation: Definition and necessity, system of ventilation. Principles of air conditioning, Air cooling, Different systems of ducting and distribution, Essentials of air-conditioning system.

**Module -3**

**Electrical and Fire Fighting Services:**

Electrical systems, Basics of electricity, single/Three phase supply, protective devices in electrical installation, Earthing for safety, Types of earthing, ISI Specifications. Electrical installations in buildings, Types of wires, Wiring systems and their choice, planning electrical wiring for building, Main and distribution boards, Principles of illumination.

Classification of buildings based on occupancy, causes of fire and spread of fire, Standard fire, Fire fighting, protection and fire resistance, Firefighting equipment and different methods of fighting fire., means of escape, alarms, etc., Combustibility of materials, Structural elements and fire resistance, Fire escape routes and elements, planning and design. Wet risers, dry risers, sprinklers, heat detector, smoke detectors, fire dampers, fire doors, etc. Provisions of NBC.

**Module -4**

**Plumbing and Fire Fighting Layout of Simple Buildings:**

Application of above studies in preparing layout and details - Plumbing layout of residential and public buildings, Fire fighting layout, Reflected ceiling plan of smoke detectors / sprinklers, etc.

**Module -5**

**Engineering Services:** engineering services in a building as a system, Lifts, escalators, cold and hot water systems, waste water systems and electrical systems.

Pumps and Machineries: Reciprocating, Centrifugal, Deep well, Submersible, Automatic pumps, Sewerage pumps, Compressors, Vacuum pump – their selection, installation and maintenance – Hot water boilers – Classification and types of lifts, lift codes, rules structural provision: escalators, their uses, types and sizes, safety norms to be adopted – Social features required for physically handicapped and elderly, DC/AC motors, Generators,

**Building Maintenance:** Preventive and protective maintenance, Scheduled and contingency maintenance planning, M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

**Course Outcomes:** After studying this course, students will be able to:

1. Describe the basics of house plumbing and waste water collection and disposal.
2. Discuss the safety and guidelines with respect to fire safety.
3. Describe the issues with respect to quantity of water, rain water harvesting and roof top harvesting.
4. Understand and implement the requirements of thermal comfort in buildings.

**Question paper pattern:**

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

**Reference Books:**

1. National Building Code.
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & D L Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd.
4. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.
5. M. David Egan, Concepts in Building Fire Safety.
6. O. H. Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom.
7. V. K. Jain, Fire Safety in Building 2edition, New Age International Publishers.
8. E. G. Butcher, Smoke control in Fire-safety Design.
9. E. R. Ambrose, Heat pumps and Electric Heating, John and Wiley and Sons Inc, New York.
10. Handbook for Building Engineers in Metric systems, NBC, New Delhi.

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b>			
<b>REINFORCED EARTH STRUCTURES</b>			
Course Code	<b>18CV743</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to; <ol style="list-style-type: none"> <li>1. Create an understanding of the latest technique such as reinforcing the soil;</li> <li>2. Analyze the concept of RE so as to ascertain stability of RE structures;</li> <li>3. Understand the different reinforcing materials that can be used efficiently in soils.</li> <li>4. Understand design concepts of different RE structures including introductory concepts of Foundations resting of RE soil bed.</li> </ol>			
<b>Module -1</b>			
<b>Basics of Reinforced Earth Construction:</b> Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil. <b>Geosynthetics and Their Functions:</b> Historical developments, Recent developments, manufacturing process woven & non-woven, Raw materials – Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics. <b>Properties and Tests on Materials Properties –</b> Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties.			
<b>Module -2</b>			
<b>Design of Reinforced Earth Retaining Walls:</b> Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, Typical design problems <b>Soil Nailing Techniques:</b> Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken.			
<b>Module -3</b>			
<b>Design of Reinforced Earth Foundations:</b> Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines.			
<b>Module -4</b>			
<b>Geosynthetics for Roads and Slopes:</b> Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique. Simple Numerical Stability Checking Problems on Reinforced Slopes.			
<b>Module -5</b>			
<b>Geosynthetics - filter, drain and landfills:</b> Filter & Drain – Conventional granular filter design criteria, Geosynthetic filter design requirements, Drain and filter properties, Design criteria – soil retention, Geosynthetic permeability, anti clogging, survivability and durability (No Numerical Problems) <b>Landfills –</b> Typical design of Landfills – Landfill liner & cover, EPA Guidelines, Barrier walls for existing landfills and abandoned dumps (No Numerical Problems).			
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. identify, formulate reinforced earth techniques that are suitable for different soils and in different structures;</li> <li>2. understand the laboratory testing concepts of Geo synthetics</li> <li>3. design RE retaining structures and Soil Nailing concepts</li> <li>4. Determine the load carrying capacity of Foundations resting on RE soil bed.</li> <li>5. asses the use of Geo synthetics in drainage requirements and landfill designs</li> </ol>			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> </ul>			


- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

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

**Reference Books:**

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

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b>			
<b>DESIGN OF HYDRAULIC STRUCTURES</b>			
Course Code	18CV744	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>CREDITS –03</b>			
<b>Course Learning Objectives:</b> This course will enable students to; <ol style="list-style-type: none"> <li>1. Analyze and design gravity dams.</li> <li>2. Find the cross-section of earth dam and estimate the seepage loss.</li> <li>3. Design spillways and aprons for diversion works.</li> <li>4. Design CD works and chose appropriate canal regulation works.</li> </ol>			
<b>Module -1</b>			
<b>Gravity Dams:</b> Introduction, forces acting on dam, cause of failure, design principles, principal and shear stresses. Elementary profile and practical profile of a gravity dam. Drainage galleries, joints in gravity dams.			
<b>Module -2</b>			
<b>Earth Dams:</b> Introduction, causes of failure of earth dams, preliminary section, Determination of parametric line by Casagrande's method. Estimation of seepage.			
<b>Module -3</b>			
<b>Spillways:</b> Types, Design of Ogee spillway, Upstream and downstream profiles, Energy dissipation devices. <b>Diversion Headworks:</b> Design of aprons- Bligh's and Koshla's theory, Simple Problems.			
<b>Module -4</b>			
<b>Cross Drainage Works:</b> Introduction, Type of C.D works, Design considerations for C.D works. Transition formula design of protection works, Design of only aqueduct.			
<b>Module -5</b>			
<b>Canal Regulation Works:</b> Introduction, Function of a regulator. <b>Canal falls:</b> Necessity and types. <b>Canal outlets:</b> Necessity and types.			
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Check the stability of gravity dams and design the dam.</li> <li>2. Estimate the quantity of seepage through earth dams.</li> <li>3. Design spillways and aprons for various diversion works.</li> <li>4. Select particular type of canal regulation work for canal network.</li> </ol>			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi.</li> <li>2. Punmia and Pandey Lal, "Irrigation and Water Power Engineering" Lakshmi Publications, New Delhi.</li> <li>3. K. R. Arora, "Irrigation, Water Power and Water Resources Engineering" Standard Publications, New Delhi.</li> </ol>			
<b>Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. R. K. Sharma, "Text Book of Irrigation Engineering and Hydraulic Structures", Oxford and IBH, New Delhi.</li> <li>2. P. N. Modi, "Irrigation, Water Resources and Water Power", Standard Book House, New Delhi.</li> </ol>			

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VII**

**URBAN TRANSPORT PLANNING**

Course Code	18CV745	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to;

5. Understand and apply basic concepts and methods of urban transportation planning.
6. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.
7. Understand the process of developing an organized mathematical modelling approach to solve select urban transportation planning problem.
8. Excel in use of various types of models used for travel forecasting, prediction of future travel patterns.

**Module -1**

**Urban transport planning:** Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

**Module -2**

**Data Collection And Inventories:** Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

**Module -3**

**Trip Generation & Distribution:** UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. **Problems on above.**

**Module -4**

**Trip Distribution:** Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. **Problems on above.**

**Module -5**

**Traffic Assignment:** Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.

**Course outcomes:** After studying this course, students will be able to:

5. Design, conduct and administer surveys to provide the data required for transportation planning.
6. Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
7. Develop and calibrate modal split, trip generation rates for specific types of land use developments.
8. Adopt the steps that are necessary to complete a long-term transportation plan.

**Question paper pattern:**

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

**Textbooks:**



4. Kadiyali. L. R., 'Traffic Engineering and Transportation Planning', Khanna Publishers, New Delhi.
5. Hutchinson, B.G, 'Introduction to Urban System Planning', McGraw Hill.
6. Khisty C.J., 'Transportation Engineering – An Introduction' Prentice Hall.
7. Papacostas, 'Fundamentals of Transportation Planning', Tata McGraw Hill.

**Reference Books:**

3. Mayer M and Miller E, 'Urban Transportation Planning: A decision oriented Approach', McGraw Hill.
4. Bruton M.J., 'Introduction to Transportation Planning', Hutchinson of London.
5. Dicky, J.W., 'Metropolitan Transportation Planning', Tata McGraw Hill.

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VII**

**FINITE ELEMENT METHOD**

Course Code	<b>18CV751</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to;

1. Develop analytical skills.
2. Learn principles of analysis of stress and strain.
3. Develop problem solving skills.
4. Understand the principles of FEM for one and two dimensional problems.

**Module -1**

Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.

**Module -2**

Discretisation; finite representation of infinite bodies and discretisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.

**Module -3**

2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisymmetric Element.

**Module -4**

Isoparametric concepts; isoparametric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isoparametric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.

**Module -5**

Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques.

Structure of computer program for FEM analysis, description of different modules, exposure to FEM softwares.

**Course outcomes:** The student will have the knowledge on advanced methods of analysis of structures.

**Question paper pattern:**

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

**Textbooks:**

1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill
2. Desai C & Abel J F., " Introduction to Finite element Method" , East West Press Pvt. Ltd.,
3. Cook R D et.al. "Concepts and applications of Finite Element analysis", John Wiley.

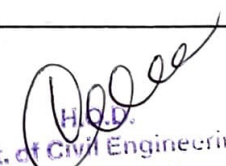
**Reference Books:**

1. Daryl L Logan, "A first course on Finite element Method", Cengage Learning.
2. Bathe K J - "Finite Element Procedures in Engineering analysis"- Prentice Hall.

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b>			
<b>NUMERICAL METHODS AND APPLICATIONS</b>			
Course Code	18CV752	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology			
<b>Module -1</b>			
<b>Solution of Equations and Eigen value Problems:</b> Solution of algebraic and transcendental equations, Fixed point iteration method, Newton Raphson method, Solution of linear system of equations, Gauss elimination method, Pivoting, Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method.			
<b>Module -2</b>			
<b>Interpolation and Approximation:</b> Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.			
<b>Module -3</b>			
<b>Numerical Differentiation and Integration:</b> Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.			
<b>Module -4</b>			
<b>Initial Value Problems for Ordinary Differential Equations :</b> Single Step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.			
<b>Module -5</b>			
<b>Boundary Value Problems in Ordinary and Partial Differential Equations:</b> Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.			
<b>Course Outcomes:</b> After studying this course, The students will have a clear perception of the power of numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from Industry, management and other engineering fields.			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b> <ol style="list-style-type: none"> <li>1. Grewal. B.S. and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi</li> <li>2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi.</li> </ol>			
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>1. Chapra. S.C. and Canale. R. P., "Numerical Methods for Engineers, Tata McGraw Hill, New Delhi.</li> <li>2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi.</li> <li>3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall of India Private, New Delhi.</li> </ol>			

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VII**

**ENVIRONMENTAL PROTECTION AND MANAGEMENT**

Course Code	18CV753	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to gain knowledge in Environmental protection and Management systems

**Module -1**

**Environmental Management Standards:** Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.

**Module -2**

**Environmental Management Objectives:** Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.

**Module -3**

**Environmental Management System:** EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.

**Module -4**

**Environmental Audit:** Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.

**Module -5**

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

**Course outcomes:** After studying this course, students will be able to:

1. Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards.
2. Lead pollution prevention assessment team and implement waste minimization options.
3. Develop, Implement, maintain and Audit Environmental Management systems for Organizations.

**Question paper pattern:**

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

**Reference Books:**

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide" Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International



Organisation for Standardisation, 2004

3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop „Pollution Prevention: Fundamentals and Practice, McGraw- Hill International, Boston, 2000.
5. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001.

  
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**B. E. CIVIL ENGINEERING**  
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**SEMESTER - VII**

**COMPUTER AIDED DETAILING OF STRUCTURES**

Course Code	18CVL76	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Be aware of the Scale Factors, Sections of drawings,
2. Draft the detailing of RC and Steel Structural member.

**Module -1 Detailing of RCC Structures**

- Beams – Simply supported, Cantilever and Continuous.
- Slab – One way, Two way and One-way continuous.
- Staircase – Doglegged
- Cantilever Retaining wall
- Counter Fort Retaining wall
- Circular Water Tank, Rectangular Water Tank.

**Module -2 Detailing of Steel Structures**

1. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.
2. Built-up Columns with lacings and battens
3. Column bases and Gusseted bases with bolted and welded connections.
4. Roof Truss – Welded and Bolted
5. Welded Plate girder
6. Gantry Girder

**Course outcomes:** After studying this course, students will be able to:

- Prepare detailed working drawings

**Question paper pattern:**

1. Two questions shall be asked from each Module.
2. One full question should be answered from each Module.
3. Each question carries 50 marks.

**Textbooks:**

1. N Krishna Raju, "Structural Design and Drawing of Reinforced Concrete and Steel", University Press
2. Krishna Murthy, "Structural Design and Drawing – Concrete Structures", CBS Publishers, New Delhi

**Reference Books:**

1. SP 34: Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards.
2. IS 13920, Ductile Design And Detailing Of Reinforced Concrete Structures Subjected To Seismic Forces - Code Of Practice, Bureau of Indian Standard.

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VII</b> <b>GEOTECHNICAL ENGINEERING LABORATORY</b>			
Course Code	18CVL77	CIE Marks	40
Teaching Hours/Week(L:T:P)	(0:2:2)	SEE Marks	60
Credits	02	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to; <ol style="list-style-type: none"> <li>1. To carry out laboratory tests and to identify soil as per IS codal procedures</li> <li>2. To perform laboratory tests to determine index properties of soil</li> <li>3. To perform tests to determine shear strength and consolidation characteristics of soils</li> </ol>			
<b>Modules</b>			
1. Field identification of soil, Specific gravity test (pycnometer and density bottle method). Water content determination by oven drying and Pycnometer method, rapid moisture meter method.			
2. Grain size analysis <ol style="list-style-type: none"> <li>i. Sieve analysis</li> <li>ii. Hydro meter analysis</li> </ol>			
3. In-situ density tests <ol style="list-style-type: none"> <li>i. Core-cutter method</li> <li>ii. Sand replacement method</li> </ol>			
4. Consistency limits <ol style="list-style-type: none"> <li>i. Liquid limit test (by Casagrande's and cone penetration method)</li> <li>ii. Plastic limit test</li> <li>iii. Shrinkage limit test</li> </ol>			
5. Standard compaction test (light and heavy compaction)			
6. Co-efficient of permeability test <ol style="list-style-type: none"> <li>i. Constant head test</li> <li>ii. Variable head test</li> </ol>			
7. Shear strength tests <ol style="list-style-type: none"> <li>i. Unconfined compression test</li> <li>ii. Direct shear test</li> <li>iii. Triaxial test (unconsolidated undrained test only)</li> </ol>			
8. Consolidation test :To determine pre consolidation pressure only(half an hour per loading-test).			
9. Laboratory vane shear test			
10. Demonstration of Swell pressure test, Standard penetration test and boring equipment			
<b>Course outcomes:</b> Students will be able to conduct appropriate laboratory/field experiments and interpret the results to determine <ol style="list-style-type: none"> <li>1. Physical and index properties of the soil</li> <li>2. Classify based on index properties and field identification</li> <li>3. To determine OMC and MDD, plan and assess field compaction program</li> <li>4. Shear strength and consolidation parameters to assess strength and deformation characteristics</li> <li>5. In-situ shear strength characteristics (SPT-Demonstration)</li> </ol>			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• All experiments are to be included in the examination except demonstration exercises.</li> <li>• Candidate to perform experiment assigned to him.</li> <li>• Marks are to be allotted as per the split up of marks shown on the cover page of answer script.</li> </ul>			
<b>Reference Books:</b>			
<ol style="list-style-type: none"> <li>1. Punmia B C, Soil Mechanics and Foundation Engineering-(2017), 16<sup>th</sup> Edition, Laxmi Publications co., New Delhi.</li> <li>2. Lambe T.W., "Soil Testing for Engineers", Wiley Eastern Ltd., New Delhi.</li> <li>3. Head K.H., "Manual of Soil Laboratory Testing" Vol. I, II, III, Princeton Press</li> <li>4. Bowles J.E., "Engineering Properties of Soil and Their Measurements", -McGraw Hill Book Co. New York.</li> <li>5. Relevant BIS Codes of Practice: IS-2720 series</li> </ol>			

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

**Programme: CIVIL ENGINEERING**

**VIII SEMESTER**

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P					
1	PCC	18CV81	Design of Pre-stressed Concrete	Civil Engg.	3	--	--	03	40	60	100	3
2	PEC	18CV82X	Professional Elective - 4	Civil Engg.	3	--	--	03	40	60	100	3
3	Project	18CVP83	Project Work Phase - 2	Civil Engg.	--	--	16	03	40	60	100	8
4	Seminar	18CVS84	Technical Seminar	Civil Engg.	--	--	2	03	100	--	100	1
5	Internship	18CVI85	Internship	Completed during the vacation/s of VI and VII semesters and /or VII and VIII semesters.)				03	40	60	100	3
<b>TOTAL</b>					<b>06</b>	<b>--</b>	<b>18</b>	<b>15</b>	<b>260</b>	<b>240</b>	<b>500</b>	<b>18</b>

**Note:** PCC: Professional Core, PEC: Professional Elective.

**Professional Electives - 4**

Course code under 18CV82X	Course Title
18CV821	Bridge Engineering
18CV822	Prefabricated Structures
18CV823	Advanced Foundation Engineering
18CV824	Rehabilitation & Retrofitting
18CV825	Pavement Design

**Project Work**

**CIE procedure for Project Work Phase - 2:**

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

The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**(ii) Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

**SEE for Project Work Phase - 2:**



(i) **Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.  
(ii) **Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

**Internship:** Those, who have not pursued /completed the internship, shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

**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.

Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VIII**

**DESIGN OF PRE-STRESSED CONCRETE**

Course Code	18CV81	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to learn Design of Pre Stressed Concrete Elements.

**Module -1**

**Introduction and Analysis of Members:** Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations -Pre stressing systems - Anchoring devices - Materials - Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete.  
 Analysis of members at transfer - Stress concept - Comparison of behavior of reinforced concrete – pre stressed concrete - Force concept - Load balancing concept - Kern point -Pressure line.

**Module -2**

**Losses in Pre stress:** Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss.  
 Deflection and Crack Width Calculations of Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio -Calculation of Crack Width - Limits of crack width.

**Module -3**

**Design of Sections for Flexure:** Analysis of members at ultimate strength - Preliminary Design - Final Design for Type 1 members.

**Module -4**

**Design for Shear:** Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.

**Module -5**

Different anchorage system and design of end block by latest IS codes.

**Course outcomes:** After studying this course, students will be able to:

1. Understand the requirement of PSC members for present scenario.
2. Analyse the stresses encountered in PSC element during transfer and at working.
3. Understand the effectiveness of the design of PSC after studying losses
4. Capable of analyzing the PSC element and finding its efficiency.
5. Design PSC beam for different requirements.

**Question paper pattern:**

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

**Textbooks:**

1. Krishna Raju, N. "Pre stressed Concrete", Tata McGraw Hill Publishing Company, New Delhi 2006
2. Krishna Raju, N., "Pre-stressed Concrete - Problems and Solutions", CBS Publishers and Distributors, Pvt. Ltd., New Delhi.
3. Rajagopalan N, "Pre - stressed Concrete", Narosa Publishing House, New Delhi

**Reference Books:**



1. Praveen Nagarajan, "Advanced Concrete Design", Person Publishers
2. P. Dayaratnam, "Pre stressed Concrete Structures", Scientific International Pvt. Ltd.
3. Lin T Y and Burns N H, 'Design of Pre - stressed Concrete Structures' , John Wiley and Sons, New York
4. Pundit G S and Gupta S P, "Pre - stressed Concrete", C B S Publishers, New Delhi
5. IS: 1343: Indian Standard code of practice for Pre stressed concrete, BIS, New Delhi.
6. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VIII**

**BRIDGE ENGINEERING**

Course Code	18CV821	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to understand the analysis and design of concrete Bridges.

**Note:** All designs have to be done by Working Stress Method

**Module -1**

Introduction to bridges, classification, selection of bridge site and preliminary and detailed survey work computation of discharge, linear waterway, economic span, afflux, scour depth.  
 Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

**Module -2**

Design of Slab Bridges: Straight and skew slab bridges.

**Module -3**

Design of T beam bridges(up to three girder only)  
 Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

**Module -4**

Other Bridges:  
 Design of Box culvert (Single vent only).  
 Design of Pipe culverts.

**Module -5**

Substructures - Design of Piers and abutments,  
 Introduction to Bridge bearings, Hinges and Expansion joints.(No design).

**Course outcomes:** After studying this course, students will be able to:

1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints and
5. Design Piers and abutments.

**Question paper pattern:**

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

**Textbooks:**

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

**Reference Books:**

1. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2.,Nem Chand Brothers.
2. Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
3. "Concrete Bridges", The Concrete Association of India



<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VIII</b> <b>PREFABRICATED STRUCTURES</b>			
Course Code	18CV822	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to 1. Understand modular construction, industrialized construction 2. Design prefabricated elements. 3. Understand construction methods.			
<b>Module -1</b>			
<b>Introduction:</b> Need for prefabrication–Principles–Materials–Modular coordination–Standarization–Systems–Production–Transportation–Erection.			
<b>Module -2</b>			
<b>Prefabricated Components:</b> Behavior of structural components–Large panel constructions–Construction of roof and floor slabs–Wall panels–Columns–Shear walls.			
<b>Module -3</b>			
<b>Design Principles:</b> Disuniting of structures–Design of cross section based on efficiency of material used–Problems in design because of joint flexibility–Allowance for joint deformation.			
<b>Module -4</b>			
<b>Joint In Structural Members:</b> Joints for different structural connections–Dimensions and detailing–Design of expansion joints.			
<b>Module -5</b>			
<b>Design For Abnormal Loads:</b> Progressive collapse–Code provisions–Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,–Importance of avoidance of progressive collapse.			
<b>Course Outcomes:</b> After studying this course, students will be able to: 1. Use modular construction, industrialized construction 2. Design prefabricated elements 3. Design some of the prefabricated elements 4. Use the knowledge of the construction methods and prefabricated elements in buildings			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			
1. CBRI, Building materials and components, India, 1990 2. Gerostiza C.Z., Hendrikson C. and Rehat D.R.," Knowledge based process planning for construction and manufacturing", Academic Press Inc., 1994			
<b>Reference Books:</b>			
1. KonczT.,"Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH,1976. 2. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland BetorVerlag, 2009			

  
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**B. E. CIVIL ENGINEERING**  
**Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**  
**SEMESTER - VIII**

**ADVANCED FOUNDATION ENGINEERING**

Course Code	<b>18CV823</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Gain knowledge of about advanced topics of foundation design and analyses, supplementing their comprehensive knowledge acquired in basic foundation engineering course.
2. Develop profound understanding of shallow and deep foundation analyses.
3. Develop understanding of choice of foundation design parameters.
4. Learn about cause and effect of dynamic loads on foundation.

**Module -1**

General bearing capacity equation – Terzaghi's, Brinch Hansen's and Mayerhof's analyses, bearing capacity of footings according to BIS, eccentrically loaded footing, footing on layered soil, Settlement of shallow Foundations: Immediate, consolidation, & differential settlements. Principles of design of footing, Proportioning of footings for equal settlement.

**Module -2**

Design of combined footings by Rigid method, Combined footings (rectangular & trapezoidal), strap footings. Types of rafts, bearing capacity & settlements of raft foundation, Design of raft foundation – Conventional rigid method, Elastic methods, Coefficient of sub-grade reaction, IS code (IS-2950) procedure.

**Module -3**

Introduction Necessity of pile foundations, Classification, Load bearing capacity of single pile by Static formula, Dynamic formula, Pile load test and Penetration tests. Introduction, Pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, laterally loaded piles and under reamed piles.

**Module -4**

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

**Module -5**

**Machine Foundations:** Introduction, free and forced vibrations, Types of Machine foundations, degrees of freedom of a block foundation, general criteria for design of machine foundation, vibration analysis of a machine foundation, determination of natural frequency, vibration isolation and control.

**Course outcomes:** After studying this course, students will be able to:

1. Estimate the size of isolated and combined foundations to satisfy bearing capacity and settlement criteria.
2. Estimate the load carrying capacity and settlement of single piles and pile groups including laterally loaded piles.
3. Understand the basics of analysis and design principles of well foundation, drilled piers and caissons.
4. Understand basics of analysis and design principles of machine foundations.

**Question paper pattern:**

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


**Textbooks:**

1. Punmia B.C., "Soil Mechanics and Foundation Engineering, Laxmi Publications Co., India.
2. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.



**Reference Books:**

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India.
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India.
4. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India.
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

  
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<b>B. E. CIVIL ENGINEERING</b> <b>Choice Based Credit System (CBCS) and Outcome Based Education (OBE)</b> <b>SEMESTER - VIII</b> <b>REHABILITATION AND RETROFITTING</b>			
Course Code	18CV824	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03
<b>Course Learning Objectives:</b> This course will enable students to; <ol style="list-style-type: none"> <li>1. Investigate the cause of deterioration of concrete structures.</li> <li>2. Strategies different repair and rehabilitation of structures.</li> <li>3. Evaluate the performance of the materials for repair.</li> </ol>			
<b>Module -1</b>			
<b>General:</b> Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.			
<b>Module -2</b>			
<b>Damage Assessment:</b> Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems.			
<b>Module -3</b>			
<b>Influence on Serviceability and Durability:</b> Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.			
<b>Module -4</b>			
<b>Maintenance and Retrofitting Techniques:</b> Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.			
<b>Module -5</b>			
<b>Materials for Repair and Retrofitting:</b> Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.			
<b>Course outcomes:</b> After studying this course, students will be able to: <ol style="list-style-type: none"> <li>1. Identify the causes for structural (Concrete) deterioration.</li> <li>2. Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.</li> <li>3. Recommend maintenance requirements of the buildings and preventive measures against influencing factors.</li> <li>4. Select suitable material and suggest an appropriate method for repair and rehabilitation.</li> </ol>			
<b>Question paper pattern:</b> <ul style="list-style-type: none"> <li>• The question paper will have ten full questions carrying equal marks.</li> <li>• Each full question will be for 20 marks.</li> <li>• There will be two full questions (with a maximum of four sub- questions) from each module.</li> <li>• Each full question will have sub- question covering all the topics under a module.</li> <li>• The students will have to answer five full questions, selecting one full question from each module.</li> </ul>			
<b>Textbooks:</b>			
<ol style="list-style-type: none"> <li>1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"</li> <li>2. Denison Campbell, Allen &amp; Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical.</li> </ol>			
<b>Reference Books:</b>			



1. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).
3. CPWD Manual

  
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**B. E. CIVIL ENGINEERING**  
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**SEMESTER - VIII**

**PAVEMENT DESIGN**

Course Code	18CV825	CIE Marks	40
Teaching Hours/Week(L:T:P)	(3:0:0)	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to

1. Gain knowledge about the process of collecting data required for design, factors affecting pavement design, and maintenance of pavement.
2. Excel in the path of analysis of stress, strain and deflection in pavement.
3. Understand design concepts of flexible pavement by various methods (CBR, IRC 37-2001, Mcleods, Kansas ) and also the same of rigid pavement by IRC 58-2002
4. Understand the various causes leading to failure of pavement and remedies for the same.
5. Develop skills to perform functional and structural evaluation of pavement by suitable methods.

**Module -1**

**Introduction:** Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement  
**Fundamentals of Design of Pavements:** Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.

**Module -2**

**Design Factors:** Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above.  
**Flexible pavement Design:** Assumptions, Mcleod Method, Kansas method, CBR method, IRC Method (old), CSA method using IRC-37-2001, problems on above.

**Module -3**

**Flexible Pavement Failures, Maintenance and Evaluation:** Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkleman beam deflection method, Falling weight deflecto meter, GPR method. Design factors for runway pavements, Design methods for Airfield pavement and problems on above.

**Module -4**

**Stresses in Rigid Pavement :** Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above.  
**Design of Rigid Pavement:** Design of CC pavement by IRC: 58-2002 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.

**Module -5**

**Rigid Pavement Failures, Maintenance and Evaluation:** Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints, Types of joints, Expansion joint, contraction joint, warping joint, construction joint, longitudinal joint, Design of joints.

**Course outcomes:** After studying this course, students will be able to:

1. Systematically generate and compile required data's for design of pavement (Highway & Airfield).
2. Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
3. Design rigid pavement and flexible pavement conforming to IRC58-2002 and IRC37-2001.
4. Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

**Question paper pattern:**

- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.



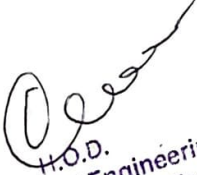
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

**Textbooks:**

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers
2. L.R.Kadiyali and Dr.N.B.Lal, " Principles and Practices of Highway Engineering", Khanna publishers
3. Yang H. Huang , "Pavement Analysis and Design", University of Kentucky.

**Reference Books:**

1. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
2. SubhaRao, "Principles of Pavement Design".
3. R Srinivasa Kumar, "Pavement Design", University Press.
4. Relevant recent IRC codes

  
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**SEMESTER - VIII**

**PROJECT WORK PHASE-2**

Course Code	<b>18CVP83</b>	CIE Marks	40
Teaching Hours/Week(L:T:P)	-	SEE Marks	60
Credits	08	Exam Hours	03

**Course objectives:**

- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

**Project Work Phase - II:** Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

**Course outcomes:** At the end of the course the student will be able to:

- Describe the project and be able to defend it.
- Develop critical thinking and problem solving skills.
- Learn to use modern tools and techniques.
- Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
- Develop skills to work in a team to achieve common goal.
- Develop skills of project management and finance.
- Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
- Prepare them for life-long learning to face the challenges and support the technological changes to meet the societal needs.

**Evaluation Procedure:**

- **As per University guidelines**
- **Internal Marks:** The Internal marks (100 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.
- **Semester End Examination:** SEE marks for the project (100 marks) shall be based on Project report, Presentation and Demonstration of the actual/model/prototype of the project, as per the University norms by the examiners appointed VTU.

  
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**SEMESTER - VIII**

**TECHNICAL SEMINAR**

Course Code	18CVS84	CIE Marks	100
Teaching Hours/Week(L:T:P)	--	SEE Marks	--
Credits	01	Exam Hours	03

**Course Learning Objectives:**

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey; organize the Course topics in a systematic order.

- Conduct literature survey in the domain area to find appropriate topic.
- Prepare the synopsis report with own sentences in a standard format.
- Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
- Present the seminar topic orally and/or through power point slides.
- Communicate effectively to answer the queries and involve in debate/discussion.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

**Course Outcomes:** At the end of the course the student will be able to:

- Develop knowledge in the field of Civil Engineering and other disciplines through independent learning and collaborative study.
- Identify and discuss the current, real-time issues and challenges in engineering & technology.
- Develop written and oral communication skills.
- Explore concepts in larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.
- Develop the skills to enable life-long learning.

**Evaluation Procedure:**

- As per University guidelines.
- The Internal Assessment marks for the seminar shall be awarded based on the relevance of the seminar topic, quality of the report, presentation skills, participation in the question and answer, and attendance in the seminar classes/sessions.

  
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**SEMESTER - VIII**

**INTERNSHIP /PROFESSIONAL PRACTICE**

Course Code	18CVI85	CIE Marks	40
Teaching Hours/Week(L:T:P)	Industry Oriented	SEE Marks	60
Credits	03	Exam Hours	03

**Course Learning Objectives:** This course will enable students to get the field exposure and experience

**Note: Internship /Professional Practice:**

1. This shall be carried out by students in industry set-up related to the construction/ materials testing laboratories/research organizations/project management consulting firms/QS and QA organizations/ planning and design offices/Professional organizations like ACCE/ICI/INSTRUCT/RMCMA/QCI, PMI, CIDC etc. and other avenues related to the civil engineering domain in consultation and approval of internship guide/HOD /internship committees of the institutions.
2. The professional certification programs like ACCE(I)- SMP, ICI-BMTPC certifications, NSTRUCT-certifications, CIDC certifications, RMC-QCI's RMCPCS Certification Programs, RMCMA-NRMCA'S Concrete Technologist India(CTI) programs and such similar programs by professional bodies with adequate industry exposures at sites/RMC plants can be considered as Internship /Professional Practice with due approvals from the guide/HOD /internship committees of the institutions
3. The industry/organization should issue certificates of internship offer and its completion. The offer letter should clearly have the nature of work to be done by the student and the supervisor's name and duration of internship.
4. The student shall make a midterm and final presentation of the activities undertaken during the first 6 weeks and at the end of 12th week of internship respectively, to a panel comprising internship guide, a senior faculty from the department and head of the department. Each student should submit the internship report at the end of semester with internship certificate.
5. Viva-Voce examination shall be conducted by a panel of examiners consisting of internship supervisor from industry or industry professional approved by university and internship guide from the institute.
6. The College shall facilitate and monitor the student internship program.
7. The internship should be completed during vacation after VI and VII semesters.

  
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**PROJECT WORK PHASE II**  
**[As per Choice Based Credit System (CBCS) scheme]**  
**(Effective from the academic year 2017 -2018)**

**SEMESTER – VIII**

Subject Code	18CVP85	IA Marks	100
Number of Lecture Hours/Week	06	Exam Marks	100
Total Number of Lecture Hours	--	Exam Hours	03


**CREDITS – 06**

**Description (If any):**

- Project: Carried out at the Institution or at an Industry.
- Project work shall preferably be batch wise, the strength of each batch shall not exceed maximum of four students
- Viva-voce examination in project work shall be conducted batch-wise.
- For Project Phase –I and Project seminar and Project Phase –II, the CIE shall be 100 respectively.
- The CIE marks in the case of projects in the final year shall be based on the evaluation at the end of VIII semester by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the project guide.
- Minimum requirement of CIE marks for Project work shall be 50% of the maximum marks.
- Students failing to secure a minimum of 50% of the CIE marks in Project work shall not be eligible for the Project examination conducted by the University and they shall be considered as failed in that/those Course/s. However, they can appear for University examinations conducted in other Courses of the same semester and backlog Courses if any. Students after satisfying the prescribed minimum CIE marks in the Course/s when offered during subsequent semester shall appear for SEE.
- Improvement of CIE marks shall not be allowed in Project where the student has already secured the minimum required marks
- For a pass in a Project/Viva-voce examination, a student shall secure a minimum of 40% of the maximum marks prescribed for the University Examination. The Minimum Passing Grade in a Course is 'E'.
- The student who desires to reject the results of a semester shall reject performance in all the Courses of the semester, irrespective of whether the student has passed or failed in any Course. However, the rejection of performance of VIII semester project shall not be permitted

**Course outcomes: The students should be able to:**

1. Identify a issue and derive problem related to society, environment, economics, energy and technology
2. Formulate and Analyze the problem and determine the scope of the solution chosen
3. Determine, dissect, and estimate the parameters, required in the solution.
4. Evaluate the solution by considering the standard data / Objective function and by using appropriate performance metrics.
5. Compile the report and take part in present / publishing the finding in a reputed conference / publications
6. Attempt to obtain ownership of the solution / product developed.

  
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