



**MANIPAL UNIVERSITY
JAIPUR**

**Department of Civil Engineering
School of Civil and Chemical Engineering
Manipal University Jaipur
Course Handout- (2019-20)**

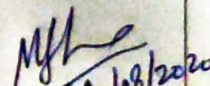
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20/08/2020
BoS Coordinator

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20/08/2020
HoD

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 BES Coordinator


 HoD 20/08/2020



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Basic Civil Engineering | CVI001 | 3 Credits | 3 0 0 3

Session: Jul 19 – Nov 19 | Faculty: Dr. Jitendra Singh Yadav | Class: B.Tech (First Year)

A. Introduction:

This course is offered by Dept. of Civil Engineering as a departmental core course. The main objectives of this course are to understand, basics of civil engineering with are essential for everyone. The course covers principle of surveying, method and equipment's used for surveying, building material used for construction, different components of building, forces and its equilibrium, evaluation of centre of gravity and moment of inertia of simple and composite sections, simple stress and strain, method of analysis of truss, estimation and costing. Overall, this course will help to understand the basic of civil engineering used in our day to day life.

B. Course Outcomes: At the end of the course, students will be able to

[CVI001.1]. Describe the importance and role of Civil Engineering and Civil Engineer in development of Society.

[CVI001.2]. Explain surveying and the type of instruments used for surveying.

[CVI001.3]. Describe the scientific terminologies related to building materials and components of building.

[CVI001.4]. Assess the force acting on a materials, centre of gravity and moment of inertia of composite area.

[CVI001.5]. Calculate the different type of stress like, simple stress, shear stress, and direct stress and strain in the material, and analysis of truss. Familiar to basic terminologies related to Estimation and Costing which create employability, and entrepreneurship.

Program Outcomes and Program Specific Outcomes

[PO.1]. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal,

health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

C. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Closed Book) | 20 |
| | Sessional Exam II (Closed Book) | 20 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 20 |
| End Term Exam (Summative) | End Term Exam (Closed Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

D. Syllabus

Introduction:- Scope of Civil Engineering, Role of Civil Engineer in Society, Impact of infrastructural development on economy of country; **Surveying:-**Principles and types of surveying, Site plans, Linear measurements, Angular measurements, Levelling, ordinary levels and total stations, Use of theodolite and plane table, contouring, L- section and cross sections; **Buildings:-**

Properties, uses of Stones, bricks, cement, timber, steel, plastics and paints. Properties of concrete. Selection of site for Buildings, Layout of building Plan, Types of buildings, Plinth Area, Carpet Area, Super built up area, floor space index, building bye laws, ventilation, components of buildings and their functions, Functional design of buildings, basic concepts of R.C.C., Type of foundations; **Mechanics of Solids**:- Forces and Equilibrium, Graphical and analytical treatment of concurrent and non-concurrent co-planer forces, Free body diagram, Frictional force in equilibrium problems; **Centroid and centre of gravity**, Moment of inertia of simple and composite areas; **Normal stress and strain**, Hooke's law, modulus of elasticity, modulus of rigidity, allowable stress, shear stress and shear strain; **Analysis of plane truss**, Method of joints, Method of sections; **Estimation and Costing**:- Types of estimates and Contracts, Tenders, NIT, EMD and Security deposits, Award of work, measurements, billing and payments.

E. Text Books

- T1.** Ramamrutham S., Basic Civil Engineering (3e), Dhanpat Rai Publishing Company (P) Ltd, 2013.
- T2.** Punamia B. C., Jain A. K., Jain A. K., Surveying Volume I (16e), S Chand, 2016.
- T3.** Dutta B. N., Estimation and Costing in Civil Engineering (28e), UBS Publishers Distributors LTD., 2016.
- T4.** Punamia B.C., Jain A. K., Jain A. K., Building Construction (11e), S Chand, 2016.
- T5.** Khurmi R. S., Strenght of Material, S Chand, 2016
- T6.** Timoshenko S., Young D.H., Rao J.V., Pati S., Engineering Mechanics (5e), Mcgraw Hill, 2013.
- T7.** SP41 Handbook on Functional Design of Buildings, Bureau of Indian Standards 2013.

Reference Books

- R1.** Timoshenko S., Young D.H., Rao J.V., Pati S., Engineering Mechanics (5e), Mcgraw Hill, 2013.
- R2.** SP41 Handbook on Functional Design of Buildings, Bureau of Indian Standards 2013.

F. Lecture Plan:

| Lec No | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing the Outcome |
|---------|---------------------|--|-------------------------|------------------|---|
| 1,2 | Introduction | Scope of Civil Engineering, Role of Civil Engineer in Society, | Lecture | 1001.1 | NA |
| 3 | Introduction | Impact of infrastructural development on economy of country | Lecture | 1001.1 | In Class Quiz |
| 4,5 | Surveying | Principles and types of surveying, Site plans, Linear measurements, | Lecture and field visit | 1001.2 | In Class Quiz End Term |
| 6,7,8 | Surveying | Angular measurements, Levelling, ordinary levels and total stations | Lecture and field visit | 1001.2 | Home Assignment End Term |
| 9,10,11 | Surveying | Use of theodolite and plane table, contouring, L- section and cross sections | Lecture and field visit | 1001.2 | In Class Quiz End Term |
| 12 | Building | Properties, uses of Stones, bricks, cement, | Lecture and field visit | 1001.3 | Class Quiz Mid Term I End Term |
| 13 | Building | Timber, steel, plastics and paints. | Lecture and field visit | 1001.3 | Class Quiz Mid Term I End term |
| 14,15 | Building | Properties of concrete. | Lecture | 1001.3 | Home Assignment Class Quiz Mid Term I End Term |
| 16,17 | Building | Selection of site for Buildings, Layout of building Plan, Types of buildings, Plinth Area, Carpet Area, Super built up area, floor space index, building bye laws, ventilation, components of buildings and their functions, | Lecture | 1001.3 | Class Quiz Mid Term I End Term |
| 18,19 | Building | Functional design of buildings, basic concepts of R.C.C., Type of foundations. | Lecture | 1001.3 | Class Quiz Mid Term I End Term |
| 20 | Mechanics of Solids | Forces and Equilibrium, | Lecture | 1001.4 | Class Quiz End Term |

| | | | | | |
|----|------------------------|---|---------|--------|---------------------------------------|
| 21 | Mechanics of Solids | Graphical and analytical treatment of concurrent and non- concurrent co- planer forces, Free body diagram | Lecture | 1001.4 | Class Quiz Mid Term II End Term |
|----|------------------------|---|---------|--------|---------------------------------------|

| | | | | | |
|-------------|------------------------|---|---------|--------|---------------------------------------|
| 22 | Mechanics of Solids | Frictional force in equilibrium problems | Lecture | 1001.4 | Class Quiz Mid Term II End Term |
| 23,24,25 | Mechanics of Solids | Numerical Exercises | Lecture | 1001.4 | Class Quiz Mid Term II End Term |
| 26 | Mechanics of Solids | Centroid and centre of gravity, | Lecture | 1001.4 | Class Quiz Mid Term II End Term |
| 27 | Mechanics of Solids | Moment of inertia of simple and composite areas. | Lecture | 1001.4 | Class Quiz End Term |
| 28,29,20,31 | Mechanics of Solids | Numerical Exercises | Lecture | 1001.4 | Class Quiz End Term |
| 32 | Mechanics of Solids | Normal stress and strain, Hooke's law | Lecture | 1001.5 | Class Quiz End Term |
| 33 | Mechanics of Solids | Modulus of elasticity, modulus of rigidity | Lecture | 1001.5 | Class Quiz End Term |
| 34 | Mechanics of Solids | Allowable stress, shear stress and shear strain | Lecture | 1001.5 | Class Quiz End Term |
| 35, 36 | Mechanics of Solids | Numerical Exercises | Lecture | 1001.5 | Class Quiz End term |
| 37 | Structure Analysis | Analysis of plane truss, Method of joints, | Lecture | 1001.5 | Class Quiz |
| 38 | Structure Analysis | Method of sections | Lecture | 1001.5 | Class Quiz Mid Term II End Term |
| 39,40,41 | Structure Analysis | Numerical Exercises | Lecture | 1001.5 | Class Quiz Mid Term II End Term |
| 42 | Estimation and Costing | Types of estimates and Contracts, | Lecture | 1001.5 | Class Quiz Mid Term II End Term |
| 43 | Estimation and Costing | Tenders, NIT, EMD and Security deposits, | Lecture | 1001.5 | Class Quiz End Term |
| 44 | Estimation and Costing | Award of work, measurements, billing and payments | Lecture | 1001.5 | Class Quiz End Term |
| 45,46 | Estimation and Costing | Numerical Exercises | Lecture | 1001.5 | Class Quiz End Term |

G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM 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 |
| CV 1001.1 | Importance and role of Civil Engineering and civil engineer in development of Society. | | | 1 | | | 1 | 2 | | | 1 | | 1 |
| CV 1001.2 | Get familiar with surveying and the type of instruments used for surveying. | 2 | 1 | 2 | 3 | 3 | | | | 3 | | | |
| CV 1001.3 | Describe the scientific terminologies related to building materials and components of building. | 3 | 3 | 2 | | 2 | 2 | 1 | | 2 | | | 3 |
| CV 1001.4 | Assess the force acting on a materials, centre of gravity and moment of inertia of composite area. | 3 | 3 | | | | | | | | | | |
| CV 1001.5 | Calculate the different type of stress like, simple stress, shear stress, and direct stress and strain in the material, and analysis of truss. Familiar to basic terminologies related to Estimation and Costing which create employability, and entrepreneurship. | 3 | 2 | 1 | | | | | | | 2 | 3 | 3 |

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Fluid Mechanics-I |CV1301| 4 Credits | 3 1 0 4

Session: July, 2019 – Dec.2019 | Faculty: Dr. Parwez M. Akhtar | Class: 3rd Semester B.Tech(Civil)

A. **INTRODUCTION:** This course is offered by Dept. of Civil Engineering as an 3rd semester course, targeting students who want to pursue a career particularly in the broad domain of hydraulics, water and water resources related technology and management and to extent for those who intends to pursue higher studies in the field of fluid dynamics related sciences and engineering, such as river mechanics, computational hydraulics, environment and eco-hydraulics, water supply and waste water distribution network and quality management etc. This is a beginners as well as preliminary course as such only fundamentals of fluid properties and behaviour aspects with a goal of developing a systematic report on the Applied Engineering Fluid Mechanics is taught. Understanding of fundamentals mass-momentum conservation, fluid statics, fluid kinematics are in general basic components of the course. This course is fundamentally multi-disciplinary engineering course, as such participating students are expected to have a strong background knowledge of basics sciences such as physics and applied mathematics.

B. **COURSE OUTCOMES:** At the end of the course, students will be able to:

[CV1301.1]. Understand the basic concept, historical context and wider importance of theoretical fluid mechanics including preliminary analysis of fluid inertial behaviour and enhance employment.

[CV1301.2]. Understand kinematics of fluid motion through knowledge of mathematics/science/fundamentals and solution of complex engineering problems. Critical review and analysis

[CV1301.3]. Understand and be able to solve fluid dynamics problems through knowledge of mathematics/science/fundamentals and solution of complex engineering problems.

[CV1301.4]. Overview of preliminary flow measurement apparatus and dissemination of preliminary model similarities covering design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[CV1301.5]. Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation and individual and group work and be trained to be able to pursue advance courses in related fields to promote entrepreneurship.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

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

2. **PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

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

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

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

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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D.

ASSESSMENT PLAN:

| Criteria | Description | Maximum Marks |
|------------------------------------|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Closed Book) | 15 |
| | Sessional Exam II (Closed Book) | 15 |
| | In class Quizzes + Assignments (Tutorials) + Class Project | 30 |
| End Term Exam (Summative) | End Term Exam (Closed Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank , so that the student is not accounted for absence. | |

| | |
|--|---|
| | These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. **SYLLABUS**

Introduction: Overview and scope of the subject, Fluid properties, ideal and real fluids, fluid pressure and its measurement using manometers. Hydrostatic: Forces on plane surface and curved surfaces, centre of pressure; stability of floating and submerged bodies. Kinematic of fluid motion: Lagrangian and Eulerian approach, classification of flows- one, two and three dimensional, steady, unsteady, uniform and non –uniform, laminar and turbulent, streamline, path line, streak line and stream tube, continuity equation, tangential and normal acceleration, velocity and stream functions , rotational and irrotational flows and flow net. Dynamics of fluid motion: Euler's equation of motion, Bernoulli's equation, and its applications, venturimeter, orifice meter and Pitot tube. Momentum equation and its application on stationary and moving vanes. Flow through pipes: Ideal fluid flow: Renolds' experiment, laminar and turbulent flow through pipes- velocity distribution, head loss, Darcy-Weisbach's equation, pipes in series and parallel. Velocity distribution in laminar flow and turbulent flow, Flow measurement: Orifices, mouthpieces, notches and weirs, sluice gate, time of emptying and filling of tanks through orifices. Dimensional Analysis: Dimensional parameters and their significance, Buckingham's Pi theorem and model similarities.

F. **TEXT BOOKS**

1. Garde R.J. and Mirajgaokar A.G., Engineering Fluid Mechanics (Including Hydraulic Machines), Nem Chand & Bros, Roorkee, Second Edn, 1983.
2. Modi P.N. & Seth. S.M., Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 2005.
3. Subramanya K., Theory and Applications of Fluid Mechanics (Including Hydraulic Machines), Tata McGraw- Hill Publishing Company Limited, New Delhi, 2011.
4. Jain A.K., Fluid Mechanics Including Hydraulic Machines, Khanna Publishers, Delhi, 2004.

G. **REFERENCE BOOKS**

1. Çengel Yunus A. and Cimbala John M., Fluid Mechanics Fundamentals and Applications Tata McGraw Hill Education Pvt. Limited New Delhi, 2011
2. Pritchard Philip J. and Leylegian John C., Fluid Mechanics, Wiley India Ltd. New Delhi, 2012

H. **LECTURE PLAN:**

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|------------------------------------|--|--------------------|------------------------------|-------------------------------|
| 1, 2 | Introduction and fundamental of FM | Scope of Fluid Mechanics : Understand the basic concept | Lecture/Class Quiz | CVCV1301.1, CVCV1301.5 | In Class Quiz |
| 3 | Introduction and fundamental of FM | Historical context and wider importance of theoretical fluid mechanics | Lecture/Class Quiz | CV1301.1, CV1301.5 | In Class Quiz |

| | | | | | |
|---|------------------------------------|--|--------------------|--------------------|--|
| 4,5 | Introduction and fundamental of FM | Preliminary analysis of fluid inertial behaviour and fluid properties. | Lecture/Class Quiz | CVI301.1, CVI301.5 | In Class Quiz End Term |
| 6 | Introduction and fundamental of FM | Pressure Measurement using Manometer | Lecture/Class Quiz | CVI301.1 | 1 st Sessional ET Exam Home Assignment In class quiz |
| 7,8 | Hydrostatics | Understand Basic Concept of Hydrostatics, Forces on plane surface and curved plane | Lecture/Class Quiz | CVI301.1 | |
| 9, 10 | Hydrostatics | Centre of pressures | Lecture/Class Quiz | CVI301.1 | |
| 11,12 | Hydrostatics | Stability of floating and submerged bodies. | Lecture/Class Quiz | CVI301.1 | 1 st Sessional ET Exam Home Assignment In class quiz |
| 13 | Kinematics of fluid motion | Lagrangian and Eulerian Approach | Lecture/Class Quiz | CVI301.2, CVI301.5 | |
| 14 | Kinematics of fluid motion | steady/unsteady flows | Lecture/Class Quiz | CVI301.2 | |
| 15 | Kinematics of fluid motion | Uniform and Non uniform flows | Lecture/Class Quiz | CVI301.2 | 1 st Sessional ET Exam Home Assignment In class quiz |
| 16, 17 | Kinematics of fluid motion | Turbulent and streamlines streaklines and stream tubes | Lecture/Class Quiz | CVI301.2 | |
| 18 | Kinematics of fluid motion | Continuity Equation | Lecture/Class Quiz | CVI301.2 | |
| 19, 20 | Kinematics of fluid motion | Tangential and normal accelerations | Lecture/Class Quiz | CVI301.2 | |
| 21, 22 | Kinematics of fluid motion | Velocity and stream functions | Lecture/Class Quiz | CVI301.2 | 1 st Sessional ET Exam Home Assignment In class quiz |
| 23, 24 | Kinematics of fluid motion | Rotational and irrotational flows | Lecture/Class Quiz | CVI301.2 | |
| 25 | Kinematics of fluid motion | Flownets and related problems | Lecture/Class Quiz | CVI301.2 | 1 st Sessional ET Exam Home Assignment |
| 1st Sessional Examination | | | | | |
| 26 | Dynamics of fluid motion | Euler's Equation of motion | Lecture/Class Quiz | CVI301.3 | 2 nd Sessional ET Exam Home In class quiz |
| 27,28 | Dynamics of fluid motion | Bernoulli's equation and its application | Lecture/Class Quiz | CVI301.3, CVI301.5 | |
| 29 | Dynamics of fluid motion | Venturimeter and orifice meter/pitot tube | Lecture/Class Quiz | CVI301.3 | 2 nd Sessional ET Exam Home In class quiz |
| 30, 31 | Dynamics of fluid motion | Momentum equation and its application on stationary and moving vanes. | Lecture/Class Quiz | CVI301.3 | 2 nd Sessional ET Exam Home In class quiz |

| | | | | | |
|---|--------------------------|--|-----------------------|--------------------|---|
| 32, 33 | Dynamics of fluid motion | Flow through pipes:- Ideal fluid flow: Reynold's Experiment Cont. | Lecture/Class Quiz | CVI301.3 | 2 nd Sessional ET Exam Home In class quiz |
| 34, 35 | Dynamics of fluid motion | Laminar and turbulent flow through pipes-velocity distribution and head loss | Lecture/Class Quiz | CVI301.3 | 2 nd Sessional ET Exam Home In class quiz |
| 2nd Sessional Examination | | | | | |
| 36 | Dynamics of fluid motion | Darcy-Weisbach's equation and its application | Lecture/Class Quiz | CVI301.3 | ET Exam Home Assignment In class quiz |
| 37, 38 | Dynamics of fluid motion | Pipes in series and parallel with examples | Lecture/Class Quiz | CVI301.3 | ET Exam Home Assignment In class quiz |
| 39, 40 | Dynamics of fluid motion | Velocity distribution in laminar and turbulent flows | Lecture/Class Quiz | CVI301.3 | ET Exam Home Assignment In class quiz |
| 41, 42 | Flow measurement | Orifice and mouth pieces | Lecture/Class Quiz | CVI301.4 | ET Exam Home Assignment In class quiz |
| 43, 44 | Flow measurement | Notches, weirs and sluice gates | Lecture/Class Quiz | CVI301.4 | ET Exam Home Assignment In class quiz |
| 45 | Flow measurement | Time of filling and emptying of tanks through orifice | Lecture/Class Quiz | CVI301.4 | ET Exam Home Assignment In class quiz |
| 46 | Dimensional analysis | Dimensional parameters and its significance | Lecture/Class Quiz | CVI301.4, CVI301.5 | ET Exam In class quiz |
| 47, 48 | Dimensional analysis | Buckingham 's Pi (π) theorem and model similarities | Lecture/Class Quiz | CVI301.4 | ET Exam In class quiz |
| END TERM EXAM | | | | | |

I. COURSE ARTICULATION MATRIX: (MAPPING OF COS WITH POS)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1301.1 | Understand the basic concept, historical context and wider importance of theoretical fluid mechanics including preliminary | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 2 |

| | | | | | | | | | | | | | | | | | | |
|----------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|
| | analysis of fluid inertial behaviour and enhance employment. . | | | | | | | | | | | | | | | | | |
| CV1301.2 | Understand kinematics of fluid motion through knowledge of mathematics/science/fundamentals and solution of complex engineering problems. Critical review and analysis | 0 | 3 | 0 | 2 | 1 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 0 | |
| CV1301.3 | Understand and be able to solve fluid dynamics problems through knowledge of mathematics/science/fundamentals and solution of complex engineering problems. | 1 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 3 | 0 | 2 | 0 | 1 | |
| CV1301.4 | Overview of preliminary flow measurement apparatus and dissemination of preliminary model similarities covering design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions | 3 | 0 | 1 | 0 | 2 | 0 | 0 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | |
| CV1301.5 | Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation and individual and group work and be trained to be able to pursue advance courses in related fields to promote entrepreneurship. | 2 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 2 | 2 | |

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-Out

Building Science and Technology | CV1302 | 3 Credits | 3 0 0 3

Session: Jul 19-Nov 19 | Faculty: Kamal Kumar | Class: B.Tech Civil III SEM



A. Introduction: This course is offered by Dept. of Civil Engineering for third semester students. The subject offers a basic understanding of different types of construction materials which will include both, conventional and modern building materials. Course work includes introduction to various types of building components such as foundations, walls and roofs and the ways to maintain and protect them. In this coursework, students will be trained for various types of brick bonds in masonry construction. Also they will develop skill for testing various building materials such as Lime, cement, aggregate, concrete, timber, bricks, tiles, etc. as per Indian Standards guidelines. The course will include activities, such as assignments, quizzes, class tests, site visits, projects, focusing on the knowledge of students for lifelong learning and making them employable.

B. Course Outcomes: At the end of the course, students will be able to:

1. Identify various type of building materials and apply his engineering skills to investigate them for their suitability in sustainable construction works for safe and ethical professional engineering practice.
2. Take critical engineering decisions on the type of building components and appropriate/modern construction techniques to be used to justify the suitability and economy of the project
3. Communicate effectively with society/engineering community for all sort of maintenance issues of a building and give/develop specific scientific solutions in the broadest context of technological advancements
4. Work independently or in a group as a consultant for material design and testing as per the guidelines of Indian Standard codes, which can increase employability.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. SYLLABUS

Plastering, Painting and Flooring: Types, properties, White washing, Colour washing and distempering of walls. Plastic emulsion, Enamel and powder Coat painting of walls, Painting of wood and metal

works, Granolithic, Concrete, Mosaic, Ceramic, Marble, Terrazzo and Synthetic material flooring, Roofs: Sloped roofs – Leaning roofs, Coupled and Collared roofs; Timber trusses: King post and Queen post trusses; Shoring, Underpinning, and Scaffolding. Bricks & Tiles; Lime: Types and their application; Timber: properties, defects and preservation, Types and uses; Tar, Bitumen and Asphalt, Modern Building Materials: Plastic, FRP, rubber, glass, Ferro-cement, glass, ceramics and paints; Corrosion: types and Corrosion prevention methods; Cements: Types, composition, properties and uses, physical tests on cement, Concrete Technology: Ingredients of concrete, properties & tests on fresh and hardened concrete as per IS codes. Foundation: Types of foundation, spread foundations, pile foundations, pier foundations, excavation of foundation. Centring, Shuttering & Scaffolding: Types, methods and material used. Types of Walls: Purpose and method of construction. Brick Masonry: Terminology, Materials used, Causes of failure of brick masonry, Types of bonds, Brick laying, Reinforced brickwork. Stone Masonry: Terminology used, Materials used, Cutting and dressing of stones, Types of stone masonry-Rubble and Ashlar, Joints of stone, Stone lining, maintenance of stone work, Artificial stones. Damp Proofing: material used for damp proofing, methods of preventing dampness. Maintenance of Buildings: Types and corrosion prevent method, Causes and prevention of cracks in building, special repair of buildings, annual maintenance.

F. TEXT BOOKS

1. Punmia B.C., *Building Construction*, Lakshmi Publications, New Delhi, 2008.

G. REFERENCE BOOKS

2. SP 20, *Handbook on Masonry Design and Construction*, B.I.S. Publication, 1991.
3. SP 62 (S&T), *Handbook on Building Construction Practices*, B.I.S. Publication, 1997.
4. Neville A. M, *Properties of Concrete*, McGraw-Hill, Singapore, 2012.
5. S.K.Duggal, *Building Materials*, TMH Publication, 2010
6. Rangwala, *Engineering Materials*, Charotar Publication, 2014

H. Lecture Plan:

| Class No. | Topics | Session Outcome | Mode of Delivery | Corresponding outcome | Mode of Assessing the Outcome |
|-----------|------------------------------------|---|------------------|-----------------------|-------------------------------|
| (A) | Building Materials: | | | | |
| 1 | Lime: Types and their application; | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 2. | Timber: Properties, defects | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 3. | Preservation, Types and uses | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 4. | Bricks & Tiles | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |

| | | | | | |
|---|--|---|---------|----------|------------|
| 5. | Tar, Bitumen and Asphalt | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| | <i>Activity1: Online Class Quiz-1, Activity2: Laboratory visits for identification of building materials</i> | | | | |
| | <i>Assignment: Based on Lectures 1 to 5</i> | | | | |
| 6. | Cements: Types, composition, properties and uses, | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 7. | Physical tests on cement | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 8. | Concrete: Ingredients of concrete, properties | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 9. | Tests on fresh and hardened concrete as per IS codes. | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| 10. | Tests on fresh and hardened concrete as per IS codes. | Basic idea of Civil Engineering materials | Lecture | CV1302.1 | Quiz, Exam |
| (B) Modern Building Materials: | | | | | |
| 11. | Plastic, FRP, rubber, glass, | Advance materials in civil engineering | Lecture | CV1302.2 | Quiz, Exam |
| 12. | Ferro-cement, glass, ceramics and paints; | Advance materials in civil engineering | Lecture | CV1302.2 | Quiz, Exam |
| (C) Centering, Shuttering & Scaffolding: | | | | | |

| | | | | | |
|---------------------------|--|---|---------|----------|------------|
| 13. | Types, methods and material used, | Learning of construction practices | Lecture | CV1302.2 | Quiz, Exam |
| 14. | Shoring, Underpinning, and Scaffolding | Learning of construction practices | Lecture | CV1302.2 | Quiz, Exam |
| | <i>Activity2: Online Class Quiz-2</i> | | | | |
| | <i>Assignment: Based on Lectures 6 to 14</i> | | | | |
| (D) Foundation: | | | | | |
| 15. | Type of foundations, Spread foundations, Pile foundations, | Learning about different type of foundation | Lecture | CV1302.2 | Quiz, Exam |
| 16. | Pier foundations, | Learning about different type of foundation | Lecture | CV1302.2 | Quiz, Exam |
| 17. | Excavation of foundation. | Learning about different type of foundation | Lecture | CV1302.2 | Quiz, Exam |
| (E) Damp Proofing: | | | | | |
| 18. | Materials used for damp proofing, | Damp Proofing | Lecture | CV1302.2 | Quiz, Exam |
| 19. | Methods of preventing dampness. | Damp Proofing | Lecture | CV1302.2 | Quiz, Exam |
| (F) Brick Masonry: | | | | | |
| 20. | Terminology, Materials used, | Basic idea of brick masonry | Lab | CV1302.3 | Quiz, Exam |
| 21. | Causes of failure of brick masonry, | Basic idea of brick masonry | Lab | CV1302.3 | Quiz, Exam |
| 22. | Types of bonds, Brick laying, Reinforced brickwork. | Basic idea of brick masonry | Lab | CV1302.3 | Quiz, Exam |
| | <i>Activity3: Online Class Quiz-3</i> | | | | |
| | <i>Assignment: Based on Lectures 15 to 22</i> | | | | |
| (G) Stone Masonry: | | | | | |

| | | | | | |
|---|---|--|---------|----------|------------|
| 23. | Terminology used, Materials used, Cutting and dressing of stones, | Basic idea of stone masonry | Lecture | CV1302.1 | Quiz, Exam |
| 24. | Types of stone masonry-Rubble and Ashlar, Joints of stone, | Basic idea of stone masonry | Lecture | CV1302.1 | Quiz, Exam |
| 25. | Stone lining, maintenance of stone work, Artificial stones | Basic idea of stone masonry | Lecture | CV1302.1 | Quiz, Exam |
| (H) Types of Walls: | | | | | |
| 26. | Purpose and method of construction | | Lecture | CV1302.1 | Quiz, Exam |
| (I) Plastering, Painting and Flooring: | | | | | |
| 27. | Types, properties, White washing, | Learning about construction material | Lecture | CV1302.1 | Quiz, Exam |
| 28. | Color washing and distempering of walls | Learning about construction material | Lecture | CV1302.1 | Quiz, Exam |
| 29. | Plastic emulsion, Enamel and powder Coat painting of walls, | Learning about construction material | Lecture | CV1302.1 | Quiz, Exam |
| 30. | Painting of wood and metal works, | Learning about construction material | Lecture | CV1302.1 | Quiz, Exam |
| 31. | Granolithic, Concrete, Mosaic, material flooring, | Learning about construction material | Lecture | CV1302.1 | Quiz, Exam |
| 32. | Ceramic, Marble, Terrazzo and Synthetic material flooring, | Learning about construction material | Lecture | CV1302.1 | Quiz, Exam |
| (J) Roofs: | | | | | |
| 33. | Sloped roofs – Leaning roofs, Coupled and Collared roofs; | Learning about different type of roofs | Lecture | CV1302.2 | Quiz, Exam |

| | | | | | |
|-----|--|--|------------|-------------------------------------|------------|
| 34. | Timber trusses: King post and Queen post trusses; | Learning about different type of roofs | Lecture | CV1302.2 | Quiz, Exam |
| | Activity4: Online Class Quiz-4 | | | | |
| | Assignment: Based on Lectures 23 to 34 | | | | |
| (K) | Maintenance of Buildings: | | | | |
| 35. | Corrosion: Types and corrosion prevent method, | Learning about maintenance practices | Discussion | CV1302.4 | Quiz, Exam |
| 36. | Causes and prevention of cracks in building, | Learning about maintenance practices | Discussion | CV1302.4 | Quiz, Exam |
| 37. | Special repair of buildings, | Learning about maintenance practices | Discussion | CV1302.4 | Quiz, Exam |
| 38. | Annual maintenance | Learning about maintenance practices | Discussion | CV1302.4 | Quiz, Exam |
| | Activity5: Presentation on Project and Report Submission | | | | |
| (L) | Revision/Class Test: | | | | |
| 39. | Revision | Revision | Discussion | CV1302.1,CV1302.2,CV1302.3,CV1302.4 | NA |
| 40. | Revision | Revision | Discussion | CV1302.1,CV1302.2,CV1302.3,CV1302.4 | NA |



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

DEPARTMENT OF CIVIL ENGINEERING

Course Hand-out

Surveying | CVI303 | 4 Credits | 4004

Session: Jul 19-Nov 19 | Faculty: Alok Damare | Class: B.Tech Civil III SEM

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Core Course, it includes application of engineering mathematics and fundamental of physics. This course the build the capacity of the student in taking measurement on field, plot map/plan, set out work (i.e. building, tunnel, foundation etc.). Also offer them to work on advance instrument and software and deals with plane surveying and geodetic survey covering essential part of field.

B. **Course Outcomes:** At the end of the course, students will be able to:

1. Take measurement on the field.
2. Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings
3. Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship.
4. Make entry in field book.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write

effective reports and design documentation, make effective presentations, and give and receive clear instructions

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. SYLLABUS

Introduction: Overview and scope of the subject, Principle of surveying-methods-plane and geodetic survey-

Principle of Chain Surveying: Offsets, cross staff and principle of optical square- error in offsets- obstacle in chaining, Compass Survey- principle, prismatic compass, surveyor compass, bearing and included angles declination- local attraction- graphical adjustment of compass transverse-latitude and departures, Plane Table survey- method of computation of areas and volumes, areas calculation, volume calculation, Levelling - introduction- simple levelling-differential levelling- errors in levelling-curvature and refraction-sensitiveness of

bubble tube-cross sectioning, profile and reciprocal levelling. Contours: Introduction-application and uses-method-characteristics of planimeter, Theodolite Survey: introduction and description of theodolite-repetition and reiteration- trigonometric levelling; Study of Minor Instrument: Hand level, abney level, electronic theodolite, Ceylon ghat tracer, Indian pattern clinometer, box sextant. Tachometry: Principles, methods, analytic tachometer, distance and elevation formulae; Curves: Introduction, simple curve, compound curve, reverse curve, transition curve, lemniscate curve, vertical curve. Triangulation and Theory of Errors, Electronic Distance Measurement.

F. TEXT BOOKS

I. Punmia B.C., Surveying and Leveling Vol. I and II, Lakshmi Publishers, New Delhi 2005.

REFERENCE BOOKS

1. Subramanian R., Surveying and Levelling, Oxford University Press 2012.
2. Subramanian R., "Surveying and Levelling", Oxford University Press 2012.
3. Chandra A.M., Plane Surveying, New Age International Pvt. Ltd., 2011
4. Punmia B.C., Surveying Vol. I and II, Lakshmi Publications, New Delhi, 2005

G. Lecture Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|----------------------|--|-------------------------|------------------------------|-------------------------------|
| 1,2 | Introduction | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Lecture | CV1303.3 | NA |
| 3 | Introduction2 | Methods of measurement on the field. | Lecture | CV1303.2 | In Class Quiz |
| 4,5 | Linear Measurement 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Lecture | CV1303.3 | In Class Quiz End Term |
| 3 | Linear Measurement 2 | Take measurement on the field. | Lecture and field visit | CV1303.1 | |

| | | | | | |
|----|----------------------|--|-------------------------|----------|---|
| 4 | Linear Measurement 3 | Error measurement | Lecture and field visit | CV1303.2 | I st Sessional ET Exam Home Assignment |
| 5 | Linear Measurement 4 | Take measurement on the field. | Lecture | CV1303.1 | |
| 6 | Chain Surveying 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Lecture | CV1303.1 | |
| 7 | Chain Surveying 2 | Take measurement on the field. | Lecture and field visit | CV1303.1 | I st Sessional ET Exam Home Assignment |
| 8 | Chain Surveying 3 | Error measurement | tutorial | CV1303.2 | |
| 9 | Chain Surveying 4 | Learn and understand working of basic and advance instrument | Lecture | CV1303.1 | |
| 10 | Chain Surveying 5 | Error measurement | tutorial | CV1303.2 | I st Sessional ET Exam Home Assignment |
| 11 | Chain Surveying 6 | Error measurement | Lecture | CV1303.2 | |
| 12 | Compass Surveying 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Lecture | CV1303.3 | |
| 13 | Compass Surveying 2 | Error measurement | Lecture | | I st Sessional |

| | | | | | |
|----|---------------------|--|-------------------------|----------|---|
| 14 | Compass Surveying 3 | Error measurement | Lecture and field visit | CV1303.2 | ET Exam Home Assignment |
| 15 | Compass Surveying 4 | Take measurement on the field. | tutorial | CV1303.1 | 1 st Sessional ET Exam Home Assignment |
| 16 | Theodolite 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Lecture | CV1303.3 | |
| 17 | Theodolite 2 | Take measurement on the field. | Lecture | CV1303.4 | |
| 18 | Theodolite 3 | Take measurement on the field. | Lecture | CV1303.1 | 1 st Sessional ET Exam Home Assignment |
| 19 | Levelling 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. | Lecture | CV1303.3 | |
| 20 | Levelling 2 | Make entry in field book. | Lecture | CV1303.4 | |
| 21 | Levelling 3 | Take measurement on the field. | Lecture and field visit | CV1303.1 | 1 st Sessional ET Exam Home Assignment |
| 22 | Levelling 4 | Take measurement on the field. | tutorial | CV1303.1 | |
| 23 | Levelling 5 | Take measurement on the field. | Lecture | CV1303.1 | |
| 24 | Contouring 1 | Make entry in field book. | Lecture | CV1303.4 | |

| | | | | | |
|----|---------------------------------------|--------------------------------|-------------------------|-----------------|---|
| 25 | Contouring 2 | | Lecture and field visit | CV1303.1 | 2 nd Sessional ET Exam Home Assignment |
| 26 | | Make entry in field book. | tutorial | CV1303.4 | |
| | Plane Table 1 | | | | |
| 27 | Plane Table 2 | Make entry in field book. | Lecture | CV1303.4 | 2 nd Sessional ET Exam Home Assignment |
| 28 | Theory Of Errors 1 | Take measurement on the field. | Lecture | CV1303.1 | |
| 29 | | Make entry in field book. | Lecture and field visit | CV1303.4 | |
| | Theory Of Errors 2 | | | | |
| 30 | Traverse Computation And Adjustment 1 | Take measurement on the field. | tutorial | CV1303.1 | 2 nd Sessional ET Exam Home Assignment |
| 31 | Traverse Computation And Adjustment 2 | Take measurement on the field. | tutorial | CV1303.1 | |
| 32 | | Take measurement on the field. | Lecture | CV1303.1 | |
| | Measurement Of Area And Volume 1 | | | | |
| 33 | Measurement Of Area And Volume 2 | Error measurement | tutorial | | 2 nd Sessional ET Exam Home Assignment |
| 34 | Circler Curve 1 | Setting circular curve | of tutorial | CV1303.1 | |
| 35 | | Setting circular curve | of Lecture | CV1303.1 | |
| | Circler Curve 2 | | | | |

| | | | | | |
|-----------------------|--------------------------|---|----------|----------|---|
| 36 | Transition Curve 1 | Setting of circular curve | Lecture | CV1303.1 | 2 nd Sessional ET Exam Home Assignment |
| 37 | Transition Curve 2 | Take measurement on the field. | Lecture | CV1303.1 | |
| 38 | | Take measurement on the field. | tutorial | CV1303. | |
| | Trigonometric Leveling 1 | | | | |
| 39 | Trigonometric Leveling 2 | Take measurement on the field. | tutorial | CV1303.1 | 2 nd Sessional ET Exam Home Assignment |
| 40 | Tachometric Surveying 1 | Take measurement on the field. | Lecture | CV1303.1 | |
| 41 | | Take measurement on the field. | tutorial | CV1303.1 | |
| | Tachometric Surveying 2 | | | | |
| SECOND SESSIONAL EXAM | | | | | |
| 42 | Triangulation 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. | Lecture | CV1303.3 | |
| 43 | Triangulation 2 | Take measurement on the field. | tutorial | CV1303.1 | |
| 44 | Photogrammetry 1 | Learn and understand working of basic and advance instrument to perform different exercises on the field. | tutorial | CV1303.3 | |
| 45 | Photogrammetry 2 | Take measurement on the field. | Lecture | CV1303.1 | |
| 46 | Remote Sensing | Learn and understand working of basic and advance instrument to perform different exercises on the field. | Lecture | CV1303.3 | |
| 47 | GPS And GIS | Learn and understand working of basic and advance instrument to | Lecture | CV1303.3 | |

| | | | | | |
|----------------------|-----|---|---------|-----------------|--|
| | | perform different exercises on the field. | | | |
| 48 | | Learn and understand working of basic and advance instrument to perform different exercises on the field. | Lecture | CV1303.3 | |
| | EDM | | | | |
| | | | | | |
| | | | | | |
| END TERM EXAM | | | | | |

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| [CV1303.1] | Take measurement on the field. | 2 | | | 2 | 3 | 1 | | 2 | 3 | 1 | | | | 3 | 2 | 1 |
| [CV1303.2] | Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings | | 3 | 1 | 3 | | | | | | | | | | 3 | | |
| [CV1303.3] | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | | | | | 3 | | | | | | | 2 | | 3 | | 2 |
| [CV1303.4] | Make entry in field book. | 3 | | | | | | | 3 | | | 2 | | 3 | | | |

I-Low Correlation; 2- Moderate
Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Engineering Geology| CV1304 | 4 Credits | 4004

Session: July – December 2019 | Faculty: Dr Harshavardhana B G | Class: Regular

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Regular Course, targeting students, wishing to pursue research and development in Construction Industries or higher studies in field of Civil Engineering. This course is developed to study the origin and evolution of earth, rocks, minerals, geological structures, geomorphic features, causes and remedies of geological hazards. An emphasis has been given to understand and minimise the possible problems to the civil engineering structures, originating from the geological conditions. Students are expected to have the basic knowledge of Geology for a better learning.

B. **Course Outcomes:** At the end of the course, students will be able to

[CV1304.1]. Apply the fundamental knowledge of rocks, minerals, and geological structures while analysing / identifying and addressing the complex engineering problems when planning for building construction, which would enhance the employability.

[CV1304.2]. Discern different geological processes, causing a variety of rock structures that may be disastrous to public health and safety and help in developing suitable solutions to civil constructions.

[CV1304.3]. Apprehend the importance and application of geophysical instruments / techniques in engineering geology to design as well as construct a safe, strong, durable and economically sustainable engineering structures.

[CV1304.4]. Explore the impact of various geological structures on civil constructions. Students can demonstrate the knowledge by participating in class debates and presentations on various topics of environmental concern with effective communication for a better entrepreneurship.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
 2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
 3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
 4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Closed Book) | 15 |
| | Sessional Exam II (Closed Book) | 15 |
| | In class Quizzes (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Closed Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Student who misses a class will have to report to the teacher about the absence. A makeup assignment (which will be considered only for attendance) on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. SYLLABUS

Introduction: Overview and scope of the subject, Geology and its role in Civil Engineering, Earth as a planet, its internal structure and composition.

Mineralogy: Description and identification of rock-forming minerals and Ores, their physical and special properties; Olivine, Augite, Hornblende, Mica group, Feldspar group, Quartz and its varieties. Carbonate group, Asbestos, Kaolin, Talc, Gypsum, Garnet, Corundum, Magnetite, Hematite, Limonite, Pyrite, Chalcopyrite, Galena and Bauxite.

Petrology: Definition, sources of rocks, classification of rocks based on mode of formation, rock-cycle. Identification and description. Igneous rocks: Granite, Syenite, Diorite, Gabbro, Dunite; Pegmatite, Porphyries, Dolerite; Rhyolite, Basalt and Pumice. Sedimentary rocks: Primary structures and description of Sandstones, Conglomerate, Breccia, Shale, Limestones and Laterite. Metamorphic rocks: Gneiss, Quartzite, Marble, Slate, Phyllite and Schists, Rock as building material.

Structural Geology: Definition, outcrop, dip and strike of a rock-bed, clinometer and compass. Folds, joints, faults, and unconformity, their recognition and importance in Civil Engineering field investigation.

Physical Geology: Weathering of rocks, types of weathering, agencies, causes and products of weathering. Origin and development of river systems, erosion, transportation and deposition by rivers, geological action of wind and its geomorphic features.

Hydrogeology: Hydrological cycle, distribution of ground water in the earth crust, types and properties of water bearing geological formation, selection of sites for well locations, techniques of ground water exploration, artificial recharge of groundwater methods, rain water harvesting. Sea water intrusion and remedial measures.

Geodynamics: Plate tectonics, earthquake, seismic waves, magnitude and intensity scales, earthquake-recording instruments, characteristics of strong ground motions and attenuation, earthquake occurrence in the world, seismic zoning map of India and its use. Tsunami and landslides, causes, effects and remedial measures.

Engineering Geology: Geological considerations in selection of sites for Dams, Reservoirs, Tunnels, Bridges and Highways.

F. TEXT BOOKS

1. Singh, P. (2013). Engineering and General Geology, Published by S. K. Kataria and Sons, New Delhi.
2. Mukherjee, P. K. (2005). A Text Book of Geology, World Press, Kolkata.
3. Reddy, D. V. (2012). Engineering Geology for Civil Engineering, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

G. REFERENCE BOOKS

1. Bell, F. G. (2007). Engineering Geology, Butterworth-Heinemann, 2nd Edition, 592 P.
2. Blyth, F. G. H. and de Freitas, M. H. (2006). Butterworth-Heinemann, 7th Edition, 325 P.

Lecture Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|---|---|--|------------------------------|-------------------------------|
| 1 | Introduction to Geology and its role in Civil Engineering, the Basics of Earth as a planet, its internal structure and composition. | Understanding the Basics of Geology for Civil Engineering | Lecture | CV1304.1 | |
| 2 | Description and identification of rock-forming minerals and Ores. | Familiarization of | | | |
| 3 | Physical and special properties of minerals. | mineral samples and their physical properties | Lecture with mineral hand-specimen for | | |

| | | | | | |
|----|---|--|--|----------|----------------------|
| 4 | Physical and special properties of Olivine, Augite and Hornblende. | | familiarization | | Quiz, MTE-I and ETE |
| 5 | Physical and special properties of Mica and Feldspar group of minerals. | | | CV1304.1 | |
| 6 | Physical and special properties of Quartz and its varieties. | | | | |
| 7 | Physical and special properties of Carbonate group, Asbestos, Kaolin, Talc and Gypsum. | | | | |
| 8 | Physical and special properties of Garnet, Corundum, Magnetite and Hematite. | Familiarization of mineral samples and their physical properties | Lecture with mineral hand-specimen for familiarization | CV1304.1 | Quiz, MTE-I and ETE |
| 9 | Physical and special properties of Limonite, Pyrite and Chalcopryite. | | | | |
| 10 | Physical and special properties of Pyrolusite and Psilomalane. | | | | |
| 11 | Physical and special properties of Chromite, Galena and Bauxite | | | | |
| 12 | Definition and sources of rocks. | | | | |
| 13 | Classification of rocks based on mode of formation and rock-cycle. | | | | |
| 14 | Identification and description of Igneous rocks. | | | | |
| 15 | Description of Granite, Rhyolite and Syenite. | | | | |
| 16 | Description of Diorite, Basalt and Gabbro. | | | | |
| 17 | Description of Dunite, Pegmatite and Dolerite. | | | | |
| 18 | Description of Porphyries and Pumice. | | | | |
| 19 | Formation and classification of Sedimentary rocks, primary structures and their description. | Familiarization of different types of rocks samples and their properties | Lecture with rock hand-specimen for familiarization | CV1304.1 | Quiz, MTE-II and ETE |
| 20 | Formation and description of Sandstones, Conglomerate, Breccia, Shale, Limestones and Laterite. | | | | |
| 21 | Formation and classification of Metamorphic rocks. | | | | |

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|----|---|---|---------------------------------------|-----------------------|----------------------|
| 22 | Description of Gneiss, Quartzite, Marble and Slate. | | | | |
| 23 | Description of Phyllite and Schists. | | | | |
| 24 | Rock as building material. Rocks as a building material. | | | | |
| 25 | Introduction to Structural Geology, outcrop, dip and strike of a rock-bed, clinometer and compass. | Understanding the basics of the rock-alignment/attitude in the field | Lecture, introducing the instrument | | |
| 26 | Definition of primary and secondary structures: Folds; formation, classification and their significance in civil engineering. | | | | |
| 27 | Joints; formation, classification and their significance in civil engineering. | Understanding the basics of geological structures important for Civil Engineers | Lecture | CV1304.1 | |
| | Faults formation, classification and their significance in civil engineering. | | | | |
| 28 | Unconformity; formation, classification and their recognition and importance in Civil Engineering field investigation. | | | | Quiz, MTE-II and ETE |
| 29 | Introduction to Geodynamics, Plate Tectonics, earthquake, seismic waves, magnitude and intensity scales. | | | | |
| 30 | Earthquake-recording instruments, characteristics of strong ground motions and attenuation. | Knowing the internal and external dynamism of the earth | Lecture with videos of real instances | CV1304.1 and CV1304.2 | |
| 31 | Earthquake occurrence in the world, seismic zoning map of India and its use. | | | | |
| 32 | Tsunami and landslides, causes, effects and remedial measures. | | | | |
| 33 | Physical Geology: Weathering (deterioration) of rocks, types of weathering and their agencies. | | | | |
| 34 | Causes and products of weathering. | | | | |
| 35 | Origin and development of river systems, erosion, transportation and deposition by rivers. | Knowing the external | Lecture with videos of real instances | CV1304.1 and CV1304.2 | Quiz and ETE |

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|----|--|-----------------------|--|--|--|
| 36 | Geological action of wind and its geomorphic features. | dynamism of the earth | | | |
|----|--|-----------------------|--|--|--|

Page Break

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|--------|---|---|---|---------------------------------|--------------|
| 37 | Introduction to Hydrogeology, Hydrological cycle and distribution of ground water in the earth crust. | | | | |
| 38 | Types and properties of water bearing geological formation. | Understanding the basics of water-bearing rock formations, technique to recharge and exploration of groundwater | Lecture with videos of real instances | CV1304.1, CV1304.2 and CV1304.3 | |
| 39 | Selection of sites for well locations. | | | | |
| 40 | Techniques of ground water exploration | | | | |
| 41 | Artificial recharge of groundwater methods, rain water harvesting. | | | | |
| 42 | Rain water harvesting. | | | | |
| 43 | Sea water intrusion and remedial measures. | Knowing the importance of coastal dynamism with respect to the groundwater | Lecture | | |
| 44 | Application of Engineering Geology in civil engineering projects, Geological considerations in selection of sites for Dams. | Understanding the application of geological knowledge in civil construction | Lecture with interactive sessions with students | CV1304.4 | Quiz and ETE |
| 45 | Geological considerations in selection of sites for reservoirs. | | | | |
| 46 | Geological considerations in selection of sites for tunnels. | | | | |
| 47 | Geological considerations in selection of sites for bridges. | | | | |
| 48 | Geological considerations in selection of sites for highways. | | | | |
| 49, 50 | Revision; emphasizing the significance of geological structures in civil engineering construction | | | | |

H. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1304.1 | Apply the fundamental knowledge of rocks, minerals, and geological structures while analysing / identifying and addressing the complex engineering problems when planning for sustainable building construction. | 3 | 3 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 3 | 1 |
| CV1304.2 | Discern different geological processes, causing a variety of rock structures that may be disastrous to public health and safety and help in developing suitable solutions to civil constructions. | 3 | 3 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 3 |
| CV1304.3 | Apprehend the importance and application of geophysical instruments / techniques in engineering geology to design as well as construct a safe, strong, durable and economically sustainable engineering structures. | 3 | 1 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 3 | 1 |



| | | | | | | | | | | | | | | | | | |
|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CV1304.4 | Explore the impact of various geological structures on civil constructions. Students can demonstrate the knowledge by participating in class debates and presentations on various topics of environmental concern with effective communication. | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 2 | 3 | 1 | 3 | 1 | 3 | 2 | 3 |
|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

DEPARTMENT OF CIVIL ENGINEERING

Course Hand-out

Surveying Practice | CVI330 | 1 Credits | 0 0 3 |

Session: Jul 19-Nov 19 | Faculty: Alok Damare | Class: B.Tech Civil III SEM

- A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Core Course, it includes application of engineering mathematics and fundamental of physics. This course the build the capacity of the student in taking measurement on field, plot map/plan, set out work (i.e. building, tunnel, foundation etc.). Also offer them to work on advance instrument and software and deals with plane surveying and geodetic survey covering essential part of field.
- B. **Course Outcomes:** At the end of the course, students will be able to:
1. Take measurement on the field.
 2. Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings
 3. Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship.
 4. Make entry in field book.
- C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
 2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
 3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks | |
|--|---|---------------|-----|
| Internal Assessment (Summative) Internal Assessment (Viva, Lab performance, Lab book maintenance, Punctuality in lab) 60 | Internal Assessment (Summative) Internal Assessment (Viva, Lab performance, Lab book maintenance, Punctuality in lab) | 60 | |
| | End Term Exam (Summative) | End Term Exam | 40 |
| | | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | | |
| Make up Lab Experiments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup laboratory experiment will be performed on the topic taught on the day of absence and it will have to be performed within two weeks from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 3 throughout the entire semester. | | |

E. SYLLABUS

Chain survey- To conduct direct and indirect ranging, Construction of Geometric figures using chain and tape - triangle, pentagon, trapezium, and hexagon. To erect perpendicular from a given point using, Chain tape and Cross staff. Compass Survey-Study of compass and construction of regular pentagon and hexagon, Construction of a quadrilateral, Distance b/w two inaccessible points. Plane table surveying -Radiation and intersection methods, Solving three point problem by Bessel's solution, Plane table traversing. Levelling Study of instrument, Simple levelling, Height of instrument method, Rise and fall method including inverted staff reading, To find difference in level b/w two points by reciprocal levelling. Theodolite -Study of the instrument, Method of repetition, Method of reiteration, Measurement of vertical angles, to find RL when base of object is inaccessible, single plane method, double plane method, Distance b/w inaccessible points, Theodolite Traversing.

F. TEXT BOOKS

I. Punmia B.C., Surveying and Leveling Vol. I and II, Lakshmi Publishers, New Delhi 2005.

REFERENCE BOOKS

1. Subramanian R., Surveying and Levelling, Oxford University Press 2012.
2. Subramanian R., "Surveying and Levelling", Oxford University Press 2012.
3. Chandra A.M., Plane Surveying, New Age International Pvt. Ltd., 2011
4. Punmia B.C., Surveying Vol. I and II, Lakshmi Publications, New Delhi, 2005

G. Lecture Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|--|--|------------------|------------------------------|-------------------------------|
| 1 | Introduction to surveying practice Lab-I | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | lecture | | NA |
| 2 | To measure the distance between two points on a level ground by ranging | Make entry in field book. | Practice lab | CV1330.4 | Field visit viva |
| 3 | To measure the area of the given field by chain | Analyse the problem and solution for all possible challenge on the field. Plan a survey appropriately with the skill to understand the surroundings | Practice lab | CV1330.2 | Field visit viva |
| 4 | Chaining a line when a hill or high ground intervenes preventing intervisibility of ends of line | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Practice lab | CV1330.4 | Field visit viva |
| 5 | To determine the magnetic bearing of line and adjustment of included angles using a compass | Analyse the problem and solution for all possible challenge on the field. Plan a survey appropriately with the skill to understand the surroundings | Practice lab | CV1330.2 | Field visit viva |
| 6 | To prepare the map of given area by plane table survey | Learn and understand working of basic and advance instrument to | Practice lab | CV1330.4 | Field visit viva |

| | | | | | |
|----|---|--|--------------|-----------------|------------------|
| | | perform different exercises on the field. Which create employability and entrepreneurship. | | | |
| 7 | Two point problem using plane table | Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings | Practice lab | CV1330.2 | Field visit viva |
| 8 | To determine the reduce level and carry out profile levelling and plot longitudinal and | Make entry in field book. | Practice lab | CV1330.4 | Field visit viva |
| 9 | to determine the RL of a point wrt MSL | Make entry in field book. | Practice lab | CV1330.4 | Field visit viva |
| 10 | 10 to determine the floor height by Autolevel. | Make entry in field book. | Practice lab | CV1330.4 | Field visit viva |
| 11 | To find difference in level b/w two points by reciprocal levelling | Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings | Practice lab | CV1330.2 | Field visit viva |
| 12 | To prepare a contour map of given area | Make entry in field book. | Practice lab | CV1330.4 | |
| 13 | to determine the hight of tower by using theodolite. | Make entry in field book. | Practice lab | CV1330.4 | |
| 14 | to determine Distance and elevation by total station | Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings | Practice lab | CV1330.4 | |
| 15 | To set out a simple curve. | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | Practice lab | CV1330.4 | |

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

| | | CORRELATION WITH PROGRAM OUTCOMES | CORRELATION WITH PROGRAM |
|--|--|-----------------------------------|--------------------------|
|--|--|-----------------------------------|--------------------------|



| CO | STATEMENT | | | | | | | | | | | | | 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 |
| [CV1330.1] | Take measurement on the field. | 2 | | | 2 | 3 | 1 | | 2 | 3 | 1 | | | | 3 | 2 | 1 |
| [CV1330.2] | Analyse the problem and solution for all possible challenge on the fieldPlan a survey appropriately with the skill to understand the surroundings | | 3 | 1 | 3 | | | | | | | | | | 3 | | |
| [CV1330.3] | Learn and understand working of basic and advance instrument to perform different exercises on the field. Which create employability and entrepreneurship. | | | | | 3 | | | | | | | 2 | | 3 | | 2 |
| [CV1330.4] | Make entry in field book. | 3 | | | | | | | 3 | | | 2 | | 3 | | | |



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Material Testing Lab-I | CVI33I | 1 Credits | 0021

Session: Aug 19 – Nov 19 | Faculty: Sourav Kumar Das | Class: B.Tech Civil III SEM

- A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Lab Course, targeting students to perform different basic test on the properties of material. It introduces the students to basic theory and concepts of strength of material. Students will learn how to perform the test and what are the resemblance of a particular test to the practical use of it in the field.
- B. **Course Outcomes:** At the end of the course, students will be able to:
1. Understanding the concept of the different properties of materials
 2. Applying the concept to determine their properties
 3. Enhance entrepreneurship skill
 4. Analysing and applying the properties will lead to employability
 5. Skills to work in groups or independently
- C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**
1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
 2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
 3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
 4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|-------------------------------------|---|---------------|
| Internal Assessment (Summative) | Internal Assessment (Viva, Lab performance, Lab book maintenance, Punctuality in lab) | 60 |
| End Term Exam (Summative) | End Term Exam | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Lab Experiments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup laboratory experiment will be performed on the topic taught on the day of absence and it will have to be performed within two weeks from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 3 throughout the entire semester. | |

E. SYLLABUS

Tension test on mild steel, Compression test on cast iron, Compression test on timber, Shear test on mild steel specimen, Torsion test on mild steel specimen, Rockwell hardness test, Brinell's Hardness test, Impact tests: a) Izod b) Charpy, Bending test on wood, Fatigue test (Demonstration), Test on Bricks - Compressive Strength, Absorption, Efflorescence, Tests on Flooring and Roofing Tiles: Wear resistance (Dorry's abrasion Test), Knife Edge Load Absorption, Tests on Bitumen: Specific Gravity, Viscosity, Softening Point, Flash and Fire Point, Ductility, Penetration Value.

F. REFERENCE BOOKS

- I. Suryanarayana A.V.K., Testing of Metallic Materials, Prentice Hall of India, New Delhi, 1990.
- II. Khanna & Justo, Highway Materials Testing, Nemchand, New Chand, 1989.
- III. Technical Teachers, Training Institute, Laboratory Manual of Strength of Materials, Oxford University Press, 1983.

G. Lecture Plan:

| Lecture Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|----------------|--------|-----------------|------------------|------------------------------|-------------------------------|
| | | | | | |

| | | | | | |
|----|---|---|---------------|--|----------------------|
| 1 | Introduction | Introduction to Material Testing Lab-I | Lab Practical | CV1331.1 | NA |
| 2 | Determination of bending stress and young's modulus | To determine the Bending stress and Young's Modulus of elasticity of a material of beam simply supported at ends and carrying a concentrated load at the centre. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 3 | Hardness test | To determine Brinell & Rockwell Hardness Number of a metallic specimen. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 4 | Toughness test | To determine the toughness of a Mild Steel specimen by Charpy & Izod Impact test | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 5 | Test on wood | To find the Compressive Strength and Material Properties of a wood specimen by conducting Compression Test on CTM. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 6 | Shear strength test | To determine the shear strength of a mild steel specimen by Single and Double Shear Test on UTM. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 7 | Tensile strength test | (i) To study the behaviour of mild steel specimen under the action of gradually increasing load tested up to failure. (ii) To determine yield stress, ultimate tensile strength, modulus of elasticity and Poisson's ratio. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 8 | Torsion test | To determine the modulus of rigidity of a solid circular rod by conducting Torsion Test. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 9 | Test on ceramic tiles | To determine the breaking load of Ceramic flooring tiles. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 10 | Test on roof tiles | To determine the percentage of water absorption of roofing tiles. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 11 | Test on Bitumen | To measure the ductility of a given sample of bitumen | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 12 | | To determine the flash and fire point of bitumen | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
| 13 | | To determine the softening point of bitumen/ tar. | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |

| | | | | | |
|----|--------------------|--|---------------|---|----------------------|
| 14 | Test on clay brick | To determine the percentage of water absorption of bricks and its Compressive strength | Lab Practical | CV1331.2, CV1331.3, CV1331.4, CV1331.5 | Daily Lab Assessment |
|----|--------------------|--|---------------|---|----------------------|

H. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 | |
| CV CV1331.1 | Understanding the concept of the different properties of materials | 3 | 2 | | | | | | | | | | 3 | 1 | 1 | | | |
| CV CV1331.2 | Applying the concept to determine their properties | 3 | 2 | | | | 1 | | | | | | 3 | 3 | 3 | 2 | 1 | |
| CV CV1331.3 | Enhance entrepreneurship skill | | 2 | 2 | | 3 | 3 | | | | | | 3 | | 1 | | 3 | |
| CV CV1331.4 | Analysing and applying the properties will lead to employability | | 3 | 3 | | 3 | 2 | | | | | | 3 | 2 | 3 | | 3 | |
| CV CV1331.5 | Skills to work in groups or independently | | | | | | | | | 3 | | | 3 | | | 3 | 3 | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Value, Ethics & Governance BBI101 [2 Credits] [2 0 0 2]

Session: Aug - Nov, 2019 | Faculty: Dr. Manvendra Singh Pahwa | Class: III SEM

Introduction: The course is offered to understand Moral Values and Ethics in personal as well as professional life. It is basic requirement of every human to be a good human being and a good citizen. It further imparts him basics of corporate governance so as to empower him to work technically and professionally in any organization with confidence and conviction and at the same time with honesty & integrity.

A. Course Objectives: At the end of the course, students will be able to

| | |
|----------|---|
| BB1101.1 | Define the meaning and relevance of Value and Ethics and apply in personal & professional life |
| BB1101.2 | Describe the importance of three Gunas for self-development, lifelong learning & growth. |
| BB1101.3 | Find issues and identify solutions related to Public & Private Governance systems. |
| BB1101.4 | Explain the relevance of Company's Act 2013 with reference to corporate world. |
| BB1101.5 | Explain the role and key objectives of organizational governance in relation to ethics and law. |
| BB1101.6 | Demonstrate the social & environmental responsibilities of corporate for sustainability, harmon and growth. |

B. Program Outcomes and Program Specific Outcomes

PROGRAM OUTCOMES

- [PO.1]. **Engineering knowledge:** Demonstrate and apply knowledge of Mathematics, Science and Engineering to classical and recent problems of electronic design & communication system.
- [PO.2]. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- [PO.3]. **Design/development of solutions:** Design a component system, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

- [PO.4]. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- [PO.5]. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- [PO.6]. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- [PO.7]. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- [PO.8]. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
- [PO.9]. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- [PO.10]. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- [PO.11]. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environment.
- [PO.12]. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAM SPECIFIC OUTCOMES

- [PSO.1]. An ability to understand the concepts of basic Electronics & Communication Engineering and to apply them to various areas like signal processing, VLSI, Embedded systems, Communication Systems, Digital & Analog Devices, etc.

- [PSO.2]. An ability to solve complex Electronics Communication Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.
- [PSO.3]. Wisdom of social and environmental awareness along with ethical responsibility to have a successful career and to sustain passion and zeal for real applications using optimal resources as an Entrepreneur.

C. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|----------------------|
| Internal Assessment (Summative) | Mid Sem Exam I (Close Book) | 15 |
| | Mid Sem Exam II (Close Book) | 15 |
| | In class Quizzes/ Assignments Students' Presentations | 20(Min 5 each) 10 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

D: Syllabus:

Values: Relevance of Value Education in day-to-day life. Mantra for success - Value, Moral and Ethics.

Determinants of human nature (Three Gunas) and its impact on human life.

Relevance of traits like Personality, Attitude, Behaviour, Ego, Character, introspection, Motivation, Leadership and 4 Qs with relevant Case Studies*.

Governance: Understanding of Public and Private sector Governance systems; Courts & CAG.

Public Sector Governance: Need, relevance, stakeholders.

Private Sector Governance: Proprietary, Partnership, Company (Pvt Ltd & Ltd), Company' Act

2013, Board of Directors; its Roles and Responsivities. Regulatory bodies; its role in ethical governance.

Projects on PPP mode-relevance & prospects.

CSR: Relationship with Society, Philanthropy and Business strategy, CSR Policy, Triple Bottom Line

Text / Reference Books:

1. Professional Module of ICSI.
2. Ghosh B.N., Business Ethics & Corporate Governance, McGraw Hill.
3. Mandal S.K., Ethics in Business & Corporate Governance, McGraw Hill .
4. Ray C.K., Corporate Governance, Value & Ethics, Vaya Education of India
5. Chatterjee Abha, Professional Ethics, Oxford Publications.

***Suggestive Case Studies:**

- 1) Uphar Theatre Tragedy- Engineering Ethics
- 2) Bhopal Gas Tragedy- Operational Engineering Ethics
- 3) Satyam Case- Financial Reporting Ethics
- 4) Enron Case- Business Ethics
- 5) Neerav Modi Case- Financial Fraudulence cases

D. Lecture Plan:

| Lec No | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing the Outcome |
|--------|--|---|--------------------------|------------------|---|
| 1 | Introduction: Values: Meaning & Relevance of value education | To acquaint and clear teacher's expectations and understand student expectations. Basics of Value Education | Lecture | BB 1101.1 | In class Quiz Mid Term I End Term E |
| 2 | Success: Meaning in perspective of morals & ethics | To understand the concept of success achieved with or without morals / ethics/ values | Lecture, case study | BB 1101.1 | In class Quiz Mid Term I End Term E |
| 3,4 | Professional Ethics & ethical dilemmas Case study-Neerav Modi | To understand the role of professional ethics in the life & deal with dilemmas | Lecture | BB 1101.1 | In class Quiz assignment Mid Term I End Term E |
| 5 | Three Gunas and their relevance, Nature and kinds of value with examples | Understand basic traits in one's personality, its causes and relevance with value based living. | Lecture | BB 1101.2 | In Class Quiz Mid Term I End Term |
| 6,7 | Relevance of traits of individual like Personality, Attitude, Behaviour | To acquaint & develop positive traits of personality in oneself | Short stories, Lecture | BB 1101.2 | Class Quiz assignment Mid Term I End Term |
| 8,9 | Ego, Character, introspection, Motivation | To acquaint & develop positive traits of personality in oneself and understand negative traits | Lecture Short stories | BB 1101.2 | In Class Quiz Mid Term I End Term |
| 10,11 | Leadership traits & 4Qs (PQ, IQ, | To realize importance of | Lecture | BB | In Class Quiz |

| | | | | | |
|--------|---|--|--------------------------|--------------------------|---|
| | EQ, SQ) | leadership and to imbibe in life | Short stories | 1101.2 | assignment Mid Term I End Term |
| 12,13 | Governance & its relevance Case studies- Bhopal Gas & Uphar Cinema | To acquaint with the concept of Governance | Lecture | BB 1101.3 | In Class Quiz Mid Term I End Term |
| 14 | Public Sector Governance: Need, relevance, stakeholders | Understand various aspects of public sector governance | Lecture | BB 1101.3 | Class Quiz, Mid Term I End Term |
| 15 | Public Finance, Audit & Control | Understand basics of Public Finance, Check & balance | Lecture Case study | BB 1101.3 | Class Quiz, assignment Mid Term I End Term |
| 16,17 | Private Sector Governance, proprietary & partnership firms and corporate, PPP mode projects | Understand meaning of proprietary & partnership in a firm / company and perspective in PPP mode | Lecture Short stories | BB 1101.3 & 1101.4 | Class Quiz Mid Term I End term |
| 18, 19 | Company' Act 2013 : Roles & Responsibilities of Directors & regulatory authorities | Explain various Regulations and practices of Corporate Governance internationally & understand key role of directors | Lecture | BB 1101.4 | Class Quiz Mid Term I End Term |
| 20,21 | Role of Ethics in Governance Case studies- Satyam & Enron | Recognize the necessity of ethics & transparency in Governance | Movie : Gandhi | BB 1101.5 | Class Quiz, assignment Mid Term I End Term |
| 22,23 | CSR: Relationship with Society, Philanthropy and Business strategy | To understand the relevance of giving back to society by a corporate & its importance in society | Lecture, case study | BB 1101.6 | Class Quiz, End Term |
| 24 | CSR Policy, Triple Bottom Line | Understand the concept of TBL in organizational frameworks | Lecture case study | BB 1101.6 | Class Quiz assignment End Term |
| 25,26 | Students' Presentation | Recall contents and their importance through case studies. | Flipped Class | ALL | Class Quiz End Term |

Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | |
|------|----------------------------------|-----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|--------------|--------------|--|-------------|
| | | P O 1 | P O 2 | P O 3 | P O 4 | P O 5 | P O 6 | P O 7 | P O 8 | P O 9 | P O 10 | P O 11 | P O 12 | P O 1 | P O 2 |
| BB11 | Define the meaning and relevance | | | | | | 1 | | 2 | | | | | | |



| | | | | | | | | | | | | | | | |
|--------------|--|--|--|--|--|--|---|---|---|---|---|---|---|--|--|
| 01.1 | of Value and Ethics and apply in personal & professional life. | | | | | | | | | | | | | | |
| BB11 01.2 | Describe the importance of three Gunas for self-development, lifelong learning & growth. | | | | | | 1 | | 2 | 1 | 1 | | 2 | | |
| BB11 01.3 | Find issues and identify solutions related to Public & Private Governance systems. | | | | | | 1 | 1 | | 1 | 2 | | | | |
| BB11 01.4 | Explain the relevance of Company's Act 2013 with reference to corporate world. | | | | | | 1 | | 1 | 1 | | | | | |
| BB11 01.5 | Explain the role and key objectives of organizational governance in relation to ethics and law. | | | | | | 1 | | 2 | 1 | | | 1 | | |
| BB11 01.6 | Demonstrate the social & environmental responsibilities of corporate for sustainability, harmony and growth. | | | | | | 1 | 3 | | | | 1 | 1 | | |

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Important Dates for Jan-May 2019 session



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Fluid Mechanics-II |CV1401| 3 Credits | 3 0 0 3

Session: Jan, 2020 – June 2020| Faculty: Dr. Parwez M. Akhtar | Class: 3rd Semester B.Tech(Civil)

A. INTRODUCTION: This course is offered by Dept. of Civil Engineering as an 4th semester course, targeting students who want to pursue a career particularly in the broad domain of hydraulics, water and water resources related technology and management and to extent for those who intends to pursue higher studies in the field of fluid dynamics related sciences and engineering, such as river mechanics and morpho-dynamics, computational hydraulics, environment and eco-hydraulics, water supply and waste water distribution network, water quality management, Ocean and sea shore engineering, Navigation and related engineering, Climate modelling, etc. This is a beginners as well as preliminary course as such only fundamentals of fluid properties and behaviour aspects with a goal of developing a systematic report on the Applied Engineering Fluid Mechanics is taught. Understanding of applied and exposure to advance fluid mechanics, free surface flows, boundary layer theory, prominent hydraulic machinery namely turbines and pump are in general basic components of the course. This course is fundamentally multi-disciplinary engineering course, as such participating students are expected to have a strong background knowledge of basics sciences such as physics and applied mathematics as well as preliminary theoretical fluid mechanics.

B. COURSE OUTCOMES: At the end of the course, students will be able to:

[CV1401.1]. Understand and comprehend the basic concept and importance of open channel flow including preliminary design and analysis of systems apparatus involving application and evaluation and enhance employability.

[CV1401.2]. Understand and comprehend various practical flow condition encountered in real world such as hydraulic jump/ varied flow of fluid motion through knowledge of mathematics/science/fundamentals and solution of complex engineering problems. Critical review and analysis

[CV1401.3]. To Understand/comprehend and be able to solve Boundary layer Theory and application

[CV1401.4]. Over view and understand hydraulic machinery processes for turbines and pumps their design, application and be able to evaluate their performances.

[CV1401.5]. be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks to promote entrepreneurship.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. PROBLEM ANALYSIS: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including preliminary prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1]. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

[PSO.2]. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

[PSO.3]. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

[PSO.4]. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

C. ASSESSMENT PLAN:

| Criteria | Description | Maximum Marks |
|---|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Closed Book) | 15 |
| | Sessional Exam II (Closed Book) | 15 |
| | In class Quizzes(15) + Assignments(05)+/group projects(10) | 30 |
| End Term Exam (Summative) | End Term Exam (Closed Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank , so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

D. SYLLABUS

Flow in open Channels: Chezy's and Manning's formulas, hydraulically efficient channel cross section, specific energy curve, Froude's Number and its significance; Gradually varied

flow: Dynamic equation of GVF, characteristics and classification of flow profiles. Step method of computation of back water curve (M1) type only; rapidly varied flow: Hydraulic jump in rectangular channel, loss of energy in hydraulic jump, Venturi standing wave and Parshall flumes. Boundary layer theory: Concept of boundary layer; Boundary layer thickness; Laminar and turbulent boundary layer on flat plate; Separation of boundary layer and measures to control. Hydraulic turbines: Description and general working principles of Pelton, Francis and Kaplan turbines, Work done and efficiencies of impulse and reaction turbine; Governing of turbines, Selection of turbines. Centrifugal Pump: Description and general working principle of centrifugal pumps, work done and efficiencies, multistage pumps; pumps in series and pumps in parallel.

E. TEXT BOOKS

1. Modi P.N. and Seth S.M, Hydraulics and Fluid Mechanics, Standard Book House, New Delhi, 2013.
2. Chow V.T., Open channel Hydraulics, Tata McGraw - Hill Publishing Co., Ltd., New Delhi, 1985.
3. Garde R.J. and Mirajgaokar A.G., Engineering Fluid Mechanics (including Hydraulic Machines), Nem Chand & Bros, Roorkee, Second Edn, 1983.
4. Raju K.G.R., Flow through Open Channels, Second Ed. Tata McGraw- Hill Publishing Company Limited, New Delhi, 1993.

F. REFERENCE BOOKS

1. Çengel Yunus A. and Cimbala John M., Fluid Mechanics Fundamentals and Applications Tata McGraw Hill Education Pvt. Limited New Delhi, 2011
2. Pritchard Philip J. and Leylegian John C., Fluid Mechanics, Wiley India Ltd. New Delhi, 2012

G. LECTURE PLAN:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|---------------------|----------------------|---|-------------------------|-------------------------------------|---|
| 1, 2 | Flow in open Channel | Concept of Chezy's and Manning's formulas | Lecture/In Class Quiz | CVI401.1, CVI401.5 | 1 st Sessional ET Exam Home Assignment In class quiz, |
| 3,4 | Flow in open Channel | Hydraulically efficient channel cross section | Lecture/In Class Quiz | CVI401.1 | 1 st Sessional ET Exam Home Assignment In class quiz, |
| 5,6 | Flow in open Channel | Specific energy curve. | Lecture/In Class Quiz | CVI401.1 | 1 st Sessional ET Exam Home Assignment In class quiz, |
| 7,8 | Flow in open Channel | Froude's Number and its significance | Lecture/In Class Quiz | CVI401.1 | 1 st Sessional ET Exam Home Assignment |
| 9,10 | Gradually | Dynamic equation of | Lecture/ | CVI401.2 | |

| | | | | | |
|---------------------------------------|-----------------------|--|------------------------|--------------------|--|
| | Varied Flow | GVF | In Class Quiz | | In class quiz, |
| 11,12 | Gradually Varied Flow | Characteristics and classification of flow profiles. | Lecture/ In Class Quiz | CVI401.2, CVI401.5 | |
| I st Sessional Examination | | | | | |
| 13, 14 | Gradually Varied Flow | Step method of computation of back water curve (M1) type only. | Lecture/ In Class Quiz | CVI401.2 | 2 nd Sessional ET Exam Home Assignment In class quiz/group project |
| 15,16 | Rapidly Varied Flow | Hydraulic jump in rectangular channel | Lecture/ In Class Quiz | CVI401.2 | |
| 17 | Rapidly Varied Flow | Loss of energy in hydraulic jump | Lecture/ In Class Quiz | CVI401.2 | |
| 18 | Rapidly Varied Flow | Venturi standing wave and Parshall flumes | Lecture/ In Class Quiz | CVI401.2 | 2 nd Sessional ET Exam Home Assignment In class quiz /group project |
| 19, 20 | Boundary Layer Theory | Concept of boundary layer | Lecture/ In Class Quiz | CVI401.3, CVI401.5 | |
| 21 | Boundary Layer Theory | Boundary layer thickness | Lecture/ In Class Quiz | CVI401.3 | |
| 22 | Boundary Layer Theory | Laminar and turbulent boundary layer on flat plate | Lecture/ In Class Quiz | CVI401.3 | 2 nd Sessional ET Exam Home Assignment In class quiz/group project |
| 23 | Boundary Layer Theory | Separation of boundary layer and measures to control | Lecture/ In Class Quiz | CVI401.3 | |
| 24 | Hydraulic Turbines | Description and general working principles of Pelton | Lecture/ In Class Quiz | CVI401.4, CVI401.5 | |
| 2 nd Sessional Examination | | | | | |
| 25, 26 | Hydraulic Turbines | Francis and Kaplan turbines | Lecture/ In Class Quiz | CVI401.4 | ET Exam Home Assignment/group project |
| 27, 28 | Hydraulic Turbines | Work done and efficiencies of impulse and reaction turbine | Lecture/ In Class Quiz | CVI401.4 | ET Exam Home In class quiz/group project |
| 29 | Hydraulic Turbines | Governing of turbines | Lecture/ In Class Quiz | CVI401.4 | |
| 30 | Hydraulic Turbines | Selection of turbines | Lecture/ In Class Quiz | CVI401.4 | ET Exam Home In class quiz/group project |
| 31, 32 | Centrifugal | Description and general | Lecture/ | CVI401.4, CVI401.5 | |



| | | | | | |
|----------------------|------------------|--|------------------------------|--------------------|---|
| | Pump | working principle of centrifugal pumps | In Class Quiz | | ET Exam Home In class quiz/group project |
| 33, 34 | Centrifugal Pump | Work done and efficiencies | Lecture/ In Class Quiz | CVI401.4 | ET Exam Home In class quiz/group project |
| 35 | Centrifugal Pump | Multistage pumps | Lecture/ In Class Quiz | CVI401.4 | ET Exam Home In class quiz |
| 36 | Centrifugal Pump | Pumps in series and pumps in parallel | Lecture/ In Class Quiz | CVI401.4, CVI401.5 | ET Exam Home Assignment In class quiz/group project |
| END TERM EXAM | | | | | |

H. COURSE ARTICULATION MATRIX: (MAPPING OF COS WITH POS)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV 1401.1 | Understand and comprehend the basic concept and importance of open channel flow including preliminary design and analysis of systems apparatus involving application and evaluation and enhance employability. | 3 | 3 | 3 | 2 | 2 | | 1 | 1 | | 1 | 1 | 3 | 1 | 1 | 1 | |
| CV 1401.2 | Understand and comprehend various practical flow condition encountered in real world such as hydraulic jump/ varied flow of fluid motion through knowledge of mathematics/science/fundamentals and solution of complex engineering problems. Critical review and analysis | 3 | 3 | 3 | 2 | 2 | | 1 | 1 | | 1 | 1 | 3 | 2 | 2 | 1 | |
| CV1401.3 | Understand/comprehend and be able to solve Boundary layer Theory and application | 3 | 3 | 2 | 3 | 2 | | 1 | | | 1 | | 3 | 1 | 1 | 1 | |
| CV1401.4 | Over view and understand hydraulic machinery processes for turbines and pumps their design, application and be able to evaluate their performances. | 3 | 3 | 3 | 2 | 2 | | 2 | 1 | | 1 | 2 | 3 | 1 | 1 | 1 | 1 |
| CV1401.5 | Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks to promote entrepreneurship. | 3 | 3 | 3 | 2 | 2 | | 2 | 1 | | 1 | 2 | 3 | 1 | 1 | 1 | 1 |

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR
School of Civil and Chemical Engineering
DEPARTMENT OF CIVIL ENGINEERING
Course Hand-out

Structural Analysis-I | CVI402| 4 Credits | 3 | 0 | 4
Session: Jan 20 - May 20 | Faculty: Sourav Kumar Das | Class: B.Tech Civil IV SEM

- A. Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Core Course, targeting students who wish to pursue higher studies in the field of Structural Engineering. It introduces the students to basic theory and concepts of structural analysis and the classical methods for the analysis of determinate structures. **Students will learn how to analyse determinate structures by hand to determine reactions, internal resistance (axial load, moment, and shear) and deformations that result from external loadings.**
- B. Course Outcomes:** At the end of the course, students will be able to:
- [CVI402.1].** Define basic structural engineering terminology
 - [CVI402.2].** Derive and draw the shear and bending moment equations and diagrams respectively
 - [CVI402.3].** Distinguish between stable and unstable and statically determinate and indeterminate structures
 - [CVI402.4].** Determine slope, deflections, torsion, stresses of beams by using different methods
 - [CVI402.5].** Familiarise with contemporary issues and solving them in structural engineering domain to enhance employment and entrepreneurship.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

- [PO.1]. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
- [PO.2]. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
- [PO.3]. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- [PO.4]. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
- [PO.5]. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
- [PO.6]. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
- [PO.7]. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- [PO.8]. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
- [PO.9]. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.5]. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

[PSO.6]. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

[PSO.7]. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

[PSO.8]. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

C. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

D. SYLLABUS

Introduction: Overview and scope of the subject, **Stress and Strain:** Thick Cylinders and Shells, Stresses due to Impact and Suddenly Applied Load – Compound Bars. **Mohr Circle Method:** Mohr's circle of stress and strain. Failure theories. **Analysis of Plane Truss:** Method of joints and section, **Shear Force and Bending Moments:** Shear force and bending moment diagrams for statically determinate beams, Relationships between SF & BM and loads intensity, **Bending and Shearing Stresses:** Bending and shearing stresses in statically determinate beams, **Deflection:** Determination slope and deflection in statically determinate beams using Macaulay's method, moment-area method and conjugate beam method. **Stability of Columns:** Slenderness ratio, failure by buckling, Euler

formula, concept of equivalent length for different support conditions, limitation of Euler's formula, Rankine-Gordon formula, **Torsion:** Torsion of circular shaft - simple torsion theory, solid and hollow circular shaft, **Arches and Suspension Bridge:** Analysis of three hinged parabolic and segmental arches, determination of horizontal reaction, normal thrust, radial shear and bending moment, analysis of suspension bridge with the hinged stiffening girder.

E. TEXTBOOKS

- I. Rajput R.K., Strength of Materials, S Chand & Co., 2015.
- II. Bhavikatti, S.S., Structural Analysis – I & II, Vikas Publishing House Pvt. Ltd., 2013.
- III. Ramamrutham. S & Narayanan. R, Strength of Materials, Dhanpat rai Publishing Co., 2017.

F. REFERENCE BOOKS

- I. Hearn E.J., Mechanics of Materials, Vol. I, Pergamon Press, 2008.
- II. Gahlot, P.S. and Gehlot, D., Fundamentals of Structural Mechanics, CBS Publishers & Distributors Pvt. Ltd., 2012.
- III. Subramanian, R., Strength of Materials, Oxford University Press, 2012.

G. Lecture Plan:

| Lecture Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|----------------|--|---|------------------|------------------------------|-------------------------------|
| 1-2 | Introduction | Introduction: Overview and scope of the subject (properties of metals), Basic concepts | Lecture | CV1402.1 | NA |
| 3-5 | Stress & Strain | Stress & Strain | Lecture | CV1402.1 | Class Quiz / Test |
| 6-8 | Mohr Circle Method | Mohr's circle of stress and strain | Lecture | CV1402.4 | Class Quiz / Test |
| 9-11 | Stresses due to Impact and Suddenly applied load | Stresses due to Impact and Suddenly Applied Load – Compound Bars | Lecture | CV1402.4 | Class Quiz / Test |
| 12-15 | Plane truss analysis | Analysis of Plane Truss: Method of joints and section | Lecture | CV1402.3 | Class Quiz / Test |
| 16-20 | Shear Force and Bending Moment calculation | Shear force and bending moment diagrams for statically determinate beams | Lecture | CV1402.2 | Class Quiz / Test |
| 21 | | Relationships between SF & BM and loads intensity | Lecture | CV1402.2 | Class Quiz / Test |
| 22-23 | | Bending and shearing stresses in statically determinate beams | Lecture | CV1402.2 | Class Quiz / Test |
| 24-25 | Deflection calculation | Deflection: Determination slope and deflection in statically determinate beams using Macaulay's method | Lecture | CV1402.4 | Class Quiz / Test |
| 26-27 | | Deflection: Determination slope and deflection in statically determinate beams using Moment Area Method | Lecture | CV1402.4 | Class Quiz / Test |
| 28-30 | | Deflection: Determination slope and deflection in statically determinate beams using Conjugate Beam Method | Lecture | CV1402.4 | Class Quiz / Test |
| 31 | Stability of column analysis | Stability of Columns: Slenderness ratio, failure by buckling | Lecture | CV1402.4 | Class Quiz / Test |
| 32-33 | | Euler formula, concept of equivalent length for different support conditions, limitation of Euler's formula | Lecture | CV1402.4 | Class Quiz / Test |
| 34 | | Rankine-Gordon formula | Lecture | CV1402.4 | Class Quiz / Test |
| 36-38 | Torsion | Torsion of circular shaft - simple torsion theory, solid and | Lecture | CV1402.4 | Class Quiz / |

| | | | | | |
|-------|---|---|---------|----------|-------------------|
| | analysis | hollow circular shaft | | | Test |
| 39-40 | Thick Cylinders and Shells | Thick Cylinders and Shells | Lecture | CV1402.4 | Class Quiz / Test |
| 41-42 | Failure Theories | Failure Theories | Lecture | CV1402.3 | Class Quiz / Test |
| 43-45 | Three hinge arch and suspension bridge analysis | Analysis of Arches and Suspension Bridge- analysis of three hinged parabolic and segmental arches, determination of horizontal reaction, normal thrust, radial shear and bending moment | Lecture | CV1402.3 | Class Quiz / Test |
| 46-48 | | Analysis of suspension bridge with the hinged stiffening girder. | Lecture | CV1402.3 | Class Quiz / Test |



MANIPAL UNIVERSITY
JAIPUR



H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | |
|------------|--|-----------------------------------|------|------|------|------|------|------|------|------|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 |
| [CVI402.1] | Define basic structural engineering terminology. | | 1 | | | | | | | |
| [CVI402.2] | Derive and draw the shear and bending moment equations and diagrams respectively. | 3 | 3 | 3 | | 3 | | | | 1 |
| [CVI402.3] | Distinguish between stable and unstable and statically determinate and indeterminate structures. | 3 | | 3 | 2 | | | | | |
| [CVI402.4] | Determine slope, deflections, torsion, stresses of beams by using different methods. | 3 | 3 | 3 | | 3 | | | | 1 |
| [CVI402.5] | Familiarise with contemporary issues and solving them in structural engineering domain to enhance employment and entrepreneurship. | 2 | | 2 | 3 | | 3 | | 1 | 2 |

1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



A. Introduction: This course is offered by Dept. of Civil Engineering as a Core Course and purpose of the course is for students to get familiar with basics of Concrete structures, both reinforced and unreinforced. Study of this course work includes details of concrete properties, various structural members made of reinforced concrete, design philosophies, behavior of these members in flexure and compression. All of this that are crucial for a student to have a promising career as a civil engineer. The student, by the end of the semester would be able to successfully design a flexure member for bending and shear, a column and footing for compression. The civil engineering market demands a student to be aware of these details to ensure they are employable. Also, the student would be erudite enough to estimate the strength of concrete by various mechanical strength tests and durability tests.

B. Course Outcomes: At the end of the course, students will be able to:

1. Learn concepts of fundamentals of reinforced concrete design.
2. Identify different types of structural elements based on applied force or moment.
3. Design of structural elements in flexure and compression.
4. Prepare detailed design and drawings to be execute in the field
5. Evaluate the behaviour of structural interaction.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice



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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so | |



| | |
|--|---|
| | that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. SYLLABUS

Introduction: Overview and scope of the subject, Concrete Mix Design as per IS code procedure. Straight line Theory: Determination of neutral axis, stress and strain, and moment of resistance of singly reinforced and doubly reinforced sections. Determination of short term, long term deflections of R.C beams & Crack width; Limit state method: Principles. Design of singly reinforced, doubly reinforced, and flanged beams. Design of one way and two way slabs: for various boundary conditions. Design of columns: combined axial load and biaxial bending of short columns. Use of SP16 handbook. Staircases: types of stairs, design of dog-legged and open newel types, spiral.

F. TEXT BOOKS

I. Verghese P.C., Limit State Design of Reinforced Concrete, Prentice Hall of India, New Delhi, 2009

REFERENCE BOOKS

1. Shah H.J., Reinforced Concrete, Vol. I, Charotar Publishing house, Anand, 2011
2. Raju N.K., Reinforced Concrete Design: Principles and Practices, New Age International, 2010
3. Syal I.C. and Goel A.K., Reinforced Concrete Structures S. Chand and Co. 2012
4. Gambhir M.L., Fundamentals of Reinforced Concrete Design, PHI Learning, 2012

G. Tutorial Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|------------|---|------------------|------------------------------|-------------------------------|
| 1 | Concrete 1 | Learn concepts of fundamentals of reinforced concrete design. | lecture | [CV1403.1] | NA |
| 2 | Concrete 2 | Identify different types of structural elements based on applied force or moment. | tutorial | [CV1403.2] | In Class Quiz |



| | | | | | |
|----|----------------------|---|----------|------------|---|
| 3 | Concrete 3 | Design of structural elements in flexure and compression. | tutorial | [CV1403.3] | In Class Quiz End Term |
| 4 | Concrete 4 | Prepare detailed design and drawings to be executed in the field | tutorial | [CV1403.4] | |
| 5 | Concrete 5 | Evaluate the behaviour of structural interaction. | tutorial | [CV1403.4] | |
| 6 | Concrete 6 | Learn concepts of fundamentals of reinforced concrete design. | tutorial | [CV1403.1] | |
| 7 | Concrete 7 | Identify different types of structural elements based on applied force or moment. | tutorial | [CV1403.2] | 1 st Sessional ET Exam Home Assignment |
| 8 | Concrete 8 | Design of structural elements in flexure and compression. | tutorial | [CV1403.3] | |
| 9 | WSM 1 | Prepare detailed design and drawings to be executed in the field | lecture | [CV1403.4] | 1 st Sessional ET Exam Home Assignment |
| 10 | WSM 2 | Evaluate the behaviour of structural interaction. | tutorial | [CV1403.4] | |
| 11 | LSM 1 | Learn concepts of fundamentals of reinforced concrete design. | lecture | [CV1403.1] | |
| 12 | LSM 2 | Identify different types of structural elements based on applied force or moment. | tutorial | [CV1403.2] | 1 st Sessional ET Exam Home Assignment |
| 13 | LSM 3 | Design of structural elements in flexure and compression. | tutorial | [CV1403.3] | |
| 14 | LSM 4 | Prepare detailed design and drawings to be executed in the field | tutorial | [CV1403.4] | |
| 15 | SINGLY BEAM DESIGN 1 | Evaluate the behaviour of structural interaction. | lecture | [CV1403.4] | 1 st Sessional ET Exam |
| 16 | SINGLY BEAM DESIGN 1 | Learn concepts of fundamentals of reinforced concrete design. | tutorial | [CV1403.1] | |



| | | | | | |
|----|-------------------------|---|----------|------------|---|
| 17 | SINGLY BEAM DESIGN 2 | Identify different types of structural elements based on applied force or moment. | tutorial | [CV1403.2] | Home Assignment |
| 18 | SINGLY BEAM DESIGN 3 | Design of structural elements in flexure and compression. | tutorial | [CV1403.3] | 1 st Sessional ET Exam Home Assignment |
| 19 | SINGLY BEAM DESIGN 4 | Prepare detailed design and drawings to be executed in the field | tutorial | [CV1403.4] | |
| 20 | Doubly Beam design 1 | Evaluate the behaviour of structural interaction. | lecture | [CV1403.4] | |
| 21 | Doubly Beam design 2 | Learn concepts of fundamentals of reinforced concrete design. | lecture | [CV1403.1] | |
| 22 | Doubly Beam design 3 | Identify different types of structural elements based on applied force or moment. | tutorial | [CV1403.2] | ET Exam Home Assignment |
| 23 | Numerical problem | Design of structural elements in flexure and compression. | tutorial | [CV1403.3] | |
| 24 | Numerical problem | Evaluate the behaviour of structural interaction. | tutorial | [CV1403.4] | 2 nd Sessional |
| 25 | Numerical problem | Learn concepts of fundamentals of reinforced concrete design. | tutorial | [CV1403.1] | ET Exam Home Assignment |
| 26 | Numerical problem | Identify different types of structural elements based on applied force or moment. | tutorial | [CV1403.2] | |
| 27 | Numerical problem | Design of structural elements in flexure and compression. | tutorial | [CV1403.3] | |
| 28 | Numerical problem | Prepare detailed design and drawings to be executed in the field | tutorial | [CV1403.4] | |



| | | | | | |
|----|-----------------|---|----------|------------|---|
| 29 | | Evaluate the behaviour of structural interaction. | | [CV1403.4] | 2 nd Sessional ET Exam Home Assignment |
| | Column design 1 | | lecture | | |
| 30 | | Learn concepts of fundamentals of reinforced concrete design. | | [CV1403.1] | |
| | Column design 2 | | tutorial | | |
| 31 | | Identify different types of structural elements based on applied force or moment. | | [CV1403.2] | 2 nd Sessional |
| | Column design 3 | | tutorial | | |
| 32 | | Design of structural elements in flexure and compression. | | [CV1403.3] | ET Exam Home Assignment |
| | Column design 4 | | tutorial | | |
| 33 | | Prepare detailed design and drawings to be executed in the field | | [CV1403.4] | |
| | one way slab 1 | | lecture | | |
| 34 | | Evaluate the behaviour of structural interaction. | | [CV1403.4] | |
| | one way slab 2 | | tutorial | | |
| 35 | | Learn concepts of fundamentals of reinforced concrete design. | | [CV1403.1] | 2 nd Sessional ET Exam Home Assignment |
| | one way slab 3 | | tutorial | | |
| 36 | | Identify different types of structural elements based on applied force or moment. | | [CV1403.2] | |
| | two way slab 1 | | lecture | | |
| 37 | | Design of structural elements in flexure and compression. | | [CV1403.3] | |
| | two way slab 2 | | tutorial | | |



| | | | | | |
|----|--------------------|---|----------|------------|---|
| 38 | | Prepare detailed design and drawings to be executed in the field | | [CV1403.4] | 2 nd Sessional ET Exam Home Assignment |
| | two way slab 3 | | tutorial | | |
| 39 | | Evaluate the behaviour of structural interaction. | | [CV1403.4] | 2 nd Sessional ET Exam Home Assignment |
| | two way slab 4 | | tutorial | | |
| 40 | | Learn concepts of fundamentals of reinforced concrete design. | | [CV1403.1] | |
| | two way slab 5 | | tutorial | | |
| 41 | | Identify different types of structural elements based on applied force or moment. | | [CV1403.2] | 2 nd Sessional ET Exam Home Assignment |
| | footing design 1 | | tutorial | | |
| 42 | | Prepare detailed design and drawings to be executed in the field | | [CV1403.4] | |
| | footing design 3 | | lecture | | |
| 43 | | Evaluate the behaviour of structural interaction. | | [CV1403.4] | 2 nd Sessional ET Exam Home Assignment |
| | footing design 4 | | tutorial | | |
| 44 | | Learn concepts of fundamentals of reinforced concrete design. | | [CV1403.1] | |
| | Staircase design 1 | | tutorial | | |
| 45 | | Identify different types of structural elements based on applied force or moment. | | [CV1403.2] | 2 nd Sessional ET Exam Home Assignment |
| | Staircase design 2 | | lecture | | |
| 46 | | Design of structural elements in flexure and compression. | | [CV1403.3] | |
| | Staircase design 3 | | lecture | | |
| 47 | | Prepare detailed design and drawings to be executed in the field | | [CV1403.4] | 2 nd Sessional ET Exam Home Assignment |
| | Staircase design 4 | | tutorial | | |
| 48 | | Evaluate the behaviour of structural interaction. | | [CV1403.4] | 2 nd Sessional ET Exam Home Assignment |
| | Staircase design 5 | | tutorial | | |



| | | | | | |
|----|--------------------|---|----------|------------|--|
| 49 | Staircase design 6 | Learn concepts of fundamentals of reinforced concrete design. | tutorial | [CV1403.1] | |
| | | | | | |

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| [CV1404.1] | Learn concepts of fundamentals of reinforced concrete design. | 3 | 2 | | | | | | | | | | | 1 | | | |
| [CV1404.2] | Identify different types of structural elements based on applied force or moment. | | | | | | | | | | | 3 | | | 3 | | |
| [CV1404.3] | Design of structural elements in flexure and compression. | | | | | 3 | | | 3 | | 2 | 3 | | | | 3 | |
| [CV1404.4] | Prepare detailed design and drawings to be execute in the field | | | | | | | | | | | 2 | | | | | 2 |
| [CV1404.5] | Evaluate the behaviour of structural interaction. | | | | | | | | | | | 2 | | | | | 3 |

1-Low Correlation; 2-

Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Building Design And Drawing | CVI430 | I Credits | 0 0 3 I

Session: January 20 – May 20 | Faculty: Priyansha Mehra | Class: Departmental Laboratory Course

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Laboratory Course, targeting students who wish to pursue higher studies in the field of Structural Engineering. The first part of the course is to introduce the students to understand the commands of AutoCAD and use them in a sequential procedure and steps while drawing plan, elevation and section. In the second part student will draw the same work practised on AutoCAD, on AI drawing sheet using different geometrical tools.

B. **Course Outcomes:** At the end of the course, students will be able to:

1. **Replicate** any furnishing details in a residential building in reality into a drawing
2. **Create** a detailed building plan with elevation and cross sectional elevation.
3. **Use** computer software like AutoCAD to convey the building drawing.
4. **Learn** the procedures of submission of drawings and Develop working and submission Drawings for building
5. **Prepare, read and interpret** the drawings which will improve student skills leading to better employability.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations



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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|-------------------------------------|---|---------------|
| Internal Assessment (Summative) | Internal Assessment (Viva, Lab performance, Lab book maintenance, Punctuality in lab) | 60 |
| End Term Exam (Summative) | End Term Exam | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Lab Experiments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup laboratory experiment will be performed on the topic taught on the day of absence and it will have to be performed within two weeks from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 3 throughout the entire semester. | |

E. SYLLABUS



Introduction: Overview and scope of the subject;

Introduction to AutoCAD: Drafting plan and elevation of single bed room RCC building with flat roof;

Foundations: Masonry foundations, RCC Footings - Isolated, Combined and Raft footings;

Doors and Windows: Wooden and Aluminium doors, PVC and Steel doors such as Collapsible Doors, Wooden windows, Aluminium windows;

Designing and Drawing of Residential Buildings: Plan, Elevation and Sectional views of Single bedroom house with Mangalore tiled roof, Double bedroom house with RCC roof;

Designing and Drawing of Public Buildings: Plan, Elevation and Sectional views of School, Bank, and Health Centre for the given Line Diagram.

F. TEXT BOOKS

I. Balagopal Pabhu T.S., Paul K.V. and Vijayan C., Building Design of Civil Engg. Drawing, Spades Publishers, Calicut. 1999.

G. REFERENCE BOOKS

II. Rangwala S.C., Elementary and Advanced Building Construction. 2009.

H. Lecture Plan:

| Lecture Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|----------------|-----------------------------|---|------------------|---|-------------------------------|
| 1 | Introduction | Basic Interface of AutoCAD and commonly used commands | Lab Practical | CV1430.3 | NA |
| 2 | Residential Building | Plan & Elevation of a Residential Building | Lab Practical | CV1430.3 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 3 | Public Building | Plan & Elevation of a Public Building | Lab Practical | CV1430.3 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 4 | Staircase | Staircase Plan and Elevation in AutoCAD | Lab Practical | CV1430.3 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 5 | Door, Window and foundation | Plan and Elevation of Door, Window & Foundation | Lab Practical | CV1430.3 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 6 | Residential Building | Section of Residential Building | Lab Practical | CV1430.3 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 7 | Residential Building | Plan of a Residential Building | Lab Practical | CV1430.1 CV1430.2 CV1430.5 | Daily Lab Assessment |



| | | | | | |
|----|-----------------------|--|---------------|--|----------------------|
| 8 | Public Building | Plan of a Public Building | Lab Practical | CV1430.1 CV1430.2 CV1430.5 | Daily Lab Assessment |
| 9 | Residential Building | Elevation & Section of Residential Building | Lab Practical | CV1430.1 CV1430.2 CV1430.5 | Daily Lab Assessment |
| 10 | Health Center | Plan, Elevation and Sectional views and Health Centre for the given Line Diagram | Lab Practical | CV1430.1 CV1430.2 CV1430.5 | Daily Lab Assessment |
| 11 | Test on roof tiles | Elevation and Sectional views and Health Centre for the given Line diagram | Lab Practical | CV1430.1 CV1430.2 CV1430.5 | Daily Lab Assessment |
| 12 | Dog legged Stair case | Dog-Legged Staircase Plan and Elevation | Lab Practical | CV1430.1 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 13 | | Dog-Legged Staircase Elevation with section | Lab Practical | CV1430.1 CV1430.2 CV1430.4 CV1430.5 | Daily Lab Assessment |
| 14 | Door Window | Plan and Elevation of Door, Window | Lab Practical | CV1430.1 CV1430.2 CV1430.4 | Daily Lab Assessment |

I. **Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV 1430.1 | Replicate any furnishing details in a residential building in reality into a drawing | 3 | | | | 3 | 3 | | | 3 | | | 3 | 1 | | | |
| CV 1430.2 | Create a detailed building plan with elevation and cross sectional elevation. | 2 | | | | 3 | 2 | | | | | | 3 | 3 | | | |
| CV 1430.3 | Use computer software like AutoCAD to convey the building drawing. | | | | | 3 | | | | | | | 3 | 3 | 3 | | |
| CV 1430.4 | Learn the procedures of submission of drawings and Develop working and submission Drawings for building | | | | | 3 | | | | 3 | | | 3 | 1 | | 2 | 2 |



| | | | | | | | | | | | | | | | | | | | | | | |
|-----------|--|---|--|--|--|---|---|--|--|--|---|---|--|--|--|---|---|--|--|--|---|---|
| CV 1430.5 | Prepare, read and interpret the drawings which will improve student skills leading to better employability. | 1 | | | | 2 | 1 | | | | 2 | 1 | | | | 2 | 1 | | | | 2 | 1 |
|-----------|--|---|--|--|--|---|---|--|--|--|---|---|--|--|--|---|---|--|--|--|---|---|

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

A. **INTRODUCTION:** This lab course is offered by Dept. of Civil Engineering as an 5th semester course, targeting students who want to pursue a career particularly in the broad domain of hydraulics, water and water resources related technology and management and to extent for those who intends to pursue higher studies in the field of fluid dynamics related sciences and engineering, This is a beginner's experimental laboratory course for flow measurement, calibration of flow measurement devices, practical functional operation of hydro machines such as pump and types of turbines. This course is fundamentally multi-disciplinary engineering course, as such participating students are expected to have a strong background knowledge as preliminary theoretical fluid mechanics.

B. **COURSE OUTCOMES:** At the end of the course, students will be able to:

[CV1431.1]. Practical understanding of calibration/operation of various types of flow measurement devices such as notches, weirs, venture-meter /orifice-meters etc. and comprehend the basic and practical concept of fluid flow.

[CV1431.2]. Practical understanding of measurement/evaluation/operation of pipe flow and corresponding pipe friction factors and comprehend the basic and practical concept of fluid flow.

[CV1431.3]. To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine

[CV1431.4]. Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks.

PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

2. **PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

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

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

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

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



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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

C. **ASSESSMENT PLAN:**

| Criteria | Description | Maximum Marks |
|------------------------------------|--|---------------|
| Internal Assessment (Summative) | QUIZES (4) | 20 |
| | VIVA (4) | 20 |
| | Experiment reports submission | 20 |
| End Term Exam (Summative) | End Term Practical Exam and viva | 30 +10 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup practical assignment on the experiment conducted on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank , so that the | |



| | |
|--|---|
| | student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | A student have to work in home, especially after conducting the experiment. These works has to be submitted immediately in the next class and evaluation will be done for the same. A student is expected to participate and perform these practical assignments with full zeal since the activity participation by a student will be assessed and marks will be awarded. |

D. SYLLABUS

Calibration of V - Notch, Rectangular notch, Cippoletti Notch; Broad crested weir, curved weir; orifices, mouth pieces; Venturimeter, orifice meter; Venturi flume, standing wave flume; Determination of Friction factor of pipes; Tests on Impact of jet on Vanes, Centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine.

E. TEXT BOOKS

1. Modi P.N. and Seth S.M., Hydraulics and Fluid Mechanics Standard Book House, New Delhi, 2005
2. Streeter V.L. and Wiley E.B, Fluid Mechanics, McGraw

F. REFERENCE BOOKS

1. Çengel Yunus A. and Cimbala John M., Fluid Mechanics Fundamentals and Applications Tata McGraw Hill Education Pvt. Limited New Delhi, 2011
2. Pritchard Philip J. and Leylegian John C., Fluid Mechanics, Wiley India Ltd. New Delhi, 2012

G. LECTURE PLAN:

| Topics | Practical | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--|-----------|--|-------------------------|------------------------------|-------------------------------|
| EXPERIMENT-1 : NOTCHES To calibrate the notch (V Notch /Rectangular Notch) | 2 | Practical understanding of calibration/operation of various types of flow measurement devices such as notches, weirs, venture-meter /orifice-meters etc. and comprehend the basic and practical concept of fluid flow Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.1 CV1431.4 | VIVA Quiz |
| EXPERIMENT-2 : WEIR To study the pressure distribution at the upstream of curved | 1 | Practical understanding of calibration/operation of various types of flow measurement devices such as notches, weirs, venture-meter | Practical Demonstration | | VIVA Quiz |



| | | | | | |
|--|---|--|-------------------------|----------------------|-----------|
| weir and to calibrate the same. | | /orifice-meters etc. Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | | | |
| EXPERIMENT-3 : ORIFICE METER To calibrate the orifice meter and to determine the coefficient of discharge. | 1 | Practical understanding of calibration/operation of various types of flow measurement devices such as notches, weirs, venture-meter /orifice-meters etc. Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.1 CV1431.4 | VIVA Quiz |
| EXPERIMENT-4 : VENTURIMETER To calibrate the venturimeter and to determine the coefficient of discharge. | 1 | Practical understanding of calibration/operation of various types of flow measurement devices such as notches, weirs, venture-meter /orifice-meters etc. Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.1 CV1431.4 | VIVA Quiz |
| EXPERIMENT-5 : FRICTION IN PIPES (MAJOR LOSSES) To determine the head loss of given length of pipe. | 1 | Practical understanding of measurement/evaluation/operation of pipe flow and corresponding pipe friction factors and comprehend the basic and practical concept of fluid Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.2 CV1431.1 | VIVA Quiz |
| EXPERIMENT-6 : IMPACT OF JET To study the relation between the force produce and the change of | 1 | Practical understanding of measurement/evaluation/operation of pipe flow and corresponding pipe friction factors and comprehend the basic and practical concept of | Practical Demonstration | CV1431.2 CV1431.4 | VIVA Quiz |



| | | | | | |
|--|---|--|-------------------------|----------------------|-----------|
| momentum when a jet strikes a vane | | fluid Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | | | |
| EXPERIMENT-7 : BERNOULLI'S THEOREM To verify Bernoulli's equation experimentally. | 1 | Practical understanding of measurement/evaluation/operation of pipe flow and corresponding pipe friction factors and comprehend the basic and practical concept of fluid Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.2 CV1431.4 | VIVA Quiz |
| EXPERIMENT-8 : RECIPROCATING PUMP TEST RIG To calculate the overall efficiency of the reciprocating pump | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |
| EXPERIMENT-9 : GEAR PUMP TEST RIG Study of Gear Pump Characteristics | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |
| EXPERIMENT-10 : HYDRAULIC RAM | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |



| | | | | | |
|---|---|--|-------------------------|----------------------|-----------|
| To study the performance of a hydraulic ram | | pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | | | |
| EXPERIMENT-11 : CENTRIFUGAL PUMP TEST RIG | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |
| To calculate the overall efficiency of the pump. | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |
| EXPERIMENT-12 : FRANCIS TURBINE TEST RIG To determine the efficiency of the Francis Turbine | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |



| | | | | | |
|---|-----------|--|----------------------------|----------------------|--------------|
| EXPERIMENT-13 : PELTON WHEEL To conduct a test on Pelton Wheel Turbine at a Constant Head | 1 | To Understand/test and evaluation of hydraulic machinery such as impact of jet on vanes, centrifugal pump, Pelton turbine, Francis turbine and Kaplan Turbine Be able to develop skills in critical thinking and professional procedures through various forms of oral and written presentation through individual and group tasks. | Practical Demonstration | CV1431.3 CV1431.4 | VIVA Quiz |
| Total Semester (hrs) | 14 | | | | |



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Material Testing Lab-II | CVI432 | I Credits | 0 0 2 I

Session: Jan 20 – May 20 | Faculty: Dr. Gaurav Sancheti | Class: B.Tech Civil IV SEM

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Lab Course, targeting students to perform different basic test on the properties of cement, sand, aggregates and concrete. It introduces the students to basic concepts and design of concrete. Students will learn how to perform the test and what are the resemblance of a particular test to the practical use of it in the field.

B. **Course Outcomes:** At the end of the course, students will be able to:

1. Understanding the concept of the different properties of materials
2. Applying the concept to determine their properties
3. Enhance entrepreneurship skill.
4. Analysing and applying the properties will lead to employability
5. Skills to work in groups or independently

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice



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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|-------------------------------------|---|---------------|
| Internal Assessment (Summative) | Internal Assessment (Viva, Lab performance, Lab book maintenance, Punctuality in lab) | 60 |
| End Term Exam (Summative) | End Term Exam | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Lab Experiments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup laboratory experiment will be performed on the topic taught on the day of absence and it will have to be performed within two weeks from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 3 throughout the entire semester. | |

E. SYLLABUS

Determination of specific gravity of cement, Determination of Fineness of cement, Determination of standard consistency of cement, Determination of setting times of



cement, Determination of soundness of cement, Determination of strength of cement, Determination of specific gravity of fine aggregate, Determination of specific gravity of coarse aggregate, Determination of fineness modulus of fine aggregate, Determination of fineness modulus of coarse aggregate, Determination of bulking of sand, Determination of clay (or silt) content in sand, Determination of workability of concrete by slump test, Determination of workability of concrete by compaction factor test, Determination of workability of concrete by Vee - Bee consistometer Test, Determination of compressive strength of concrete, Determination of tensile strength of concrete, Determination of flexural strength of concrete, Determination of permeability of concrete, Determination of modulus of elasticity of concrete, Determination of aggregate impact value, Determination of aggregate abrasion value (Los Angeles Test).

F. REFERENCE BOOKS

1. Shetty M.S., Concrete Technology, S. Chand and Co, 2006.
2. Neville and Brooks, Concrete Technology, Pearson Education, 2003.
3. Singh G., Materials of Construction, Std. Publishers, 1998.

G. Lecture Plan:

| Lecture Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|----------------|---------------------------------------|--|------------------|--|-------------------------------|
| 1 | Introduction | Introduction to Material Testing Lab-I | Lab Practical | CV1432.1 | NA |
| 2 | Fineness of cement | Determination of Fineness of cement | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 3 | Consistency of cement | Determination of standard consistency of cement | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 4 | Soundness of cement | Determination of soundness of cement | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 5 | Strength of cement | Determination of strength of cement, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 6 | Specific gravity of fine aggregate, | Determination of specific gravity of fine aggregate, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 7 | Specific gravity of coarse aggregate, | Determination of specific gravity of coarse aggregate, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |



| | | | | | |
|----|---------------------------------------|---|---------------|--|----------------------|
| 8 | Fineness modulus of fine aggregate | Determination of fineness modulus of fine aggregate, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 9 | Fineness modulus of coarse aggregate, | Determination of fineness modulus of coarse aggregate, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 10 | Bulking of sand | Determination of bulking of sand, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 11 | Workability of concrete | Determination of workability of concrete by slump test, Determination of workability of concrete by compaction factor test, Determination of workability of concrete by Vee - Bee consistometer Test, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 12 | Compressive strength of concrete | Determination of compressive strength of concrete, Determination of tensile strength of concrete, Determination of flexural strength of concrete, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 13 | Permeability of concrete | Determination of permeability of concrete, Determination of modulus of elasticity of concrete, | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |
| 14 | Test of aggregate | Determination of aggregate impact value, Determination of aggregate abrasion value (Los Angeles Test). | Lab Practical | CV1432.2, CV1432.3, CV1432.4, CV1432.5 | Daily Lab Assessment |

H. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 | |
| CV 1432.1 | Understanding the concept of the different properties of materials | 3 | 2 | | | | | | | | | | 3 | 1 | 1 | | | |
| CV 1432.2 | Applying the concept to determine their properties | 3 | 2 | | | | 1 | | | | | | 3 | 3 | 3 | 2 | 1 | |



| | | | | | | | | | | | | | | | | | |
|--------------|--|--|---|---|--|---|---|--|---|--|--|---|---|---|---|---|--|
| CV 1432.3 | Enhance entrepreneurship skill | | 2 | 2 | | 3 | 3 | | | | | 3 | | 1 | | 3 | |
| CV 1432.4 | Analysing and applying the properties will lead to employability | | 3 | 3 | | 3 | 2 | | | | | 3 | 2 | 3 | | 3 | |
| CV 1432.5 | Skills to work in groups or independently | | | | | | | | 3 | | | 3 | | | 3 | 3 | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering
Course Hand-out

Engineering Geology Laboratory Practices| CV I433| I Credit| 0 0 2 I

Session: January–May 2020| Faculty: Dr Harshavardhana B G | Class: Regular

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Regular Course, to support students for gaining the practical knowledge of identifying different variety of minerals and rocks. The course introduces the application of Brunton Compass to explore the dip and strike of a rock-bed in the field. Demarcation of rock outcrop from the contour- and geological- maps, their profiling with an estimation and mapping of inclined beds would strengthen and supplement the theoretical knowledge of Geology learnt in the earlier semester. This would also help students understand the importance of different geological structures before undertaking construction.

B. **Course Outcomes:** At the end of the course, students will be able to

[CV1433.1]. Apply the fundamental knowledge of physical properties of minerals and rocks for their identification, which helps to decide on the type of rock needed for the construction. This practical knowledge, along with the theoretical knowledge of the subject would increase the employability.

[CV1433.2]. Discern geological/contour/topographic maps and extract necessary information related to the thickness and attitude of a rock outcrop.

[CV1433.3]. Understand the importance of the subsurface geological structures and their attitudes while planning civil constructions. This allows them to incorporate suitable measures while providing solutions to the problems associated with geological structures and thus, help for an entrepreneurship.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate



consideration for the public health and safety, and the cultural, societal, and environmental considerations

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
 5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
 2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
 3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
 4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. **Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---------------------------------|---|---------------|
| Internal Assessment (Summative) | Assignment + Record + Lab Performance + Viva | 60 |
| End Term Exam (Summative) | Performance in exam + viva | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |



| | |
|---|--|
| Make up Assignments (Formative) | Student who misses a class will have to report to the teacher about the absence. A makeup assignment (which will be considered only for attendance) on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. Syllabus:

Identification and description of the following minerals with uses and distribution in India. Rock forming Minerals: Quartz group - rock crystal, Amethyst, Rose crystal, agate, flint, Jasper, Orthoclase, Microcline, Plagioclase, Muscovite, Biotite, Koaline, Calcite, Magnesite, Dolomite, Hornblende, gypsum, Olivine, Corundum, Garnet, Talc, Asbestose, Chlorite. Ore minerals: hematite, Magnetite, Limonite, Chromite, Chalcopyrite, Pyrite, Galena, Azurite, Malacite. Megascopic study of the following rocks with their composition, texture, structure, and engineering importance- Granite, gabbro, dunite, pegmatite, dolomite, basalt, obsidian, pumice, conglomerate, breccia, sandstone, limestone, shale, laterite, gneiss, slate, quartzite and marble. Interpretation of geologic maps with horizontal inclined, folded, faulted and unconformity. Determination of thickness of strata on horizontal ground, Dip and strike problems, Borehole problems and their uses in dams, tunnels and reservoir site.

References:

1. Reddy M.T.M., Engineering Geology Practicals, New Age International Publishers, New Delhi 2002.
2. Gurappa K.M., Structural Geology Maps and Problems, 1975.
3. Gokhale W., Manual of Geological Maps, CBS publications, New Delhi 1987.

F. Lecture Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|---|--|------------------------|------------------------------|-------------------------------|
| 1 | Formation of flow chart for minerals identification | Understand the relation of minerals with their physical properties | Practical session with | CV1433.1 | |
| 2 | Identification and description of Silicate Minerals | | | | |
| 3 | Identification and description of Non-Silicate Minerals – | | | | |



| | Oxide and Sulphide group | Mineral identification through their properties | mineral samples in lab | | Viva while practical session |
|----|--|--|--|-----------------------|------------------------------|
| 4 | Identification and description of Non-Silicate Minerals – Halide, carbonate & sulphate group | | | | |
| 5 | Formation of Flow chart for Rock identification | | | | |
| 6 | Identification and description of Igneous rocks | | Practical session with rock samples in lab | CV1433.1 | Viva while practical session |
| 7 | Identification and description of Sedimentary rocks | Understand the relation of minerals with their physical properties | | | |
| 8 | Identification and description of Metamorphic rocks | | | | |
| 9 | Determination of thickness of subsurface strata | | | | |
| 10 | Dip and strike problem - Determination of true dip using apparent dip values | Calculation of the attitude of subsurface geological formations | Practical session | CV1433.2 and CV1433.3 | Viva while practical session |
| 11 | Dip and strike problem - Determination of true dip using apparent dip values and strike | | | | |
| 12 | Dip and strike problem - Determination of apparent dip using true dip | | | | |
| 13 | Determination of trend of a strata from the geological map | | | | |

G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|----------|--|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|--|------|------|------|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CV1433.1 | Apply the fundamental knowledge of physical properties of minerals and rocks for their identification, which helps to decide on the type of rock needed for the construction. | 3 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 |
| CV1433.2 | Discern geological/contour/topographic maps and extract necessary information related to the thickness and attitude of a rock outcrop. | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 | 1 | 1 |
| CV1433.3 | Understand the importance of the subsurface geological structures and their attitudes while planning civil constructions. This allows them to incorporate suitable measures while providing solutions to the problems associated with geological structures. | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 2 |

1. **Low Correlation;** 2- **Moderate Correlation;** 3- **Substantial Correlation**



A. Introduction: This course is offered by Dept. of Civil Engineering as a departmental core course. The main objectives of this course are to understand, determine and analyses the physical and engineering properties of soils. The course covers index properties of soils, classification of soils, soil structure, clay mineralogy, and movement of water through soils, stresses in soil mass, seepage analysis, compaction, soil improvement and shear strength of soils. Further, the course also includes the laboratory and field determination of various properties of soils and interpretation/presentation of results. Overall, this course will help to solve the complex geotechnical engineering problem and to handle the various civil engineering projects.

B. Course Outcomes: At the end of the course, students will be able to

- [CV1501.1]. Realize the importance of geotechnical engineering in civil engineering construction.
- [CV1501.2]. Identify the basic properties and mineralogy in soils for prediction and analyses of its engineering properties.
- [CV1501.3]. Investigate the suitability of soils and its improvement techniques for structures to be constructed.
- [CV1501.4]. Determine the properties of soils and its critical evaluation for design and construction of civil engineering structures.
- [CV1501.5]. Apply the knowledge to handle the various geotechnical projects independently/or, in group to develop self-employment and entrepreneurship among learner.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals,

and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems

reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health

and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research



methods including design of experiments, analysis and interpretation of data, and synthesis of the information to

provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern

engineering and IT tools including prediction and modeling to complex engineering activities with an understanding

of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,

health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering

practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in

societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the

engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse

teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering

community and with society at large, such as, being able to comprehend and write effective reports and design

documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering

and management principles and apply these to one's own work, as a member and leader in a team, to manage projects

and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in

independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. **Assessment Plan:**

| Criteria | Description | Maximum Marks |
|----------|--------------------------------|---------------|
| | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |



| | | |
|--|---|-----|
| Internal Assessment (Summative) | In class Quizzes and Assignments, Projects/Activity feedbacks (Accumulated and Averaged) | |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Homework/ Home Assignment/Quizzes/ Activity Assignment (Formative) | There are situations where a student may have to work in home, the scheduled and grading of these works will be decided by course instructor. However, a student is expected to participate and perform these assignments with full zeal as per academic plan prepared by instructor. | |

E. SYLLABUS

Introduction: definition, historical development of soil mechanics, origin and classification of soils: transported soils, residual soils, alluvium, colluviums; Basic Definitions and Relationships: phase relationship of soil: two and three phase diagram, basic definitions: specific gravity, volume relationships (void ratio, porosity, degree of saturation, air void and air content), weight relationships (water content, densities/unit weights), weight-volume inter-relationships; Determination of Index Properties: water content, specific gravity, particle size distribution by sieve and sedimentation analysis, consistency limits, void ratio and density index, field identifications: density of undisturbed soils; sensitivity, thixotropy and activity of clays; Classification of Soils: introduction, gradation of soil and its importance, particle size classification: USBS and PRA Classification, International Classification, MIT Classification, Textural Classification, Highway Research Board Classification, AASHTO Classification, Unified Soil Classification and Indian Standard Classification, Classification based on shapes; Soil Structure and Clay Mineralogy: introduction, inter-particle forces, classification of soil structure, single grained, honey combed, flocculent and dispersed structure, clay minerals: kaolinite, montmorillonite and illite and their properties; Flow through Soils: soil water: free or gravitation water, held water, structural water, adsorbed water and capillary water. permeability: Darcy's law of permeability, factors effecting permeability, laboratory determination of permeability: constant and variable head methods, field determination of permeability: pumping in and pumping out test for confined and unconfined strata, permeability of stratified soil deposits; Stress in Soil Mass: stresses within a soil: total, effective and neutral stress, effective stress principle, stress point and stress path, calculation of stresses, soil-water systems-capillarity, quick sand phenomenon; Seepage Analysis: introduction: seepage forces, flow net and its elements, boundary conditions, graphical method of flow net construction, one dimensional and two dimensional flow, Laplace equation, stream and potential functions, uses of flow net, Casagrande and analytical method to



determine phreatic line of an earthen dam, design of filters; Compaction of Soils: definition and objectives, theory of compaction, laboratory compaction tests: proctor and modified proctor test, factors effecting compaction, effect of compaction on soil properties, placement water content, placement layer thickness, methods of compaction and types of equipment used in field, field control of compaction, Proctor's needle; Shear Strength of Soils: introduction, shear resistance of soil, principle stresses, Mohr's circle, Mohr's strength theory, Mohr- coulomb's strength theory, determination of shear strength parameters: direct shear test, unconfined compression test, vane shear test, tri-axial shear test, typical stress-strain curves for soils, typical failure envelopes for cohesionless soils and normally consolidated clay soils, critical void ratio..

F. Text Books

T1. Murthy, V. N. S., "Soil Mechanics and Foundation Engineering: A Book for Students and Practising Engineers", Dhanpat Rai, 1977.

T2. K. R, Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2005.

G. Reference Books

R1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications, 6th edition, 2005.

R2. Ranjan G. and Rao A.S.R., "Soil Mechanics and Foundation Engineering", New Age International Publisher, New Delhi, 2006.

H. Lecture Plan:

| Lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode Of Assessing CO |
|---------|--|--|------------------|--------------------|---|
| 1 | Definition, Historical development of soil mechanics | To provide background information about development of subject | Lecture | CVI501.1 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 2 | Origin and Classification of soils: transported soils, residual soils, alluvium, colluviums. | To realize the importance of geotechnical engineering in civil engineering construction. | Lecture | CVI501.1; CVI501.2 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|---|--|---|----------|--------------------|---|
| 3 | Phase relationship of soil: Two and three phase diagram, Basic definitions: specific gravity, volume relationships (void ratio, porosity, degree of saturation, air void and air content) Weight relationships (water content, densities/unit weights) | To introduce the basic terminologies of soil mechanics | Lecture | CVI501.2; CVI501.4 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 4 | Weight-volume inter-relationships | To derive the interrelation between various properties of soils | Lecture | CVI501.2; CVI501.4 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 5 | Weight-volume inter-relationships | To derive the interrelation between various properties of soils | Lecture | CVI501.2; CVI501.4 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 6 | Numerical practice and exercises | To solve the practical problem of phase relations of soil | Tutorial | CVI501.2; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 7 | Numerical practice and exercises | To solve the practical problem of phase relations of soil | Tutorial | CVI501.2; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|----|--|---|----------|------------------------------|---|
| 8 | Water content, specific gravity | To explain about determination of index properties | Lecture | CVI501.3; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 9 | Particle size distribution by sieve and sedimentation analysis | To explain about determination of index properties | Lecture | CVI501.4; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 10 | Consistency limits, void ratio and density index | To explain about determination of index properties | Lecture | CVI501.3; CVI501.4; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 11 | Field identifications: density of undisturbed soils; Sensitivity, Thixotropy and Activity of clays | To explain about determination of index properties | Lecture | CVI501.3; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 12 | Numerical practice and exercises | To solve the practical problem of determination of index properties | Tutorial | CVI501.4; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|----|--|---|----------|--------------------|--|
| 13 | Numerical practice and exercises | To solve the practical problem of determination of index properties | Tutorial | CVI501.4; CVI501.5 | Mid Term I, End Term Quiz; Assignment; Class Test, Project work |
| 14 | Introduction, Gradation of soil and its importance, Particle size classification: USBS and PRA Classification | To introduce about various soil classification system | Lecture | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 15 | International Classification, MIT Classification, Textural Classification, Highway Research Board Classification | To introduce about various soil classification system | Lecture | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 16 | AASHO Classification, Unified Soil Classification and Indian Standard Classification, Classification based on shapes | To introduce about various soil classification system | Lecture | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 17 | Numerical Exercises | To practice the problems for classifying the soils | Tutorial | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|----|--|---|---------|--------------------|--|
| 18 | Introduction, inter-particle forces, classification of soil structure, single grained, honey combed, flocculent and dispersed structure. | To acquaint with formation of clay mineral and its properties | Lecture | CVI501.2; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 19 | Clay minerals: Kaolinite, Montmorillonite and Illite | To acquaint with formation of clay mineral and its properties | Lecture | CVI501.2; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 20 | Properties of clay minerals | To acquaint with formation of clay mineral and its properties | Lecture | CVI501.2; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 21 | Soil water: free or gravitation water, held water, structural water, adsorbed water and capillary water | To familiarize with various types of soil-water | Lecture | CVI501.3; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 22 | Permeability: Darcy's law of permeability, factors effecting permeability | To know the movement of water through soils | Lecture | CVI501.3; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|----|---|---|----------|--------------------|--|
| 23 | Laboratory determination of permeability: constant and variable head methods | To determine the hydraulic conductivity of soils | Lecture | CVI501.3; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 24 | Field determination of permeability: pumping in and pumping out test for confined and unconfined strata, Permeability of stratified soil deposits | To know the field determination of permeability of soils | Lecture | CVI501.4; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 25 | Numerical Exercises | To practice of solving problems related to permeability of soils | Tutorial | CVI501.4; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 26 | Numerical Exercises | To practice of solving problems related to permeability of soils | Tutorial | CVI501.4; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 27 | Stresses within a soil: total, effective and neutral stress, effective stress principle, stress point and stress path | To understand the different stresses caused due to water within soils | Lecture | CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|----|--|---|----------|--------------------|--|
| 28 | Calculation of stresses, soil-water systems-capillarity, quick sand phenomenon | To calculate the hydrostatics stresses within soils mass | Lecture | CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 29 | Numerical Exercises | To practice of solving problems related to stresses | Tutorial | CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 30 | Introduction: seepage forces, flow net and its elements, boundary conditions | To explain about the background of pressures caused due to seepage of water through soils | Lecture | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, Project work |
| 31 | Graphical method of flow net construction, One dimensional and two dimensional flow | To evaluate the seepage pressures | Lecture | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, Project work |
| 32 | Laplace Equation, stream and potential functions, uses of flow net | To derive the equation to get seepage pressures | Lecture | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, Project work |
| 33 | Casagrande and analytical method to determine phreatic line of an earthen dam, Design of filters | To evaluate the seepage pressures | Lecture | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, |



| | | | | | |
|----|---|---|----------|--------------------|--|
| | | | | | Project work |
| 34 | Numerical Exercises | To practice of solving problems related to seepage pressure | Tutorial | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, Project work |
| 35 | Numerical Exercises | To practice of solving problems related to seepage pressure | Tutorial | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, Project work |
| 36 | Definition and objectives, Theory of compaction, Laboratory compaction tests: Proctor and Modified Proctor test | To get the idea about densification of soils | Lecture | CVI501.3; CVI501.4 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 37 | Factors affecting compaction, Effect of compaction on soil properties | To know about the compaction and related changes in soil properties | Lecture | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 38 | Placement water content, Placement layer thickness | To understand the compaction control | Lecture | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |



| | | | | | |
|----|--|---|----------|--------------------|--|
| 39 | Methods of compaction and types of equipment used in field, Field control of compaction, Proctor's needle. | To understand the methods of compaction | Lecture | CVI501.3; CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 40 | Numerical Exercises | To solve the critical problem to determine compaction characteristics | Tutorial | CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 41 | Numerical Exercises | To solve the critical problem to determine compaction characteristics | Tutorial | CVI501.5 | Mid Term II, End Term Quiz; Assignment; Class Test, Project work |
| 42 | Introduction, shear resistance of soil, principle stresses, Mohr's circle | To know about the shear strength of soils | Lecture | CVI501.2; CVI501.3 | End Term Quiz; Assignment; Class Test, Project work |
| 43 | Mohr's strength theory, Mohr-coulomb's strength theory | To understand the theory behind the shear strength of soil | Lecture | CVI501.1; CVI501.2 | End Term Quiz; Assignment; Class Test, Project work |
| 44 | Determination of shear strength parameters: Direct Shear Test, | To determine the shear strength | Lecture | CVI501.3; CVI501.4 | End Term Quiz; Assignment; |



| | | | | | |
|----|--|--|----------|--------------------|---|
| | | parameters in laboratory | | | Class Test, Project work |
| 45 | Unconfined Compression Test, Vane Shear Test | To determine the shear strength parameters in laboratory | Lecture | CVI501.3; CVI501.4 | End Term Quiz; Assignment; Class Test, Project work |
| 46 | Tri-axial Shear Test | To determine the shear strength parameters in laboratory | Lecture | CVI501.3; CVI501.4 | End Term Quiz; Assignment; Class Test, Project work |
| 47 | Typical stress-strain curves for soils | To determine the shear strength parameters | Lecture | CVI501.3; CVI501.4 | End Term Quiz; Assignment; Class Test, Project work |
| 48 | Numerical Exercises | To calculate the shear strength parameters by various approach | Tutorial | CVI501.4; CVI501.5 | End Term Quiz; Assignment; Class Test, Project work |

I. **Course Articulation Matrix: (Mapping of COs with POs and PSOs)**

| COs | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CVI501.1 | Realize the importance of geotechnical engineering in civil engineering construction. | 3 | | | | | 2 | | | | | | | 1 | | 1 | |



| | | | | | | | | | | | | | | | | | | |
|----------|---|---|---|---|---|--|---|--|--|--|---|---|---|---|---|---|---|--|
| CVI501.2 | Identify the basic properties and mineralogy in soils for prediction and analyses of its engineering properties. | 2 | 3 | 1 | | | | | | | | | | | | | | |
| CVI501.3 | Investigate the suitability of soils and its improvement techniques for structures to be constructed. | 2 | 2 | 1 | 3 | | | | | | | | 1 | 1 | 3 | 1 | | |
| CVI501.4 | Determine the properties of soils and its critical evaluation for design and construction of civil engineering structures. | 2 | 3 | 2 | 1 | | | | | | | | 2 | 1 | 2 | | | |
| CVI501.5 | Apply the knowledge to handle the various geotechnical projects independently/or, in group to develop self-employment and entrepreneurship among learner. | 2 | 2 | 2 | 2 | | 1 | | | | 1 | 1 | 2 | 1 | 2 | 3 | 1 | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Environmental Engineering I | CVI504 | 1 Credits | 3 | 0 4

Session: July 19 – Nov 19 | Faculty: Prof. R. C. Gaur | Class: Environmental Engineering I

A. Introduction: This course is offered by Dept. of Civil Engineering as a Departmental Laboratory Course, targeting students who wish to work in the field of environmental engineering. The first part deals with quality and quantity of water. In all it deals with quality and quantity of water. Conventional and advanced treatment methods are considered. The design of distribution system is there. The second part deals with Air and noise pollution along with effect of air pollutants.

B. Course Outcomes: At the end of the course, students will be able to:

- [CVI504.1]** Comprehend about different quality parameters of water and water demand.
- [CVI504.2]** Design of Sources and Transmission of water.
- [CVI504.3]** Understand the various treatment systems of water and distribution system.
- [CVI504.4]** Analysis of effect of Air and noise pollution.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings



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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1] Design economic, environment friendly, sustainable Civil engineering structures keeping in view national and social requirements.

[PSO.2] Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex Civil engineering problem.

[PSO.3] Manage/ execute Civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

[PSO.4] Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. Syllabus



CV1504

ENVIRONMENTAL ENGINEERING – I

[3 1 0 4]

Introduction, Water demand, Population forecasting methods, Factors affecting water consumption, Variation in water demand, Design capacities for various water supply components. Source of water and water collection works. Water quality requirements, Transmission of water. Preliminary treatment of water, Water treatment processes Design of sedimentation, Coagulation, feeding mixing devices, flocculation-design consideration, other treatment, processes. Secondary treatment of water: Filtration-types of filters, Design of filters, Dissolved solids removal, Treatment plant design, Preparation of hydraulic profiles, Disinfection-theory, methods of disinfection, chlorination. Advance treatment of water. Design of distribution systems, Hydraulic analysis of distribution systems. Design of plumbing system. Air and noise pollution: Sources and types of air pollutants, Effect of air pollutants and Economic aspects, Greenhouse effect, Acid rain. Noise pollution and control.

References:

1. S.K. Garg, “*Environmental Engg.-I*”, Khanna Publishers, New Delhi, 2012.
2. G.S. Birdie, “*Water Supply and Sanitary Engineering*”, Dhanpath Rai and Sons, New Delhi, 2012.
3. B.C. Punmia, “*Water Supply and Sanitary Engg.*”, Dhanpath Rai and Sons, New Delhi, 2010
4. Modi and Sethi, “*Water Supply and Sanitary Engg.*”, Dhanpath Rai and Sons, New Delhi, 2010

BIS Publications:

1. Manual on water supply and treatment CPHEEO, Ministry of Urban development, New Delhi, 1991.

Lecture Plan:

A. Lecture Plan:

| lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode Of Assessing CO |
|---------|---|---|------------------|------------------|-----------------------------|
| 1 | General definitions and introduction to subject | To acquaint knowledge about basics of subject | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 2 | General definitions and introduction to subject | To acquaint knowledge about basics of subject | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 3 | Water demand. Variations in demand | Describing Water Demand | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 4 | Water demand. Variations in demand | Variations Demand | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |



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| 5 | Factors affecting water demand | Different Parameters | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 6 | Factors affecting water demand | Different Parameters | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 7 | Design capacities of water supply components. | Design capacities | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 8 | Design capacities of water supply components. | Design capacities | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 9 | Population forecasting methods and numerical | numerical | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 10 | Population forecasting methods and numerical | numerical | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 11 | Population forecasting methods and numerical | Comparison of Various methods | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 12 | Sources of water and their comparison | Ground water and surface water | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 13 | Sources of water and their comparison | Comparison of sources | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 14 | Water quality parameters | Physical Parameter | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 15 | Water quality parameters | Chemical Parameters | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 16 | Water quality parameters | Bacteriological parameters | Lecture | [CVI504.1] | Mid Term I, Quiz & End Term |
| 17 | Design of conveying mains and type of pipes, joints | Design of rising man | Lecture | [CVI504.2] | Mid Term I, Quiz & End Term |
| 18 | Design of conveying mains and type of pipes, joints | Design of distribution | Lecture | [CVI504.2] | Mid Term II, Quiz & End Term |



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| 19 | Design of conveying mains and type of pipes, joints | Pipe types | Lecture | [CVI 504.2] | Mid Term II, Quiz & End Term |
| 20 | Preliminary treatment of water | Screening | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 21 | Preliminary treatment of water | Sedimentation | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 22 | Theory of sedimentation and numerical on settling velocity | Numerical | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 23 | Theory of sedimentation and numerical on settling velocity | Settling Velocity | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 24 | Theory of sedimentation and numerical on settling velocity | Theory of sedimentation | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 25 | Coagulation, Flocculation | Coagulation | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 26 | Coagulation, Flocculation | Alum as coagulant | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 27 | Coagulation, Flocculation | Clarifloculator | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 28 | Filtration, type of filters | Theory of filtration | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 29 | Filtration, type of filters | Filtration | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 30 | Filtration, type of filters | Types of filters | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 31 | Slow sand and Rapid gravity sand filters, comparison | Slow and rapid Sand filters | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |



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|----|--|------------------------------|---------|-------------|------------------------------|
| 32 | Slow sand and Rapid gravity sand filters, comparison | comparison | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 33 | Slow sand and Rapid gravity sand filters, comparison | Hydraulic Design | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 34 | Treatment plant hydraulic design | Profile and Head loss | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 35 | Treatment plant hydraulic design | Case study Mansi Vakal plant | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 36 | Disinfection, chlorination, residual chlorine | Dis infection | Lecture | [CVI 504.3] | Mid Term II, Quiz & End Term |
| 37 | Disinfection, chlorination, residual chlorine | Chlorination | Lecture | [CVI 504.3] | Quiz & End Term |
| 38 | Disinfection, chlorination, residual chlorine | Residual Chlorine | Lecture | [CVI 504.3] | Quiz & End Term |
| 39 | Design of distribution system, Hardy Cross method | Design of pipe lines | Lecture | [CVI 504.3] | Quiz & End Term |
| 40 | Design of distribution system, Hardy Cross method | Hardy Cross method | Lecture | [CVI 504.3] | Quiz & End Term |
| 41 | Advanced treatment of water | Removal of phosphorus | Lecture | [CVI 504.3] | Quiz & End Term |
| 42 | Advanced treatment of water | Removal of nitrogen | Lecture | [CVI 504.3] | Quiz & End Term |
| 43 | Plumbing systems | House Connection | Lecture | [CVI 504.3] | Quiz & End Term |
| 44 | Plumbing systems | House drainage system | Lecture | [CVI 504.3] | Quiz & End Term |
| 45 | Air and Noise pollution | Air pollutants | Lecture | [CVI 504.4] | Quiz & End Term |
| 46 | Air and Noise pollution | Secondary air pollutant | Lecture | [CVI 504.4] | Quiz & End Term |
| 47 | Air and Noise pollution | SPM | Lecture | [CVI 504.4] | Quiz & End Term |
| 48 | Effects of air pollutants | Effect of human beings | Lecture | [CVI 504.4] | Quiz & End Term |



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| 49 | Effects of air pollutants | Effect on vegetation, buildings | Lecture | [CVI504.4] | Quiz & End Term |
| 50 | Effects of air pollutants | Mitigation | Lecture | [CVI504.4] | Quiz & End Term |
| 51 | Sources and types of Air pollutants | Sox (Nox) | Lecture | [CVI504.4] | Quiz & End Term |
| 52 | Sources and types of Air pollutants | Line source | Lecture | [CVI504.4] | Quiz & End Term |
| 53 | Sources and types of Air pollutants | Stationary source | Lecture | [CVI504.4] | Quiz & End Term |
| 54 | Greenhouse effect, Acid rain, | Green house | Lecture | [CVI504.4] | Quiz & End Term |
| 55 | Greenhouse effect, Acid rain, | Acid rain | Lecture | [CVI504.4] | Quiz & End Term |
| 56 | Greenhouse effect, Acid rain, | Global Warming | Lecture | [CVI504.4] | Quiz & End Term |

I. **Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV 1504.1 | Comprehend about different quality parameters of water and water demand. | 3 | 2 | | 2 | | | | | | | | 2 | | 2 | | |
| CV 1504.2 | Design of Sources and Transmission of water | 2 | | 3 | 3 | 2 | 1 | | | | | | 3 | | 3 | 1 | |
| CV 1504.3 | Understand the various treatment systems of water and distribution system | 2 | | | 2 | 2 | 3 | 3 | | 1 | | | | | 3 | | |
| CV 1504.4 | Analysis of effect of Air and noise pollution. | | | | 2 | 3 | 1 | | | 3 | 2 | 3 | | | 2 | 2 | 2 |

I. **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Transportation Engineering - I | CVI505 | 4 Credits | 4 0 0 4

Session: July 19 – November 19 | Faculty: Sanchit Anand | Class: B.Tech, 3rd Year

A. Introduction: This course is offered by Dept. of Civil Engineering as a Core Course, targeting students who wish to pursue their career in the field of highway design and construction or go for higher studies in the field of Transportation Engineering. The course offers in depth knowledge of Highway Engineering, Traffic management and design, Highway Safety and Accident studies. Various highway materials used for construction, conventional design of various types of pavements, economics involved in Highway construction and management have been emphasized in this course. Students are expected to have a prerequisite knowledge of general physics for geometric design, building materials for highway materials and Surveying for Highway Alignment.

B. Course Outcomes: At the end of the course, students will be able to:

1. Identify possible highway alignment between given origin and destination
2. Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways
3. Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector
4. Conduct the quality assurance of various highway materials through different tests and identify new materials that could be used for sustainable construction of highways in order to promote entrepreneurship
5. Design traffic signals and manage traffic management projects and operations in urban areas

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations



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

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

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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of | |



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| | absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. SYLLABUS**Introduction**

Highway classifications, design of road length as per 20 year plans

Geometric design

Sight distance-stopping and overtaking, horizontal curve, extra widening. Super elevation, transition curve, vertical curves-summit and valley Curves, design problems, design of cross drainage structures.

Pavement materials

Tests on different highway materials, Soil-CBR and Plate load test, Bitumen, Difference between tar and bitumen

Design of pavements

Design of flexible pavements, rigid pavement design, stresses in rigid pavement, joints and failures of rigid pavement.

Highway economics and finance

Methods of Economic Analysis-benefit cost ratio, net present value method. Transport planning.

Traffic engineering

Traffic engineering, vehicular and road user characteristics. Traffic studies, relation between speed, travel time and traffic volume. Traffic density and passenger car units, traffic signs and traffic signals, design of traffic signals. Accident studies- overview, objectives, causes, accident analysis and road safety.

F. TEXT BOOKS

- I. *Highway Engineering*, S.K Khanna, CEG Justo, A. Veeraragavan, 10th Edition, Nem Chand Bros.



2. *Traffic and transport planning, L.R Kadiyali*

G. REFERENCE BOOKS

1. *Highway and Traffic Engineering, Subhash C Saxena, CBS Publishers*
2. *Transportation Engineering and Planning, C.S Papacostas, P.D. Prevedouros, PHI Learning*
3. *Transportation Engineering, Volume I: Highway Engineering, C Venkatramaiah*
4. *Highway Engineering, 7th Edition, Wright and Dixon, Wiley Publication*

H. Lecture Plan:

| lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode Of Assessing CO |
|----------------|--|--|-------------------------|-------------------------|-----------------------------|
| 1 | Importance of Types of Transportation | Identify possible highway alignment between given origin and destination | Lecture | CVI505.1 | Mid Term I, Quiz & End Term |
| 2 | Current road development programmes in India | Identify possible highway alignment between given origin and destination | Lecture | CVI505.1 | Mid Term I, Quiz & End Term |
| 3 | Development of road construction in world | Identify possible highway alignment between given origin and destination | Lecture | CVI505.1 | Mid Term I, Quiz & End Term |
| 4 | 1 st , 2 nd , 3 rd 20 year road development plan in India | Identify possible highway alignment between given origin and destination | Lecture | CVI505.1 | Mid Term I, Quiz & End Term |
| 5 | Highway Alignment | Identify possible highway alignment between given origin and destination | Lecture | CVI505.1 | Mid Term I, Quiz & End Term |
| 6 | Engineering surveys for highway alignment | Identify possible highway alignment between given origin and destination | Outdoor Activity | CVI505.1 | Mid Term I, Quiz & End Term |
| 7 | Engineering surveys for highway alignment | Identify possible highway alignment between given origin and destination | Lecture | CVI505.1 | Mid Term I, Quiz & End Term |
| 8 | Geometric design and importance of it | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for | Lecture | CVI505.2 | Mid Term I, Quiz & End Term |



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| | | safe and convenient highways | | | |
| 9 | Stopping sight distance | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | Lecture | CV1505.2 | Mid Term I, Quiz & End Term |
| 10 | Overtaking sight distance (ISD & HSD also) | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | Lecture | CV1505.2 | Mid Term I, Quiz & End Term |
| 11 | Pavement unevenness and camber | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | Lecture | CV1505.2 | Mid Term I, Quiz & End Term |
| 12 | Other cross sectional elements | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | Lecture | CV1505.2 | Mid Term I, Quiz & End Term |
| 13 | Design of horizontal curves | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | Activity | CV1505.2 | Mid Term I, Quiz & End Term |
| 14 | Super elevation and its design | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | Lecture | CV1505.2 | Mid Term I, Quiz & End Term |
| 15 | Widening of pavement at curves | Apply the knowledge of mathematics, science, engineering fundamentals for | Lecture | CV1505.2 | Mid Term I, Quiz & End Term |



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| | | geometric design for safe and convenient highways | | | |
| 16 | Highway materials(Soil) | Learning the quality control of highway materials | Lecture | CVI505.4 | Mid Term I, Quiz & End Term |
| 17 | Highway materials(Aggregates) | Learning the quality control of highway materials | Lecture | CVI505.4 | Mid Term I, Quiz & End Term |
| 18 | Highway materials(Bitumen) | Learning the quality control of highway materials | Lecture | CVI505.4 | Mid Term II, Quiz & End Term |
| 19 | Design elements and criteria | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 20 | Flexible pavement and its components | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 21 | Factors affecting design and performance of pavement | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 22 | Elastic layer system | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |



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| | | urban roads to enhance employability in Highway sector | | | |
| 23 | CBR method of pavement design | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 24 | IRC method of pavement design | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 25 | Components of Rigid pavement | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 26 | Stresses in Rigid pavement | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 27 | Design of dowel and tie bars | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |



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| | | urban roads to enhance employability in Highway sector | | | |
| 28 | Highway construction(Embankment) | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 29 | Granular subbase and Base layer(WBM,WMM) | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 30 | Binder and surface layer | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 31 | CC pavement and its construction | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture, Activity | CVI505.3 | Mid Term II, Quiz & End Term |
| 32 | Highway construction(Embankment) | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |



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| | | urban roads to enhance employability in Highway sector | | | |
| 33 | Granular subbase and Base layer(WBM,WMM) | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 34 | Binder and surface layer | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture, Activity | CVI505.3 | Mid Term II, Quiz & End Term |
| 35 | Highway Economics and Finance | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 36 | Net present value method and numericals | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CVI505.3 | Mid Term II, Quiz & End Term |
| 37 | Cost Benefit ratio method | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to | Lecture | CVI505.3 | Quiz & End Term |



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| | | enhance employability in Highway sector | | | |
| 38 | Numericals on method | CBR Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | Lecture | CV1505.3 | Quiz & End Term |
| 39 | Transport planning | Design traffic signals and manage traffic management projects and operations in urban areas | Lecture | CV1505.5 | Quiz & End Term |
| 40 | Traffic(Road user and vehicular characteristics) | Design traffic signals and manage traffic management projects and operations in urban areas | Lecture | CV1505.5 | Quiz & End Term |
| 41 | Traffic Engineering studies and analysis | Design traffic signals and manage traffic management projects and operations in urban areas | Lecture | CV1505.5 | Quiz & End Term |
| 42 | Origin and destination survey and accident analysis | Design traffic signals and manage traffic management projects and operations in urban areas | Lecture | CV1505.5 | Quiz & End Term |
| 43 | Continued | Design traffic signals and manage traffic management projects and operations in urban areas | Lecture | CV1505.5 | Quiz & End Term |
| 44 | Passenger car unit | Design traffic signals and manage traffic management projects and operations in urban areas | Lecture | CV1505.5 | Quiz & End Term |

I. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | CORRELATION WITH 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 | |
|----------|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|--|
| CV1505.1 | Identify possible highway alignment between given origin and destination | 3 | 3 | 1 | 3 | 3 | | 1 | 2 | | 2 | | | 2 | 3 | 2 | 1 | |
| CV1505.2 | Apply the knowledge of mathematics, science, engineering fundamentals for geometric design for safe and convenient highways | 3 | 2 | 3 | 2 | 3 | | 1 | | 1 | | | | 2 | | | 2 | |
| CV1505.3 | Apply modern engineering and IT tools to design and construct various kinds of pavements for highways and urban roads to enhance employability in Highway sector | 3 | 1 | 3 | 3 | | | | | 1 | 1 | 2 | 2 | 3 | 2 | 2 | | |
| CV1505.4 | Conduct the quality assurance of various highway materials through different tests and identify new materials that could be used for sustainable construction of highways in order to promote entrepreneurship | | | | 3 | 2 | | 2 | 2 | | | | 2 | 3 | 2 | 1 | | |
| CV1505.5 | Design traffic signals and manage transport planning projects and operations in urban areas | 1 | 0 | 2 | 1 | 1 | 2 | 2 | 1 | 0 | 0 | 3 | 0 | 1 | 0 | 2 | 0 | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Concrete Technology | CVI560 | 3 Credits | 3 0 0 3

Session: Jul 2019 – Dec 2019 | Faculty: Dr. Gaurav Sancheti | Class: Dep. Elective (V Sem)

A. Introduction: This course is offered by Dept. of Civil Engineering as a Department Elective, targeting all civil students to give them a basic idea about Concrete. This course is designed to impart basic knowledge on concrete technology including the composition of concrete, strength gain parameters in it, durability of concrete, etc. At the same time this course is designed to prepare students for concrete mix design, handle, and alter concrete which will develop their skill in concrete technology and make them employable.

B. Course Outcomes: At the end of the course, students will be able to:

- [CVI560.1].** Understand the composition of concrete and apply their engineering knowledge in analysing and formulating solutions for the specific problems in concrete
- [CVI560.2].** Develop skill for designing environment friendly and sustainable concrete mixes as per codal provisions, maintaining ethical practices for concrete production
- [CVI560.3].** Conduct investigations on the strength and durability parameter of concrete by using advanced and modern tools and equipment such as UTM, RCPT and Carbonation chamber
- [CVI560.4].** Apply his knowledge of concrete technology in various structures, according to the specific needs of public/government/project, making himself employable and involvement in independent and lifelong learning.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations



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

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

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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for discharging social responsibility as a civil engineer by innovative approaches at global platform

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |



| | |
|--|--|
| Make up Assignments (Formative) | Students who miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. SYLLABUS

Chemistry of cement: Composition of cement, hydration of Bogue's compounds, structure of hydrated cement, C-S-H gel, heat of hydration, gel- space ratio and its significance. **Concrete:** Definition, Grade, water cement ratio and its role, Properties of fresh concrete, workability, air content, Flow ability, Segregation, Bleeding and Viscosity etc. Factors affecting workability. Influence of aggregate properties on workability of fresh concrete, methods of workability determination. Concrete Admixtures: Chemical and mineral admixtures, their types and uses, water reducers, accelerator, retarders, water-proofing plasticizers, super plasticizers, air-entraining agents. **Hardened Concrete:** Properties of hardened concrete, strength, permeability, creep, shrinkage, and factors influencing properties of concrete in hardened state. **Concrete mix design:** Concrete Mix Design as per Indian Standards **Concrete Production:** Batching, mixing, placing, transportation, compaction, and finishing of concrete; equipment used in production, methods of concrete curing. **Durability of Concrete:** Definition, parameters effecting durability. Deteriorating mechanisms, alkali aggregate reaction, freeze and thaw, carbonation, chloride attack, sulphate attack, corrosion of steel reinforcement. **Modern Concrete Technology:** Ready Mix Concrete, Pumpable concrete, High Strength and High-performance Concrete, Self-Compacting Concrete, waste utilization in concrete.

F. TEXT BOOKS

1. Concrete Technology, M.S.Shetty, S.Chand publishing, (8e), 2019
2. Concrete Technology, A.R. Santhakumar, Oxford University Press, 2006.
3. Properties of concrete, A.M. Neville, Pearson Education India; (5e) 2012

G. REFERENCE BOOKS

1. Concrete: Microstructure, Properties & Materials, P.K. Mehta, Tata Mc Graw Hill.
2. IS 10262 (2009), Bureau of Indian Standards, New Delhi.
3. Durability of Concrete Structures: Investigation, Repair, Protection, Geoffrey Mays, E & FN Spon, London, 1992.

Lecture Plan:

LECTURE PLAN – CV 1560 CONCRETE TECHNOLOGY



| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|--|--|------------------|------------------------------|-----------------------------------|
| 1 | Composition of cement | Understanding of cement composition | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 2 | Hydration of Bogue's compounds | Knowledge of hydrated cement products | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 3 | Structure of hydrated cement, C-S-H gel | Information on structure of hydrated cement products | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 4 | Heat of hydration | Effects of heat of hydration | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 5 | Gel-space ratio and its significance | Characteristics of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 6 | Definition, Grade | Characteristics of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 7 | Water cement ratio and it's role | Significant properties of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 8 | Properties of fresh concrete, workability | Significant properties of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 9 | Air content, Flow ability | Significant properties of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 10 | Segregation, Bleeding and Viscosity etc. | Significant properties of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 11 | Factors affecting workability | Factors affecting properties of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 12 | Influence of aggregate properties on workability of fresh concrete | Aggregate impact on fresh properties of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 13 | Methods of workability determination | Workability of concrete | Lecture | CV1560.1 | Quiz, Assignments, Periodic exams |
| 14 | Concrete Mix Design as per Indian Standards | Concrete Mix Design as per Indian Standards | Lecture | CV1560.2 | Quiz, Assignments, Periodic exams |
| 15 | Concrete Mix Design as per Indian Standards | Concrete Mix Design as per Indian Standards | Lecture | CV1560.2 | Quiz, Assignments, Periodic exams |
| 16 | Chemical and mineral admixtures, their types and uses | Significance of concrete admixtures | Lecture | CV1560.2 | Quiz, Assignments, Periodic exams |
| 17 | Water reducers, accelerator | Significance of concrete admixtures | Lecture | CV1560.2 | Quiz, Assignments, Periodic exams |



| | | | | | |
|----|--|--|---------|----------|-----------------------------------|
| 18 | Retarders, water-proofing plasticizers | Significance of concrete admixtures | Lecture | CV1560.2 | Quiz, Assignments, Periodic exams |
| 19 | Super plasticizers, air-entraining agents | Significance of concrete admixtures | Lecture | CV1560.2 | Quiz, Assignments, Periodic exams |
| 20 | Properties of hardened concrete, strength | Behaviour of hardened concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 21 | Permeability, creep, shrinkage | Long term loading behaviour of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 22 | Factors influencing properties of concrete in hardened state | Behaviour of hardened concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 23 | Batching, mixing, placing | Manufacture of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 24 | Transportation, compaction, and finishing of concrete | Manufacture of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 25 | Equipment used in production | Manufacture of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 26 | Methods of concrete curing | Manufacture of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 27 | Definition, parameters effecting durability. | Durability of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 28 | Deteriorating mechanisms, alkali aggregate reaction | Durability of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 29 | Freeze and thaw, carbonation | Durability of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 30 | Chloride attack | Durability of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 31 | Sulphate attack | Durability of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 32 | Corrosion of steel reinforcement | Durability of concrete | Lecture | CV1560.3 | Quiz, Assignments, Periodic exams |
| 33 | Ready Mix Concrete, Pumpable concrete | Various types of concrete to suit a particular situation | Lecture | CV1560.4 | Quiz, Assignments, Periodic exams |
| 34 | High Strength and High-performance Concrete | Various types of concrete to suit a particular situation | Lecture | CV1560.4 | Quiz, Assignments, Periodic exams |
| 35 | Self-Compacting Concrete | Various types of concrete to suit a particular situation | Lecture | CV1560.4 | Quiz, Assignments, Periodic exams |



| | | | | |
|----|-------------------------------|---|---------|----------|
| 36 | Waste utilization in concrete | Advance research on concrete utilizing waste products | Lecture | CV1560.4 |
|----|-------------------------------|---|---------|----------|

H. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1560.1 | Understand the composition of concrete and apply their engineering knowledge in analysing and formulating solutions for the specific problems in concrete | 3 | 1 | 1 | 1 | | 1 | 1 | | | | | 1 | 2 | | | |
| CV1560.2 | Develop skill for designing environment friendly and sustainable concrete mixes as per codal provisions, maintaining ethical practices for concrete production | 2 | 1 | 1 | 1 | | 1 | 2 | 1 | | | | 1 | | 2 | 1 | |
| CV1560.3 | Conduct investigations on the strength and durability parameter of concrete by using advanced and modern tools and equipment such as UTM, RCPT and Carbonation chamber | 2 | 2 | 1 | 3 | 3 | 1 | | | 1 | | | | | 2 | 1 | |
| CV1560.4 | Apply his knowledge of concrete technology in various structures, according to the specific needs of public/government/project, making himself employable and involvement in independent and lifelong learning. | 3 | 2 | 2 | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | | | 3 | 1 |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Structural Analysis-II | CV I564 | 3 Credits | 3 0 0 3

Session: Aug 19 – Dec 19 | Faculty: Mr. Sourav Kumar Das | Class: B.Tech Civil V SEM

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a department elective, targeting students who wish to pursue research & development in industries or higher studies in field of Structural Engineering. Offers in depth knowledge. This course offers in depth knowledge about the analysis process and techniques of indeterminate structures. Analysis for Shear Force, Bending Moment, Deflection, Rotation, moment distribution in beams and frames with sway and non-sway and also with sinking of supports will be executed in this course. Students are expected to have background knowledge on the analysis process of determinate structures for a better learning.

B. **Course Outcomes:** At the end of the course, students will be able to

1. Understanding the concept of indeterminate structures for better employability
2. Applying the concept to degree of indeterminacy of structural systems
3. Analysing the displacement methods related to indeterminate structure
4. Determining response of structure using force method of analysis
5. Creating live problems to analyse a structure by inducing entrepreneurship skills to face problems

C. **Program Outcomes and Program Specific Outcomes**

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals,

and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems

reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health

and safety, and the cultural, societal, and environmental considerations



[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research

methods including design of experiments, analysis and interpretation of data, and synthesis of the information to

provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern

engineering and IT tools including prediction and modeling to complex engineering activities with an understanding

of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,

health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering

practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in

societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the

engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse

teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering

community and with society at large, such as, being able to comprehend and write effective reports and design

documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering

and management principles and apply these to one's own work, as a member and leader in a team, to manage projects

and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in

independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment

D. Assessment Plan:



| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | Class test and assignments | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. Syllabus

Deflection of beams. Macaulay's method, area moment method and conjugate beam method. **Analysis of indeterminate structures:** Introduction to indeterminate structures, degrees of freedom per node, static and kinematic indeterminacy, releases in structures. **Analysis of beams and frames** by slope deflection method, analysis of fixed and continuous beams by theorem of three moments, effect of sinking and rotation of supports. **Analysis of structures** using moment distribution methods applied to continuous beams and portal frames with and without sway. **Unit load method.** Strain energy for gradually applied, suddenly applied and impact loads, Strain energy due to axial loads, bending, shear and torsion; **Castiglione's theorems;** stresses due to temperature and lack of fit in redundant frames; deflection of determinate beams, and frames using energy methods.

F. Text Books

1. B.C. Punmia, "*Strength of Materials and Mechanics of Structures: Vol. I*", Laxmi Publications (P) Ltd., 2014
2. Junarkar and Shah, "*Mechanics of Structures Vol.-I*", Charotar Publishing House, 2013
3. R. S. Khurmi and N. Khurmi, "*Theory of Structures*", S.Chand, 2018.

G. Reference Books

1. Timoshenko and Young, "*Mechanics of Structures*", Mc.Graw Hill Book Co., 2015

**H. Lecture Plan:**

| Lecture Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|----------------|--|--|------------------|------------------------------|-------------------------------|
| 1 | Introduction to Structural Analysis-II | To acquaint and clear teachers' expectations and understand student expectations | Lecture | CV1564.1 | NA |
| 2-4 | Deflection of beams using conjugate beam method | Recall of conjugate mean method | Lecture | CV1564.1 | Class Quiz / Test |
| 5 | Deflection of beams using Macaulay's method and area moment method | Recall of Macaulay's and moment area method | Lecture | CV1564.4 | Class Quiz / Test |
| 6 | Introduction to indeterminate structures and calculation of degrees of freedom per node | Understanding of indeterminate structures | Lecture | CV1564.4 | Class Quiz / Test |
| 7-8 | Calculation of static and kinematic indeterminacy | Understanding and calculation of indeterminacies | Lecture | CV1564.3 | Class Quiz / Test |
| 9 | Theory and process to find releases in structures | Understanding of indeterminate structures | Lecture | CV1564.2 | Class Quiz / Test |
| 10-12 | Analysis of beams and frames by slope deflection method | Understanding of Slope Deflection method | Lecture | CV1564.2 | Class Quiz / Test |
| 13-14 | Analysis of fixed and continuous beams by theorem of three moments | Understanding of Three moments theorem | Lecture | CV1564.2 | Class Quiz / Test |
| 15-16 | Effect of sinking and rotation of supports related to Slope-deflection and Three moment theorem | Understanding the effect of sinking of supports and its analysis by slope deflection and three moments theorem | Lecture | CV1564.4 | Class Quiz / Test |
| 17-21 | Analysis of structures using moment distribution methods applied to continuous beams and portal frames with and without sway | Understanding the process and effect of sway of frames | Lecture | CV1564.4 | Class Quiz / Test |
| 22 | Unit load method | Understanding and learning of unit load method | Lecture | CV1564.4 | Class Quiz / Test |



| | | | | | |
|-------|---|---|---------|--------------------|-------------------|
| 23-24 | Strain energy for gradually applied, suddenly applied and impact loads | Understanding the effect of different application of loadings and effects on strain energy | Lecture | CV1564.4 | Class Quiz / Test |
| 25-27 | Strain energy due to axial loads, bending, shear and torsion | Understanding the strain energy concept due to axial load, bending effect, shear force and torsion resistance | Lecture | CV1564.4 | Class Quiz / Test |
| 28-30 | Castiglione's theorems | Understanding and applications of Castigliano's method. | Lecture | CV1564.4, CV1564.5 | Class Quiz / Test |
| 31-33 | Stresses due to temperature and lack of fit in redundant frames | Calculation of stress due to temperature and lack of fit in redundant structures | Lecture | CV1564.4 | Class Quiz / Test |
| 34-36 | Calculation of deflection for determinate beams and frames using Energy Methods | Understanding the concept of energy methods and its application | Lecture | CV1564.4, CV1564.5 | Class Quiz / Test |

I. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV 1564.1 | Understanding the concept of indeterminate structures for better employability | 3 | | 1 | | | 2 | | | | 2 | | 3 | | | | 1 |
| CV 1564.2 | Applying the concept to degree of indeterminacy of structural systems | 3 | 3 | 2 | 2 | | 3 | | | | 2 | | 3 | | 3 | | 2 |
| CV 1564.3 | Analysing the displacement methods related to indeterminate structure | 3 | 3 | 2 | 2 | | 3 | | | | 2 | | 3 | 2 | 3 | 3 | 2 |
| CV 1564.4 | Determining response of structure using force method of analysis | 3 | 3 | 2 | 2 | | 3 | | | | 2 | | 3 | 2 | 3 | 3 | 2 |



| | | | | | | | | | | | | | | | | |
|--------------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CV 1564.5 | Creating live problems to analyse a structure by inducing entrepreneurship skills to face problems | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|--------------|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



A. **Introduction:** This course is offered by Dept. of Civil Engineering as a departmental core course. The course covers a detailed laboratory testing by using various method as per standard test procedures to determine and understand the physical and engineering properties of soils for design of different civil engineering construction projects.

B. **Course Outcomes:** At the end of the course, students will be able to
[CVI530.1]. Determine physical properties of soil.
[CVI530.2]. Determine the index properties of natural soils.
[CVI530.3]. Understand the compaction control in the field.
[CVI530.4]. Determine shear strength and compressibility characteristics of soil.
[CVI530.5]. Apply the knowledge to handle the various geotechnical projects independently/or, in group to develop self-employment and entrepreneurship among learner.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals,

and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems

reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health

and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research

methods including design of experiments, analysis and interpretation of data, and synthesis of the information to

provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern

engineering and IT tools including prediction and modeling to complex engineering activities with an understanding

of the limitations



[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | - |
| | Sessional Exam II (Close Book) | - |
| | Online quiz, class exam, viva, discipline, report writing | 60 |
| End Term Exam (Summative) | Live test, report writing, viva with external | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |



Make up Assignments
(Formative)

Students who misses a class will have to report to the teacher about the absence. If student missed any quizzes and class tests, he/she will be allowed to appear only one substitute quiz and class test.

E. SYLLABUS

Determination of water content, specific gravity, particle size distribution of coarse and fine grained soil, Atterberg's limits of soil. Determination of dry density of natural soil. Determination of compaction characteristics (optimum moisture content and maximum dry density of soil) using standard proctor method and modified proctor method. Determination of California Bearing Ratio (CBR) of soil in dry and wet condition. Determination of Unconfined Compressive Strength (UCS) of soil. Determination of shear strength parameters of soil using direct shear test. Determination of shear strength of clay by using Vane shear test. Determination of the coefficient of permeability of soils by constant and falling head method. Determination of shear strength parameters of soils using Triaxial tests. Determination of compressibility characteristics of soil by using one dimensional oedometer test.

F. Text Books

- T1. Indian Standard codes practices for soil testing.
T2. K. R, Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2005.

G. Reference Books

- R1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications, 6th edition, 2005.
R2. Ranjan G. and Rao A.S.R., "Soil Mechanics and Foundation Engineering", New Age International Publisher, New Delhi, 2006.

H. Lecture Plan:

| Lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode Of Assessing CO |
|---------|---|--|------------------|--------------------|--|
| 1 | Determination of water content of soils by oven drying method and rapid moisture meter method | To provide background information about development of subject | Practical | CVI530.1; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 2 | Determine specific gravity of soils using pycnometer method | To realize the importance of geotechnical engineering in civil engineering construction. | Practical | CVI530.1; CVI530.5 | Online quiz, class exam, viva, discipline, report writing |



| | | | | | |
|---|--|---|-----------|--------------------|---|
| | | | | | Live test, report writing, viva with external |
| 3 | Determine particle size distribution of coarse and fine grained soil using by dry and wet sieve analysis | To introduce the basic terminologies of soil mechanics | Practical | CVI530.1; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 4 | Determine particle size distribution of fine grained soil using hydrometer method | To derive the interrelation between various properties of soils | Practical | CVI530.1; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 5 | Determine the Atterberg's limits of soil by Casagrande's method and cone penetration method | To derive the interrelation between various properties of soils | Practical | CVI530.2; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 6 | Determine the Plastic limit of soil | To solve the practical problem of phase relations of soil | Practical | CVI530.2; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |



| | | | | | |
|----|---|---|-----------|--------------------|---|
| 7 | Determine the Shrinkage limit of soil | To solve the practical problem of phase relations of soil | Practical | CVI530.2; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 8 | Determine dry density of natural soil by a) Sand replacement method b) Core cutter method | To explain about determination of index properties | Practical | CVI530.3; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 9 | Determine compaction characteristics (optimum moisture content and maximum dry density of soil) using a) Standard proctor method b) Modified proctor method | To explain about determination of index properties | Practical | CVI530.3; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 10 | Determine California Bearing Ratio (CBR) of soil a) Dry condition b) Wet condition | To explain about determination of index properties | Practical | CVI530.4; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 11 | Determine Unconfined Compressive Strength (UCS) of soil | To explain about determination of index properties | Practical | CVI530.4; CVI530.5 | Online quiz, class exam, viva, discipline, report writing |



| | | | | | |
|----|--|---|-----------|--------------------|--|
| | | | | | Live test, report writing, viva with external |
| 12 | Determine shear strength parameters of soil using direct shear test | To solve the practical problem of determination of index properties | Practical | CVI530.4; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 13 | Determine shear strength of clay by using Vane shear test | To solve the practical problem of determination of index properties | Practical | CVI530.4; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 14 | Determine the coefficient of permeability of soils by a) Constant head method b) Falling head method | To introduce about various soil classification system | Practical | CVI530.4; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 15 | Determine shear strength parameters of soils using Triaxial tests | To introduce about various soil classification system | Practical | CVI530.4; CVI530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |



| | | | | | |
|----|---|---|-----------|--------------------|---|
| 16 | Determine compressibility characteristics of soil by using one dimensional oedometer test | To introduce about various soil classification system | Practical | CV1530.4; CV1530.5 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
|----|---|---|-----------|--------------------|---|

I. **Course Articulation Matrix: (Mapping of COs with POs and PSOs)**

| COs | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1530.1 | Determine physical properties of soil. | 2 | 2 | 2 | 1 | 1 | | | 1 | 1 | | | 2 | | 3 | 1 | |
| CV1530.2 | Determine the index properties of natural soils. | 2 | 2 | 2 | 1 | 1 | | | 1 | 1 | | | 2 | | 3 | 1 | |
| CV1530.3 | Understand the compaction control in the field. | 2 | 2 | 2 | 1 | 1 | | | 1 | 1 | | | 2 | | 3 | 1 | |
| CV1530.4 | Determine shear strength and compressibility characteristics of soil. | 2 | 2 | 2 | 1 | 1 | | | 1 | 1 | | | 2 | | 3 | 1 | |
| CV1530.5 | Apply the knowledge to handle the various geotechnical projects independently/or, in group to develop self-employment and entrepreneurship among learner. | 2 | 2 | 2 | 2 | | | | 1 | 2 | 2 | | 2 | 1 | 2 | 2 | 1 |

I. **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**



A. Course Outcomes: At the end of the course, students will be able to:

- [CVI532.1].** Applying knowledge to classify and analysing various water quality parameters.
- [CVI532.2].** Analysing various physio-chemical and biological parameters of water and wastewater.
- [CVI532.3].** Understanding the importance of advance waste treatment technologies with functional design of low-cost treatment systems used in rural areas for the sake of waste management.
- [CVI532.4].** Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning.

B. SYLLABUS

Analysis of water/wastewater for physicochemical parameters: Turbidity, alkalinity, pH, hardness, chlorides, sulphates, ammonical nitrogen, nitrates, sulphate, oil and grease, available chlorine, dissolve oxygen, biochemical oxygen demand, chemical oxygen demand. Residual chlorine and chlorine demand, determination of available chlorine in Bleaching powder, Determination of Calcium, Potassium and Sodium. Determination of heavy metals in aqueous solution – Chromium, Lead and Zinc. Coagulation and flocculation of water – optimization of dose / pH / time of flocculation. Characteristics of Industrial wastewater. Analysis of solid wastes: characterisation of wastes from different industries.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering



activities with an understanding of the limitations **[PO.6]. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. [Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

| Criteria | Description | Maximum Marks |
|------------------------------------|----------------------------------|---------------|
| Internal Assessment (Summative) | QUIZES (4) | 20 |
| | VIVA (4) | 20 |
| | Experiment reports submission | 20 |
| End Term Exam (Summative) | End Term Practical Exam and viva | 30 +10 |
| | Total | 100 |



| | |
|---|--|
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup practical assignment on the experiment conducted on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank , so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | A student have to work in home, especially after conducting the experiment. These works has to be submitted immediately in the next class and evaluation will be done for the same. A student is expected to participate and perform these practical assignments with full zeal since the activity participation by a student will be assessed and marks will be awarded. |

D. TEXT BOOKS

1. Standard Methods for the Examination of Water and Waste Water - ALPHA - AWWA – WPCF.
2. Sawyer C. McCarty P. and, Parkin G., Chemistry for Environmental Engineering, McGraw Hill, New York. 1994.
3. IS - 3025 - 1964 - Methods of Sampling and Test (Physical and Chemical) for Water Used in Industry, IIT New Delhi.
4. Drinking water Standards IS - 10500-1991.

E. Lesson Plan

| Topics | Practical | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|-------------------------------------|-----------|--|-------------------------|------------------------------|-------------------------------|
| Determination of pH of given sample | 1 | Applying knowledge to classify and analysing various water quality parameters. | Practical Demonstration | CV1532.1 CV1532.4 | VIVA Quiz |



| | | | | | |
|--|---|---|-------------------------|----------------------|-----------|
| | | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | | | |
| Determination of alkalinity of water of given water sample | 1 | Applying knowledge to classify and analysing various water quality parameters. Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | | VIVA Quiz |
| Determination of acidity of water of given water sample | 1 | Applying knowledge to classify and analysing various water quality parameters. | Practical Demonstration | CV1532.1 CV1532.4 | VIVA Quiz |



| | | | | | |
|--|---|---|-------------------------|----------------------|-----------|
| | | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | | | |
| Determination of turbidity of given water sample | 1 | Applying knowledge to classify and analysing various water quality parameters. Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | CV1532.1 CV1532.4 | VIVA Quiz |
| Determination of optimum dosage of coagulating required for the coagulation of suspended solids in the given water sample (jar test) | 1 | Analysing various physio-chemical and biological parameters of water and wastewater. Apply knowledge of quality requirement and analysing | Practical Demonstration | CV1532.2 CV1532.1 | VIVA Quiz |



| | | | | | |
|---|---|---|-------------------------|----------------------|-----------|
| | | techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | | | |
| Determination of solids in given water sample | 1 | Analysing various physio-chemical and biological parameters of water and wastewater. Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | CV1532.2 CV1532.4 | VIVA Quiz |
| Determination of hardness in given water sample | 1 | Analysing various physio-chemical and biological parameters of water and wastewater. Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the | Practical Demonstration | CV1532.2 CV1532.4 | VIVA Quiz |



| | | | | | |
|---|---|--|-------------------------|----------------------|-----------|
| | | specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | | | |
| Determination of dissolved oxygen in given water sample | 1 | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |
| Determination of chlorides in given water sample | 1 | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |
| Determination of chlorine demand and chlorine residue | 1 | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |



| | | | | | |
|--|---|---|-------------------------|----------------------|-----------|
| | | specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | | | |
| Determination of B.O.D of given sample | 1 | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |
| Determination of C.O.D of given sample | 1 | Understanding the importance of advance waste treatment technologies with functional design of low-cost treatment systems used in rural areas for the sake of waste management. Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |



| | | | | | |
|--|---|--|-------------------------|----------------------|-----------|
| | | and involvement in independent and lifelong learning | | | |
| Preparation of culture media, nutrient agar and MaConkey's broth | 1 | Understanding the importance of advance waste treatment technologies with functional design of low-cost treatment systems used in rural areas for the sake of waste management. Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |
| Estimation of bacterial number | 1 | Understanding the importance of advance waste treatment technologies with functional design of low-cost treatment systems used in rural areas for the sake of waste management. Apply knowledge of quality requirement and analysing | Practical Demonstration | CV1532.3 CV1532.4 | VIVA Quiz |



| | | | | | |
|-----------------------------|-----------|---|--|--|--|
| | | techniques in the field of water and wastewater, according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning | | | |
| Total Semester (hrs) | 14 | | | | |

J. COURSE OUTCOME ATTAINMENT LEVEL MATRIX:

| CO | STATEMENT | ATTAINMENT OF PROGRAM OUTCOMES | | | | | | | | | | | | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
|-----------|---|--------------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | | | | |
| CV 1532.1 | Applying knowledge to classify and analysing various water quality parameters | 2 | 2 | 3 | 2 | 2 | | | | 3 | | | 3 | | 3 | | 3 |
| CV 1532.2 | Analysing various physio-chemical and biological parameters of water and wastewater. | 2 | 2 | 3 | 2 | 2 | | | | 3 | | | 3 | | 3 | 3 | 1 |
| CV 1532.3 | Understanding the importance of advance waste treatment technologies with functional design of low-cost treatment systems used in rural areas for the sake of waste management. | 2 | 2 | 3 | 2 | 2 | | | | 3 | | | 3 | 1 | 3 | 3 | 1 |
| CV 1532.4 | Apply knowledge of quality requirement and analysing techniques in the field of water and wastewater, | 2 | 2 | 3 | 2 | 2 | | | | 3 | | | 3 | 1 | | | 1 |



| | | | | | | | | | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| according to the specific needs of public/ institute/ industry, making himself employable and involvement in independent and lifelong learning. | | | | | | | | | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

0-No Attainment; 1- Low Attainment; 2- Moderate Attainment; 3- Substantial Attainment



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Geotechnical Engineering-II | CV1601| 4 Credits | 3 1 0 4

Session: January 20 – May 20 | Faculty: Mr. Kamal Kumar | Class: Departmental Core Course

A. **INTRODUCTION:** This course is offered by Dept. of Civil Engineering as a departmental core course. The main objectives of this course are to understand, determine and analyses the engineering properties of soils and their application on the foundation design of structures. The course covers stress distribution in soils, consolidation of soils, earth pressure, and stability of slopes, shallow foundations, deep foundations, and site investigations. Overall, this course will help to solve the complex geotechnical engineering problems, design the foundation on different ground conditions and to handle the various civil engineering projects.

B. **COURSE OUTCOMES:**

After successful study of course, students will be able to:

1. Analyse the problem related to foundation engineering.
2. Determine and analyse the compressibility characteristics of soil.
3. Determine earth pressure, stability of retaining walls and slopes for structural design.
4. Determine bearing capacity of soils for application in the foundations design.
5. Conduct site investigations and interpret results for engineering applications.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development



8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. **ASSESSMENT PLAN:**

| Criteria | Description | Maximum Marks |
|------------------------------------|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments, Projects/Activity feedbacks (Accumulated and Averaged) | 30* |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment/quiz/viva on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the | |



| | |
|--|--|
| | student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/Quizzes/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although the grading of these works will be decided by course instructor. However, a student is expected to participate and perform these assignments with full zeal. Since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

* *The detail criteria for internal assessment is given at section J.*

E.

SYLLABUS:

Stress distribution in soils: Elastic theories of stress distributions in soils: Boussinesq equation, pressure distribution diagram. Vertical pressure under uniformly loaded circular and rectangular area, equivalent point load method. Newmark's influence chart. Westergaard analysis, and Contact pressure. Numerical Exercises.

Consolidation of soils: Introduction, comparison between compaction and consolidation, Component of settlement- immediate, primary and secondary settlement. Terzaghi's one dimension consolidation theory, normally, under and over consolidated soils, laboratory one-dimensional consolidation test, time factor. Compressibility characteristics: determination of void ratio, coefficient of volume change, coefficient of consolidation and settlement. Estimation of pre-consolidation pressure, factors influencing compressibility behaviour of soils. Numerical Exercises.

Earth pressure: Active, passive and earth pressure at rest. Rankine's and Coulomb's theories of earth pressure. Rebhann's and Culman's graphical methods for active earth pressure for vertical and inclined back retaining walls, horizontal and inclined cohesionless back fill. Earth pressure on cantilever sheet piles, Stability analysis of retaining walls. Numerical Exercises.

Stability of slopes: Classifications of slopes, Stability analysis of infinite slopes, Stability analysis of finite slopes by Swedish and Friction circle method, Stability analysis by Taylor's stability number, Taylor stability number curves, Stability of slopes of earthen embankments under sudden draw down, steady seepage and during construction, Bishop's method of stability analysis. Numerical Exercises.

Shallow foundation: Introduction, bearing capacity, types of foundations. Rankine's method for minimum depth of foundation. Terzaghi and Meyehoff's theory for bearing capacity. Skempton's method. Effect of eccentricity and water table on bearing capacity. Introduction to machine foundations. Numerical Exercises.

Deep foundation: Types of piles, pile driving, Load carrying capacity of piles, Static and dynamic formulae Pile load test, Group behaviour of piles and negative skin friction, Introduction to well foundation, Numerical Exercises.

Site Investigations: Methods of explorations. Planning of Investigations, Depth of exploration, and number of boreholes. Undisturbed and Disturbed samples. Types of samplers. Brief description of procedures of sampling, Transportation and Storage of samples. Plate load and penetration tests for determining bearing capacity. Geophysical methods of investigations. Numerical Exercises.

F.

TEXT BOOKS:



1. Murthy, V. N. S., "Soil Mechanics and Foundation Engineering: A Book for Students and Practising Engineers", Dhanpat Rai (1977).
2. K. R, Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi (2005).
3. Bowles J. E., "Foundation Analysis and Design." McGraw Hill, New York (1997).

G. REFERENCE BOOKS:

1. Punmia B.C., "Soil Mechanics and Foundations", Laxmi Publications, 6th edition (2005).
2. Ranjan G. and Rao A.S.R., "Soil Mechanics and Foundation Engineering", New Age International Publisher, New Delhi (2006).
3. S. K. Garg, "Soil Mechanics and Foundation Engineering", Khanna Publishers, Delhi (2005).
4. Terzaghi K., Peck R. B. and Gholamreza Messi, "Soil Mechanics in Engineering Practice", Wiley India (P) Ltd., New Delhi, 3rd Edition (2013).
5. B. M. Das, "Advanced Soil Mechanics", Taylor and Francis, Washington (1997).
6. Alam Singh, "Soil Engineering in Theory and practice", CBS Publishers and Distributors, Delhi (2006).

LECTURE PLAN:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|--|------------------------------|------------------|------------------------------|------------------------------------|
| 1 | Elastic theories of stress distributions in soils: Boussinesq Equation, pressure distribution diagram. | Stress distribution in soils | Lecture | CV1601.1 | Quiz; Home Assignment; Class Test; |
| 2 | Vertical pressure under uniformly loaded circular and rectangular area, equivalent point load method. | Stress distribution in soils | Lecture | CV1601.1 | Quiz; Home Assignment; Class Test; |
| 3,4 | Newmark's influence chart. Westergaard Analysis, and Contact Pressure. | Stress distribution in soils | Lecture | CV1601.1 | Quiz; Home Assignment; Class Test; |
| 5,6 | Numerical Exercises | Stress distribution in soils | Lecture | CV1601.1 | Quiz; Home Assignment; Class Test; |
| 7 | Introduction, comparison between compaction and consolidation, Component of settlement- immediate, primary and secondary settlement. | Consolidation of soils | Lecture | CV1601.2 | Quiz; Home Assignment; Class Test; |



| | | | | | |
|-------|--|------------------------|---------|----------|--|
| 8,9 | Terzaghi's one dimension consolidation theory, normally, under and over consolidated soils, laboratory one-dimensional consolidation test, time factor. | Consolidation of soils | Lecture | CV1601.2 | Quiz; Home Assignment; Class Test; |
| 10 | Compressibility characteristics: determination of void ratio, coefficient of volume change, coefficient of consolidation and settlement. | Consolidation of soils | Lecture | CV1601.2 | Quiz; Home Assignment; Class Test; |
| 11 | Estimation of pre-consolidation pressure, factors influencing compressibility behaviours of soils. | Consolidation of soils | Lecture | CV1601.2 | Quiz; Home Assignment; Class Test; |
| 12,13 | Numerical Exercises | Consolidation of soils | Lecture | CV1601.2 | Quiz; Home Assignment; Class Test; |
| 14 | Active, passive and earth pressure at rest. | Earth pressure | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 15,16 | Rankine's and Coulomb's theories of earth pressure. | Earth pressure | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 17,18 | Rebhann's and Culman's graphical methods for active earth pressure for vertical and inclined back retaining walls, horizontal and inclined cohesionless back fill. | Earth pressure | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 19 | Earth pressure on cantilever sheet piles, Stability analysis of retaining walls. | Earth pressure | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 20,21 | Numerical practice and exercises | Earth pressure | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 22 | Classifications of slopes, Stability analysis of infinite slopes. | Stability of slopes | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 23,24 | Stability analysis of finite slopes by Swedish and Friction circle method. | Stability of slopes | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 25 | Stability analysis by Taylor's stability number, Taylor stability number curves. | Stability of slopes | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |



| | | | | | |
|-------|--|---------------------|---------|----------|--|
| 26 | Stability of slopes of earthen embankments under sudden draw down, steady seepage and during construction. | Stability of slopes | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 27 | Bishop's method of stability analysis. | Stability of slopes | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 28,29 | Numerical Exercises | Stability of slopes | Lecture | CV1601.3 | Quiz; Home Assignment; Class Test; |
| 30 | Introduction, bearing capacity, types of foundations. Rankine's method for minimum depth of foundation. | Shallow foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 31 | Terzaghi and Meyehoff's theory for bearing capacity. Skempton's method | Shallow foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 32 | Effect of eccentricity and water table on bearing capacity | Shallow foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 33 | Introduction to machine foundations | Shallow foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 34,35 | Numerical Exercises | Shallow foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 36 | Types of piles, pile driving | Deep foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 37 | Load carrying capacity of piles, Static and dynamic formulae | Deep foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 38 | Pile load test | Deep foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 39 | Group behaviour of piles and negative skin friction | Deep foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |



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|-------|---|---------------------|---------|----------|--|
| 40 | Introduction to well foundation | Deep foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 41,42 | Numerical Exercises | Deep foundation | Lecture | CV1601.4 | Quiz; Home Assignment; Class Test; |
| 43 | Methods of explorations. | Site Investigations | Lecture | CV1601.5 | Quiz; Home Assignment; Class Test; |
| 44 | Planning of Investigations, Depth of exploration, and number of boreholes. | Site Investigations | Lecture | CV1601.5 | Quiz; Home Assignment; Class Test; |
| 45 | Undisturbed and Disturbed samples. Types of samplers. Brief description of procedures of sampling, Transportation and Storage of samples. | Site Investigations | Lecture | CV1601.5 | Quiz; Home Assignment; Class Test; |
| 46 | Plate load and penetration tests for determining bearing capacity. | Site Investigations | Lecture | CV1601.5 | Quiz; Home Assignment; Class Test; |
| 47 | Geophysical methods of investigations. | Site Investigations | Lecture | CV1601.5 | Quiz; Home Assignment; Class Test; |
| 48 | Numerical Exercises | Site Investigations | Lecture | CV1601.5 | Quiz; Home Assignment; Class Test; |

Page Break

H. COURSE ARTICULATION MATRIX: (MAPPING OF COS WITH POS)

| COs | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1601.1 | Analyse the problem related to foundation engineering. | 3 | 1 | | | | | | | | | | | | 2 | | |
| CV1601.2 | Determine and analyse the compressibility characteristics of soil. | 2 | 3 | 1 | | | | | | | | | | 1 | 2 | | |
| CV1601.3 | Determine earth pressure, stability of | 2 | 2 | 3 | | | | | | | | | | 2 | 1 | | |



1. **Low Correlation**; 2- **Moderate Correlation**; 3- **Substantial Correlation**



A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Core Course, targeting B. Tech students to have a basic understanding in the field of Transportation Engineering, including Railway and Airport Engineering. Offers in depth knowledge of Railway and Airport Systems by covering alignment, geometric design, types of tracks, significance of coning, gauges, wind rose diagram, aircraft characteristics, airport planning and design, airport pavement design, and much more. This is a preliminary/introductory course on railways and Airport engineering which will help the students to make their path in the said course work in terms of higher technical education.

B. **Course Outcomes:** At the end of the course, students will be able to:

1. Understand the characteristics of Railway and Airport Systems
2. Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems
3. Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics
4. Demonstrate the knowledge in terms of design reports and presentations for Railway and Airport projects

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice



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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, | |



| | | |
|---|------------------|---|
| | | so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Assignment/ Assignment (Formative) | Home Activity | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. SYLLABUS

Railway engineering: Introduction, Scope, terminology, Survey, Tractive resistance, Permanent way, Components parts rail and rail fastenings, ballast, sleepers, Railway creep, Anti-creep devices, coning of wheel, wear of rail. Alignment Details; Points and crossing: Necessity of turnouts, Switches and track junction, Design of turnouts; Railway Station and Yards: Types and classification, equipment in Station Yards, Signals- Classification, function, Control on movement of train by different methods. Interlocking: Types and function.

Airport engineering: Introduction, History and development, Aviation organizations and their functions, Aircraft characteristics and its influence on airport planning, Airport Planning, Site selection, Obstructions, Airport configuration; Geometric Design: Runway orientation, Basic runway lengths, Geometric design of Runway and Exit taxiways; Airport Capacity: Runway and Terminal capacity and its improvement, Delay related capacity, Gate position and gate capacity, Terminal area, Aircraft parking system. Visual aids and Air traffic control system: - Flight rules, Navigational and landing aids, VASI, PAPI enroute air traffic control, ILS, MLS; Pavement Design: ESWL concepts, FAA method and LCN-PCN method of pavement design; Airport Drainage System:-Design runoff, Surface and subsurface drainage.

F. TEXT BOOKS

1. Saxena S.C. and Arora S.P, *A Text Book of Railway Engineering*.
2. Rangwala S.C., *Airport Engineering*, Charotar Publication, 2013

G. REFERENCE BOOKS

1. Rangwala S.C., *Airport Engineering*, Charotar Publication, 2013
2. Horenjeff R. and McKelvey F. *Planning and Design of Airports*, Fourth edition, McGraw Hill Company, New York, 1994.
3. Ashford N. and Wright P.H., *Airport Engineering*, Third edition, John Wiley and Sons, New York, 1992.

4. Lecture Plan:



| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|--|--|-------------------------|------------------------------|---|
| 1,2 | Introduction | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | NA |
| 3 | Types and Selection of Gauges, | Understand about different types of gauges in Indian railway network | Lecture | CV1603.1 | In Class Quiz |
| 4,5 | Selection of Alignment, | Identify the different routes between origin and destination | Lecture and field visit | CV1603.1 | In Class Quiz End Term |
| 3 | Ideal Permanent Ways and Cross-sections in different conditions, | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | 1 st Sessional ET Exam Home Assignment |
| 4 | Drainage, Salient Features | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |
| 5 | Types of Components viz. Rails, | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |
| 6 | Types of Components viz. Sleepers, | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |
| 7 | Types of Components viz. Ballast, | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | Home Assignment |
| 8 | Types of Components viz. Fastenings. | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |



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|----|--|--|---------|----------|---|
| 9 | Coning of Wheels, Creep, Wear, | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | 1 st Sessional ET Exam Home Assignment |
| 10 | Failures in Rails, Rail Joints, Length of Rail, Sleeper Density and Spacing Stations, Yards and Sidings, Turn-Table, Signalling. | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |
| 11 | Failures in Rails, Rail Joints, Length of Rail, Sleeper Density and Spacing Stations, Yards and Sidings, Turn-Table, Signalling. | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |
| 12 | Failures in Rails, Rail Joints, Length of Rail, Sleeper Density and Spacing Stations, Yards and Sidings, Turn-Table, Signalling. | Understand the characteristics of Railway and Airport Systems | Lecture | CV1603.1 | |
| 13 | Types of Turnouts, Points or Switches, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | 1 st Sessional ET Exam Home Assignment |
| 14 | Types of Turnouts, Points or Switches, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 15 | layout Plans of different types of Crossings, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 16 | Design calculations of turnouts. | Investigate and Identify the problems and give the solutions in terms of | Lecture | CV1603.2 | |



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| | | updated designs for Railway and Airport Systems | | | 1 st Sessional |
| 17 | Surface railways (suburban railway system of Mumbai, Chennai and Delhi), | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | ET Exam Home Assignment |
| 18 | Underground system (Metro of Kolkata/Delhi), | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | 1 st Sessional ET Exam Home Assignment |
| 19 | Elevated Systems (as Proposed for Jaipur, Delhi, Mumbai), | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 20 | Light Rail System (MRTS, Thane). | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 21 | Recent developments in Railway Networking. | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | 1 st Sessional ET Exam Home Assignment |
| 22 | Gradient and Grade Compensation, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 23 | Super elevation | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |



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| 24 | Types of Curves, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | 2 nd Sessional ET Exam Home Assignment |
| 25 | Transition curves, their designs, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 26 | Transition curves, their designs, | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | |
| 27 | Widening of Gauges. | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | Lecture | CV1603.2 | 2 nd Sessional ET Exam Home Assignment |
| 28 | Introduction: | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | |
| 29 | Requirements to Airport Planning, Airport Classifications, | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | |
| 30 | Factors in Airport Site Selection, | Apply modern tools such as AutoCAD for geometric design and alignment of railway | Lecture | CV1603.3 | |



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| | | tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | | | 2 nd Sessional ET Exam |
| 31 | Airport Size, Obstructions, Zoning. | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | Home Assignment |
| 32 | Requirements of Airport, Planning of Terminal Area, and different Layouts | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | |
| 33 | Planning of Terminal Area, and different Layouts | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | |
| 34 | Location of Gates, Types of Runway patterns, | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | 2 nd Sessional ET Exam Home Assignment |
| 35 | Runway Layout, Runway Length, | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized | Lecture | CV1603.3 | |



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| | | manner to benefit the environment, society and maintaining professional ethics. | | | |
| 36 | Geometric Design of Runways, | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | 2 nd Sessional |
| 37 | Geometric Design of Runways | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | ET Exam |
| 38 | Geometric Design of Runways | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | Lecture | CV1603.3 | Home Assignment |
| 39 | Layout of Taxiways, Geometric Standards, | Demonstrate the knowledge in terms of design reports and presentations for Railway and Airport projects | Lecture | CV1603.4 | |
| 40 | Exit or Turn around Taxiways, Apron and Hangers | Demonstrate the knowledge in terms of design reports and presentations for Railway and Airport projects | Lecture | CV1603.4 | 2 nd Sessional |
| 41 | Factors Affecting Pavement Design, | Demonstrate the knowledge in terms of design reports | Lecture | CV1603.4 | ET Exam |
| | | | | | Home Assignment |



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| | | and presentations for Railway and Airport projects | | | |
| SECOND SESSIONAL EXAM | | | | | |
| 42 | | Demonstrate the knowledge in terms of Design methods of Flexible Pavements, design reports and presentations for Railway and Airport projects | Lecture | CV1603.4 | |
| 43 | | Demonstrate the knowledge in terms of Design methods of Flexible Pavements, design reports and presentations for Railway and Airport projects | Lecture | CV1603.4 | |
| 44 | | Demonstrate the knowledge in terms of Design methods of Rigid Pavements. design reports and presentations for Railway and Airport projects | Lecture | CV1603.4 | |
| 45 | | Demonstrate the knowledge in terms of Design methods of Rigid Pavements. design reports and presentations for Railway and Airport projects | Lecture | CV1603.4 | |
| 46 | Revision-1 | | | | |
| 47 | Revision-2 | | | | |
| END TERM EXAM | | | | | |

5. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|-----------|---|-----------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|--|------|------|------|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CV 1603.1 | Understand the characteristics of Railway and Airport Systems | 1 | | | | | 1 | | | | | 1 | 2 | | | 1 | 1 |



| | | | | | | | | | | | | | | | | | | |
|--------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--|---|---|
| CV 1603.2 | Investigate and Identify the problems and give the solutions in terms of updated designs for Railway and Airport Systems | 2 | 3 | 3 | 3 | | 2 | | 1 | | | | | | | | | |
| CV 1603.3 | Apply modern tools such as AutoCAD for geometric design and alignment of railway tracks in the optimized manner to benefit the environment, society and maintaining professional ethics. | | | | | 3 | | 2 | 1 | | | | 1 | 1 | 2 | | | |
| CV 1603.4 | Demonstrate the knowledge in terms of design reports and presentations for Railway and Airport projects | | | | | 1 | | | | 1 | 2 | 1 | 2 | | | | 2 | 1 |
| | | | | | | | | | | | | | | | | | | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental lecture, targeting students who wish to pursue higher studies in the field of Structural Engineering. The course offers in depth knowledge of Structural fasteners: Bolted and welded connections, Design of Tension members, Design of compression member, Design of column base, Design of flexural member, Design of plate girder and Plastic analysis and application of these theory in beams with different support conditions, symmetrical and asymmetrical portal frame as per sign as per IS 800.

B. **Course Outcomes:** At the end of the course, students will be able to

1. Understand the load transfer mechanism in steel structures
2. Various connections in the steel structures and their applicability
3. Design of various structural steel elements for flexure, compression and in truss members.
4. The applicability of plastic analysis and how it varies from conventional design methods.

C. **Program Outcomes and Program Specific Outcomes**

[PO.1]. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals,

and an engineering specialization to the solution of complex engineering problems

[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems

reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design

system components or processes that meet the specified needs with appropriate consideration for the public health

and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research

methods including design of experiments, analysis and interpretation of data, and synthesis of the information to

provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern

engineering and IT tools including prediction and modeling to complex engineering activities with an understanding

of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal,

health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering

practice

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in



societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the

engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse

teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering

community and with society at large, such as, being able to comprehend and write effective reports and design

documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering

and management principles and apply these to one's own work, as a member and leader in a team, to manage projects

and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in

independent and life-long learning in the broadest context of technological change.

[PSO.1]. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

[PSO.2]. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

[PSO.3]. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

[PSO.4]. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Open Book) | 15 |
| | Sessional Exam II (Open Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Open Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the | |



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| | student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. Syllabus

Introduction: Scope and use of structural steel. Structural fasteners: Bolted and welded connections. Design of Tension members: Design of axially loaded tension members for yielding, rupture and block shear - Sections with welded and bolted connections, lug angle. **Design of compression member** Design of axially loaded compression member -laced and battened columns, Design of column splices. Design of column base: Simple slab base, gusseted base and grillage foundation. **Design of flexural member:** Design of beams-laterally supported and laterally unsupported compression flange. Design of plate girder and gantry girder: Design of plate girder: proportioning of web, proportioning of flanges, stiffeners. Design of Gantry girder. **Plastic analysis:** Plastic theory, Shape factor, Upper bound and lower bound theory, application of these theory in beams with different support conditions, symmetrical and asymmetrical portal frame.

F. Text Books

1. N. Subramanian, "Design of Steel Structures", Oxford University press, New Delhi, 2008.
2. S.K. Duggal, "Limit State Method of Design of Steel Structures", Tata McGraw-Hill, New Delhi, 2010.

G. REFERENCE BOOKS

1. IS 800-2007: General Construction in Steel-Code of Practice (Third Revision), Bureau of Indian Standards, New Delhi.
2. SP: (6)-1964: Hand Book for Structural Engineers, Bureau of Indian Standards, New Delhi.

H. Lecture Plan:

| Lec No | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing the Outcome |
|--------|---|---|------------------|------------------|-------------------------------|
| 1 | Introduction and Course Hand-out briefing | To acquaint and clear teachers expectations and understand student expectations | Lecture | NA | NA |
| 2 | Scope and use of structural steel | Recall the use of steel as a potential construction material | Lecture | 1604.1 | In Class Quiz (Not Accounted) |



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|-------|--|---|----------|----------|---|
| 3,4 | Structural fasteners: bolted connections [L] [SEP] | Identify various types of bolted connections | Lecture | CVI604.2 | In Class Quiz End Term |
| 5,6 | Structural fasteners: bolted connections [L] [SEP] | Learn applicability of each of the connections | Tutorial | CVI604.2 | Home Assignment End Term |
| 7,8 | Structural fasteners: bolted connections [L] [SEP] | Understand factors that govern the strength of the joint | Lecture | CVI604.2 | In Class Quiz End Term |
| 9 | Structural fasteners: bolted connections [L] [SEP] | Use of Eccentric connections | Tutorial | CVI604.2 | Class Quiz Mid Term I End Term |
| 10 | Structural fasteners: bolted connections [L] [SEP] | Use of Eccentric connections | Lecture | CVI604.2 | Class Quiz Mid Term I End term |
| 11 | Structural fasteners: Welded connections [L] [SEP] | Identify various types of Welded connections | Lecture | CVI604.2 | Home Assignment Class Quiz Mid Term I End Term |
| 12 | Structural fasteners: Welded connections [L] [SEP] | Learn applicability of each of the connections | Lecture | CVI604.2 | Class Quiz Mid Term I End Term |
| 13 | Structural fasteners: Welded connections [L] [SEP] | Understand factors that govern the strength of the joint | Lecture | CVI604.2 | Class Quiz Mid Term I End Term |
| 14 | Structural fasteners: Welded connections [L] [SEP] | Use of Eccentric connections | Tutorial | CVI604.2 | Class Quiz End Term |
| 15,16 | Design of axially loaded tension member [L] [SEP] | Study the implications of tension members | Lecture | CVI604.3 | Class Quiz Mid Term II End Term |
| 17 | Design of axially loaded tension member [L] [SEP] | Understand the various load mechanism in a tension member | Lecture | CVI604.3 | Class Quiz Mid Term II End Term |
| 18 | Design of axially loaded tension member [L] [SEP] | Design a tension member for a given load | Lecture | CVI604.3 | Class Quiz Mid Term II End Term |
| 19 | Design of axially loaded tension member [L] [SEP] | Design a tension member for a given load | Tutorial | CVI604.3 | Class Quiz Mid Term II End Term |
| 20 | Design of axially loaded tension member [L] [SEP] | Design a tension member for a given load | Lecture | CVI604.3 | Class Quiz End Term |
| 21 | Design of axially loaded tension member [L] [SEP] | Design a tension member for a given load | Lecture | CVI604.3 | Class Quiz End Term |



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|--------|--|--|----------|----------|---------------------------------------|
| 22 | Design of axially loaded tension member [L] [SEP] | Design a tension member for a given load | Tutorial | CVI604.3 | Class Quiz End Term |
| 23 | Design of axially loaded tension member [L] [SEP] | Design a tension member for a given load | Lecture | CVI604.3 | Class Quiz End Term |
| 24 | Design of axially loaded tension member [L] [SEP] | Joining of various tension members | Lecture | CVI604.3 | Class Quiz End Term |
| 25 | Design of axially loaded compression member [L] [SEP] | Study the implications of tension members | Lecture | CVI604.3 | Class Quiz End term |
| 26 | Design of axially loaded compression member | Understand the various load mechanism in a compression member | Lecture | CVI604.3 | Class Quiz |
| 27 | Design of axially loaded compression member | Design a compression member for a given load | Tutorial | CVI604.3 | Class Quiz Mid Term II End Term |
| 28,29 | Design of axially loaded compression member | Design a compression member for a given load | Lecture | CVI604.3 | Class Quiz Mid Term II End Term |
| 30,31 | Design of axially loaded compression member | Design a compression member such as lacings for a given load | Lecture | CVI604.3 | Class Quiz Mid Term II End Term |
| 32,33 | Design of axially loaded compression member | Design a compression member such as battens for a given load | Tutorial | CVI604.3 | Class Quiz End Term |
| 34,35 | Design of flexural member | Understand the difference in the structural response of a RCC beam and steel beam in flexure | Lecture | CVI604.3 | Class Quiz End Term |
| 36, 37 | Design of flexural member | Study the various boundary condition in the design of the flexural member | Lecture | CVI604.3 | Class Quiz End Term |
| 38 | Design of flexural member | Design a steel beam for flexure | Tutorial | CVI604.3 | Class Quiz End Term |
| 39 | Design of plate girder | Introduction to industrial steel structures | Lecture | CVI604.3 | End Term |
| 40 | Design of plate girder | Understand the mechanism of rolling loads and influence line diagrams | Lecture | CVI604.3 | End Term |
| 41 | Design of plate girder | Design of steel girder | Lecture | CVI604.3 | End Term |
| 42 | Design of plate girder | Design of steel girder | Lecture | CVI604.3 | End Term |



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|----|------------------------|--|----------|----------|----------|
| 43 | Design of plate girder | Design of steel girder | Tutorial | CV1604.3 | End Term |
| 44 | Design of plate girder | Design of steel girder | Lecture | CV1604.3 | End Term |
| 45 | Design of plate girder | Design of steel girder | Tutorial | CV1604.3 | End Term |
| 46 | Plastic analysis | Understand the difference between plastic and elastic method of analysis | Lecture | CV1604.4 | End Term |
| 47 | Plastic analysis | Understand the concept of plastic hinge | Lecture | CV1604.4 | End Term |
| 48 | Plastic analysis | Study failure mechanism in a beam | Lecture | CV1604.4 | End Term |
| 49 | Plastic analysis | Study failure mechanism in a portal frame | Tutorial | CV1604.4 | End Term |
| 50 | Plastic analysis | Understand the applications of work energy theorem in steel design | Tutorial | CV1604.4 | End Term |

I. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1604.1 | Understand the load transfer mechanism in steel structures | 3 | | | | | | | 1 | | | | | 2 | | 2 | 1 |
| CV 1604.2 | Various connections in the steel structures and their applicability | | 2 | 2 | | | | | | | | 2 | | | 2 | | 1 |
| CV 1604.3 | Design of various structural steel elements for flexure, compression and in truss members. | | | | 2 | 2 | | | | | | | | | | | 1 |
| CV 1604.4 | The applicability of plastic analysis and how it varies from conventional design methods. | | | | | | 2 | | 2 | 3 | | | | | | 3 | 1 |

I. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental elective Course, targeting students who wish to work in the field of environmental engineering. The first part deals with quality and quantity of wastewater. In all it deals with collection conveyance treatment and disposal of wastewater. Conventional and advanced treatment methods are considered. The design of sewer lines is there. Disposal on land and in water are discussed. The second part deals with plumbing and house drainage.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CVI660.1] **Comprehend** about different characteristics of waste water.

[CVI660.2] Design the sewer lines and the sewerage systems.

[CVI660.3] Understand the various treatment systems of waste water.

[CVI660.4] **Utilize the knowledge in Waste water disposal and reuse and design of house drainage.**

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

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

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

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

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

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

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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings



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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

[PSO.1] Design economic, environment friendly, sustainable Civil engineering structures keeping in view national and social requirements.

[PSO.2] Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex Civil engineering problem.

[PSO.3] Manage/ execute Civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

[PSO.4] Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. Syllabus



CV1660

ENVIRONMENTAL ENGINEERING

II

[3 0 0 3]

Overview and general terms. Characteristics of sewage, standards of disposal into natural waters and on land, Indian standards. Collection of sewage, components of sewerage systems, systems of layout, quantity of sanitary sewage and variations. Hydraulic design of sewers. Treatment of sewage: Various unit and their purpose, sequence and efficiencies, preliminary treatment, screening and grit removal units, oil and grease removal, primary treatment, secondary treatment, activated sludge process, trickling filter, sludge digestion and drying beds, stabilization pond, septic tank, soakage systems, recent trends in sewage treatment. Advanced wastewater treatment - nutrient removal, solids removal. Waste water disposal and reuse: Disposal of sewage by dilution, self-purification of streams, sewage disposal by irrigation sewage farming, waste water reuse. Plumbing for design of buildings: Various systems of plumbing, layout of house drainage.

References:

1. Sawyer and Mc Carty, “*Chemistry for Environmental Engineering*” International student Edition, McGraw Hill Book Company, New York., 1994.
2. IS Standards 2490 - 1974, 3360 – 1974, 3307 – 1974, Indian Standard Institution, Manak Bhavan, New Delhi.
3. “*Manual on sewage and sewage treatment CPHEO*”, Ministry of Urban development, New Delhi.
4. Metcalf and Eddy, “*Waste Water Engg, Treatment and Reuse*”, Tata McGraw Hill, New Delhi, 1974.
5. “*Standard Methods*”, APHEA, American Public Health Association, 1015 Fifteenth Street, NW Washington DC.
6. S. K. Garg, “*Environmental Engg- II*”, Volume – II, Khanna Publishers, New Delhi, 2015.
7. G.S. Birdie, “*Water Supply and Sanitary Engineering*”, Dhanpat Rai and Sons, New Delhi, 2012

G. Lecture Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|-----------------|------------------------------------|------------------|------------------------------|-------------------------------|
| 1,2 | Introduction | General Definitions | Lecture | CV1660.I | NA |
| 3,4 | Characteristics | Characteristics of sewage, BOD COD | Lecture | CV1660.I | I Sessional |



| | | | | | |
|----------|--------------------------|--|---------|----------|---|
| 5,6 | Derivation | Derivation of BOD equation Significance of 5 day BOD | Lecture | CVI660.1 | Sessional |
| 7,8 | Numerical | Numerical on BOD | Lecture | CVI660.1 | 1 st Sessional ET Exam Home Assignment |
| 9,10 | Sewerage | Sewerage systems. Runoff calculation. | Lecture | CVI660.1 | |
| 11,12 | Quantity | Quantity of sewage and variation peak factor | Lecture | CVI660.2 | |
| 13,14 | Hydraulic design | Hydraulic design of Sewers flowing partially full | Lecture | CVI660.2 | 1 st Sessional |
| 15 | Flow diagram | Flow diagram of Sewage Treatment and efficiencies | Lecture | CVI660.2 | ET Exam |
| 16 | Design of Screens | Design of Screens | Lecture | CVI660.3 | Home Assignment |
| 17,18 | Design of Grit Chambers | Design of Grit Chambers and factors affecting quantity of Grit Collected | Lecture | CVI660.3 | Skill Development |
| 19,20 | | Activity=Site visit to STP | Visit | CVI660.3 | |
| 21,22 | Growth Systems | Attached and Suspended Growth Systems | Lecture | CVI660.3 | |
| 23,24,25 | ASP | Activated Sludge Process Design, Modifications | Lecture | CVI660.3 | 2 nd Sessional |
| 26,27 | Filtration | Tickling filters, Standard and High rate. | Lecture | CVI660.3 | ET Exam |
| 28,29 | Sludge Digestion | Sludge Digestion. Thickening and drying | Lecture | CVI660.3 | Home Assignment |
| 30,31 | Stabilization pond | Stabilization pond. Design of Oxidation ponds | Lecture | CVI660.3 | Skill Development |
| 32,33,34 | External Treatment Plant | Activity= Site Visit to external plant | Visit | CVI660.3 | |
| 35,36 | Septic Tanks | Septic Tanks. Anaerobic digestion | Lecture | CVI660.3 | |
| 37,38 | Reuse | Waste Water Disposal and reuse | Lecture | CVI660.3 | ET Exam |
| 39 | Self purification | Self purification of streams | Lecture | CVI660.3 | Home Assignment |
| 40,41,42 | Advanced Treatment | Advanced wastewater treatments. Nutrient removal | Lecture | CVI660.3 | |
| 43,44,45 | House Connections | Plumbing systems, layout of house drainage | Lecture | CVI660.4 | ET Exam |

I. **Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | CORRELATION WITH 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 | PSO 5 |
|-----------|--|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| CV1660.1 | Comprehend about different characteristics of waste water | 3 | 2 | | 2 | | | | | | | | 2 | | 2 | | | |
| CV 1660.2 | Design the sewer lines and the sewerage systems. | 2 | | 3 | 3 | 2 | 1 | | | | | | 3 | | 3 | 1 | | |
| CV 1660.3 | Understand the various treatment systems of waste water. | 2 | | | 2 | 2 | 3 | 3 | | 1 | | | | | 3 | | | |
| CV 1660.4 | Utilize the knowledge in Waste water disposal and reuse and design of house drainage. | | | | 2 | 3 | 1 | | | 3 | 2 | 3 | | | 2 | 2 | 2 | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering

Course Hand-out

Geographical Information System | CV 1690 | 3 Credits | 3 0 0 3

Session: January–May 2020 | Faculty: Dr Harshavardhana B G | Class: Open Elective



Introduction: This course is offered by Department of Civil Engineering as an Open Elective Course, targeting students, wishing to understand the application of Remote Sensing and Geographical Information System techniques in the present world. This course introduces remote sensing (RS) and geographical information system (GIS) with their application in different fields of scientific research such as geology, ocean science, land use land cover studies, environmental science, etc. It is to impart knowledge about the processes involved in developing a useful data out of aerial photographs / satellite imageries. Capturing information regarding the changing world and its compilation in a useful manner, in terms of GIS, for future references is a need of present day. In this respect, this course would equip students with basic idea about the usefulness of RS and GIS.

A. **Course Outcomes:** At the end of the course, students will be able to;

[CV1690.1]. Understand the concept and basics of remote sensing (RS) and geographical information system (GIS) required for employment opportunities in the related field.

[CV1690.2]. Know about different satellites and sensors involved in the RS and GIS application.

[CV1690.3]. Discern the application of RS and GIS in spatial and temporal investigations of geological, climatic and environmental problems and hence, helping for an entrepreneurship.

B. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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



5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
 6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
 7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
 8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices
 9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
 10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
 11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
 12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
 2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
 3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
 4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

C. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Open Book) | 15 |
| | Sessional Exam II (Open Book) | 15 |
| | In class Quizzes only (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Open Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |



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| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |
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D. SYLLABUS

Introduction and Concepts: Introduction of remote sensing: energy sources and radiation principles, energy equation, electromagnetic radiation (EMR) and spectrum, interaction of EMR with atmosphere and earth surface features, spectral response pattern and spectral reflectance of vegetation, soil and water bodies. Introduction to aerial photography.

Satellite Remote Sensing Principles: Data acquisition procedure, digital image processing, intensity reference data, ground-truth, analogue to digital conversion, detector mechanism: spectro-radiometer, platforms and sensors, orbit types and image resolution.

Remote Sensing Satellites: Land observation satellites, characters and applications, IRS series, LANDSAT series, SPOT series, high resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, weather/meteorological satellites, INSAT series, NOAA, GOES, NIMBUS applications, Marine observation satellites OCEANSAT.

Types of Remote Sensing and Image Interpretation: Introduction to active and passive remote sensing, optical remote sensing, visible, infrared, thermal sensors, concept of microwave remote sensing and sensors, SLAR, SAR scatterometer, image interpretation characters.

Geographical Information Systems (GIS): Database, raster and vector data, database management system, digital elevation models and their applications, strategies involved in GIS (data capture, data retrieval, spatial measurement, data integration, spatial interpolation, data analysis); application of GIS in various fields such as land use and land cover, water and land resources, environment and traffic system etc.

E. TEXT BOOKS

1. Cambell J.B., "Introduction to Remote Sensing", Taylor & Francis, UK, 22.
2. Sabins Jr F.F., "Remote Sensing - Principles and Interpretation", W.H. Freeman and Co., New York, 1986.
3. Burrough P. A. and McDonnell, R. A., "Principles of Geographical Information Systems", 2nd Edition, Oxford University Press, 1998.
4. Demers M. N., "Fundamentals of Geographic Information Systems", John Wiley and Sons, 3rd Edition, 22.

F. REFERENCE BOOKS

1. Weng, F., "Passive Microwave Remote Sensing of the Earth: for Meteorological Applications", John Wiley and Sons, 384 P, 217.
2. Janssen, L. L. F. and Huurneman, G. C. (Eds.), "Principles of Remote Sensing", ITC Educational Text Book Series, 41 P, 2nd Edition, 21.


Page Break

G. Lecture Plan:



| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|---|---|------------------|------------------------------|-------------------------------|
| 1 | Introduction to Remote Sensing, energy sources and radiation principles, energy equation. | Understanding the basics of Remote Sensing | Lecture | CV1690.1 | Quiz, MTE-I and ETE |
| 2 | Electromagnetic radiation (EMR) and spectrum. | | | | |
| 3 | Interaction of EMR with atmosphere and earth surface features. | | | | |
| 4 | Spectral response pattern and spectral reflectance of vegetation, soil and water bodies. | | | | |
| 5, 6, 7 | Introduction to aerial photography | Knowing the basics of Aerial Photography | | | |
| 8 | Satellite Remote Sensing Principles | Understand the process and terminologies involved in satellite remote sensing | Lecture | CV1690.1 | Quiz, MTE-I and ETE |
| 9 | Data acquisition procedure, digital image processing. | | | | |
| 10 | Digital image processing, intensity reference data. | | | | |
| 11 | Ground-truth, analogue to digital conversion. | | | | |
| 12 | Detector mechanism: spectro-radiometer, platforms and sensors and orbit types. | | | | |
| 13 | Image resolution. | Knowing the types of satellites in use | Lecture | CV1690.2 | Quiz, MTE-II and ETE |
| 14 | Remote Sensing Satellites: Land observation satellites, characters and applications. | | | | |
| 15 | IRS series, LANDSAT series and SPOT series, | | | | |
| 16 | High resolution satellites, character and applications, | | | | |
| 17 | CARTOSAT series, IKONOS Series and QUICKBIRD series. | | | | |
| 18 | Weather/meteorological satellites, INSAT series. | | | | |



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|------------|---|---|---------|--|----------------------|--|
| 19 | NOAA, GOES, NIMBUS applications and Marine observation satellites OCEANSAT. | | |  JAIPUR <small>INSPIRED BY LIFE</small> | | |
| 20 | Types of Remote Sensing and Image Interpretation. | Understand the remotely sensed data and its interpretation | Lecture | CV1690.2 | Quiz, MTE-II and ETE | |
| 21 | Introduction to active and passive remote sensing. | Knowing the basics of remote sensing carried out at different frequencies | Lecture | CV1690.2 | Quiz, MTE-II and ETE | |
| 22 | Optical remote sensing and visible sensors. | | | | | |
| 23 | Infrared and thermal sensors. | | | | | |
| 24 | Concept of microwave remote sensing and sensors. | | | | | |
| 25 | SLAR, SAR Scatterometer. | | | | | |
| 26 | Image interpretation characters. | Understanding the basics of image interpretation and GIS platform | Lecture | CV1690.2 | Quiz and ETE | |
| 27 | Introduction to Geographical Information Systems (GIS). | | Lecture | CV1690.3 | | |
| 28 | Database, raster and vector data. | | | | | |
| 29 | Database management system, digital elevation models. | | | | | |
| 3 | Digital elevation models and their applications. | | | | | |
| 31, 32, 33 | Strategies involved in GIS; data capture, data retrieval, spatial measurement, data integration, spatial interpolation, data analysis). | | | | | |
| 34, 35, 36 | Application of GIS in land use and land cover. | | | | | |
| 37, 38, 39 | Application of GIS in water resources. | | | | | |
| 4, 41, 42 | Application of GIS in land resources. | | | | | |
| 43, 44, 45 | Application of GIS in environment. | | | | | |
| 46, 47, 48 | Application of GIS in | | | | | |



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| traffic systems. | | | |
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H. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1690.1 | Understand the concept and basics of remote sensing (RS) and geographical information system (GIS). | 3 | | | | | | 1 | | | | | 3 | | | | 2 |
| CV1690.2 | Know about different satellites and sensors involved in the RS and GIS application. | 3 | | | | | | | | | | | 3 | | | | 2 |
| CV1690.3 | Discern the application of RS and GIS in spatial and temporal investigations of geological, climatic and environmental problems. | 3 | | | | 1 | | 1 | | | | | 3 | | | | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental Laboratory Course, targeting students who wish to pursue higher studies in the field of Structural Engineering. The first part of the course is to introduce the students to understand the commands of AutoCAD and use them in a sequential procedure and steps while drawing the reinforcement layout for RCC structure and Steel Structure. In the second part student will design a full RCC and Steel structure using Staad-Pro and will draw the layout of the designed structure using AutoCAD. **This course will help the student to develop their skills in drawing different RCC and Steel structures along with their detailing in terms of reinforcement and layout.**

B. **Course Outcomes:** At the end of the course, students will be able to:

1. **Replicate** the reinforcement layout details of a residential building into a drawing
2. **Create** a detailed residential building/commercial building reinforcement layout.
3. **Use** computer software like Staad-Pro and AutoCAD to design and draw the reinforcement layout along with the section, elevation view.
4. **Learn** the procedures of submission of drawings and Develop working and submission Drawings for
Different types of structures.
5. **Prepare, read and interpret** the drawings in a professional set up.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development



8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|-------------------------------------|---|---------------|
| Internal Assessment (Summative) | Internal Assessment (Viva, Lab performance, Lab book maintenance, Punctuality in lab) | 60 |
| End Term Exam (Summative) | End Term Exam | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Lab Experiments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup laboratory experiment will be performed on the topic taught on the day of absence and it will have to be performed within two weeks from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 3 throughout the entire semester. | |

E. SYLLABUS

RCC design and detailing of one-way and two-way continuous slab, singly and doubly rectangular square isolated beam and T-beam, axial, biaxial and uniaxial column, Rectangular combined, isolated and raft footings, dog-legged type and open newel type staircase. Steel design and detailing of axial/uniaxial/biaxial loaded steel column with



lacings, battening and splices, roof truss purlin and bearing plate, beam to beam and beam to column connection, Welded plate girder.

F. REFERENCE BOOKS

1. Krishnamoorthy, “*Structural Design and Drawing (Concrete Structures)*”, CBS Publications, New Delhi 2008.
2. S.K. Duggal, “*Limit State Design of Steel Structures*”, Tata McGraw Hill Education Private Limited - New Delhi, 2008.

G. Lecture Plan:

| Lecture Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|----------------|--------------|--|------------------|--|-------------------------------|
| 1-2 | RCC Design | RCC design and detailing of one-way and two-way continuous slab | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |
| 3-4 | | RCC design and detailing of singly and doubly rectangular square isolated beam and T-beam | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |
| 5 | | RCC design and detailing of axial, biaxial and uniaxial column | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |
| 6 | | RCC design and detailing of rectangular combined, isolated and raft footings | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |
| 7 | | RCC design and detailing of dog-legged type and open newel type staircase | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.2, CV1630.3 | Daily Class Assessment |
| 8-9 | Steel Design | Steel design and detailing of axial/uniaxial/biaxial loaded steel column with lacings, battening and splices | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |
| 10 | | Steel design and detailing of roof | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |



| | | | | | |
|-------|--|--|-----------|--|------------------------|
| | | truss purlin and bearing plate | | | |
| 11-12 | | Steel design and detailing of beam to beam and beam to column connection | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.3 | Daily Class Assessment |
| 13-14 | | Steel design and detailing of Welded plate girder | Practical | CV1630.1, CV1630.5, CV1630.4, CV1630.2, CV1630.3 | Daily Class Assessment |

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| [CV1630.1] | Replicate the reinforcement layout details of a residential building into a drawing | 3 | | | | 3 | 3 | | | 3 | | | 3 | 1 | | | |
| [CV1630.2] | Create a detailed residential building/commercial building reinforcement layout. | 2 | 1 | 3 | | 3 | 2 | | | | | | 3 | 3 | | | |
| [CV1630.3] | Use computer software like Staad-Pro and AutoCAD to design and draw the reinforcement layout along with the section, elevation view. | | | | | 3 | | | | | | | 3 | 3 | 3 | | |
| [CV1630.4] | Learn the procedures of submission of drawings and develop working and submission drawings for different types of structures. | | | | | 3 | | | | 3 | | | 3 | 1 | | 2 | 2 |
| [CV1630.5] | Prepare, read and interpret the drawings in a professional set up. | 1 | | | 2 | 2 | 1 | | | | 2 | 2 | 3 | 2 | 3 | 2 | 1 |

I-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

DEPARTMENT OF CIVIL ENGINEERING

Course Hand-out

Computer Aided Design | CV1631 | 1 Credits | 0 0 2 1

Session: Jan 20-May 20 | Faculty: Raghuvesh Tiwari | Class: B.Tech VIth SEM

A. Introduction:

This course is offered by Dept. of Civil Engineering as a departmental Laboratory course for sixth semester students. The subject offers a basic understanding of different softwares such as STAAD Pro V8i, MS-Project, MX Road Suite V8i, Bentley Power Civil for Country, Bentley SewerGEMS V8i, WaterGEMS V8i available in civil engineering domain for designing and analysis of various civil engineering structures. Some of the key domains of civil engineering such as Structural engineering, Transportation engineering, Water resource engineering, Environmental engineering and Study of GIS and Remote Sensing softwares are highlighted in this laboratory course. Because of application of various software being used in industry this course makes our students more employable and professional.

B. Course Outcomes: At the end of this course, students will be able to:

[CV 1631.1] Comprehend about different software used in civil engineering.

[CV 1631.2] Design and analysis of buildings using STAAD software and exposure to employment in similar industry.

[CV 1631.3] Apply knowledge of engineering fundamentals to analyse the results from software.

[CV 1631.4] Use modern tools for proper represents the results of software and entrepreneurial opportunities

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

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

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

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

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



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

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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | - |
| | Sessional Exam II (Close Book) | - |
| | Online quiz, class exam, viva, discipline, report writing | 60 |
| End Term Exam (Summative) | Live test, report writing, viva with external | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |



Make up Assignments
(Formative)

Students who misses a class will have to report to the teacher about the absence. If student missed any quizzes and class tests, he/she will be allowed to appear only one substitute quiz and class test.

E. SYLLABUS

Analysis of plane truss, space truss, plane frames, space frames by STAAD Pro V8i. Analysis of a four noded plate element with one end fixed and point load at free end in StaadPro V8i. Design of trusses using STAAD V8i software. Design of frames using STAAD Pro V8i software. Study of GIS and Remote Sensing software. Modelling of an isolated footing in STAAD Foundation V8i. Modelling of a dome structure using structure wizard in StaadPro V8i. Demonstration of packages in Engineering Management - MS-Project, and Estimation. Demonstration of packages in Transportation Engineering - Bentley MX Road Suite V8i, Bentley Power Civil for Country. Demonstration of packages in Environmental Engineering - Bentley SewerGEMS V8i, WaterGEMS V8i. Analysis and design of a G+4 reinforced concrete building in StaadPro StaadPro V8i

F. TEXT BOOKS

1. www.bently.com/ software manual
2. Design of R.C.C. Buildings using Staad Pro V8i with Indian Examples: Static and Dynamic Methods By TS Sharma

G. REFERENCE BOOKS

1. Various Indian Standard Codes of civil engineering for designing.
2. Various Software manuals and related helping materials.

G. Lecture Plan:

| Lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode Of Assessment CO |
|---------|---|---|------------------|--------------------|--|
| 1 | Basic Introduction of STAAD Pro. And other software's. | To provide background information about the development of software's | Practical | CVI631.1; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 2 | Analysis of plane truss, space truss, plane frames, space frames by STAAD Pro V8i | To know how to begin with designing of structure. | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 3 | Modeling of a four noded plate element | To know how to model four noded plate elements. | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing |



| | | | | | |
|----|---|---|-----------|--------------------|--|
| | | | | | Live test, report writing, viva with external |
| 4 | Analysis of a four noded plate element with one end fixed and point load at free end in StaadPro V8i. | To solve for various outcomes of a elements. | Practical | CVI631.3; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 5 | Design of frames using STAAD Pro V8i software | To design a fame structure on STAAD. | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 6 | Study of GIS and Remote Sensing softwares | To study of GIS and Remote Sensing softwares | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 7 | Modelling of an isolated footing in STAAD Foundation V8i. | To study modelling of a isolated | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 8 | Modelling of a dome structure using structure wizard in StaadPro V8i | To study modelling of a dome | Practical | CVI631.4; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 9 | Demonstration of packages in Engineering Management - MS-Project, and Estimation | To explain about the packages of engineering management | Practical | CVI631.3; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 10 | Demonstration of packages in Transportatio | To explain about the packages of transportation engineering | Practical | CVI631.3; CVI631.4 | Online quiz, class exam, viva, discipline, report writing |



| | | | | | |
|----|---|--|-----------|--------------------|--|
| | n Engineering | | | | Live test, report writing, viva with external |
| 11 | Demonstration of packages in Environmental Engineering | To explain about the packages of environmental engineering | Practical | CVI631.3; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 12 | Bentley SewerGEMS V8i, WaterGEMS V8i. | To study about the sewer GEMS | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 13 | Analysis and design of a G+4 reinforced concrete building in StaadPro V8i | To learn how to design a multi-storey building structure | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |
| 14 | Analysis and design of a G+4 reinforced concrete building in StaadPro V8i | To learn how to design a multi-storey building structure | Practical | CVI631.2; CVI631.4 | Online quiz, class exam, viva, discipline, report writing Live test, report writing, viva with external |

H. Course Articulation Matrix: (Mapping of COs with POs & PSOs)

| COs | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CVI631.1 | Comprehend about different software used in civil engineering | 2 | 2 | 2 | 1 | 1 | 1 | | 1 | 1 | | | 2 | 1 | 3 | 2 | 1 |
| CVI631.2 | Design and analysis of buildings using STAAD software and exposure to employment in similar industry. | 3 | 2 | 2 | 1 | 1 | 1 | | 1 | 1 | | | 2 | 2 | 3 | 1 | 1 |



| | | | | | | | | | | | | | | | | |
|----------|---|---|---|---|---|---|---|--|---|---|--|---|---|---|---|---|
| CVI631.3 | Apply knowledge of engineering fundamentals to analyse the results from software. | 3 | 2 | 2 | 1 | 1 | 1 | | 1 | 1 | | 2 | 3 | 3 | 1 | 1 |
| CVI631.4 | Use modern tools for proper represents the results of software and entrepreneurial opportunities | 2 | 2 | 2 | 1 | 1 | 1 | | 1 | 1 | | 2 | 3 | 3 | 1 | 2 |

1-Low Correlation; 2-Moderate Correlation; 3- Substantial Correlation



MANIPAL UNIVERSITY JAIPUR

School of Civil and Chemical Engineering

Department of Civil Engineering Estimating, Costing and Valuation| CV1701|

4 Credits | 3 1 0 4

Session: August 19 – December 19 | Faculty: Firoz Alam | Class: Core Course

A. Introduction: This course is offered by Dept. of Civil Engineering as a Core Course and purpose of the course is for students to get familiar with basics of estimation, costing and valuation. Study of this course work includes estimates of building work, applicable rates in a particular zone, different types of contracts and the factors affecting the value of assets, all of this that are crucial for a student to have a promising career as a civil engineer. The student, by the end of the semester would be able to successfully estimate the quantities of construction and cost to undertake the process. The civil engineering market demands a student to be aware of these details to ensure they are employable. Also, the student would be erudite enough to bid contracts at an entry level for the civil engineering structures with ample field and market comparisons according to the current PWD rates which again is one of the most sought out prerequisites few construction companies look out for.

B. Course Outcomes: At the end of the course, students will be able to:

[CV1701.1] Apply the knowledge of mathematics and engineering fundamentals in estimation of a building

[CV1701.2] Perform rate analysis under various existing conditions

[CV1701.3] Understand the basics of Estimation and valuation and able to bid for tenders

[CV1701.4] Analyse and understand various contracts documents and take decisions accordingly

[CV1701.5] Estimate the value of property and formulate future investment plans which increase employability

A. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice



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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|---------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who miss a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence | |



| | |
|--|---|
| | will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. |

E. SyllabusEstimation

Introduction, Definition, Types of estimate, approximate estimate.

Units of measurement

IS 1200, Work charged establishment, Plinth area, Carpet area. Estimate of building, doors and windows, RCC work, Different types of roof, Detailed specification for different components of the buildings.

Rate Analysis

Purpose, Factors effecting, Overhead charges, Turn out of work, Rate analysis for different items of building; Contract-Functioning and organization of PWD; Tender and its notification, EMD and Security deposit;

Contracts and Tenders

Contracts, Types of contract, Termination of contract, Work slip qualification of contractor, Responsibilities of engineer, owner, and contractor.

Valuation

Purpose of valuation, Scrap value, Salvage value, Market value, Factors which affect the value, Sinking fund, Year's purchase, Depreciation, Calculation of standard rent.

F. Text Books

1. Dutta B.N., Estimating and Costing in Civil Engineering, UBS Publishers' Distributors Ltd. Sixteenth reprint, 2000.

G. Reference Books

1. Chakraborti M., Estimating, Costing, Specification & Valuation in Civil Engineering, Published by the Author, Sixteenth edition, 2003.

H. Lecture Plan

| Lecture Number | Topics to be covered | Session outcome | Mode of delivery | Corresponding Course outcome | Mode of assessing the outcome |
|----------------|----------------------|--------------------------------|------------------|------------------------------|-------------------------------|
| 1 | ,Introduction | Estimation: Introduction | lecture | CV1701.1 | Quiz/Assignment/Exam |
| 2 | Introduction | Definition, Types of estimate, | lecture | CV1701.1 | Quiz/Assignment/Exam |



| | | | | | |
|----|-----------------------------------|---|---------|----------|----------------------|
| 3 | Estimate | Approximate estimate and numerical examples | lecture | CV1701.1 | Quiz/Assignment/Exam |
| 4 | Units | Units of measurement: IS 1200, | lecture | CV1701.1 | Quiz/Assignment/Exam |
| 5 | Methods | Methods of taking out Estimates | lecture | CV1701.1 | Quiz/Assignment/Exam |
| 6 | Different components of building | Plinth area, Carpet area. Estimate of building, | lecture | CV1701.1 | Quiz/Assignment/Exam |
| 7 | Different components of building | Doors and windows, | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 8 | Different components of building | RCC work, | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 9 | Different components of building, | Different types of roof | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 10 | Measurements | Measurement of earth-work by cross-sections, | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 11 | Measurements | Spot levels, | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 12 | Measurements, | Contours | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 13 | Measurements | Mass diagram and its characteristics; | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 14 | Measurements | Mass diagram and its characteristics; | lecture | CV1701.2 | Quiz/Assignment/Exam |
| 15 | , Detailed specification | Specification-Definition | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 16 | Detailed specification, | Types, Principles | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 17 | Detailed specification | Detailed specification for different components of the buildings; | lecture | CV1701.3 | Quiz/Assignment/Exam |



| | | | | | |
|----|--|--|---------|----------|----------------------|
| 18 | Rate analysis | Rate Analysis: Purpose, Factors effecting the rates, | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 19 | Rate analysis | Rate Analysis: Purpose, Factors effecting the rates, | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 20 | Rate analysis | Overhead charges, | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 21 | Rate analysis | Turn out of work, | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 22 | Rate analysis | Rate analysis for different items of building; | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 23 | Rate analysis for different items of building; | Rate analysis for different items of building; | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 24 | Contracts | Contract- Functioning and organization of PWD | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 25 | Contracts; | Contract- Functioning and organization of PWD | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 26 | Tenders | Tender and its notification | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 27 | Tenders | EMD and Security deposit; | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 28 | Contracts | EMD and Security deposit; | lecture | CV1701.3 | Quiz/Assignment/Exam |
| 29 | Contracts | Contracts: Types of contract | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 30 | Contracts | Contracts: Types of contract | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 31 | Contracts, | Termination of contract | lecture | CV1701.4 | Quiz/Assignment/Exam |



| | | | | | |
|----|-------------|--|---------|----------|----------------------|
| 32 | , Contracts | Termination of contract | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 33 | Contracts | Work slip qualification of contractor, | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 34 | Contracts | Responsibilities of engineer, | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 35 | Contracts; | Owner and contractor | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 36 | Valuation | Valuation: Introduction | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 37 | Valuation | Purpose of valuation, | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 38 | Valuation | Scrap value, | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 39 | , Valuation | Salvage value | lecture | CV1701.4 | Quiz/Assignment/Exam |
| 40 | Valuation | Market value, | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 41 | Valuation, | Factors which affect the value | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 42 | Valuation | Factors which affect the value, | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 43 | Valuation | Sinking fund, | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 44 | Valuation | Year's purchase | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 45 | Valuation | Depreciation | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 46 | Valuation | Depreciation | lecture | CV1701.5 | Quiz/Assignment/Exam |
| 47 | Revision | Whole course | lecture | CV1701.5 | N/A |
| 48 | Revision | Whole course | lecture | CV1701.5 | N/A |

B. Course Articulation Matrix: (Mapping of COs with POs)



| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1701.1 | Apply the knowledge of mathematics and engineering fundamentals in estimation of a building | 3 | 2 | | | | | | | | | | | 1 | | | |
| CV1701.2 | Perform rate analysis under various existing conditions | | | | | | | | | | | 3 | | | 3 | | |
| CV1701.3 | Understand the basics of Estimation and valuation and able to bid for tenders | | | | | | | | 3 | | 2 | 3 | | | | 3 | |
| CV1701.4 | Analyse and understand various contracts documents and take decisions accordingly | | | | | | | | | | | 2 | | | | | 2 |
| CV1701.5 | Estimate the value of property and formulate future investment plans. | | | | | | | | | | | 2 | | | | | 2 |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



[GroupDrawing]

A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Core Course, targeting students who wish to pursue higher studies in the field of Water Resources Engineering, including Hydrology, Irrigation Engineering, River Engineering, Canal Irrigation, Reservoir Planning and Design of Diversion & Storage Works. Water resources engineering is the science which deals with the conception, planning, design, construction and operations of facilities and structures related with the utilization of water available on the earth. It also deals with control of water and the water quality management for the benefits of mankind.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CVI702.1]. Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development articulating the professional solution

[CVI702.2]. Identify the sources of water and their characteristics for ensuring the sustainability pertaining to field application and inculcating employability skills

[CVI702.3]. Plan, design and compute different parameters for catchment and water resources system to provide real problem solution and contributing towards professional development and inculcating employability skills

[CVI702.4]. Analyze complex field situations and provide engineering solutions for water management and inculcating employability skills

[CVI702.5]. Analyze the planning, regulation and distribution of Catchment and water Resources System to simulate research and inculcating employability skills

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

[PO.1]. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems



[PO.2]. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

[PO.3]. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

[PO.4]. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

[PO.5]. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

[PO.6]. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

[PO.7]. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

[PO.8]. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

[PO.9]. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

[PO.10]. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

[PO.11]. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

[PO.12]. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|----------|----------------------------------|---------------|
| | Sessional Exam I (Close Book) | 15 |



| | | |
|---|---|-----|
| Internal Assessment (Summative) | Sessional Exam II (Close Book) | |
| | In class Quizzes and Assignments, Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |

E. SYLLABUS

Introduction: Scope and need of the subject, Available potential and present status of its utilization.

Hydrology: Definition and scope, Hydrologic cycle, Peak flows, rainfall and runoff process, infiltration, flood hydrograph, concept of unit hydrograph.

Irrigation Engineering: Necessity, benefits and ill effects of irrigation; soil water relationships; water requirements of crops; methods of irrigation; waterlogging and design of drainage system.

River Engineering: Basic concepts of resistance and sediment transport in rivers.

Canal Irrigation: Types of canals and their functions; parts of a canal system, preparation of canal project. Methods of design of stable channels – Lacey, Kennedy and Lane's methods; design of lined channel; L –sections and cross sections Types of structures on canal, design considerations



from surface and sub-surface flows, Energy dissipation. Falls, cross-drainage works, cross and distributary head regulators.

Reservoir Planning: Purpose and types; investigations; reservoir capacity, reservoir sedimentation.

Design of Diversion and Storage works: Diversion head works; River training works; Dams- Gravity and earth dams their functions and basic principles of design.

F. TEXT BOOKS

1. Singh B., *Fundamentals of Irrigation Engineering*, Nem Chand & Bros, Roorkee, 9th Edn. 1997.

G. REFERENCE BOOKS

1. Modi P.N., *Water resources and Water Power Engineering*, Standard Book House Publications, Delhi 1988.

2. Varshney R.S., Gupta S.C. and Gupta R.L., *Theory and Design of Irrigation Structures, Vol. I, Channels and Tube Wells*, Nem Chand & Bros, 7th Edn. 2000.

3. Varshney R.S., Gupta S.C. and Gupta R.L., *Theory and Design of Irrigation Structures, Vol.2, Canals and Storage Works*, Nem Chand & Bros, 6th Edn. 1993.

4. Viessman and Knapp, *Introduction to Hydrology*, Harper and Row Publishers, Singapore 1989.

5. Lecture Plan:

| lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing CO |
|---------|--|---|-------------------|------------------|-----------------------------|
| 1 | Introduction | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development | Lecture | CVI702.1 | Mid Term I, Quiz & End Term |
| 2 | Scope and need of the subject, Available potential and present status of its utilization | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development | Flipped Classroom | CVI702.1 | Mid Term I, Quiz & End Term |
| 3 | Hydrology Hydrology: Definition, scope and Hydrologic cycle. Rainfall: optimum number | Identify the sources of water and their characteristics | Lecture | CVI702.2 | Mid Term I, Quiz & End Term |
| 4 | | Identify the sources of water and their characteristics | Lecture | CVI702.2 | Mid Term I, Quiz & End Term |
| 5 | | Plan, design and compute different | Guided Self-Study | CVI702.3 | Mid Term I, Quiz & End Term |



| | | | | | |
|----|--|--|-----------------------------|-----------------|-----------------------------|
| | of rain gauges in a catchment | parameters for catchment and water resources system. | | | |
| 6 | Estimation of missing rainfall data | Plan, design and compute different parameters for catchment and water resources system. | Lecture | CVI702.3 | Mid Term I, Quiz & End Term |
| 7 | Average rainfall depth over an area | Plan, design and compute different parameters for catchment and water resources system. | Lecture | CVI702.3 | Mid Term I, Quiz & End Term |
| 8 | Mass rainfall curve & hyetograph | Plan, design and compute different parameters for catchment and water resources system. | Lecture | CVI702.3 | Mid Term I, Quiz & End Term |
| 9 | Runoff, components of runoff, factors affecting runoff | Plan, design and compute different parameters for catchment and water resources system. | Lecture | CVI702.3 | Mid Term I, Quiz & End Term |
| 10 | Infiltration, Factors affecting infiltration rates, Infiltration Indices | Plan, design and compute different parameters for catchment and water resources system. | Activity (Think Pair Share) | CVI702.3 | Mid Term I, Quiz & End Term |
| 11 | Flood hydrograph, concept of unit hydrograph. | Plan, design and compute different parameters for catchment and water resources system. | Lecture | CVI702.3 | Assignment No. I |
| 12 | Irrigation Engineering Necessity, benefits and ill effects of irrigation | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development. | Lecture | CVI702.1 | Assignment No. I |



| | | | | | |
|----|--|--|-------------------|-----------------|------------------------------|
| 13 | | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development. | Activity (jigsaw) | CVI702.1 | Assignment No.I |
| 14 | Types of Irrigation | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI702.3 | Assignment No.I |
| 15 | Water requirement of crops: crop seasons in India, factors affecting water requirement, consumptive use of water | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI702.3 | Assignment No.I |
| 16 | Irrigation requirements, efficiencies, duty of water | Plan, design and compute different parameters for catchment and water resources system | Flipped Class | CVI702.3 | Assignment No.I |
| 17 | Numerical & Factors affecting duty. | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI702.3 | Assignment No.I |
| 18 | Soil moisture irrigation relation, water logging, causes of water logging. | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI702.3 | Mid Term II, Quiz & End Term |
| 19 | Ill effects of water logging, Prevention measure. | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI702.3 | Mid Term II, Quiz & End Term |



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|----|---|--|-----------------------------------|------------------|---------------------------------|
| 20 | Drainage systems, Design of open drain. | Plan, design and compute different parameters for catchment and water resources system | Activity (Think Pair Share) | CVI 702.3 | Mid Term II, Quiz & End Term |
| 21 | River Engineering Basic concepts of resistance and sediment transport in rivers. | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI 702.3 | Mid Term II, Quiz & End Term |
| 22 | | Plan, design and compute different parameters for catchment and water resources system | Lecture | CVI 702.3 | Mid Term II, Quiz & End Term |
| 23 | Canal Irrigation Canal Irrigation, types of distribution system, types of canals | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development | Lecture | CVI 702.1 | Mid Term II, Quiz & End Term |
| 24 | | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development | Lecture | CVI 702.1 | Mid Term II, Quiz & End Term |
| 25 | Preparation of canal project, Investigations, canal alignment | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |
| 26 | Methods of design of stable channel- lacey, Kennedy & lane. Comparison of methods. | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |



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|----|---|--|-------------------|------------------|------------------------------|
| 27 | Design of lined channel. | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |
| 28 | L –sections and cross sections Types of structures on canal | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |
| 29 | design considerations from surface and sub-surface flows | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |
| 30 | Energy dissipation | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |
| 31 | Canal Falls and types. | Analyze complex field situations and provide engineering solutions for water management. | Lecture, Activity | CVI 702.4 | Mid Term II, Quiz & End Term |
| 32 | Design of Sarda type fall | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Mid Term II, Quiz & End Term |
| 33 | Cross drainage works, types of CD works, types and site selection | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Assignment No. 2 |



| | | | | | |
|----|--|---|-------------------|------------------|------------------|
| 34 | Canal Regulation works, functions, types of regulators. | Analyze complex field situations and provide engineering solutions for water management. | Lecture, Activity | CVI 702.4 | Assignment No. 2 |
| 35 | Reservoir Planning Reservoir Planning: Purpose and types | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Assignment No. 2 |
| 36 | | Analyze complex field situations and provide engineering solutions for water management. | Lecture | CVI 702.4 | Assignment No. 2 |
| 37 | Investigations; reservoir capacity, reservoir sedimentation. | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI 702.5 | Quiz & End Term |
| 38 | Design of Diversion and Storage works Planning of diversion head works | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI 702.5 | Quiz & End Term |
| 39 | | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI 702.5 | Quiz & End Term |
| 40 | Layout of diversion head works | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI 702.5 | Quiz & End Term |



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|----|---|---|-----------------------------|-----------------|-----------------|
| 41 | Basic principles of design of hydraulic structures | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI702.5 | Quiz & End Term |
| 42 | Bligh's creep theory, khosla's solution for a horizontal floor. | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI702.5 | Quiz & End Term |
| 43 | Gravity dam & earth dams | Analyze the planning, regulation and distribution of Catchment and water Resources System | Activity (Think Pair Share) | CVI702.5 | Quiz & End Term |
| 44 | Forces acting on gravity dams. | Analyze the planning, regulation and distribution of Catchment and water Resources System | Lecture | CVI702.5 | Quiz & End Term |
| 45 | types of earth dams | Analyze the planning, regulation and distribution of Catchment and water Resources System | Activity (Think Pair Share) | CVI702.5 | Quiz & End Term |
| 46 | Basic principles of design | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development | Lecture | CVI702.1 | Quiz & End Term |
| 47 | Revision | Apply knowledge of basic sciences and engineering to analyze water resources systems for | Activity (Think Pair Share) | CVI702.1 | Quiz & End Term |



| | | | | | |
|----|-----------|---|-----------------------------|-----------------|-----------------|
| | | socio-economic development | | | |
| 48 | Spillover | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development | Activity (Think Pair Share) | CVI702.I | Quiz & End Term |

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CVI702.1 | Apply knowledge of basic sciences and engineering to analyze water resources systems for socio-economic development articulating the professional solution and inculcating employability skills | 3 | | | | | | | 1 | | | | | 3 | | 3 | 1 |
| CVI702.2 | Identify the sources of water and their characteristics for ensuring the sustainability pertaining to field application and inculcating employability skills | | 2 | 2 | | | | | | | | 2 | | | 3 | 3 | |
| CVI702.3 | Plan, design and compute different parameters for catchment and water resources system to provide real problem solution and contributing towards professional development and inculcating employability skills | | | | 2 | 2 | | | | | | | | 2 | 3 | | 3 |
| CVI702.4 | Analyze complex field situations and provide engineering solutions for water management and inculcating employability skills | | | | | | 2 | | 2 | 3 | | | | 2 | 3 | 3 | |



| | | | | | | | | | | | | | | | | | | |
|----------|---|--|--|---|--|--|--|--|--|--|---|---|---|--|---|--|---|---|
| CV1702.5 | Analyze the planning, regulation and distribution of Catchment and water Resources System to simulate research and inculcating employability skills | | | I | | | | | | | I | I | 3 | | 3 | | 3 | 2 |
|----------|---|--|--|---|--|--|--|--|--|--|---|---|---|--|---|--|---|---|

Building Construction and Project Management | CV1763 | 3 Credits | 3 0 0 3
Session: July 2019 – December 2019 | Faculty: Dr. Bhavna Tripathi | Class: Program Elective Course

A. **Introduction:** Construction is the most important field related activity of Civil Engineering discipline. This course covers basic terminology and fundamentals of different types of buildings, their components, temporary arrangements, and sequence of construction activities. The course also includes knowledge of construction project management, network preparation and its analysis. This course aims at providing practical knowledge and skills to the fresh graduates to be able to work at as site engineer and tackle everyday challenges related with construction and management of buildings.

B. **Course Outcomes:** At the end of the course, students will be able to:

1. Recall types of buildings as per NBC and functions of its components necessary for employment of civil engineer.
2. Apply the knowledge of construction techniques and components involved in building construction necessary for employment as site engineer.
3. Apply the elements of construction project management and create work breakdown structure.
4. Create construction project networks and analyse using PERT and CPM techniques for being able to work as an entrepreneur.

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.



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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|------------------------------------|---|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Quiz (Formative) | Four quizzes will be taken, out of which, best three will be considered for evaluation and added for compilation of CWS marks. | |
| Assignment (Formative) | Four assignments will be given, of which, best three will be considered for evaluation and added for compilation of CWS marks. All students are expected to participate and perform these assignments with full zeal since the assignment/ activity/ flipped classroom/ Class assignment participation by a student will be assessed and marks will be awarded. | |

E. SYLLABUS

Building types & components: Definition and classification of buildings, load bearing and framed structure. Sequence of construction activity and co-ordination, building components and their functions, requirement of foundation, shallow and deep foundations, floor types and selection of flooring, types of stairs, classification of roofs, types of pitched roofs, trussed roofs, steel roof trusses.

Brick and Stone Masonry: different types of bonds in brick and stone masonry, merits and limitations, Comparison between stone and brick masonry.



Damp Proofing: Causes and effects of dampness, methods and materials used for damp proofing.

Joints: Requirements of construction joints and different types.

Temporary structural measures: Types & methods of shoring, underpinning and scaffolding. Fabrication and Erection work: Fabrication, handling, transportation, and erection of steel members and structures, difference between prefabricated, precast and cast-in-situ construction.

Construction Project Management: Characteristics of a construction project, Stages of Construction Project, Construction team, functions of project management, Work Breakdown Structure, scheduling techniques.

Network preparation and analysis: Rules for drawing a network diagram, PERT and CPM Analysis, calculation of Slack, Critical Path, Floats, and probability of meeting scheduled completion time.

F. TEXT BOOKS

1. B.C. Punmia, A.K. Jain, and A.K. Jain, *Building Construction*, Laxmi Publications, 11th Edition, 2016.
2. K.K. Chitkara, *Construction Project Management: Planning, Scheduling and Controlling*, McGraw Hill Education, 3rd Edition, 2014.

G. REFERENCE BOOKS

1. S.K. Sarkar and S. Saraswati, *Construction Technology*, Oxford University Press, 2008
2. B.C. Punmia, and K.K. Khandelwal, *Project Planning and Control with PERT and CPM*, Laxmi Publications, 4th Edition, 2016.

H. Lecture Plan:

| Lecture No. | Topics to be covered | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing the Outcome |
|-------------|---|---|--------------------|-----------------------|--|
| 1 | Introduction to course, its outcome, assessment etc | To acquaint and clear teachers expectations and understand student expectations | Lecture | NA | NA |
| 2 | Definition and classification of buildings | Identify different types of buildings and reason for categorisation | Lecture & Activity | CV1763.1 | Quiz, Mid Term Exam – I End Term Exam |
| | Activity: Expert Lecture | Understand the requirement of soil improvement techniques and techniques through case studies | Lecture | CV1763.1 | NA |
| 3 | Sequence of construction activity and co-ordination | Identify sequential order of construction activities and generate understanding for construction management | Lecture | CV1763.1 and CV1763.3 | Quiz and assignment |



| | | | | | |
|---------------|---|--|------------------------|----------|--|
| 4 | Building components and their functions | Recall the functions of building components | Lecture | CV1763.1 | Quiz, Mid Term Exam – I End Term Exam |
| 5,6 | Foundations: Shallow and deep foundation | Recall knowledge of different types of foundations and their suitability | Lecture | CV1763.1 | Quiz, Mid Term Exam - I End Term Exam |
| | Activity: Quiz | Recall the topics related with CO1 | Online | CV1763.1 | NA |
| 7 | Floor types and selection of flooring | Explain various types of floors | Lecture | CV1763.1 | Quiz, End Term Exam |
| 8 | Types of stairs | Explain the function and types of Stairs | Lecture and assignment | CV1763.1 | Assignment, Mid Term Exam – I End Term Exam |
| 9, 10, 11 | Classification of roofs, Pitched Roofs, Trussed Roofs, Steel roof trusses | Explain various types of roofs | Lecture and assignment | CV1763.1 | Quiz, End Term Exam |
| 13 | Activity: Assignment | Discussion on assignment | Discussion in class | CV1763.1 | NA |
| 14, 15, 16 17 | Brick and Stone Masonry | Apply knowledge of construction techniques | Lecture | CV1763.2 | Quiz, Mid Term Exam – I End Term Exam |
| 18, 19 | Damp Proofing- Causes and effects of dampness | Apply knowledge of construction techniques | Lecture | CV1763.2 | Quiz, Mid Term Exam - I End Term Exam |
| 20 | Construction Joints and its types | Apply knowledge of construction joints | Lecture | CV1763.2 | Quiz, Mid Term Exam - I End Term Exam |

| Lecture No. | Topics to be covered | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing the Outcome |
|-------------|----------------------|-----------------|------------------|------------------|-------------------------------|
|-------------|----------------------|-----------------|------------------|------------------|-------------------------------|



| | Activity: Assignment | Discussion on case studies | Discussion | CV1763.2 | NA |
|--------|---|---|---------------|----------|--|
| 21, 22 | Types & methods of shoring, underpinning and scaffolding. | Apply knowledge of construction techniques | Lecture | CV1763.2 | Quiz, Mid Term Exam - I End Term Exam |
| 23, 24 | Fabrication and Erection work | Apply knowledge of construction techniques | Lecture | CV1763.2 | Quiz, Mid Term Exam - I End Term Exam |
| | Activity: Quiz | Knowledge assessment related to CO 2 | Online | CV1763.2 | Quiz |
| 25 | Characteristics of a construction project | Understand difference between construction project and any other industrial project | Lecture | CV1763.3 | Quiz, Mid Term Exam – II, End Term Exam |
| 26 | Stages of Construction Project | Understand stages of construction and liabilities of different parties involved. | Lecture | CV1763.3 | Quiz, Mid Term Exam – II, End Term Exam |
| 27, 28 | Construction team, functions of project management | Identify responsibilities of different parties involved | Flipped Class | CV1763.3 | Quiz, Mid Term Exam – II, End Term Exam |
| 29, 30 | Work Break down Structure | Create work breakdown structure | | CV1763.3 | Quiz, Mid Term Exam – II, End Term Exam |
| | Activity: Quiz | Knowledge assessment related to CO 3 | Online | CV1763.3 | Quiz |
| 31 | Scheduling techniques | Create construction project networks | Flipped Class | CV1763.4 | Quiz, Mid Term Exam – II, End Term Exam |
| 32 | Rules for drawing a network diagram | Create construction project networks | Lecture | CV1763.4 | Quiz, Mid Term Exam – II, End Term Exam |
| 33, 34 | Activity: Network Preparation | Analyse and manage construction project using PERT and CPM techniques | Lecture | CV1763.4 | Quiz, Mid Term Exam – II, End Term Exam |
| 35, 36 | PERT and CPM Analysis | Analyse and manage construction project using PERT and CPM techniques | Lecture | CV1763.4 | Quiz, Mid Term Exam – II, End Term Exam |



| | | | | | |
|--------|--|---|---------|----------|---|
| 37, 38 | Activity: Problems solving using PERT and CPM network analysis | Analyse and manage construction project using PERT and CPM techniques | Lecture | CV1763.4 | Quiz, Mid Term Exam – II, End Term Exam |
|--------|--|---|---------|----------|---|

I. Course Articulation Matrix: (Mapping of COs with POs and PSOs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1763.1 | Recall types of buildings as per NBC and functions of its components necessary for employment of civil engineer. | | | 2 | | | 3 | | | | | | | 2 | | 3 | |
| CV1763.2 | Apply the knowledge of construction techniques and components involved in building construction necessary for employment as site engineer. | | | 2 | 3 | | | | | | | | | | 2 | 3 | 2 |
| CV1763.3 | Apply the elements of construction project management and create work breakdown structure. | | | 1 | | | | | | | | 3 | | | | 3 | 2 |
| CV1763.4 | Create construction project networks and analyse using PERT and CPM techniques for being able to work as an entrepreneur. | | | 2 | | | | | | | | 3 | 1 | | 2 | 3 | |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



[Text Box]

A. **Introduction:** This course is offered by Dept. of Civil Engineering for seventh semester students as program elective, targeting students who want to pursue higher studies in the field of environmental engineering, including environmental management and sustainable development. The course offers in depth knowledge of the need for environmental protection from pollution caused by developmental projects. The students will learn various methods for impact identification, evaluation and mitigation. The course will include activities, such as group discussions, quizzes, and projects, focusing on the development of industry ready skills.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CV I766.1]. Describe the importance of EIA, steps involved in EIA methodology and the need to protect the environment to promote sustainable development

[CV I766.2]. Analyse environmental impacts of developmental projects and the characteristics of these impacts for enhancing employability skills

[CV I766.3]. Recall the mitigation methodology and draft EIA report

[CV I766.4]. Evaluate the impact of developmental projects in societal and environmental context

C. **PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

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

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

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

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

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

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

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

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings



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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.

2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.

3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.

4. Communicate effectively with multidisciplinary members with discharge of social responsibilities as a civil engineer and engage in independent and lifelong learning for global betterment

D. **Assessment Plan:**

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Closed Book) | 15 |
| | Sessional Exam II (Closed Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Closed Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |



E. SYLLABUS

Definition and importance: Planning and Management of impact studies; Impact identification: Matrices, Networks, and Checklists. Description of affected environment, Indices and indicators for describing affected environment;
Prediction and Assessment of Impacts: Air, Surface water, Soil and groundwater, Noise, Biological, Cultural and socio-economic environment, Decision methods for evaluation of alternatives, Public participation in environmental decision making;
Documentation and environmental monitoring: Case studies, Environmental audit, Meaning, Importance.

F. TEXT BOOKS

W.L. Canter, Environmental Impact Assessment, McGraw Hill International editions, New York 1996.

G. REFERENCE BOOKS

C.H. Eccleston, "Environmental Impact Assessment: A Guide to Best Professional Practices" CRC Press, 2017.
P. Morris and R. Therivel, "Methods of Environmental Impact Assessment", Taylor & Francis, 2001.
A.K. Biswas and S.B.C. Agarwal, "Environmental Impact Assessment for Developing Countries", Elsevier, 1992.
P. Wathern, "Environmental Impact Assessment: Theory and Practice", Routledge, 1988.

H. Lecture Plan:

| Lecture | Topics | Session Outcome | Mode of Delivery | Corresponding CO | Mode of Assessing CO |
|---------|---|--|------------------|--------------------|-----------------------------|
| L1 | Introduction to the concept of EIA | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L2 | Perspectives on Sustainable Development | Describing the importance of EIA , Evaluating the impact of developmental projects | Lecture | CV1766.1, CV1766.4 | Mid Term I, Quiz & End Term |
| L3 | Purpose, Aim and Limitations of EIA | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L4 | Class Activity – Group Discussion | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |



| | | | | | |
|-----|---|---|---------|----------|------------------------------|
| L5 | Nature and scope of environmental issues | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L6 | Typology of environmental impacts | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term I, Quiz & End Term |
| L7 | Key elements of EIA process | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L8 | Introduction to steps in an EIA process | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L9 | Screening of EIA projects | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L10 | Framework for Screening | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L11 | Preliminary EIA | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L12 | Criteria for the determination of the need for, and level of, EIA | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L13 | Class Activity – Quiz | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L14 | Scoping of EIA projects | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L15 | Purpose and Objectives of Scoping | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L16 | Methods of Scoping | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term I, Quiz & End Term |
| L17 | Activities involved in Scoping | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term II, Quiz & End Term |
| L18 | Class Activity – Group Discussion | Describing the importance of EIA | Lecture | CV1766.1 | Mid Term II, Quiz & End Term |



| | | | | | |
|-----|---|---|---------|----------|------------------------------|
| L19 | Environmental Impacts and identification of impacts | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L20 | Impact identification methods | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L21 | Checklists and Matrices | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L22 | Networks and overlays | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L23 | Baseline studies | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L24 | Characteristics of environmental impacts | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L25 | Presentation of impact results and uncertainty in impacts | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L26 | Mitigation of Impacts | Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.3 | Mid Term II, Quiz & End Term |
| L27 | Elements of mitigation | Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.3 | Mid Term II, Quiz & End Term |




| | | | | | |
|-----|---|--|---------|--------------------|------------------------------|
| L28 | Approaches to mitigation | Analyse environmental impacts of developmental projects | Lecture | CV1766.2 | Mid Term II, Quiz & End Term |
| L29 | Components of Environmental management plan (EMP) | Analyse environmental impacts of developmental projects, Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.2, CV1766.3 | Mid Term II, Quiz & End Term |
| L30 | Class Activity – Quiz | Analyse environmental impacts of developmental projects, Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.2, CV1766.3 | Mid Term II, Quiz & End Term |
| L31 | EIA reporting | Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.3 | End Term |
| L32 | Elements of an EIA report | Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.3 | End Term |
| L33 | Guidelines for effective EIA report | Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.3 | End Term |
| L34 | Environmental audit (EA) | Learning the mitigation methodology and drafting EIA report | Lecture | CV1766.3 | End Term |
| L35 | Types of EA and EA methodology | Learning the mitigation | Lecture | CV1766.3, CV1766.4 | End Term |



| | | | | | |
|-----|--|--|-------------------|--------------------|----------|
| | | methodology and drafting EIA report, Evaluating the impact of developmental projects | | | |
| L36 | Class Activity – Group Discussion and Quiz | Analyse environmental impacts of developmental projects, Learning the mitigation methodology and drafting EIA report | Lecture, Activity | CV1766.2, CV1766.3 | End Term |
| L37 | EIA case studies | Evaluating the impact of developmental projects | Flipped classroom | CV1766.4 | End Term |
| L38 | EIA case studies | Evaluating the impact of developmental projects | Lecture, Activity | CV1766.4 | End Term |
| L39 | EIA case studies | Evaluating the impact of developmental projects | Lecture, Activity | CV1766.4 | End Term |
| L40 | EIA case studies | Evaluating the impact of developmental projects | Lecture, Activity | CV1766.4 | End Term |

I. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV1766.1 | Describe the importance of EIA, steps involved in EIA methodology and the need to protect the environment to | 1 | 3 | | 2 | | | 3 | | | 1 | | 1 | 3 | | | |

| | | | | | | | | | | | | | | |
|-----------|---|---|---|--|---|---|---|---|---|---|--------|--|---|---|
| | promote sustainable development | | | | | | | | |  | JAIPUR | | | |
| CV 1766.2 | Analyse environmental impacts of developmental projects and the characteristics of these impacts for enhancing employability skills | 2 | 3 | | 1 | | 1 | | | | 1 | | 2 | |
| CV 1766.3 | Recall the mitigation methodology and draft EIA report | | | | 3 | | 1 | 2 | | | 1 | | 1 | 3 |
| CV 1766.4 | Evaluate the impact of developmental projects in societal and environmental context | 3 | | | 2 | 3 | 2 | 1 | 2 | | 1 | | 1 | 1 |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



A. **Introduction:** This course is offered by Dept. of Civil Engineering as a Departmental elective, targeting students who wish to pursue higher studies in the field of Earthquake Engineering. The course offers in depth knowledge of Generation and Propagation of Seismic waves, Free and Forced vibration of Single degree damped and un-damped systems, Resonance, Multiple degree of freedom system, Structural Irregularities, Ductile Detailing and retrofitting methods. Case studies of important earthquakes have been emphasized in this course. Students are expected to have background knowledge on general design of strength of materials, design of reinforced concrete structures and structural analysis for better learning.

B. **Course Outcomes:** At the end of the course, students will be able to:

[CV 1767.1] An ability to understand the load transfer mechanism in structures.

[CV 1767.2] To do investigative work in design structures for better employment opportunity.

[CV 1767.3] Gain knowledge to do inter disciplinary work for entrepreneurial skills enhancement.

C. PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development



8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practices

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

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

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

1. Design economic, environment friendly, sustainable civil engineering structures keeping in view national and social requirements.
2. Conduct investigation, analysis and interpretation of the results using modern scientific tools and technical skills for solving complex civil engineering problem.
3. Manage/ execute civil engineering projects effectively and ethically as a member or/and leader in diverse teams.
4. Communicate effectively with multidisciplinary members and engage in independent and lifelong learning for global betterment.

D. Assessment Plan:

| Criteria | Description | Maximum Marks |
|--|--|---------------|
| Internal Assessment (Summative) | Sessional Exam I (Close Book) | 15 |
| | Sessional Exam II (Close Book) | 15 |
| | In class Quizzes and Assignments , Activity feedbacks (Accumulated and Averaged) | 30 |
| End Term Exam (Summative) | End Term Exam (Close Book) | 40 |
| | Total | 100 |
| Attendance (Formative) | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |
| Make up Assignments (Formative) | Students who misses a class will have to report to the teacher about the absence. A makeup assignment on the topic taught on the day of absence will be given which has to be submitted within a week from the date of absence. No extensions will be given on this. The attendance for that particular day of absence will be marked blank, so that the student is not accounted for absence. These assignments are limited to a maximum of 5 throughout the entire semester. | |
| Homework/ Home Assignment/ Activity Assignment (Formative) | There are situations where a student may have to work in home, especially before a flipped classroom. Although these works are not graded with marks. However, a student is expected to participate and perform these assignments with full zeal since the activity/ flipped classroom participation by a student will be assessed and marks will be awarded. | |



E. SYLLABUS

Introduction: Plate tectonics, Elastic rebound theory of earthquake, Seismic zoning map of India, Seismic waves, Seismograms, Earthquake magnitude and intensity. Introduction to theory of vibration: Free vibration of single degree un-damped and damped systems. Forced vibration (Harmonic Loading) of single degree un-damped and damped systems. Introduction to Resonance and MDOF system, Primary and secondary effects of earthquake.

Structural irregularities: the performance of RC buildings during Earthquakes: Vertical irregularities, Plan configuration problems; equivalent static method (is 1893). Ductile detailing of RC frames as per IS 13920 (1993). Restoration and retrofitting: of exciting structures. Case studies: of important earthquakes: Indian earthquakes, Major world earthquakes.

F. TEXT BOOKS

1. P. Agarwal and M. Shrikhande, Earthquake Resistant Design of Structures, Prentice-Hall of India Private Limited, New Delhi. 2006.

G. REFERENCE BOOKS

1. C.V.R Murty, Earthquake Tips- Learning Earthquake Design and Construction, National Information Centre of Earthquake Engineering, IIT Kanpur 2005.
2. Anil K Chopra, Dynamics of structures, Theory and Application of Earthquake Engineering, Pearson Publication.
3. IS: 1893 (Part 1) - 2002, Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
4. IS: 13920 - 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces- Code of Practice, Bureau of Indian Standards, New Delhi.

H. Lecture Plan:

| Class Number | Topics | Session Outcome | Mode of Delivery | Corresponding Course Outcome | Mode of Assessing the Outcome |
|--------------|--------------------------------------|--|------------------|------------------------------|--|
| 1,2 | Introduction | Plate tectonics, elastic rebound theory of earthquake | Lecture, PPT | CV1767.1 | Online quiz I and I st Sessional Exam |
| 3,4 | Introduction | Seismic zoning map of India, seismic waves, seismograms, | Lecture, PPT | CV1767.1 | |
| 5,6 | Introduction | Earthquake magnitude and intensities. | Lecture, PPT | CV1767.1 | |
| 7,8,9 | Introduction to theory of vibrations | Free vibration of SDOF system. | Lecture, PPT | CV1767.1 | Online quiz I and I st Sessional |
| 10,11 | Introduction to theory of vibrations | Free vibration of Un-damped SDOF system. | Lecture, PPT | CV1767.1 | |



| | | | | | |
|----------------------|--|---|--------------|----------|---|
| 12,13 | Introduction to theory of vibrations | Free vibration of Damped SDOF system. | Lecture, PPT | CVI767.1 | |
| 14,15,16 | Introduction to theory of vibrations | Forced vibration of SDOF system. | Lecture, PPT | CVI767.2 | Online quiz 2 and 1 st Sessional |
| 17,18,19 | Introduction to theory of vibrations | Forced vibration of Undamped SDOF system. | Lecture, PPT | CVI767.2 | |
| 18,19,20 | Introduction to theory of vibrations | Forced vibration of Damped SDOF system. | Lecture, PPT | CVI767.2 | Online quiz 2 and 1 st Sessional |
| 21,22,23,24 | Introduction to theory of vibrations | Numerical Problems | Lecture, PPT | CVI767.2 | |
| 25,26,27 | Introduction to theory of vibrations | Introduction to Resonance and MDOF system | Lecture, PPT | CVI767.2 | |
| 28,29,30 | Introduction to theory of vibrations | Primary and secondary effects of earthquake. | Lecture, PPT | CVI767.2 | |
| FIRST SESSIONAL EXAM | | | | | |
| 31,32 | Effect of Structural Irregularities on the performance of RC buildings during Earthquake | Plan configuration problem. | Lecture, PPT | CVI767.3 | Online quiz 3 and 2 nd Sessional |
| 33,34 | Effect of Structural Irregularities on the performance of RC buildings during Earthquake | Introduction to Equivalent Static method (IS 1893) | Lecture, PPT | CVI767.3 | |
| 35,36,37,38 | Effect of Structural Irregularities on the performance of RC buildings during Earthquake | Numerical on Equivalent Static Method | Lecture, PPT | CVI767.3 | |
| 39,40 | Effect of Structural Irregularities on the performance of RC buildings during Earthquake | Introduction to Ductile detailing of RC frames as per IS 13920-1993 | Lecture, PPT | CVI767.3 | Online quiz 4 and 2 nd Sessional |
| 41,42,43,44 | Effect of Structural Irregularities on the performance of RC buildings during Earthquake | Numerical on Ductile detailing of RC frames. | Lecture, PPT | CVI767.3 | |
| 45,46,47 | Effect of Structural Irregularities on the performance of RC buildings during Earthquake | Restoration and retrofitting of existing structures. | Lecture, PPT | CVI767.3 | |
| 48,49 | Case studies of important earthquake | Indian earthquake, Major National and | Lecture, PPT | CVI767.3 | |



| | | | | | |
|-----------------------|------------|----------------------------|--|--|--|
| | | International earthquakes. | | | |
| SECOND SESSIONAL EXAM | | | | | |
| 50 | Assignment | Assignment | | | |
| 51,52 | Revision | Revision | | | |
| END SEMESTER EXAM | | | | | |

I. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH 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 |
| CV 1767.1 | An ability to understand the load transfer mechanism in steel structures. | 3 | 3 | 1 | | | | | | | | 1 | 1 | | 1 | | |
| CV 1767.2 | To do investigative work in design steel structures for better employment opportunity. | 3 | 3 | 3 | 2 | 1 | | 1 | 1 | | | 1 | 1 | 3 | 2 | | |
| CV 1767.3 | Gain knowledge to do inter disciplinary work for entrepreneurial skills enhancement. | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | | 1 | 2 | 3 | 3 | 1 | 2 |

1. Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation



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