Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum

For

First Year
Bachelor of Engineering
(Choice Based Credit System)

(2019 Course)

(With Effect from Academic Year 2019-20)

TABLE -1 First Engineering _Structure for Semester-I														
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						**Credits**			
		Theory	**Practical**	**Tutorial**	**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**TUT**	**Total**
107001	Engineering Mathematics-I	03	--	01	30	70	25	--	--	125	03	--	01	04
107002/ 107009	Engineering Physics / Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
102003	Systems in Mechanical Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
111006	Workshop[@]	--	02	--	--	--	--	25	--	25	--	01	--	01
	Total	16	10	01	150	350	25	125	--	650	16	05	01	22
101007	Audit Course 1[&]	02	Environmental Studies-I											
Induction Program : 2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II														
TABLE -2 First Engineering_ Structure for Semester-II														
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						**Credits**			
		Theory	**Practical**	**Tutorial**	**ISE**	**ESE**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**TUT**	**Total**
107008	Engineering Mathematics-II	04	--	01	30	70	25	--	--	125	04	--	01	05
107002/ 107009	Engineering Physics/ Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
102012	Engineering Graphics [Ω]	01	02	01	--	50	25		--	75	01	01		02
110013	Project Based Learning[§]	--	04	--	--	--	25	50	--	75	--	02	--	02
	Total	15	12	02	120	330	75	125	--	650	15	05	02	22
101014	Audit Course 2[&]	02	Environmental Studies-II											
107015		--	Physical Education-Exercise and Field Activities											

Instructions:

- PR/Tutorial must be conducted in three batches per division.
- Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective subjects.
- Every Student should appear for Engineering Physics, Engineering Chemistry, Engineering Mechanics, Basic Electrical Engineering, Basic Electronics Engineering, Programming and Problem solving during the year.
- College is allowed to distribute Teaching workload of subjects Engineering Physics, Engineering Chemistry, Basic Electrical Engineering, Basic Electronics Engineering, Engineering Mechanics, Programming and Problem solving in semester I and II dividing number of FE divisions into two appropriate groups.
- Assessment of tutorial work has to be carried out as term-work examination. Term-work Examination and Practical Examination at first year of engineering course **shall be internal continuous assessment only.**

Ω 1 Credit for Engineering Graphics theory has to be awarded on the basis of End semester examination of 50 marks while 1 credit of tutorial and practical **shall be awarded on internal continuous assessment only**.

@ Credit for the course of workshop practical is to be awarded on the basis of continuous assessment / submission of job work.

§ Project based learning (PBL) requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload a load of 2 Hrs/week/batch needs to be considered for the faculty involved. The Batch needs to be divided into sub-groups of 5 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester.

& Audit course for Environmental Studies and II (As per D.O.No.F.13-1/2000 (EA/ENV/COS-I) dated 14 May, 2019) is mandatory but non-credit course. Examination has to be conducted at the end of Sem I & II respectively for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point &CGPA.

Audit course for Physical education is mandatory non-credit course. Examination has to be conducted at the end of Semester for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point &CGPA.

Guidelines for Induction Program

Induction programme for first year students is introduced to familiarize them to the new environment and encourage them to look beyond classrooms. Objective is to help new students adjust and feel comfort-able in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self exploration. Induction Program should be preferably of 3 weeks (**2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II)**.

In order to implement the (SIP) in the College the following activities can be taken at College.

- Physical Activity-This would involve a daily routine of physical activity with games and sports.
- Creative Arts: - Every students would chose one skill related to the arts whether visual arts or performing arts.
- Mentoring and Universal Human values:-Mentoring and connecting the students with faculty members and other students is the most important part of student induction. This can be effectively done by forming a group of 20-22 students with a faculty mentor each. This can be implemented through group discussion and real life activities rather than lecturing.
- Familiarization with College, Department, Branch :-The incoming student should be told about the credit, grading system and scheme of the examination. They should be explained how the study in College differs from the study in school. They should be taken on College tour and shown important points such as library, canteen, gymkhana etc. They should be shown their department.
- Literary Activity :-Literary Activity would compass reading book, writing a summery, debating, checking play etc.
- Proficiency modules :- The modules can be designed to overcome some critical lacunas that students might have like English Speaking, Computer familiarity etc.
- Lectures by Eminent People:- The lectures of Eminent people to be organized to expose the student to social activity public life.
- Visit to local Area:-A couple of visits to the landmark of the city or a hospital are orphanage could be organized.
- Extracurricular activities in College:-The new students should be introduced to the extracurricular activities at the College.
- Feedback and Report on the program:-Students should be asked to give their mid program Feedback and a each group of 20-22 students should be asked to prepare a single report on their experience of the program.

To Summarize the above activity the sequence of activities can be planned as given below :

- Address by Principal, HOD's and other functionaries and welcome the new students along with their parents.
- The branch wise allocation of students to be done and a group of 20-22 students is to farmed along with one faculty as mentor.
- A detail time table of various activities is to be prepared and displayed for all students. The timetable should give details of location and details of faculty in charge of the activity.
- The visit to local areas can be arranged on Saturdays.

The various activities to be carried out can be divided into three phases :-

1. Initial phase:- Which may induce Address by Principal, HOD's and other functionaries College and Dept Visit, interaction with parents Forming of students group and assigning of mentor mentee.
2. Regular Phase:- This phase may include the activities such as creative arts / universal

Human values Games & Sports in the morning session and in the afternoon session. Literary activities, Proficiency module, Lectures & workshop, Extra curricular Activities can be scheduled.

3. Closing Phase:- This phase may include taking feed back of students, preparation of Report by each group, Test of creative Arts, Human Values can be taken.

These are summarized guidelines given to the student inducing induction programme (SIP) Please refer SIP Manual published by AICTE for detail guidelines [2].

Savitribai Phule Pune University

First Year Engineering (2019 Course)

107001 – Engineering Mathematics – I

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 3 Hrs./Week	**04**	**In-Semester Exam :30 Marks**
TUT : 1 Hr/Week		**End-Semester Exam :70 Marks**
		TW :25 Marks

Prerequisites:
Differentiation, Integration, Maxima and Minima, Determinants and Matrices.

Course Objectives:
To make the students familiarize with concepts and techniques in Calculus, Fourier series and Matrices. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes (COs): The students will be able to learn

CO1: Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems.

CO2: the Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems.

CO3: to deal withderivative of functions of several variables that are essential in various branches of Engineering.

CO4: to apply the concept of Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function.

CO5: the essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems

Course Contents

Unit I: Differential Calculus: (08 Hrs.)

Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits and Applications.

Unit II: Fourier Series (08 Hrs.)

Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Parseval's identity and Applications to problems in Engineering.

Unit III: Partial Differentiation (08Hrs.)

Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative, Change of Independent variables

Unit IV: Applications of Partial Differentiation (08 Hrs.)

Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Unit V: Linear Algebra-Matrices, System of Linear Equations (08 Hrs.)

Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in Engineering.

Unit VI: Linear Algebra-Eigen Values and Eigen Vectors, Diagonaliztion (08 Hrs.)

Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonaliztion of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations.

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I & Vol. II) by P.N.Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Linear Algebra –An Introduction, Ron Larson, David C. Falvo (Cenage Learning, Indian edition)

Tutorial and Term Work:

i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division.

ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on performance and continuous internal assessment.

107002: Engineering Physics

Teaching Scheme:	Credits	Examination Scheme:
TH: 04 Hr/week	**05**	**In-Semester :30 Marks**
PR: 02 Hr/Week		**End-Semester :70 Marks**
		PR :25 Marks

Prerequisite Courses, if any:
Fundamentals of: optics, interference, diffraction polarization, wave-particle duality, semiconductors and magnetism

Companion Course, if any: Laboratory Practical

Course Objectives:
To teach students basic concepts and principles of physics, relate them to laboratory experiments and their applications

Course Outcomes:
On completion of the course, learner will be able to–

CO1: Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.

CO2: Learn basics of lasers and optical fibers and their use in some applications.

CO3: Understand concepts and principles in quantum mechanics. Relate them to some applications.

CO4: Understand theory of semiconductors and their applications in some semiconductor devices.

CO5: Summarize basics of magnetism and superconductivity. Explore few of their technological applications.

CO6: Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application.

Course Contents

Unit I **Wave Optics** **(08 Hrs)**

Interference

- Introduction to electromagnetic waves and electromagnetic spectrum
- Interference in thin film of uniform thickness (with derivation)
- Interference in thin film wedge shape (qualitative)
- Applications of interference: testing optical flatness, anti-reflection coating

Diffraction

- Diffraction of light
- Diffraction at a single slit, conditions for principal maxima and minima, diffraction pattern
- Diffraction grating, conditions for principal maxima and minima starting from resultant amplitude equations, diffraction pattern
- Rayleigh's criterion for resolution, resolving power of telescope and grating

Polarization

- Polarization of light, Malus law
- Double refraction, Huygen's theory of double refraction

Applications of polarization: LCD

Unit II **Laser and Optic Fibre** **(08 Hrs)**

Laser

- Basics of laser and its mechanism, characteristics of laser
- Semiconductor laser: Single Hetro-junction laser
- Gas laser: CO_2 laser
- Applications of lasers: Holography, IT, industrial, medical

Optic Fiber

- Introduction, parameters: Acceptance Angle, Acceptance Cone, Numerical Aperture
- Types of optical fiber- step index and graded index
- Attenuation and reasons for losses in optic fibers (qualitative)
- Communication system: basic building blocks

Advantages of optical fiber communication over conventional methods.

Unit III **Quantum Mechanics** **(08 Hrs)**

- De-Broglie hypothesis
- Concept of phase velocity and group velocity (qualitative)
- Heisenberg Uncertainty Principle
- Wave-function and its physical significance
- Schrodinger's equations: time independent and time dependent
- Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in RigidBox)
- Particle in Finite potential well (Particle in Non Rigid box) (qualitative)
- Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode
- Introduction to quantum computing

Unit IV **Semiconductor Physics** **(08 Hrs)**

- Free electron theory (Qualitative)
- Opening of band gap due to internal electron diffraction due to lattice Band theory of solids
- Effective mass of electron Density of states
- Fermi Dirac distribution function
- Conductivity of conductors and semiconductors
- Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration)
- Working of PN junction on the basis of band diagram
- Expression for barrier potential (derivation)
- Ideal diode equation
- Applications of PN junction diode: Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell
- Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect

Unit V **Magnetism and Superconductivity** **(8Hrs.)**

Magnetism

- Origin of magnetism
- Classification of magnetism on the basis of permeability (qualitative)
- Applications of magnetic devices: transformer cores, magnetic storage, magneto-optical recording

Superconductivity

- Introduction to superconductivity; Properties of superconductors: zero electrical
- resistance, critical magnetic field, persistent current, Meissner effect
- Type I and Type II superconductors
- Low and high temperature superconductors (introduction and qualitative)
- AC/DC Josephson effect; SQUID: basic construction and principle of working; Applications of SQUID
- Applications of superconductors

Unit VI **Non Destructive Testing and Nanotechnology** **(8 Hrs.)**

Non Destructive Testing

- Classification of Non-destructive testing methods
- Principles of physics in Non-destructive Testing
- Advantages of Non-destructive testing methods
- Acoustic Emission Testing
- Ultrasonic (thickness measurement, flaw detection)
- Radiography testing

Nanotechnology

- Introduction to nanotechnology
- Quantum confinement and surface to volume ratio
- Properties of nanoparticles: optical, electrical, mechanical

Applications of nanoparticles: Medical (targeted drug delivery), electronics, space and defense, automobile

Books & Other Resources:

Text Books:

1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications
2. A textbook of optics – N Subrahmanyam and BriLal , S. Chand Publications
3. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications

Reference Books:

1. Fundamentals of Physics, Resnick and Halliday (John Wiley and Sons)
2. Optics, Jenkins and White (Tata Mcgraw Hill)
3. Principles of Physics, Serway and Jewett (Saunders college publishing)
4. Introduction to Solid State Physics, C. Kittel (Wiley and Sons)
5. Principles of Solid State Physics, H. V. Keer, New Age International
6. Laser and Non-Linear Optics, B. B. Laud (Oscar publication)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni (Capital Publishing Company

Guidelines for Instructor's Manual

Lab manual is expected to cover following points:

1. Engineering Program Outcome (Graduate Attribute) and which attributes will be covered during practical
2. List of experiments to be performed with mention of objectives and outcome of the experiment

Guidelines for Student's Lab Journal

Student's lab journal is expected to cover:

1. List of experiments to be performed with mention of objectives and outcome of the experiment.
2. Instructions to students for performing the experiments
3. Precautions for each experiment
4. Write up of experiment (Preferably mentioning significance of experiment).

Guidelines for Lab /TW Assessment

1. The distribution of weightage of term work marks should be informed to students before start of the semester.
2. Term work assessment should be on continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction

1. DO's and DONT'S, along with precautions, are need to be displayed at prominent location in laboratory
2. Students should be informed about DO'S and DON'T and precautions before performing the experiment

Suggested List of Laboratory Experiments (<u>Any eight</u>)

Sr.	Experiment
1	Experiment based on Newton's rings (determination of wavelength of monochromatic light, determine radius of curvature of plano-convex lens)
2	To determine position of diffraction minima by studying diffraction at a single slit
3	To determine unknown wavelength by using plane diffraction grating
4	To find out Resolving power of Diffraction Grating/Telescope
5	To verify Malus Law
6	Any experiment based on Double Refraction (Determination of refractive indices, identification of types of crystal)
7	Any Experiment based on Laser (Thickness of wire, determination of number of lines on grating surface)
8	An experiment based on optic fibers
9	To study IV characteristics of Solar Cell and determine parameters (fill factor and efficiency)
10	To determine band gap of given semiconductor
11	To determine Hall coefficient and charge carrier density
12	Temperature dependence characteristics of semiconductor laser
13	To find out Magnetic susceptibility of given material
14	Ultrasonic Interferometer: Determination of velocity of ultrasonic waves in given liquid and find its compressibility
	Suggested Demonstration Experiments
1	Michelson interferometer
2	Half shade Polarimeter
3	Determination of absorption coefficient of sound of given material
4	Temperature dependence
5	Brewster's law
6	Measurement of sound pressure level

102003 - Systems in Mechanical Engineering		
Teaching Scheme: **TH : 3 Hrs./week** **PR : 2 Hrs./Week**	**Credits** **04**	**Examination Scheme:** **In-Semester :30 Marks** **End-Semester :70 Marks** **PR :25 Marks**

Course Objectives:

1. To identify the sources of energy and their conversions
2. To explain the basic concept of engineering thermodynamics and its application
3. To understanding the specifications of vehicles
4. To get acquainted with vehicle systems
5. To introduce manufacturing processes applying proper method to produce components
6. To be able to select and compare domestic appliances

Course Outcomes

On completion of the course, learner will be able to

CO1: Describe and compare the conversion of energy from renewable and non-renewable energy sources

CO2: Explain basic laws of thermodynamics, heat transfer and their applications

CO3: List down the types of road vehicles and their specifications

CO4: Illustrate various basic parts and transmission system of a road vehicle

CO5: Discuss several manufacturing processes and identify the suitable process

CO6: Explain various types of mechanism and its application

Course Contents

Unit I Introduction of energy sources & its conversion (06 Hrs)

Energy sources: Thermal energy, Hydropower energy, Nuclear energy, Solar energy, Geothermal energy, Wind energy, Hydrogen energy, Biomass energy and Tidal energy. Grades of Energy. (*Numerical on efficiency calculation of thermal power plant*)

Energy conversion devices: Introduction of pump, compressor, turbines, wind mills etc (*Simple numerical on power and efficiency calculations)*

Unit II Introduction to Thermal Engineering (06Hrs)

Laws of thermodynamics, heat engine, heat pump, refrigerator *(simple numerical)*

Modes of heat transfer: conduction, convection and radiation, Fourier's law, Newton's law of cooling, Stefan Boltzmann's law. *(Simple numerical)*

Two stroke and Four stroke engines (Petrol, Diesel and CNG engines). Steam generators.

Unit III Vehicles and their Specifications (04 Hrs)

Classification of automobile. Vehicle specifications of two/three wheeler, light motor vehicles, trucks, buses and multi-axle vehicles. Engine components (Introduction). Study of engine specifications, comparison of specifications of vehicles. Introduction of Electric and Hybrid Vehicles. Cost analysis of the Vehicle.

Unit IV Vehicle systems (08 Hrs)

Introduction of chassis layouts, steering system, suspension system, braking system, cooling system and fuel injection system and fuel supply system. Study of Electric and Hybrid Vehicle systems. Study of power transmission system, clutch, gear box (Simple Numerical), propeller shaft, universal joint, differential gearbox and axles. Vehicle active and passive safety arrangements: seat, seat belts, airbags and antilock brake system.

Unit V **Introduction to Manufacturing** **(06 Hrs)**

Conventional Manufacturing Processes: Casting, Forging, Metal forming (Drawing, Extrusion, etc.), Sheet metal working, Metal joining, etc. Metal cutting processes and machining operations- Turning, Milling and Drilling, etc.

Micromachining. Additive manufacturing and 3D Printing. Reconfigurable manufacturing system and IOT, Basic CNC programming**:** Concept of Computer Numerical Controlled machines.

Unit VI Engineering Mechanisms and their application in Domestic Appliances (6Hrs.)

Introduction to Basic mechanisms and equipment: Pumps, blowers, compressors, springs, gears, Belt-Pulley, Chain-Sprocket, valves, levers, etc. Introduction to terms: Specifications, Input, output, efficiency, etc.

Applications of: Compressors - Refrigerator, Water cooler, Split AC unit; Pumps - Water pump for overhead tanks, Water filter/Purifier units; Blower - Vacuum cleaner, Kitchen Chimney; Motor - Fans, Exhaust fans, Washing machines; Springs - Door closure, door locks, etc.; Gears - Wall clocks, watches, Printers, etc.; Application of Belt-Pulley/Chain-Sprocket - Photocopier, bicycle, etc.; Valves - Water tap, etc.; Application of levers - Door latch, Brake pedals, etc.; Electric/Solar energy - Geyser, Water heater, Electric iron, etc. (simple numerical on efficiency calculation)

Books & Other Resources

Text Books

1. Nag, P. K., "Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd.
2. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai
3. Agrawal,Basant and Agrawal, C. M., (2008), "Basics of Mechanical Engineering", John Wiley and Sons, USA
4. Rajput, R.K., (2007), "Basic Mechanical Engineering", Laxmi Publications Pvt. Ltd.
5. Pravin Kumar, (2018), " Basic Mechanical Engineering, 2nd Ed.", Pearson (India) Ltd.
6. Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. "Fundamentals of Engineering Thermodynamics", Wiley
7. Surinder Kumar, (2011), "Basic of Mechanical Engineering", Ane Books Pvt. Ltd. New Delhi

Reference Books

1. Khan, B. H., "Non Conventional Energy Sources, Tata McGraw-Hill Publisher Co. Ltd.
2. Boyle, Godfrey, "Renewable Energy",2nd Ed., Oxford University Press
3. Khurmi, R.S. ,and Gupta, J. K.,"A Textbook of Thermal Engineering", S. Chand & Sons
4. Incropera, F. P. and Dewitt, D.P., (2007), "Fundamentals of Heat and Mass Transfer, 6th Ed., John Wiley and Sons, USA
5. Groover,Mikell P., (1996), "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Prentice Hall, USA
6. Norton, Robert L., (2009), "Kinematics and Dynamics of Machinery", Tata McGrawHill
7. Cleghorn, W. L., (2005), "Mechanisms of Machines", Oxford University Press
8. Juvinal, R. C., (1994), "Fundamentals of Machine Component Design", John Wiley and Sons, USA
9. Ganeshan, V., (2018), "Internal Combustion Engines", McGraw Hill
10. Anderson, Curtis Darrel and Anderson,Judy, (2010), "Electric and Hybrid Cars: A History", 2nd Ed., McFarland

Guidelines for Instructor's Manual

The Instructor's Manual should contain following related to every experiment:

- Brief theory related to the experiment.
- Apparatus with their detailed specifications.

- Schematic, Layout /diagram.
- Observation table/ simulation plots/graphs.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few questions related to the experiment.
- Relevance of practical in real life /industry

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment:

- Theory related to the experiment.
- Apparatus with their detailed specifications.
- Schematic, Layout /diagram.
- Observation table/ simulation plots/graphs.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical, and understanding.
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

The student shall complete the following activity as a term work.

Sr. No.	Activity
1.	**Group A: Industry / Workshop / Showroom Visit:** The visit of students is mandatory, to provide awareness and understanding of the course.
2.	**Group B: Assignments:** The student shall complete the following assignments on: i. Energy sources (Minimum one assignment on Conventional and one on Non-conventional sources) ii. Vehicle specifications and systems in passenger car iii. Electric vehicle specifications and its systems iv. Domestic appliances viz. refrigerator, air-conditioner, washing machine, cold storage
3.	**Group C: Experiments:** The student shall complete the following (**any four)** experiments: i. Demonstration of power train system in the vehicle ii. Demonstration of vehicle systems (automobile chassis, steering system, suspension system, braking system - Any Two) iii. Demonstration of energy conversion devices iv. Demonstration of additive manufacturing / rapid prototyping techniques v. Demonstration of CNC

103004: Basic Electrical Engineering		
Teaching Scheme: **TH : 03 Hr/week** **PR : 02 Hr/Week**	**Credits** **04**	**Examination Scheme:** **In-Semester : 30 Marks** **End-Semester : 70 Marks** **PR : 25 Marks**

Prerequisite Courses, if any: Engineering physics**,** electron theory, electricity, potential and kinetic energy

Course Overview: This course aims at enabling students of all Engineering Branches to understand the basic concepts of electrical engineering. This course is designed to provide knowledge of fundamentals and various laws in electromagnetic and magnetic circuits, electrostatics. The steady state analysis of AC and DC circuits, and its applications transformer, batteries and different energy conversion techniques are also included in this course.

Course Objectives:

1. To introduce fundamental concepts, various laws-principles and theorems associated with electrical systems.
2. To impart basic knowledge of all electrical quantities such as current, voltage, power, energy, frequency along with different types of fields.
3. To provide knowledge about fundamental parameters such as resistance, inductance and capacitance and magnetic circuits, AC and DC circuits.
4. To provide knowledge of the concepts of transformer, different energy conversions techniques.

Course Outcomes:

At the end of course students will be able to

CO1: Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect.

CO2: Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic

CO3: Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram.

CO4: Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions

CO5: Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply.

CO6: Evaluate work, power, energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge.

Course Contents

Unit I **Electromagnetism**: (**6Hrs**)

Review: resistance, emf, current, potential, potential difference and Ohm's law

Electromagnetism: Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of mmf, flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series magnetic circuit, Introduction to parallel magnetic circuit(Only theoretical treatment), comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left hand rule. Faradays laws of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of couplings. Energy stored in magnetic field.

Unit II **Electrostatics and AC Fundamentals** **(6 Hrs)**

A) Electrostatics: Electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance. Capacitor, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors (no derivation) and time constant. **(2Hrs)**

B) AC Fundamentals: Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, Period, frequency, instantaneous, peak(maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor. **(4Hrs)**

Unit III **Single Phase AC Circuits** **(06 Hrs)**

Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance, series R-L, R-C and R-L-C circuits, phasor diagrams, voltage, current and power waveforms, resonance in series RLC circuits, concept of impedance, concept of active, reactive, apparent, complex power and power factor, Parallel AC circuits (No numericals), concept of admittance

Unit IV **Polyphase A.C. Circuits and Single phase Transformers** **(06 Hrs)**

A) Polyphase A.C. Circuits: Concept of three-phase supply and phase sequence. Balanced and unbalanced load, Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. **(3Hrs)**

B) Single phase transformers: principle of working, construction and types, emf equation, voltage and current ratios. Losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformers. **(3Hrs)**

Unit V **DC Circuits:** **(06 Hrs)**

Classification of electrical networks, Energy sources – ideal and practical voltage and current sources, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoff's laws and their applications for network solutions using loop analysis, Superposition theorem, Thevenin's theorem.

Unit VI **Work, Power, Energy and Batteries** **(06 Hrs)**

A) Work, Power, Energy: Effect of temperature on resistance, resistance temperature coefficient, insulation resistance, conversion of energy from one form to another in electrical, mechanical and thermal systems. (**4Hrs**)

B) Batteries : Different types of batteries (Lead Acid and Lithium Ion), construction, working principle, applications, ratings, charging and discharging, concept of depth of charging, maintenance of batteries, series -parallel connection of batteries **(2Hrs)**

Books & Other Resources:

Text Books:

1. V.D. Toro, Principles of Electrical Engineering, Prentice Hall India, 1989
2. D. P. Kothari, I.J. Nagrath, Theory and Problems of Basic Electrical Engineering, PHI Publication
3. V.K. Mehta, RohitMehata Basic Electrical Engineering, S Chand Publications
4. B.L. Theraja, A text book on electrical technology Vol-I

Reference Books:

1. H Cotton, Electrical technology, CBS Publications
2. L. S. Bobrow, ―Fundamentals of Electrical Engineering‖, Oxford University Press, 2011.
3. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
4. D. C. Kulshreshtha, ―Basic Electrical Engineering‖, McGraw Hill, 2009.

Guidelines for Instructor's Manual

The Instructor's Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Apparatus with their detailed specifications.

- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few questions related to the experiment.
- Relevance of practical in real life /industry

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

- Theory related to the experiment.
- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical, understanding .
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

Suggested List of Laboratory Experiments/Assignments

Group A

Following **eight** practical are compulsory

1. To study safety precautions while working on electrical systems, handling of various equipment's such as multimeter, ammeters, voltmeters, wattmeter's, real life resistors, inductors and capacitors
2. To calculate and measure of charging and discharging of capacitor and observe the response on storage oscilloscope.
3. To measure steady state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms on storage oscilloscope.
4. To derive resonance frequency and analyze resonance in series RLC circuit.
5. To verify the relation between phase and line quantities in three phase balanced star delta connections of load.
6. To determine efficiency and regulation of transformer by direct loading test of a single phase transformer.
7. To verify KVL and Superposition theorem.
8. To verify Thevenin's theorem in a DC network

Group B

From following **minimum two** practical are compulsory

1. To measure insulation resistance of electrical equipment's/cable using Megger
2. To demonstrate different types of electrical protection equipments such as fuses, MCB, MCCB, ELCB.
3. To measure of earth resistance at substation earthing using fall of potential method with IS 3043 standard.
4. To study of LT and HT electricity bills.

110005: Programming and Problem Solving		
Teaching Scheme: **TH: 03 Hrs/Week** **PR : 02 Hrs/Week**	**Credits** **04**	**Examination Scheme:** **In-Semester : 30 Marks** **End-Semester : 70 Marks** **PR : 25 Marks**

Prerequisite Courses, if any: students are expected to have a good understanding of basic computer principles.

Companion Course, if any: Programming and Problem Solving Laboratory (110005)

Course Objectives:

Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

1. To understand problem solving, problem solving aspects, programming and to know about various program design tools.
2. To learn problem solving with computers
3. To learn basics, features and future of Python programming.
4. To acquaint with data types, input output statements, decision making, looping and functions in Python
5. To learn features of Object Oriented Programming using Python
6. To acquaint with the use and benefits of files handling in Python

Following Fields are applicable for courses with companion Laboratory course

Course Outcomes: On completion of the course, learner will be able to–

CO1: Inculcate and apply various skills in problem solving.

CO2: Choose most appropriate programming constructs and features to solve the problems in diversified domains.

CO3: Exhibit the programming skills for the problems those require the writing of well-documented programs including use of the logical constructs of language, Python.

CO4: Demonstrate significant experience with the Python program development environment.

Course Contents

Unit I Problem Solving, Programming and Python Programming (07 Hrs)

General Problem Solving Concepts- Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies,

Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms.

Basics of Python Programming: Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.

Unit II Decision Control Statements (08 Hrs)

Decision Control Statements: Decision control statements, **Selection/conditional** branching Statements: if, if-else, nested if, if-elif-else statements. **Basic loop** Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The *break, continue, pass, else* statement used with loops. Other data types- Tuples, Lists and Dictionary.

Unit III **Functions and Modules** **(08 Hrs)**

Need for functions, **Function**: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.

Unit IV **Strings** **(07 Hrs)**

Strings and Operations- concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Unit V **Object Oriented Programming** **(08 Hrs)**

Programming Paradigms-monolithic, procedural, structured and object oriented, **Features of Object oriented programming-**classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation.

Classes and Objects: classes and objects, class method and self object, class variables and object variables, public and private members, class methods.

Unit VI **File Handling and Dictionaries** **(07 Hrs)**

Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. Dictionary method. **Dictionaries-** creating, assessing, adding and updating values.

Case Study: Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination).

Text Books:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN-10: 938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN-10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978-0132492645
2. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN-10: 9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978-9382609810

Programming and Problem Solving Laboratory

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), copy of curriculum, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of

tool/framework/language used, Design, test cases, conclusion. Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

List of laboratory assignments is provided below for reference. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of coding style, proper indentation and comments.

Use of open source software and recent version is to be encouraged.

In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Suggested List of Laboratory Experiments/Assignments
(Any 6 to 8 laboratory assignments)

Sr. No.	Problem Statement Write Program in Python (with function/class/file, as applicable)
1.	To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions.
2.	To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as $e=mc^2$ where m is the mass of the object and c is its velocity.
3.	To accept N numbers from user. Compute and display maximum in list, minimum in list, sum and average of numbers.
4.	To accept student's five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is 60>= and <75 then the grade if first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.
5.	To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself. Ex. 371.
6.	To simulate simple calculator that performs basic tasks such as addition, subtraction, multiplication and division with special operations like computing x^y and x!.

7.	To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors
8.	To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
9.	To accept a number from user and print digits of number in a reverse order.
10.	To input binary number from user and convert it into decimal number.
11.	To generate pseudo random numbers.
12.	To accept list of N integers and partition list into two sub lists even and odd numbers.
13.	To accept the number of terms a finds the sum of *sine* series.
14.	To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series.
15.	Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring
16.	To copy contents of one file to other. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.
17.	To count total characters in file, total words in file, total lines in file and frequency of given word in file.
18.	Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation "Asst Manager"
19.	Create class STORE to keep track of Products (Product Code, Name and price). Display menu of all products to user. Generate bill as per order.
Mini-Projects	
20.	Calculator with basic functions. Add more functionality such as graphic user interface and complex calculations.
21.	Program that simulates rolling dice. When the program runs, it will randomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.
22.	Use raspberry pi/or similar kit and python for- • Room Temperature Monitoring System • Motion Detection System • Soil Moisture Sensor • Home Automation System • A robot • Smart mirror or a smart clock. • Smile Detection using Raspberry Pi Camera
23.	Guess Number: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user's guess is wrong, the program should return some sort of indication as to how wrong (e.g. the number is too high or too low). If the user guesses correctly, a positive indication should appear. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.

111006 -Workshop Practice

Teaching Scheme:	Credits	Examination Scheme:
PR : 2 Hrs/Week	01	PR : 25 Marks

Course Objectives:

1. To understand the construction and working of machine tools and functions of its parts.
2. To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop leading to understanding of a production processes.
3. To understand workshop layout and safety norms.

Course Outcomes:

CO1: Familiar with safety norms to prevent any mishap in workshop.
CO2: Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job.
CO3: Able to understand the construction, working and functions of machine tools and their parts.
CO4: Able to know simple operations (Turning and Facing) on a centre lathe.

Note

1. The demonstration of machine tools to be conducted by **teaching** faculty.
2. Minimum eight experiments to be conducted out of 10.

Guidelines for Instructor's Manual

Instructor manual shall contain:

- The production drawing of a job with all linear and geometric dimensions, Raw material, size and shape, allowances provided.
- List of tooling required.
- Process plan to complete the job.
- General safety instructions.

Guidelines for Student's Lab Journal

i. Student has to maintain a workshop diary consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job and time schedule.
ii. Student has to maintain one file for write ups based on demonstration of machine tools and safety norms

Guidelines for LAB/TW Assessment

Term work assessment shall be based on the timely completion of jobs, quality of job, skill acquired, and maintain of workshop diary and brief write-ups on illustrations/sketches of demonstrated parts/mechanisms/machine tools etc.

Guidelines for Laboratory Conduction

i. 1st on importance of workshop practical and shop floor safety norms
ii. 2nd to 6th Sessions are about demonstration of machine tools (Any 4)
iii. 7th to 9th on making utility job (Any 2)
iv. 10th& 11th session on preparation of workshop layout and safety norms.

Suggested List of Laboratory Experiments/Assignments

Sr. No.	List of Experiments
1.	Mandatory briefing on shop-floor safety
2.	**Demonstration and working of centre lathe** Demonstration on various functions of lathe parts: Headstock, Tailstock, Carriage, Lead screw, All geared Mechanism, Apron mechanism etc.
3.	**Demonstration of Lathe operations:** Step turning and facing, drilling operation on a Mild Steel cylindrical job on centre lathe. Understanding the concept of speed, feed and depth of cut.

4.	**Demonstration of Drilling machine** Demonstration on construction of Radial drilling machine, Tool holding devices, Concept of speed, feed and depth of cut.
5.	**Demonstration on Milling machine** Demonstration on construction, table movements, indexing and tooling of milling machine.
6.	**Demonstration of Shaper/Grinding machine (Any one)** Shaper: Crank and slotted link mechanism, Work feed mechanism Grinding: Surface grinder/Cylindrical grinding machine, Mounting of grinding wheel
7.	**Term work includes one job of Carpentry** Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns and its allowances.
8.	**Term work to include one job involving fitting** to size, male-female fitting with drilling and tapping operation on Mild Steel plate; Introduction to marking, cutting and sawing, sizing of metal, shearing, Concept of fits and interchangeability, selection of datum and measurements.
9.	**Term work to include one utility job preferably using sheet metal** (e.g. Tray, Funnel etc.) with riveting/welding/brazing/soldering (at least one temporary and one Permanent joint either using resistance welding/Arc welding); Introduction to sheet metal operations: punching, blanking, bending, drawing.
10.	**Prepare a Layout of Workshop** To prepare a work shop layout.
11.	**Collection of information about safety norms** in any one of the following type of industry:Metalworking/Chemical/Cement/Pharmaceuticals/Defense/Atomic energy/Aerospace /Marine/Construction/Railway etc.

Reference/Text Books

1. John, K. C., (2010),"Mechanical Workshop Practice, Prentice Hall Publication, New Delhi
2. Hazra and Chaudhary, Workshop Technology-I & II, Media promoters & Publisher Pvt. Ltd.

101007: Environmental Studies-I

TH:02 Hrs./week **(Mandatory Non-Credit Course)**

Course Objectives:

1. To explain the concepts and strategies related to sustainable development and various components of environment.
2. To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships.
3. To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources.
4. To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity on national and local scale.

Course Outcomes: On completion of the course, learner will be able to–

CO1:Demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO2: Explain and identify the role of the organism in energy transfers in different ecosystems.

CO3: Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources.

CO4: Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings.

Course Contents

Unit I **Introduction to environmental studies** **(02 Hrs)**

Multidisciplinary nature of environmental studies; components of environment – atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.

Unit II **Ecosystems** **(06 Hrs)**

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III **Natural Resources: Renewable and Non-renewable Resources** **(08 Hrs)**

Land Resources and land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods droughts, conflicts over water (international & inter-state).

Heating of earth and circulation of air; air mass formation and precipitation.

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit IV **Biodiversity and Conservation** **(08 Hrs)**

Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity; In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Suggested Readings:

1. Carson, R. 2002. Silent spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principals of Conservation Biology.
   Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.
7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp.29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

107008 – Engineering Mathematics – II

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 4 Hrs./Week	**05**	**In-Semester : 30 Marks**
TUT : 1 Hr./Week		**End-Semester : 70 Marks**
		TW : 25 Marks

Prerequisites:

Integration, Differential Equation, Three-dimensional coordinate systems

Course Objectives:

To make the students familiarize with Mathematical Modeling of physical systems using differential equations advanced techniques of integration, tracing of curve, multiple integrals and their applications. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes (COs): The students will be able to learn

CO1: the effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.

CO2: advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications.

CO3: to trace the curve for a given equation and measure arc length of various curves.

CO4: the concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner.

CO5: evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.

Course Contents

Unit I: First Order Ordinary differential Equations (09 Hrs.)

Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form, Bernoulli's equation.

Unit II: Applications of Differential Equations (09 Hrs.)

Applications of Differential Equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, Rectilinear Motion, Simple Harmonic Motion, One dimensional Conduction of Heat.

Unit III: Integral Calculus (09 Hrs.)

Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions.

Unit IV: Curve Tracing (09 Hrs.)

Tracing of Curves – Cartesian, Polar and Parametric curves, Rectification of curves.

Unit V: Solid Geometry (09 Hrs.)

Cartesian, Spherical polar and Cylindrical coordinate systems, Sphere, Cone and Cylinder.

Unit VI: Multiple Integrals and their Applications (09 Hrs.)

Double and Triple integrations, Change of order of integration, Applications to find Area, Volume, Mass, Centre of Gravity and Moment of Inertia.

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I and II) by P.N. Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Differential Equations by S. L. Ross (John Wiley and Sons)

Tutorial and Term Work:

i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students) per division.

ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on

performance and continuous internal assessment.

107009: Engineering Chemistry

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 04 Hrs/week	**05**	**In Semester : 30 Marks**
PR : 02 Hrs/Week		**End Semester: 70 Marks**
		PR : 25 Marks

Prerequisite Courses, if any:
Types of titrations, volumetric analysis, structure property relationship, types of crystals, periodic table, classification and properties of polymers, electromagnetic radiation, electrochemical series

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To understand technology involved in analysis and improving quality of water as commodity.
2. To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials.
3. To understand structure, properties and applications of speciality polymers and nano material.
4. To study conventional and alternative fuels with respect to their properties and applications.
5. To study spectroscopic techniques for chemical analysis.
6. To understand corrosion mechanisms and preventive methods for corrosion control.

Course Outcomes:
On completion of the course, learner will be able to–

CO1: Apply the different methodologies for analysis of water and techniques involved in softening of water as commodity.

CO2: Select appropriate electro-technique and method of material analysis.

CO3: Demonstrate the knowledge of advanced engineering materials for various engineering applications.

CO4: Analyze fuel and suggest use of alternative fuels.

CO5: Identify chemical compounds based on their structure.

CO6: Explain causes of corrosion and methods for minimizing corrosion.

Course Contents

Unit I Water Technology (08Hrs)

Impurities in water, hardness of water: Types, Units and Numericals. Determination of hardness (by EDTA method using molarity concept) and alkalinity, numericals. Ill effects of hard water in boiler - priming and foaming, boiler corrosion, caustic embrittlement, scale and sludge.

Water treatment: i) Zeolite method and numericalsii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis.

Unit II Instrumental Methods of Analysis (08Hrs)

Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), ion selective electrode: ion selective membranes such as solid membrane, enzyme based membrane and gas sensing membrane.

[A] Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve.

[B] pHmetry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve.

Unit III **Engineering Materials** **(08Hrs)**

A] Speciality polymers: Introduction, preparation, properties and applications of the following polymers:

1. Engineering Thermoplastic: Polycarbonate,
2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalanate),
3. Conducting Polymer: Polyacetylene,
4. Electroluminescent polymer: Polyphenylenevinylene,
5. Polymer composites: Fiber reinforced plastic (FRP)- Glass reinforced and Carbon reinforced polymer composite

[B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).

Unit IV **Fuels** **(08Hrs)**

Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel),

Calorific value (CV): Higher calorific value (HCV) and Lower calorific value (LCV), Determination of Calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numericals,

Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, numericals,

Liquid fuel: Petroleum: Refining of petroleum /crude oil and composition, boiling range and uses of various fractions,

Gaseous fuel: Composition, properties and applications of CNG. Hydrogen gas as a future fuel

Alternative fuels: Power alcohol and biodiesel.

Unit V **Spectroscopic Techniques** **(08Hrs)**

[A]UV-Visible Spectroscopy:

Introduction, interaction of electromagnetic radiation with matter, statement of Beer's law and Lambert's law, absorption of UV radiation by organic molecule leading to different electronic transitions, terms involved in UV-visible Spectroscopy- chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift, Instrumentation and basic principle of single beam spectrophotometer, applications of UV-visible spectroscopy.

[B] Infra red Spectroscopy:

Introduction, Principle of IR Spectroscopy, types of vibrations: Stretching (symmetric and asymmetric) and bending (scissoring, rocking, wagging and twisting), conditions of absorption of IR radiations, vibration of diatomic and polyatomic molecules. Instrumentation with block diagram. Parts of IR spectrum, fundamental group region, fingerprint region, applications of IR spectroscopy.

Unit VI **Corrosion Science** **(08Hrs)**

Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, galvanic cell corrosion, concentration cell corrosion, Factors influencing rate of corrosion. Methods of corrosion control and prevention: cathodic and anodic protection, metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, cladding, electroplating, cementation.

Books & Other Resources:

Text Books:

1. Engineering Chemistry by O .G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
2. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher

Reference Books:

1. Engineering Chemistry, Wiley India Pvt. Ltd.
2. Inorganic Chemistry, 5 ed by Shriver and Atkins, Oxford University Press
3. Basic Concept of Analytical Chemistry, 2ed , S. M. Khopkar, New Age-International Publisher
4. Instrumental Methods of Chemical Analysis, G. R. Chatwal& S. K. Anand, Himalaya Publishing House
5. Spectroscopy of organic compounds, 2 ed, P. S. Kalsi, New Age-International Ltd., Publisher
6. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, jayadevSreedhar, Wiley Eastern Limited

1. To determine hardness of water by EDTA method
2. To determine alkalinity of water
3. To determine strength of strong acid using pH meter
4. To determine maximum wavelength of absorption of $CuSO_4$/$FeSO_4$/ $KMnO_4$, verify Beer's law and find unknown concentration of given sample.
5. Titration of a mixture of weak acid and strong acid with strong base using conductometer
6. Preparation of polystyrene/phenol-formaldehyde/urea-formaldehyde resin
7. To determine molecular weight/radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
8. Proximate analysis of coal.
9. To coat copper and zinc on iron plate using electroplating.
10. Preparation of biodiesel from oil.
11. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nanoparticles

104010:Basic Electronics Engineering

Teaching Scheme:	**Credits**	**Examination Scheme**
TH : 03 Hrs./week	**04**	**In - Semester : 30 Marks**
PR : 02 Hrs./week		**End - Semester : 70 Marks**
		PR : 25 Marks

Course Objectives:

1. The principle of electronics and working principle of PN junction diode and special purpose diodes.
2. The functioning of transistors like BJT, MOSFETs and OPAMP.
3. Basics of various logic gates, digital circuits and their applications.
4. Working and functions of various electronic instruments.
5. The operating principles and applications of various active and passive sensors.
6. Basic principles of communication systems.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Explain the working of P-N junction diode and its circuits.

CO2: Identify types of diodes and plot their characteristics and also can compare BJT with MOSFET.

CO3: Build and test analog circuits using OPAMP and digital circuits using universal/basic gates and flip flops.

CO4: Use different electronics measuring instruments to measure various electrical parameters.

CO5: Select sensors for specific applications.

CO6: Describe basic principles of communication systems.

Course Contents

Unit I **Introduction to Electronics** **(08Hrs)**

Evolution of Electronics, Impact of Electronics in industry and in society.

Introduction to active and passive components, P-type Semiconductor, N-type Semiconductor. Current in semiconductors(Diffusion and Drift Current)

P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias condition, V-I characteristics of P-N junction Diode, Diode as a switch, Half Wave Rectifier, Full wave and Bridge Rectifier.

Special purpose diodes: Zener diode, Light Emitting Diode (LED) and photo diode along with V-I characteristics and their applications.

Unit II **Transistor and OPAMP** **(07Hrs)**

Bipolar Junction Transistor : Construction, type, Operation, V-I Characteristics, region of operation, BJT as switch and CE amplifier

Metal Oxide Semiconductor Field Effect Transistors (MOSFET): Construction, Types, Operation, V-I characteristics, Regions of operation, MOSFET as switch & amplifier.

Operational amplifier: Functional block diagram of operational amplifier, ideal operational amplifier, Op-amp as Inverting and Non inverting amplifier

Unit III **Number System and Logic Gates** **(07Hrs)**

Number System:- Binary, BCD, Octal, Decimal, Hexadecimal their conversion and arithmetic, De-Morgan's theorem.

Basic Gates:- AND, OR, NOT, Universal Gate- XOR, XNOR, Half adder, Full adder

Flip Flop's SR, JK, T and D

Introduction to Microprocessor and Microcontroller (Only block diagram and explanation)

Unit IV **Electronic Instrumentation** **(06Hrs)**

Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO) Power scope, AC/DC power supply, Auto transformer, Analog ammeter and voltmeter.

Unit V **Sensors** **(07Hrs)**

Classification of a sensors, Active /Passive Sensors, Analog/Digital Sensors, Motion Sensors (LVDT, Accelerometer), Temperature Sensors (Thermocouple, Thermistor, RTD), Semiconductor Sensors(Gas Sensors), Optical Sensors (LDR), Mechanical Sensors (Strain Guage, Load Cell, Pressure sensors), Biosensors. (Working Principle and one application).

Unit VI **Communication Systems** **(07Hrs)**

Basic Communication System: Block Diagram, Modes of Transmission, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Allotment of frequency band for different applications, Block Diagram of AM and FM Transmitter and receiver,

Mobile Communication System: Cellular concept, Simple block diagram of GSM system.

Books & Other Resources:

Text Books:

1. "Electronics Devices" by Thomas. L. Floyd, 9th Edition, Pearson (Unit I, II)
2. "Modern Digital Electronics" by R.P. Jain, 4th Edition, Tata McGraw Hill (Unit III)
3. "Electronic Instrumentation" by H.S. Kalsi, 3rd Edition, Tata McGraw Hill (Unit IV)
4. "Sensors and Transducers" by D. Patrnabis, 2nd Edition, PHI (Unit V)
5. "Electronic Communication Systems" by Kennedy & Davis, 4th Edition, Tata McGraw Hill (Unit VI)
6. "Mobile Wireless communication" by M. Schwartz, Cambridge University Press (Unit VI)

Reference Books:

1. "Digital Fundamentals" by Thomas. L. Floyd, 11th Edition, Pearson

2. "Mobile Communication" by J. Schiller, 2nd Edition, Pearson
3. "Sensors Handbook", by S. Soloman, 2nd Edition.

List of Laboratory Experiments/Assignments

1.	**Electronic Components:** Study of Active and Passive components a) Resistors (Fixed & Variable), Calculation of resistor value using color code. b) Capacitors (Fixed & Variable) c) Inductors, Calculation of inductor value using color code. d) Devices such Diode, BJT, MOSFETs, various IC packages e) Switches & Relays
2.	**Measurements using various measuring equipments:** a) Set up CRO and function generator for measurement of voltage, frequency b) Obtain the phase shift between to signals using CRO with the help of Lissagous pattern. c) Measure voltage, resistance using digital multimeter. Also use multimeter to check diode, BJT
3.	**V-I characteristics of:** a) P-N Junction Diode **(Study the datasheet of typical PN junction diode 1N 400X)** b) Zener Diode **(Study the datasheet of typical Zener diode 1N 4148)**
4.	**Rectifier circuits:** a) Implement half wave, full wave and bridge rectifier using diodes b) Observe the effect of capacitor filter on rectifier output
5.	**Frequency response of MOSFET:** a) To plot frequency response of BJT amplifier.**(Simulation)** b) To plot frequency response of MOSFET amplifier.**(Simulation)**
6.	**Linear applications of Op-amp:** Build inverting and non-inverting amplifier using op-amp **(Study the datasheet of typical Op-Amp 741)**
7.	**Test and verify the truth tables of:** a) Basic and Universal Gates **(Study the data sheet of respective IC's)** b) Half / Full Adder c) RS/JK/T/D flip flop
8.	**Study of transducers : (Any 3)**
9.	Build and test any circuit using BJT/MOSFET/Op-Amp/Logic Gates using any one sensor.
10.	Case Study of any one electronics appliances with block diagram, specification etc.

Guidelines for Instructor's Manual

- The instructor's manual is to be developed as a hands-on resource and reference.
- Copy of Curriculum, Conduction & Assessment guidelines, List of Experiments to be attached.

Guidelines for Student's Lab Journal

- The laboratory assignments/experiments are to be submitted by student in the form of journal.
- Journal consists of Certificate, table of contents, and handwritten write-up for each experiment.
- Each experiment should consist of :
  - ✓ Title.
  - ✓ Objectives.
  - ✓ Problem Statement, Outcomes
  - ✓ Hardware / Software (If any) requirements.
  - ✓ Concept.
  - ✓ Experimental procedure / Setup.

- ✓ Observation table
- ✓ Conclusion.

Guidelines for Laboratory Conduction

- All the experiments mentioned in the syllabus are compulsory.
- Use of open source software and recent version is to be encouraged.

Guidelines for Lab /TW Assessment

- Continuous assessment of laboratory work is done based on overall performance.
- Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include:
  - ✓ Timely completion.
  - ✓ Performance.
  - ✓ Punctuality and neatness.
- The parameters for assessment is to be known to the students at the beginning of the course.

101011: Engineering Mechanics

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 3 Hrs./week	**04**	**In-Semester : 30 Marks**
PR : 2 Hrs./Week		**End-Semester : 70 Marks**
		PR : 25 Marks

Prerequisite Courses, if any: 12th Physics, Maths

Course Objectives:

1. To impart knowledge about force systems and methods to determine resultant centroid and moment of inertia
2. To teach methods to calculate force of friction
3. To impart knowledge to determine reaction of beams, calculate member forces in trusses, cables and frames using principles of equilibrium
4. To teach space force systems
5. To train students to solve problems related to particle mechanics using principles of kinematics, kinetics and work power energy

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Determine resultant of various force systems

CO2: Determine centroid, moment of inertia and solve problems related to friction

CO3: Determine reactions of beams, calculate forces in cables using principles of equilibrium

CO4: Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space

CO5: Calculate position, velocity and acceleration of particle using principles of kinematics

CO6: Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy

Course Contents

Unit I Resolution and Composition of Forces (07Hrs)

Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent forces. Moment of a force, Varignon's theorem, resultant of parallel force system, Couple, Equivalent force couple system, Resultant of parallel general force system

Unit II Distributed Forces and Friction (06Hrs)

Moment of area, Centroid of plane lamina and wire bends, Moment of Inertia.

Friction- Laws of friction, application of friction on inclined planes Wedges and ladders friction Application to flat belt

Unit III **Equilibrium** **(06Hrs)**

Free body diagram Equilibrium of concurrent, parallel forces in a plane Equilibrium of general forces in a plane Equilibrium of three forces in a plane, Types of beams, simple and compound beams, Type of supports and reaction,

Forces in space, Resultant of concurrent and parallel forces in a space, Equilibrium of concurrent and parallel forces in a space.

Unit IV **Analysis of Structures** **(06 Hrs)**

Two force member, Analysis of plane trusses by Method of joints Analysis of plane trusses by method of section, Analysis of plane frames, Cables subjected to point load multi force member.

Unit V **Kinematics of Particle** **(06 Hrs)**

Kinematics of linear motion- Basic concepts Equation of motion for constant acceleration Motion under gravity, Variable acceleration motion curves.

Kinematics of curvilinear motion- Basic Concepts Equation of motion in Cartesian coordinates Equation of motion in path coordinates Equation of motion in polar coordinates Motion of projectile.

Unit VI **Kinetics of Particle** **(06Hrs)**

Kinetics- Newton's Second Law of motion Application of Newton's Second Law.

Work, power, energy, conservative and non-conservative forces Conservation of energy for motion of particle, Impulse, Momentum, Direct central impact. Coefficient of restitution, Impulse Momentum principle of particle.

Books & Other Resources:

Text Books:

1. Vector Mechanics for Engineers, by F. P. Beer and E. R. Johnson, McGraw-Hill Publication
2. Engineering Mechanics by R. C. Hibbeler, Pearson Education

Reference Books:

1. Engineering Mechanics by S. P. Timoshenko and D. H. Young, McGraw- Hill publication
2. Engineering Mechanics by J. L. Meriam and Craige, John Willey
3. Engineering Mechanics by F L Singer, Harper and Rowe publication
4. Engineering Mechanics by A. P. Boresi and R. J. Schmidt, Brooks/Cole Publication

Laboratory Course

Guidelines for Instructor's Manual

An instruction manual with aim, objective, apparatus, procedure and calculations to be performed for each experiment to be provided for students called as Lab Manual. Every year problems for assignment should be changed. It is advisable to give different data to different batches

Guidelines for Student's Lab Journal

Journal should be hand written

Guidelines for Lab /TW Assessment

Each and every experiment should be assessed and given mark out of 10. Finally the marks can be converted as per given in the structure.

Guidelines for Laboratory Conduction

Divide the students of a batch in groups of not more than 4 students and ask each group to take readings separately followed by calculations for each experiment. After every experiment faculty should sign the lab manual of readings of every student in the batch

Suggested List of Laboratory Experiments/Assignments

Sr. No.	Group A
	1. Verification of law of parallelogram of forces/polygon of forces. 2. To determine support reaction of simple/compound beams. 3. Determination of coefficient friction of belt/inclined plane. 4. To determine forces in the members of space force system. 5. To study the curvilinear motion. 6. Determination of coefficient of restitution.
	Group B
	Assignment of five problems on every unit to be solved during practical
	Group C
	Any two assignments of the following by graphical method using any drawing software. a) To determine the resultant of general force system. b) To determine unknown forces of concurrent force system c) To determine the forces in the member of the plane truss d) To determine velocity and acceleration of particle from given s-t diagram.

102012: Engineering Graphics		
Teaching Scheme: **TH : 01 Hr/week** **PR : 02 Hrs/Week** **TUT : 01 Hr/Week**	**Credits** **02**	**Examination Scheme:** **End-Semester : 50 Marks** **TW : 25 Marks**

Course Objectives

1. To acquire basic knowledge about engineering drawing language, line types, dimension methods, and simple geometrical construction.
2. To draw conic sections by various methods, involutes, cycloid and spiral.
3. To acquire basic knowledge about physical realization of engineering objects and shall be able to draw its different views.
4. To visualize three dimensional engineering objects and shall be able to draw their isometric views.
5. To imagine visualization of lateral development of solids.
6. To acquire basic knowledge about the various CAD drafting software's and its basic commands required to construct the simple engineering objects.

Course Outcomes

On completion of the course, learner will be able to

CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.

CO2: Construct the various engineering curves using the drawing instruments.

CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.

CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.

CO5: Draw the development of lateral surfaces for cut section of geometrical solids.

CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools.

Course Contents

Unit I Fundamentals of Engineering Drawing (01 Hrs)

Need of Engineering Drawing and design, Sheet layout, Line types and dimensioning and simple geometrical constructions

Unit II Introduction to 2D and 3D computer aided drafting packages (02 Hrs)

Evolution of CAD, Importance of CAD, Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D and 3D drawings

Unit III Engineering Curves (01 Hr)

Introduction to conic sections and its significance, various methods to construct the conic sections. Helix for cone and cylinder , rolling curves (Involutes , Cycloid) and Spiral

Unit IV Orthographic Projection (02 Hrs)

Principle of projections, Introduction to First and Third angle Projection methods, Orthographic projection of point, line, plane, solid and machine elements/parts

Unit V Isometric Projection (03 Hrs)

Introduction to isometric projection, oblique projection and perspective projection. Draw the isometric projection from the given orthographic views

Unit VI Development of Lateral Surfaces (03 Hrs)

Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfaces for cut section of cone, pyramid, prism etc.

Books & Other Resources

Text Books

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi
3. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), " A First Course in Engineering Drawing", Springer Nature Singapore Pte. Ltd., Singapore

Reference Books

1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), "Machine Drawing", Chartor Publishing house, Anand, India
3. Dhawan, R. K., (2000), "A Textbook Of Engineering Drawing", S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA
5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), "Principles of engineering graphics", McMillan Publishing, USA

6. Jensen, C., Helsel, J. D., Short, D. R., (2008), "Engineering Drawing and Design", McGraw-Hill International, Singapore

Guidelines for Laboratory Conduction

Tutorial Session

Can be utilized to teach the basic commands of any drafting package, by using this knowledge students shall be able to complete the five assignments on the CAD software. (Minimum 2 problems in each assignment)

Assignment 1: Construct any Engineering Curve using any method

Assignment 2: Orthographic view of any machine element along with sectional view.

Assignment 3: Draw Isometric view for given orthographic views.

Assignment4 :Draw the isometric or Orthographic view of a product/object (For example Workshop Job prepared during the workshop practice or any product developed during the first year session).

Assignment 5: Draw the development of lateral surface of a solid/ truncated solid.

Practical Session

Draw minimum two problems on each assignment on the A3 size drawing sheet.

Suggested List of Laboratory Experiments/Assignments

Assignment 1: Construct any Engineering Curve by any method

Assignment 2: Orthographic view of any machine element along with sectional view.

Assignment 3: Draw Isometric view for given orthographic views.

Assignment 4: Draw the development of lateral surface of a solid/ truncated solid

Assignment 5: Draw the isometric or Orthographic view of a product/object (For example Workshop Job prepared during the workshop practice or any product developed during the first year session.)

110013: Project Based Learning

Teaching Scheme:	**Credits**	**Examination Scheme:**
PR: 04 Hrs/Week	**02**	**PR : 50 Marks**

Preamble:

For better learning experience, along with traditional classroom teaching and laboratory learning; project based learning has been introduced with an objective to motivate students to learn by working in group cooperatively to solve a problem.

Project-based learning (PBL) is a student-centric pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems. Students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge, or problem. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Problem based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development.

Course Objectives:

1. To emphasizes learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engages students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes:

CO1: Project based learning will increase their capacity and learning through shared cognition.
CO2: Students able to draw on lessons from several disciplines and apply them in practical way.
CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning.

Group Structure:

Working in supervisor/mentor –monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem.

- There should be team/group of 5 -6 students
- A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame.

A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be **exemplary**. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize and present their learning.
- Activities may include- Solving real life problem, investigation /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment AND evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

- Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
- Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
- Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that the all activities are to be record and regularly, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor (you may call it PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment, evaluation and weightage:

- Idea Inception **(5%)**
- Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product **(50%)** (Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) **(25%)**
- Demonstration (Presentation, User Interface, Usability etc) **(10%)**
- Contest Participation/ publication **(5%)**
- Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects **(5%)**

PBL workbook will serve the purpose and facilitate the job of students, mentorand project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

References:

- Project-Based Learning, Edutopia, March 14, 2016.
- What is PBL? Buck Institute for Education.
- www.schoology.com
- www.wikipedia.org
- www.howstuffworks.com

101014: Environmental Studies-II

TH: 02 Hr/week **Mandatory Non-Credit Course**

Course Objectives:

1. To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.
2. To understand the evolution of environmental policies and laws.
3. To explain the concepts behind the interrelations between environment and the development.
4. To examine a range of environmental issues in the field, and relate these to scientific theory.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Have an understanding of environmental pollution and the science behind those problems and potential solutions.

CO2: Have knowledge of various acts and laws and will be able to identify the industries that are violating these rules.

CO3: Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources.

CO4: Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.

Course Contents

Unit V **Environmental Pollution** **(08 Hrs)**

Environmental pollution : types, causes, effects and controls; Air, water, soil, chemical and noise pollution

Nuclear hazards and human health risks

Solid waste management: Control measures of urban and industrial waste

Pollution case studies.

Unit VI **Environmental Pollution** **(07 Hrs)**

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities& agriculture.Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto Protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC).Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context

Unit VII **Human Communities and the Environment** **(06 Hrs)**

Human population and growth; Impacts on environment, human health and welfares.

Carbon foot-print. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods earthquakes, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit VIII **Field work** **(05 Hrs)**

- Visit to an area to document environmental assets; river/forest/flora/fauna, etc.
- Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river Delhi Ridge, etc

Suggested Readings:

1. Carson, R. 2002. Silent spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principals of Conservation Biology, Sunderland: Sinauer Associates, 2006
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.
7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp.29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

Savitribai Phule Pune University

Syllabus for SE (Civil Engineering) 2019 course

(To be implemented from June 2020)

Board of Studies in Civil Engineering

Faculty of Science and Technology

SPPU June 2020

SE Civil

Savitribai Phule Pune University, Pune SE(Civil Engineering) 2019 Course (With effect from Academic Year 2020-21)														
Semester-III														
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						**Credit**			
		Theory	**Practical**	**Tutorial**	**IN-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**TUT**	**Total**
201001	Building Technology and Architectural Planning	03	-	-	30	70	--	-	-	100	03	--	--	03
201002	Mechanics of structure	03	-		30	70		-	-	100	03	-	-	03
201003	Fluid Mechanics	03	-	-	30	70	-	-	-	100	03	-	-	03
207001	Engineering Mathematics III	03	--	01	30	70	25	--	--	125	03		01	04
207009	Engineering Geology	03	-	-	30	70	-	-	-	100	03	-	-	03
201004	Building Technology and Architectural Planning **Lab**	-	04	-	-	-	50		-	50	-	02	-	02
201005	Mechanics of structure **Lab**	-	04	-	-	-	-	-	50	50	-	02	-	02
201006	Fluid Mechanics **Lab**	-	02	-	-	-	-		50	50		01		01
207010	Engineering Geology **Lab**	-	02	-	-	-	25		-	25	-	01	-	01
201007	**Audit Course 1 Awareness to civil Engineering Practices / Road Safety Management / Foreign Language**	--	01	-	-	Grade	-	-	-	Grade	--	--	-	--
Total		15	13	01	150	350	100	--	100	700	**15**	**06**	**01**	**22**

Abbreviations:
H : Theory TW: Term Work PR : Practical OR: Oral TUT : Tutorial

Note: Interested students of S.E. (Civil) can opt any one of the audit course from the list of audit courses prescribed by BoS (Civil Engineering)

Note: The Underlined portion of the syllabus will be covered by video lectures/ on-line lectures/ flip classroom, self study, NPTEL course lecture and/or using relevant ICT technique

Semester-IV														
Course Code	**Course Name**	**Teaching Scheme (Hours/Week)**			**Examination Scheme and Marks**						**Credit**			
		Theory	**Practical**	**Tutorial**	**IN-Sem**	**End-Sem**	**TW**	**PR**	**OR**	**Total**	**TH**	**PR**	**TUT**	**Total**
201008	Geotechnical Engineering	03	-	-	30	70	--	-	-	100	03	--	--	03
201009	Survey	03	-		30	70		-	-	100	03	-	-	03
201010	Concrete Technology	03	-	-	30	70	-	-	-	100	03	-	-	03
201011	Structural Analysis	03	-	01	30	70	25	-	-	125	03	-	01	04
201012	Project management	03	--	-	30	70	--	--	--	100	03		-	03
201013	Geotechnical Engineering **Lab**	-	02	-	-	-	-	-	50	50	-	01	-	01
201014	Survey **Lab**	-	04	-	-	-	-	50	-	50		02		02
201015	Concrete Technology **Lab**	-	02	-	-	-	25		-	25	-	01	-	01
201017	Project Based Learning	-	04	-	-	-	50		-	50	-	02	-	02
Total		15	12	01	150	350	100	50	50	700	**15**	**06**	**01**	**22**

Abbreviations:
TH : Theory TW: Term Work PR : Practical OR: Oral TUT : Tutorial

Note: The Underlined portion of the syllabus will be covered by video lectures/ on-line lectures/ flip classroom, self study, NPTEL course lectures and/or using relevant ICT technique

SEMESTER I

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201001 Building Technology and Architectural Planning

Credits: 3

Teaching Scheme:	**Examination Scheme:**
Theory : 03hrs/week	In-semester : 30 Marks
Practical : 04 hrs/week	End- semester : 70 Marks

Prerequisites:

Fundamentals of Engineering Graphics

Course Objectives:

1. To enumerate different types of structure and their requirement.
2. To describe all basic activities of construction.
3. To study different types of materials, byelaws and Architectural aspects used in construction for civil engineering projects.
4. To plan different building units, Town planning parameters and safety of buildings.

Course Outcomes:

On completion of the course, learner will be able to:

1. Identify types of building and basic requirements of building components.
2. Make use of Architectural Principles and Building byelaws for building construction.
3. Plan effectively various types of Residential Building forms according to their utility, functions with reference to National Building Code.
4. Plan effectively various types of Public Buildings according to their utility functions with reference to National Building Code.
5. Make use of Principles of Planning in Town Planning, Different Villages and Safety aspects.
6. Understand different services and safety aspects

Course Contents

Unit I: Introduction to Building Construction and Masonry. (06 Hours)

a) Introduction to building construction– definition, types of building as per National Building Code. Building components and their basic requirements i.e substructure and superstructure requirements. Introduction to automation in construction

b) Masonry– Introduction of stone masonry and brick masonry, characteristics of good building bricks, IS specification and tests, classification of bricks, types of bonds: English, Flemish, Header, Stretcher, construction procedure, supervision. Recent trends in light weight construction

Form work and casting procedure for reinforced concrete columns, R.C.C. beams, R.C.C. slabs, Slip form work, introduction of underpinning and Scaffolding.

Unit 2: Building bye laws and introduction to Architectural drawing (06Hours)

a) Building Byelaws

Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), concept of

V.P.R. Marginal distances, building line, control line, height regulations, room sizes, Area calculations (built-up area, carpet area etc.), Rules for ventilation, lighting, Vertical circulation, Sanitation and Parking of vehicles.Minimum Standard Dimensions

b) Introduction to Architectural drawing : Principles of Building Planning and Principles of Architectural design relation between form and function, utility, aesthetics, Concept of Line plan, Developed Plan, Elevation, Section, Selection of scales for various drawings, dimensioning, abbreviations and symbols as per IS 962, Elements of perspective drawings, parallel and angular perspective of small building elements.

Unit 3: Building Components: (06 Hours)

a) Doors and Windows: Definition of technical terms, installation of doors and window frames and their size specifications, fixtures and fastenings. Different types of doorsand windows: Ventilators: purpose and types.

b) Arches and Lintels – Introduction of arch construction, **Lintels:** necessity and types, chajja or weather shade necessity and types.

Functional requirement of flooring, types of floor finishes and their suitability, Types of flooring.

Roofing Materials – galvanized iron pre-coated aluminium sheets, fiber sheets. Roof construction types and their suitability, method of construction, Protective Coatings with plastering and finishing.

Unit 4: Residential Buildings and green buildings (06Hours)

a) **Residential Buildings**- Functional requirements and dimensions of Residential Buildings like Bungalows, Twin bungalows, Row houses, Apartment. Prepare Developed Plan, Elevation and Sectional Elevation of above mentioned categories. Design of staircase : Dog legged /Quarter turn

b) **Green Building** -Salient features, benefits, planning concepts of Green Building (site selection, orientation, sun path and wind diagram etc.), introduction to Leadership in Energy and Environmental Design (LEED)

Unit 5: Planning of Public Buildings (06Hours)

Functional requirements and dimensions and planning of Public Buildings like industrial buildings, commercial buildings, School, Colleges , Hostel, Auditorium, Restaurant/ Hotel building, Primary Health Center/ Hospital, Shopping complex, Sports complex, Vegetable market, Post office, and Bank buildings.

Unit 6 (ONLINE): Town Planning and Legal Aspects: (06 Hours)

a) Town Planning and legal aspects: Necessity of town planning. Development plan and its importance, Land use zoning, N.A. Sanction procedure, Introduction to different zones of land in town planning, Aspects of zoning.7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, Concept of TDR, List of documents to be submitted to local authority. , Introduction to RERA act. Introduction to Maharashtra Regional and Town Planning (MRTP) Act

b) Safety aspects and services –Fire load, grading of occupancies by fire loads, Evacuation Time, fire escape elements, Need for earthquake resistant structures.

Noise and Acoustics – Sound insulation, Acoustical defects, Reverberation time, Sabine's formula, sound absorbents, planning for good acoustics.

Ventilation – Necessity and types of Ventilation.

Lighting -Principles of day lighting,Solar energy systems for lighting (BIPV).
Plumbing –Types of plumbing system.

Books

Text books:

1. Building Construction by B.C. Punmia, Laxmi Publications.
2. Building Materials by S.V.Deodhar, Khanna Publication.
3. Building Construction by Bindra and Arora, DhanpatRai Publications.
4. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition.)

Reference books:

1. Building Materials by S. K. Duggal, New Age International Publishers.
2. Building Construction by S.C. Rangwala, Charotdar Publications.
3. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.
4. Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, Tata McGraw Hill. 5. National Building Code (latest).
6. Building Design and construction by Frederick Merrit, Tata McGraw Hill.
7. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
8. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.

Savitribai Phule University of Pune
Second Year Civil Engineering (2019 Course)
201002 Mechanics of Structures

Credit : 3

Teaching Scheme:	**Examination Scheme:**
Theory : 03hrs/ week	In-semester : 30 Marks
Practical : 04 hrs/week	End-semester : 70 Marks

Prerequisites:

Fundamentals of Physics, Mathematics and Engineering Mechanics.

Course Objectives:

1. To study various types of stresses for determinate structural members.
2. To learn concept of Shear Force and Bending Moment Diagram for determinate beams.
3. To learn the concept of slope and deflection for determinate structural members.

Course Outcomes:

On completion of the course, learner will be able to:

1. Understand concept of stress-strain and determine different types of stress, strain in determinate, indeterminate homogeneous and composite structures.
2. Calculate shear force and bending moment in determinate beams for different loading conditions and illustrate shear force and bending moment diagram.
3. Explain the concept of shear and bending stresses in beams and demonstrate shear and bending stress distribution diagram.
4. Use theory of torsion to determine the stresses in circular shaft and understand concept of Principal stresses and strains.
5. Analyze axially loaded and eccentrically loaded column.
6. Determine the slopes and deflection of determinate beams and trusses.

Course Contents:

Unit I: Simple Stresses and Strains (06 Hours)

a) Materials used in construction and their nature, Hook's Law, Stress-Strain Diagram for elastic, plastic materials and brittle material, Idealized stress-strain diagram , Concept of axial stresses (compression, tension), strains(linear, lateral, shear and volumetric), Elastic constants and their relations. Stresses and strains due to change in temperature.

b) Stresses, strains and deformations in determinate and indeterminate structures for homogeneous and composite structures under concentrated loads and temperature changes.

Unit II: Shear Force and Bending Moment Diagram (06Hours)

Concept of shear force and bending moment. Relation between shear force, bending moment and intensity of loading. Shear force and bending moment diagrams for determinate beams due to concentrated, uniformly distributed, uniformly varying loads and couples. Bending moment and loading diagram from given shear force diagram.

Unit III: Shear and Bending Stresses (06Hours)

a) Shear stresses in beams: concept of shear, complimentary shear, derivation of shear stress formula, shear stress distribution for various cross sections, maximum and average shear stress for circular and rectangular sections.

b) Bending stresses in beams: theory of simple or pure bending, assumptions, derivation of flexure formula, bending stress distribution diagrams, Moment of Resistance of cross-section.

Unit IV: Torsion of Circular Shaftsand Principal Stresses and Strains (06Hours)

a) Torsion of circular shafts: theory of torsion, assumptions, derivation of torsion formula. Stresses, strains and deformations in determinate and indeterminate shafts of hollow, solid, homogeneous cross-sections subjected to twisting moments. Power transmitted by shafts.

b) Principal stresses and strains: concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses andmaximum shear stress.

Unit V: Axially and Eccentrically Loaded Columns. (06 Hours)

a) Axially loaded columns: concept of critical load and buckling, Euler's formula for buckling load with hinged ends, concept of equivalent length for various end conditions, Rankine's formula, safe load on column and limitations of Euler's formula.

b) Direct and bending stresses for eccentrically loaded short column and other structural components such as retaining walls, dams, chimneys, etc. Effect of lateral force and self-weight. Resultant stress diagrams due to axial loads, uni-axial, and bi-axial bending. Concept of core of section for solid and hollow rectangular and circular sections.

Unit VI: Slope and Deflection of Beams and Trusses (06Hours)

a) Slope and deflection of determinate beams by Macaulay's method and Strain energy method, Castigliano's first theorem. Joint displacement of determinate trusses by Unit load method.

Note: Only the concept explanation can be taught through Online teaching mode, however, the problem solving is to be done in offline mode.

Books:

Text books:

1. Mechanics of Structures Vol. I &II by S. B. Junnarkar and Dr. H. J. Shah, Twenty second edition, Charotar Publishing House Pvt Ltd.
2. Strength of Materials by R. Subramanian, Oxford University Press.
3. Strength of Materials by S. S. Ratan, Tata McGraw Hill.

Reference books:

1. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd.
2. Strength of Materials by F.L. Singer and Andrew Pytel, Harper and Row Publication.
3. Mechanics of Materials by Beer and Johnston, McGraw Hill Publication.
4. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication.
5. Mechanics of Materials by Gere & Timoshenko, CBC publisher.
6. Elementary Structural Analysis by Norris, Wilbur and Utku, Tata McGraw Hill Publisher.
7. Intermediate Structural Analysis by R. C. Hibbler, Pearson Education Publishers.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Pattern)
201003 : Fluid Mechanics
Credits : 03

Teaching Scheme:
Theory : 03 hrs/week
Practical : 02hrs/week

Examination Scheme:
In-semester : 30 Marks
End-Semester : 70 Marks

Prerequisites:
Engineering Physics, Engineering Mathematics and Engineering Mechanics

Course Objectives:
1. To understand conceptually the properties of fluid, fluid statics, fluid kinematics and fluid dynamics, dimensional analysis, boundary layer theory, open channel flow and fluid flow around submerged objects.
2. Apply principles of continuity, mass, momentum and energy as applied to fluid at rest as well as for fluid flow in open channel.
3. To apply fundamental principles of fluid mechanics for the solution of practical Civil Engineering problems.

Course Outcomes:
At the end of the course, the learners will be able to
1. Understand the use of Fluid Properties, concept of Fluid statics, basic equation of Hydrostatics, measurement of fluid pressure, buoyancy & floatation and its application for solving practical problems.
2. Understand the concept of fluid kinematics with reference to Continuity equation and fluid dynamics with reference to Modified Bernoulli's equation and its application to practical problems of fluid flow
3. Understand the concept of Dimensional analysis using Buckingham's π theorem, Similarity & Model Laws and boundary layer theory and apply it for solving practical problems of fluid flow.
4. Understand the concept of laminar and turbulent flow and flow through pipes and its application to determine major and minor losses and analyze pipe network using Hardy Cross method.
5. Understand the concept of open channel flow, uniform flow and depth-Energy relationships in open channel flow and make the use of Chezy's and Manning's formulae for uniform flow computation and design of most economical channel section.
6. Understand the concept of gradually varied flow in open channel and fluid flow around submerged objects, compute GVF profile and calculate drag and lift force on fully submerged body.

Course Contents:
Unit I: **(07 hours)**

a) Properties of Fluids: Definition of fluid and fluid mechanics: examples and practical

applications, classification of fluids: Real and Ideal, , physical properties of fluids: mass density, specific weight, specific volume, relative density, viscosity, Newton's law of viscosity Dynamic and kinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure.

b) Fluid Statics: Basic equation of hydrostatics, concept of pressure, pressure head, Pascal's Law, measurement of pressure (absolute, gauge), principle of manometers: Balancing liquid column, dead weight, pressure transducers and their types, total pressure and centre of pressure: on plane horizontal, vertical, inclined and curved surfaces: practical applications, **Buoyancy and Floatation:** Principle of floatation and buoyancy, stability of floating and submerged bodies

Unit II: (07 Hours)

a) Fluid Kinematics

Eulerian and Lagrangian approach, velocity and acceleration, and theircomponents in Cartesian co-ordinates, Classification of flows, stream line, stream tube, path line, streak line, control volume. Equation of continuity for 3-D flow in Cartesian co-ordinates, components of rotation, velocity potential, stream function and flow net.

b) Fluid Dynamics: Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration to get Bernoulli's equation and its limitations, Modified Bernoulli's equation, concept of HGL and TEL, Application of Bernoulli's equation to measure discharge and velocity of flow: Venturimeter, Orifice meter, Rotameter and Pitot tube.

Unit III: (07 Hours)

a) Dimensional Analysis and Model Studies

Dimensional homogeneity, dimensional analysis using Buckingham's π theorem method, geometric, kinematic and dynamic similarity, important dimensionless Numbers (Reynolds No., Froude No., Euler No., Mach no. and Weber No) and their significance, Model Laws (Reynold's law and Froude's Law)

b) Boundary layer Theory

Concept, development of boundary layer on flat plate and factors affecting growth, Boundary layer thickness, displacement thickness, momentum and energy thickness, Laminar sub layer, Local and mean drag coefficients, Hydrodynamically smooth and rough boundary, boundary layer separation and methods to control separation

Unit IV (07Hours)

a) Laminar & Turbulent Flow through Pipe: Characteristics of laminar flow**,** laminar flow through a circular pipe: Hagen Poiseuille equation**,**Characteristics of turbulent flow, instantaneous velocity, temporal mean velocity, scale of turbulence and intensity of turbulence, Prandtl's mixing length theory, velocity distribution equation, variation of friction factor for laminar flow and for turbulent flow, resistance to flow in smooth and rough pipes, friction factor for commercial pipes, Moody's diagram.

b)Flow through pipes: Energy losses in pipe flow, Equation for major loss and minor losses in pipe, flow through pipes in simple and compound pipe, pipes in series, parallel, Dupit's equation, pipe network analysis by Hardy Cross method, Introduction to siphon.

Unit V (07 Hours)

a) Introduction to Open channel flow: Classification of channels, channel flows and geometric

elements of channel, Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, One dimensional approach, Velocity distribution in open channel flow.

b) Uniform flow in open channels: Uniform flow formulae: Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections: rectangular, triangular and trapezoidal. **Depth-Energy Relationships in Open Channel Flow:** Specific energy and Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent

Unit VI **(07 Hours)**

a) Gradually Varied Flow (GVF) in Open Channel Flow: Theory and Computation

Basic Assumptions of GVF; Dynamic equation of GVF - Alternative forms; Classification of channel bed slopes,Various GVF profiles, Methods of GVF computations: Direct Step method. (mention of other method)

b) Fluid Flow around Submerged Objects:

Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Introduction to Drag on sphere, cylinder, flat plate and Aerofoil, Karman's vortex street, Development of lift, Introduction to Magnus effect, Lift on cylinder and Aerofoil, Polar diagram.

Books:

Text books:

1 Hydraulics and Fluid Mechanics including Hydraulic Machine by Dr P. N. Modi & S. M. Seth Pub: Standard book house, Delhi-6
2. Flow in Open Channels by K Subramanya, Pub: Tata McGraw Hill, New Delhi
3. A Text Book on Fluid Mechanics and Hydraulic Machines by Sukumar Pati Pub: McGraw Hill, New Delhi

Reference books:

1. Engineering Fluid Mechanics by R. J. Garde and A.J Mirajgaonkar, Pub: SCITECH Publications(India)Pvt.Ltd, Chennai
2. Fluid Mechanics and its Applications, Vijay Gupta, Santosh K Gupta, New Age international pvt. Ltd, New Delhi,
3. Fluid Mechanics, Fundamentals and applications by Yunus. A Cengel and John.M Cimbala, Mc Graw Hill International, New Delhi.
4. Fluid Mechanics by Streeter, Wylie and Bedford – Pub: McGraw Hill International, New Delhi.
5. Open Channel Hydraulics by Ven Tee Chow, Pub: Mcgraw- Hill Book Company- Koga.
6. A Text Book of Fluid Mechanics and Hydraulic Machines- by Dr. R K Rajput Pub: S Chand and Co Ltd. New Delhi

Savitribai Phule Pune University, Pune
Second Year of Civil Engineering– Sem I (2019 Course)
207001 Engineering Mathematics III

Credits: **04**

Teaching Scheme:
Theory : 03hrs/ week
Tutorial : 01hrs/week

Examination Scheme:
In-semester : 30 Marks
End-semester : 70 Marks
Term Work : 25 marks

Prerequisites:

Differential and Integral Calculus, Differential equations of first order and first degree, Fourier series, Collection, classification & representation of data, Permutations & combinations and Vector algebra.

Course Objectives:

To make the students familiarize with concepts and techniques in Ordinary & Partial differential equations, Numerical methods, Statistical methods, Probability theory and Vector calculus. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes:

At the end of this course, students will be able to

1. Solve Higher order linear differential equations and its applications to modelling and analysing Civil engineering problems such as bending of beams, whirling of shafts and mass spring systems.
2. Solve System of linear equations using direct & iterative numerical techniques and develop solutions for ordinary differential equations using single step & multistep methods applied to hydraulics, geotechnics and structural systems.
3. Apply Statistical methods like correlation, regression and probability theory in data analysis and predictions in civil engineering.
4. Perform Vector differentiation &integration, analyze the vector fields and apply to fluid flow problems.
5. Solve Partial differential equations such as wave equation, one and two dimensional heat flow equations.

Course Contents:

Unit I: Linear Differential Equations (LDE) and Applications (08 Hours)

LDE of n^{th} order with constant coefficients, Complementary Function, Particular Integral, General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE, Simultaneous and Symmetric simultaneous DE.

Modelling of problems on bending of beams, whirling of shafts andmass spring systems.

Unit II: Numerical Methods (08 Hours)

Numerical solutions of system of linear equations: Gauss elimination method, Cholesky, Jacobi and Gauss-Seidel methods.
Numerical solutions of ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order and Predictor-Corrector methods.

Unit III: Statistics and Probability **(07 Hours)**

Measures of central tendency, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression estimates.
Probability, Probability density function, Probability distributions: Binomial, Poisson, Normal, Test of hypothesis: Chi-square test, t-test.

Unit IV: Vector Differential Calculus **(08 Hours)**

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit V: Vector Integral Calculus and Applications **(08 Hours)**

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics, Continuity equations, Streamlines, Equations of motion, Bernoulli's equation.

Unit VI: Applications of Partial Differential Equations (PDE) **(07 Hours)**

Basic concepts, modeling of Vibrating String, Wave equation, One and two dimensional Heat flow equations, method of Separation of variables, use of Fourier series, Applications of PDE to problems of Civil and allied Engineering.

Books:

Text Books:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill).
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).

Reference Books:

1. Advanced Engineering Mathematics, 10e, by Erwin Kreyszig (Wiley India).
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Cengage Learning).
4. Numerical Methods for Engineers,7e by S. C. Chapra and R. P. Canale (McGraw-Hill Education)
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press)
6. Partial Differential Equations for Scientists and Engineers by S. J. Farlow (Dover Publications, 1993)

Guidelines for Tutorial and Term Work:

Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.

Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

Savitribai Phule Pune University, Pune

Second Year of Civil Engineering– Sem I (2019 Course)

207009 Engineering Geology

Credits: 03

Teaching Scheme:		**Examination Scheme:**	
Theory	: 03 hrs/week	In-semester	:30 Marks
Practical	: 02 hrs/week	End-semester	: 70 Marks

Prerequisites:

Course Objectives:

1. To get the knowledge of the physical properties of mineral and differentiate between the rocks types, their inherent characteristics with Civil Engineering applications.
2. To learn geomorphic features formed by fluvial, marine processes and their role, Indian stratigraphy and historical geology in civil engineering projects.
3. To comprehend Structural geology applied to civil engineering projects and to get idea about plate tectonics.
4. To acquire and apply knowledge of PGE essential for civil engineering projects.
5. To identify and to enable the Students to examine favorable & unfavorable conditions for the proposed construction of dams, reservoir and tunnels. Precautions and treatments required to improve the site conditions of dams, reservoir and tunnels.
6. To learn the role played by the effect of Ground water, Geological hazards and the requirement and utility of good building stone.

Course Outcomes:

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

1. Explain about the basic concepts of engineering geology, various rocks, and minerals both in lab and on the fields and their inherent characteristics and their uses in civil engineering constructions.
2. Exploring the importance of mass wasting processes and various tectonic processes that hampers the design of civil engineering projects and its implications on environment and sustainability.
3. Recognize effect of plate tectonics, structural geology and their significance and utility in civil engineering activities.
4. Incorporate the various methods of survey, to evaluate and interpret geological nature of the rocks present at the foundations of the dams, percolation tanks, tunnels and to infer site / alignment/ level free from geological defects.
5. Assess the Importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs, and tunnels.
6. Explain geological hazards and importance of ground water and uses of common building stones.

Course Contents:

Unit I: General Geology, Mineralogy and Petrology (07 Hours)

a) Introduction to the subject, scope and sub divisions. **General Geology:**The Earth as a planet, Interior & General composition of the Earth, The rock cycle

b) Introduction to mineralogy: Physical Properties of Minerals, Classification of Minerals, silicate and non-silicate minerals, Rock forming minerals.

c) Introduction to petrology and Broad classification of rocks.

Igneous Petrology: Plutonic, Hypabyssal and Volcanic rocks, Structures, Textures and Classification of Igneous rocks. Study of common rock types prescribed in practical work and their engineering applications.

Secondary Petrology: Rock weathering, Sedimentary Structures, lithification and digenesis Process, Genetic classification of secondary rocks and grain size classification and Textures, Study of common rock types prescribed in practical work and their civil engineering applications.

Metamorphic Petrology: Agents, Types of metamorphism, Texture and structures. Study of common rock types prescribed in practical work and their civil engineering applications.

Unit II: Geomorphology and Historical Geology. (07 Hours)

a) Geomorphology: Endogenic and Exogenic processes, Geological action by fluvial process i.e. river and Landforms formed it, Aeolian and glacial process, Coastal geomorphology.

b) Historical Geology: General principles of Stratigraphy, Geological time scale w.r.t. Indian geological time scale, Physiographic divisions of India, Archean's&Dharwar formation, Cudappah formations, Vindhyan formations, Gondwana formations, Deccan Trap formations, significance of their structural characters in major civil engineering activities.

Unit III: Structural Geology, Plate Tectonics (07 Hours)

a) Introduction to plate tectonics and Mountain building activity.

b) Structural Geology: Out crop, dip and strike, conformable series, unconformity, its types and overlap, faults and their types, folds and their types, inliers and outlier. Civil engineering importance of faults and folds with examples.

c) Structures of rocks: Igneous intrusions and their types, joints and their types, stratification and lamination.

Unit IV: Remote Sensing and G.I.S., Preliminary Geological Studies (07 Hours.)

a) Remote sensing (RS): Definition, Stages of Remote sensing, Remote sensing platforms, Active & Passive Remote sensing, Electromagnetic spectrum, visible band, scattering & absorption of EMR in atmosphere and its effect on Satellite Imagery; resolution of satellite images, Elements of remote sensing for Visual interpretation viz.Tone, shape, size, pattern, texture, shadow and Association.

b) Geographical Information System (GIS): Introduction, Definition, tools, applications of remote sensing and geographical information system in Civil Engineering.

c) Preliminary Geological Exploration: reconnaissance survey, Desk Study, surface and subsurface Geological Investigations: Direct methods likeTest& trial pits, pilot trenches, Drilling, Core inspection significance and limitations of it. Indirect methods like Resistivity, seismic survey and its significance and limitations.

Unit V: Role of Engineering Geology in Dams, Reservoirs and Tunneling. (07 Hours.)

a) Geology of Dams & Reservoir*:* Strength, stability and water tightness of foundation rocks, influence of geological conditions on the choice and type of dam, preliminary geological work on dam and reservoir sites, precautions to be taken to counteract unsuitable conditions and their relevant treatments with case studies.

b) Tunneling: Preliminary geological investigations, important geological considerations while choosing alignment, difficulties during tunneling as encountered due to various geological conditions, Role of groundwater and suitability of common rock types for excavation and tunneling and important case studies in Kasara and BorGhat sections of central railway in Maharashtra and in India, particularly in Himalayas etc.

Unit VI: Geological Hazards, Ground Water and Building Stones. (07 Hours)

a) Geological Hazards: Volcanism, Earthquakes & Seismic zones of India, Landslides and stability of hill slopes and preventive measures.

b) Groundwater: Types of ground water, water table and depth zones, influence of hydro geological properties of rocks, types of aquifers, artesian wells and its geological conditions, artificial recharge of groundwater. Geological work of groundwater, levels, effects of dams and canals, effect of pumping, cone of depression, circle of influence, fluctuations in water table Methods of conservation of groundwater and its management; introduction of watershed management.

c) Building stones: Requirements of good building stone: strength, durability, ease of dressing, appearance, mineral composition, textures and field structures, suitability of common rocks as building stone.

Books:

Text Books:

1. Text Book of Engineering Geology by R.B. Gupte , 2001, P.V.G. Publications, Pune.
2. A Text Book of Engineering Geology by N. ChennaKesavulu. 2010, McMillan India Ltd.
3. Principles of Engineering Geology by D. Venkat Reddy. 2010, Vikas Publishers.

Reference Books:

1. Geology P. K. Mukerjee, World Press
2. Engineering Geology by F. G. H Blyth and De Frietus, Reed Elsevier India
3. Geology for geotechnical engineers, J. C. Harvey, Cambridge University Press
4. Principals of Engineering Geology,S.K. Garg, VikasPublishe
5. Engineering Geology, Parbin Singh
6. Geology and Engineering, K. V. G. K. Gokhale, D. M. Rao ,Tata McGraw Hill.
7. Structural Geology, M. P. Billings, Pearson India Pvt. Ltd.

Any Other book of prominent publisher that is recommended by Geology faculty.

Savitribai Phule Pune University, Pune

Second Year of Civil Engineering– Sem I (2019 Course)

201004 Building Technology and Architectural Planning –Lab

Credits: 01

Teaching Scheme:	**Examination Scheme:**
Practical : 04 hrs/week	Term Work : 50 Marks

List of Laboratory Assignments

1. Students shall prepare drawings of types of masonry and Brick bonds (Quarter plate)
2. Prepare sheet showing details of at least two Doors, windows and Arches.(Quarter plate)
3. Draw the line plans of any one residential building and any two Public Buildings (Graph Paper)
4. Perspective drawing of a small building element (Total 2 problems - 1 based on one point and two point each)
5. Floor Plan/ Typical floor plan with construction notes, schedule of openings, of any type of building, Plan, Elevation and Section on separate sheet **(Full Imperial sheet)**
6. Developing typical floor plan drawing exercise completed in assignment number 5, using CAD and Printout of the same.
7. Layout/ Site plan indicating water supply and drainage line (with area statement, make max. four students in one group).
8. **Site Visit** : Any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)

OR

8. Site Visit : **Green Building**, Salient features like materials used/technology etc, benefits, planning concepts of Green Building (site selection, orientation, sun pathand wind diagram etc.),
9. Document collection: Different sanction forms and at least six brochures of building materials

Report file:

1. It shall consist of data given for the project, Planning considerations and line plans, Design calculations.
2. Terminology of Perspective drawing
3. Dimension standards of Residential building and Public building
4. Visit Report

Savitribai Phule Pune University, Pune

Second Year of Civil Engineering– Sem I (2019 Course)

201005 Mechanics of Structures-Lab

Credits: 02

Teaching Scheme: Practical : 04 hrs/week

Examination Scheme: Oral : 50 Marks

List of Laboratory Experiments

Sr. No.	Group A
1	**Metals** 1. Tension test on mild and TMT steel. 2. Shear (Single & Double)test on mild steel. 3. Torsion test on mild steel. 4. Impact (Izod&Charpy) test on mild steel, aluminum, brass.
	Group B
2	**Timber & Ply wood** 1. Compression test on timber (Parallel & Perpendicular) 2. Bending test on timber and plywood.
	Group C
3	**Bricks &Tiles** 1. Field tests on bricks 2. Water absorption test on bricks. 3. Efflorescence test on bricks. 4. Compressive strength test on bricks 5. Flexural strength of flooring tiles. 6. Abrasion test of flooring tiles.
5	One Assignment on each unit of this subject.
6	Assignment on Influence Line Diagram (ILD) of Reactions, Shear Force and Bending moment of determinate beams.
7	Market survey of structural materials including its costing.
Oral : Based on above syllabus	

*** The concept explanation part can be taught through Online teaching mode, however, the problem solving needs offline mode.**

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Pattern)
201006 : Fluid Mechanics - Lab
Credits : 01

Teaching Scheme:
Practical : 02hrs/week

Examination Scheme:
Oral : 50 Marks

The Term work shall consists of Experiments (09), Assignments(02) and Visit Report (01)

Term work:

A) Any nine experiments of below mentioned experiments, out of which **first seven are compulsory:**

1. Measurement of viscosity of fluid by Redwood/Saybolt viscometer.
2. Experimental verification of Bernoulli's theorem with reference to loss of energy.
3. Calibration of Venturimeter / Orifice meter.
4. Determination of Darcy-Weisbach friction factor (*f*) for a given pipe and study of variation of *f* with Reynolds Number (*Re*).
5. Flow around a Circular Cylinder/Aerofoil.
6. Study of Uniform Flow Formulae for Open channel.
7. Velocity Distribution in Open Channel Flow.
8. Calibration of Rectangular and Triangular Notch.
9. Determination of Stability of Floating Bodies using Ship Model
10. Drawing Flow net by Electrical Analogy for flow below Weir (with & without sheet pile)
11. Measurement of Pressure using different Pressure Measuring Devices (including Transducers /state of arts Digital Instruments also).
12. Measurement of Surface Tension.
13. Determination of Minor Losses inPpipes

B) Assignments: Any two assignments of below mentioned**. First assignment is compulsory.**

1. Analysis of pipe network using Hardy Cross Method (minimum two loops) – both by hand calculations and using computer any language/software solution.
2. Developing a Demo Model related to any fluid flow phenomenon (physical model/soft model).
3. Demonstration of any Software related to Fluid Mechanics/Hydraulics.
4. GVF computation using any computer Language/Software.

C) Site visit : Report on Site visit to any one of the Research Institute like **CWPRS, WALMI, MERI etc.**

Savitribai Phule Pune University, Pune
Second Year of Civil Engineering– Sem I (2019 Course)
207010 Engineering Geology - Lab
Credits: 01

Teaching Scheme:	**Examination Scheme:**
Practical : 02 hrs/week	Term Work : 25 Marks

List of Laboratory Assignments:

Following experiments are to be compulsorily performed. Term work shall consist of journal giving details of the experiments performed.

1. Megascopic identification of following mineral specimens (around 50).

Rock Forming Minerals, Economic Minerals and Ore Minerals such as:

Silica group: Rock Crystal, Rosy Quartz, Transparent Quartz, Milky Quartz, Smoky Quartz, Amethyst, Chalcedony, different varieties of Agate, Jasper Banded Hematite Jasper

Feldspar group: Orthoclase, Microcline, Plagioclase **Mica group**: Muscovite, Biotite

Olivine group: Olivine **Pyroxene group:** Augite, Diopside, Hypersthene, **Amphibole group**: Hornblende, Asbestos, **Zeolite and other group:** Apophyllite, Stilbite, different varieties of Calcite, Gypsum Tourmaline, Chromite, Limonite, Laterite, Kyanite, Graphite, Hematite, Micaceous Haematite, Pyrite, Garnet etc.

2. Megascopic identification of following different rock specimens.(Around 50).

a) Igneous Petrology: Plutonic, Hypabyssal, Volcanic Rocks and their varieties like Granites , Syenite, Pegmatite, Graphic Granite, Dolerite,Andesite,Diorite, Gabbro, Rhyolite, Pumice, Trachyte, All varieties of Basalt like Compact, Giant Phenocryst Basalt (GPB),Amygdaloidal, Pipe A.B, Volcanic Breccia, Tachylytes,Tuff breccia.

b) Sedimentary Rocks: Rudaceous, Areanceous, Argillaceous, Chemical and Organic Deposits: Laterite, Bauxite, Conglomerates, Secondary Breccia, varieties of Sandstones (Red), Grit,Arkose sandstone, Sandstone with Ripple marks, Sandstone (Current Bedding), Shahabad Limestone, Black Limestone (Cudappah), Stalactite Limestone, Oolitic limestone, Shelly Limestone, Mudstone, Shale (White), Shale (Yellow), Shale (Black).

c) Metamorphic Petrology: Contact Metamorphic rocks, Dynamothermal Metamorphic rocks: Quartzite's, Marbles, Phyllite, Slate, varieties of Schists (Mica Schist, Biotite Schist with Garnet, Muscovite Schist, Chlorite Schist, Hornblende Schist, Chlorite Schist, Talc Schist, Quartz Sericite Schist), varieties of Gniesses (Augen Gneiss, Hornblende Biotite Gneiss, Hornblende Gneiss), Khondalite, Charnockite, Amphibolite.

3. **Interpretation and construction of geological sections from contoured geological maps (A. G. Series—IV Total 8 maps and 2 maps to be constructed by the faculty members.)**

4. Solution of engineering geological problems such as alignment of dams, tunnels, roads, canals, bridges, etc. based on geological maps.

5. Logging of drill core and interpretation of drilling data with graphical representation of core log.

6. Two Site visits are desirable to study various geological features.

7. GRAM++ software and open source software like QGIS, ARCGIS software may be optional to perform.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Pattern)
Awareness to Civil Engineering Practices
Audit Course I

Teaching Scheme:
Practical: 01 hrs/week

(Certificate to be issued by institute based on performance assessment)

Civil Engineering is the oldest engineering profession comprising of a variety of sub-disciplines such as Structural Engineering, Geotechnical, Water resources, Environmental Engineering, Construction technology, Transportation Engineering etc. Undergraduate programs are designed with different theoretical approaches on the application of basic sciences to solve different societal problems by engineering knowledge. However, there is a need to make the students aware about how the Civil Engineering industry operates and how theories taught in different courses are applied in practice. The students can learn from the experience gained from different workplaces such Civil Engineering consultancies, contracting companies, construction sites etc. The course aims to provide insight of the different practices followed by the industry such as use of different documents & contracts in Civil Engineering practice, drawings required, engineering ethics, duties and responsibilities of the engineers, site records and diaries, health and safety practices on site.

Course Objectives:

1. To provide basic overview of functioning of different Civil Engineering related industries / firms.
2. To create awareness about application of different drawings, contract documents in Civil Engineering.
3. To provide insight of code of ethics, duties and responsibilities, health and safety as a Civil Engineer.

Course Outcomes:

On completion of the course, learner will be able to…

CO1: Describe functioning/working of different types of industries/sectors in Civil Engineering.

CO2: Describe drawings and documents required and used in different Civil Engineering works.

CO3: Understand the importance of Code of Ethics to be practiced by a Civil Engineer and also understand the duties and responsibilities as a Civil Engineer.

CO4: Understand different health and safety practices on the site.

Course Contents (During 1hr. Practical Session per week)

Unit I: Sectors in Civil Engineering **(03 Hours.)**

Details of different Sectors/sub-disciplines in Civil Engineering along with the following details: description, eminent institutes in India & abroad, related research institutes, noteworthy projects, higher education, latest & ongoing research in the domain, jobs opportunities in government as well as private sector.

Suggestion for effective content delivery:

Lecture cum interaction by alumni of your college working in different sectors of Civil Engineering

Unit II: Drawings and Documents **(03 Hours.)**

Types of drawings in different construction projects. Contract agreement & other documents in different construction projects.

Suggestion for effective content delivery:

i.] Visit to various construction sites/ architectural firms/ structural engineering firms etc. to understand drawings, documents & working culture.

ii.] Lecture by professional practitioner

Unit III: Engineering Ethics **(03 Hours.)**

Introduction, moral issues and moral dilemmas. Code of ethics in Civil Engineering followed by Construction Industry Development Council (CIDC) of India, national & international associations and institutes. Effective case studies (Minimum 2 case studies).

Suggestion for effective content delivery:

Case study based content delivery menthod, Lecture by professional practitioner

Unit IV: Construction Site Safety **(03 Hours.)**

Importance of site safety. Different health and safety parameters during actual execution of Civil Engineering constructions. Safety measures: conventional and modern.

Suggestion for effective content delivery:

On site visit & lecture by professional practicing Safety Engineer.

Guidelines for Assessment (Any one or more of following but not limited to)

1. Group discussion
2. Presentation
3. Mini Project / Activity
4. Site visit report
5. Guest lecture report

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Pattern)
Road Safety Management
Audit Course I

Teaching Scheme:
Practical: 01 hrs/week

(Certificate to be issued by institute based on performance assessment)

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory implementation of regulations have been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the world statistics; but the comparable proportion for accidents is substantially large. The need for strict enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the important stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

Course Objectives:

1. To provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
2. To explain the engineering & legislative measures for road safety.
3. To discuss measures for improving road safety education levels among the public.

Course Outcomes:

On completion of the course, learners will be able to…

CO1: Summarize the existing road transport scenario of our country

CO2: Explain the method of road accident investigation

CO3: Describe the regulatory provisions needed for road safety

CO4: Identify the safety issues for a road and make use of IRC's road safety manual for conducting road safety audit.

Course Contents (During 1hr Practical Session per week)

Unit I: Existing Road Transport Scenario **(02 Hours.)**

Introduction, national & international statistics related to road transport. Factors responsible for increase in vehicle growth. Share of public transport: importance and current scenario (national & international)

Suggestion for effective content delivery: Displaying updated and authentic statistics & real time scenario images during the session.

Unit II: Road Accidents & its Investigation **(03 Hours.)**

Definition of road accident. National & international statistics related to road accidents. Causes of road accident. Remedies / Measures for control road accidents. Methods for accident investigation. Condition diagram & collision diagram. Black spots & its identification based on accident data.

Suggestion for effective content delivery:

i.] Activity related to drawing condition & collision diagram based on actual accident data.

ii.] Activity related to identification of black spots based on actual accident data

Unit III: Motor Vehicle Act & Central Motor Vehicle Rules (03 Hours.)

The Motor Vehicle Act of 1988. Central Motor Vehicle Rules (CMVR) of 1989. Amendments to CMVR – 2017 & 2019.

Suggestion for effective content delivery:

i.] Guest lecture by RTO Officer / Traffic Police Officer.

ii.] Public awareness campaign

Unit IV: Road Safety Audit (RSA) (04 Hours.)

Introduction & importance of RSA. Methodology, phases and checklists for Road Safety Audit as per IRC SP: 88 – 2010 (Manual on Road Safety Audit)

Suggestion for effective content delivery:

Mini project – Conducting Road Safety Audit on minimum 2 km (both directions included) road stretch in the nearby vicinity.

Guidelines for Conduction(Any one or more of following but not limited to)

1. Guest Lectures.
2. Visits and reports.
3. Assist government authorities like Municipal corporations, RTO in Road Safety Audits
4. Mini Project

Guidelines for Assessment(Any one or more of following but not limited to)

1. Written Test
2. Practical Test
3. Presentation
4. Report

Savitribai Phule Pune University, Pune

Second Year Civil Engineering (2019 Pattern)

Foreign Language

Audit Course I

Teaching Scheme:

Practical: 01 hrs/week

(Certificate to be issued by institute based on performance assessment)

The institute can offer any foreign language as audit course as per the teaching scheme depending upon the demand of the students and availability of the faculty

SEMESTER II

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201008 Geotechnical Engineering

Credits: 03

Teaching Scheme:		**Examination Scheme:**	
Theory	: 03 hrs/week	In-semester	: 30 Marks
Practical	: 02hrs/week	End-Semester	: 70 Marks

Prerequisites :

Fundamentals of Physics, Mathematics, Engineering Mechanics

Course Objectives:

1. To describe soil properties, classification and its behavior under stress.
2. To learn methods for measurements and determination of index & engineering properties of soil.
3. To study the interaction between water and soil and the effects of static vs flowing water on soil strength

Course Outcomes:

On completion of the course, learner will be able to,

1. Identify and classify the soil based on the index properties and its formation process
2. Explain permeability and seepage analysis of soil by construction of flow net.
3. Illustrate the effect of compaction on soil and understand the basics of stress distribution.
4. Express shear strength of soil and its measurement under various drainage conditions.
5. Evaluate the earth pressure due to backfill on retaining structures by using different theories.
6. Analysis of stability of slopes for different types of soils.

Course Contents

Unit I: Introduction and Index Properties (06 Hours)

a) Introduction to Geotechnical Engineering and its applications to Civil Engineering.(Types of soil structure, major soil deposits of India), Field identification of soils. {Introduction to soil exploration: objective and purpose.}

b) Three phase soil systemweight – volume relationships, Index properties of soil: Methods of determination and their significance. [IS and Unified Soil classification systems.]

Unit II: Permeability and Seepage. (06 Hours)

a)Soil water, permeability definition and necessity of its study, Darcy's law, factors affecting permeability. (Laboratory measurement of permeability: Constant head method and Falling head method as per IS 2720.) {Field test for determination of permeability- Pumping in test and Pumping out test as per IS 5529 Part-I.}Permeability of stratified soil deposits.

b) Seepage and Seepage Pressure, quick sand phenomenon, critical hydraulic gradient, General flow equation for 2-D flow (Laplace equation).[Flow Net, properties and application]Flow Net construction for flow under sheet pile and earthen dam.

Unit III: Compaction and Stress Distribution. **(06 Hours)**

a) Compaction – Introduction, Comparison between compaction and consolidation.[Compaction tests- Standard Proctor test, Modified Proctor test]. Zero air void line. Factors affecting compaction. Effect of compaction on soil properties. (Field compaction methods and compaction equipment for different types of soil), Placement water content, Field compaction control- use of compaction test result. {Proctor needle in field compaction control.}

b) Stress Distribution in Soils – Geostatic stress, Boussinesq's theory with assumptions for point load and circular load (with numerical), Pressure Distribution diagram on a horizontal and vertical plane, Pressure bulb and its significance. Westergaard's theory, equivalent point load method.Approximate stress distribution method.

Unit IV: Shear Strength of Soil. **(06 Hours)**

a) Introduction – Shear strength an Engineering Property. Mohr's stress circle, Mohr- Coulomb failure theory. The effective stress principle- Total stress, effective stress and neutral stress / pore water pressure. [Peak and Residual shear strength], {factors affecting shear strength.} (Stress-strain behaviour of sands and clays.)

b) Measurement of Shear Strength – Direct Shear test, Triaxial Compression test, Unconfined Compression test, Vane Shear test. Their suitability for different types of soils, advantages and disadvantages. Different drainage conditions for shear tests. (Sensitivity and thixotropi of cohesive soils.)

Unit V: Earth Pressure. **(06 Hours)**

a) Earth Pressure – Introduction, Rankine's state of Plastic Equilibrium in soils- Active and Passive states due to wall movement, Earth Pressure at rest. [Rankine's Theory: Earth pressure on Retaining wall due to submerged backfill.]

b) Backfill with uniform surcharge, backfill with sloping surface, layered backfill.

(Coulomb's Wedge theory. Rebhann's and Culmann's graphical method of determination of earth pressure.)

Unit VI: Stability of Slopes. **(06 Hours)**

a) Stability of Slopes – Classification of slopes and their modes of failure, Stability of slope: i) Taylor's stability number, ii) Swedish slip circle method, iii) Friction circle method, iv) Bishop's method. (Infinite Slopes in cohesive and cohesion less soil,) {Landslides- Causes and remedial measures.}

Books:

Text Books:

1. Soil Mechanics and Foundation Engineering by Dr. B. C. Punmia, Laxmi Publications.
2. GeotechnicalEngineeringbyShashiK.Gulati&ManojDatta,TataMcGrawHill.
3. Geotechnical Engineering by T N Ramamurthy & T G Sitharam, S Chand Publications.

Reference Books:

1. GeotechnicalEngineeringbyC.Venkatramaiah,NewAgeInternationalPublishers.
2. Principles of Geotechnical Engineering by Braj M. Das, Cengage Learning.
3. Geotechnical Engineering by P.Purushothma Raj, Tata Mc GrawHill.
4. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education.
5. Basic and Applied Soil Mechanics by GopalRanjan and A. S. R. Rao, Newage International.
6. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International StudentsEdition.

e-Resources:

1. http://ascelibrary.org/page/books/s-gsp.
2. http://accessengineeringlibrary.com/browse/geotechnical-engineersportable-handbook-second edition.
3. http://nptel.ac.in/courses/105101084/
4. http://nptel.ac.in/courses/105106142/

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201009 Surveying

Credit : 3

Teaching Scheme:
Theory: 03hrs/ week
Practical: 04 hrs/week

Examination Scheme:
In-semester : 30 Marks
End-semester : 70 Marks

Pre- requisites:

Basic Introduction to Civil Engineering field,Engineering Mathematics

Course Objectives:

With the successful completion of the course, the student should have the capability to:

1. Describe the function of surveying in civil engineering construction,
2. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements,
3. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses,
4. Effectively communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments.
5. Be able to identify hazardous environments and take measures to insure one's personal and team safety
6. Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse. Use appropriate software for calculations and plotting.
7. Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system,
8. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion,
9. Calculate, design and establish curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

Course Outcomes:

On successful completion of this course, Student will be able to:

1. Define and Explain basics of plane surveying and differentiate the instruments used for it**.**
2. Express proficiency in handling surveying equipment and analyse the surveying data from these equipment.
3. Describe different methods of surveying and find relative positions of points on the surface of earth**.**
4. Execute curve setting for civil engineering projects such as roads, railways etc.
5. Articulate advancements in surveying such as space based positioning systems

6. Differentiate map and aerial photographs, also interpret aerial photographs.

Course Contents

Unit I: Compass and Levelling. **(08 Hours)**

a) Definition and Importance of Surveying; Principles of Surveying,

b) Definition, objective and fundamental classification of surveying (Plane and Geodetic), concept of Scale, Ranging, Chaining, Offsetting and Traversing. Construction and use of prismatic compass, Concept of bearing &, types of bearings such as Whole Circle Bearing, Quadrental Bearing, meridian and their types, local attraction and correction for local attraction, dip, declination and calculation of true bearings, including numericals of all types.

c) Equipment required for plane table surveying, uses, advantages and disadvantages and errors in plane table surveying. Methods of plane table Survey Radiation, intersection, traversing and resection –

d) Introduction to leveling, Types of leveling, Types of benchmarks, Study and use of dumpy level, auto level, digital level and laser level in construction industry, principal axes of dumpy level, testing and permanent adjustments reciprocal leveling, curvature and refraction corrections, distance to the visible horizon. Collimation Plane Method, Rise & Fall Method

Unit II: Theodolite Surveying **(08 Hours)**

a) Study of vernier transit 20" theodolite, uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles, measurement of deflection angles using transit theodolite and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite. Fundamental axes of theodolite: testing and permanent adjustments of a transit theodolite.

b) Theodolite traversing – computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gales traverse table. Checks, omitted measurements, area calculation by independent co-ordinates.

Unit III: Tacheometry and Contouring. **(06 Hours)**

a) **Tacheometry –** applications and limitations, principle of stadia tacheometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points, finding tacheometric constants. Tacheometric contouring. Numericals

b) **Contouring** – Definition of Contours, Characteristics of Contours, Contour Patterns for various natural features, direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile leveling and cross-sectioning and their applications

Unit IV: Curves. **(07 Hours)**

Introduction to horizontal and vertical curves (including numericals but derivation not expected), different types of curves and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. Angular methods: Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves and compound curves to be asked), Transition curves: necessity.

Unit V: Construction Survey & Modern Techniques such as Space Based Positioning System (SBPS) (06 Hours)

a. Introduction to construction survey, establishing of horizontal and vertical controls, setting out of buildings, maintaining verticality of tall buildings, survey for open traverse (roadway, railways, drainage lines, water lines, canals)., Setting out of a bridge, Determination of the length of the central line and the location of piers. Setting out of a tunnel – Surface setting out and transferring the alignment underground.

b. Introduction to SBPS, SBPS systems - GPS, GLONASS, Galileo, GAGAN, BeiDou and their features, Segments of SBPS (Space, Control and User), applications of SBPS in surveying.

Unit VI: Introduction to Geodetic Survey, Hydrograph Survey & Aerial Photogrammetry (07 Hours)

Introduction to Geodetic Survey, Objects, Methods of Geodetic Surveying, Introduction to triangulation and trilateration, Objective of triangulations surveys, Classification of triangulation systems, Triangulation figures, Strength of figure, Study and use of one second theodolite and Electronic Total Station,

Introduction to Hydrographic Survey Objects, Applications, Shore line survey, Sounding, Sounding equipment, Methods of Sounding & Sounding Equipment, Stream gauging,

Three point problem

Aerial Photogrammetry Objects, Classification- qualitative & quantitative photogrammetry, Applications, comparison of Map and aerial photographs, Flight Planning , Calculation of no of Photographs.

Books:

Text Books:

1. Surveying and Levelling Vol. I and Vol. II by T. P. Kanetkar and S. V. Kulkarni, Pune Vidyarthi Griha Prakashan.
2. Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain, Laxmi Publications.
3. Plane Surveying & Higher Surveying by Dr A. M. Chandra, New age international publishers New Delhi.

Reference Books:

1. GPS Satellite Surveying—Alfred Leick—Wiley
2. Principles of Geographical Information System—Burrough-- Oxford University Press
3. Surveying—M. D. Saikia—PHI Learning Pvt .Ltd. Delhi
4. Advanced Surveying -Total Station, GIS and Remote Sensing by Satheesh Gopi, R. Sathikumar and N. Madhu , Pearson publication
5. Surveying & levelling by R. Subramanian, Oxford Publication.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering
201010 Concrete Technology
Credits: 03

Teaching Scheme:
Theory : 03 hrs/week
Practical : 02 hrs/week

Examination Scheme:
In-semester : 30 Marks
End-semester : 70 Marks

Course Objectives:
1. To know properties of various ingredients of concrete and concept of mix design.
2. To learn the behavior and propertiesof concrete infresh and hardened state.
3. To understand special concrete and their applications.
4. To understand the durability aspects and preventive measures to enhance the fife of concrete.

Course Outcomes:
1. Able to select the various ingredients of concrete and its suitable proportion to achieved desired strength.
2. Able to check the properties of concrete in fresh and hardened state.
3. Get acquainted to concreting equipments, techniques and different types of special concrete.
4. Able to predict deteriorations in concrete and get acquainted to various repairing methods and techniques.

Course Contents

Unit I: Introduction to Concrete and Ingredients of Concrete. (06 Hours)

a) Cementand Aggregate– Manufacture, chemical composition, hydration, physical and mechanical properties, classification, types and application of cement, tests on cement, Classification of aggregate, physical and mechanical properties of aggregate, deleterious materials in aggregate, alkali-aggregate reaction, Fineness and gradation of aggregates using sieve analysis, tests on aggregates.

b) Water and Admixtures –Quality of water for use in concrete, role of admixture, classification and types of admixtures like accelerators, retarders, plasticizers, super plasticizers, mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag.

Unit II: Production, Properties and Testing of Fresh Concrete (06 Hours)

a) Production and Properties of Fresh Concrete: Nominal mixes, Water-cement ratio, Process of manufacturing fresh concrete-batching, mixing, transportation, compaction, curing of concrete, curing methods, influence of temperature, maturity rule, workability and factors affecting workability, cohesion and segregation.

b) Tests on fresh concrete – Workability by slump cone, compaction factor, Vee-Bee consistometer and flow table apparatus, Effect of admixture on workability of concreteand optimum dosage of admixture by Marsh cone test.

Unit III: Properties and Testing of Hardened Concrete (06 Hours)

a) Hardened concrete – Strength of concrete, factors affecting strength, micro-cracking and stress-strain relationship, relation between tensile and compression strength, impact strength, abrasion resistance, creep and shrinkage.

b) Testing of hardened concrete –Destructive tests -compression strength, flexural strength, indirect tensile strength, core test. Nondestructive tests: rebound hammer, ultrasonic pulse velocity, pullout test and impact echo test.

Unit IV: Concrete Mix Design and Methods of Mix Design (06 Hours)

a)Concrete Mix Design– Concept and objectives of concrete mix design, factors affecting the mix design, quality control, variability of laboratory test result, acceptance criteria, Grade designation and IS requirements as per IS 456 (Exposure conditions, minimum & maximum cement content and maximum W/C ratio

b) Methods of Mix Design: IS code method and DOE method (with and without mineral admixture), Use of spreadsheet/programming/ software for concrete mix design.

Unit V: Concreting Equipments, Techniques and Special concretes (06 Hours)

a) Concreting Equipments and Techniques–Batching plants, concrete mixers, hauling, pumps, concrete vibrators and compaction equipments. Special concreting techniques- ready mix concrete, under water concreting, roller compacted concrete, cold and hot weather concreting.

b) Special concretes – Light weight concrete and its types, foam concrete, no fines concrete, self compacting concrete, high density concrete, fiber reinforced concrete,geo-polymer concrete and Ferrocement technique.

Unit VI: Deterioration and Repairs in Concrete (06 Hours)

a) Deterioration –Durability, factors affecting the durability of concrete, Permeability, sulphate attack, acid attack, chloride attack, corrosion of reinforcement, carbonation of concrete

b) Repairs – Symptoms and diagnosis of distress, evaluation of cracks, selection of repair procedure, repair of defects using various types and techniques – shotcrete and grouting. Introduction to retrofitting of concrete structures by fiber reinforced polymer (FRP), polymer impregnated concrete. Corrosion monitoring and preventive measures.

Books:

Text Books:

1. Concrete Technology by M. S. Shetty, S Chand,New Delhi-110055.
2. Concrete Technology by M. L. Gambhir, Tata McGraw-Hill.
3. Concrete technology by A. M. Neville, J.J. Brooks, Pearson.

Reference Books:

1. Concrete Technology by A. R. Shantakumar, Oxford University Press, 2018.
2. Properties of Concrete by A. M. Neville, Longman Publishers.
3. Concrete Technology by R.S. Varshney, Oxford and IBH.
4. Microstructure and Properties of Concrete by P. Kumar Mehta, Prentice Hall.
5. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
6. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, CBS Publishers & Distributors Pvt. Ltd.
7. Durability Design of Concrete Structures, by A. Sarja and E. Vesiari, E & FN Spon Publication, 1996.

IS Codes : Latest revised editions of IS codes: IS 456, IS 269, IS 1489, IS 4031, IS 383, IS 2386, IS 9103, IS 516, IS 1199, IS 10262, SP 23.IS 13311.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201011: Structural Analysis
Credits : 03

Teaching Scheme:	**Examination Scheme :**	
Theory : 03 hrs/week	In-semester	: 30 Marks
Tutorial : 01 hrs/week	End-semester	: 70 Marks
	Term Work	: 25 Marks

Prerequisites:
Fundamentals of Physics, Mathematics, Engineering Mechanics andMechanics of Structures

Course Objectives:
1. This subject will build on the concepts from Engineering Mechanics and Mechanics of Structures.
2. This will create a foundation for analyzing real life structures by imparting knowledge about various methods involved in the analysis of indeterminate structures.

Course Outcomes:
On completion of the course, learner will be able to:
1. Understand the basic concept of static and kinematic indeterminacy and analysis of indeterminate beams.
2. Analyze redundant trusses and able to perform approximate analysis of multi-story multi-bay frames.
3. Implement application of the slope deflection method to beams and portal frames.
4. Analyze beams and portal frames using moment distribution method.
5. Determine response of beams and portal frames using structure approach of stiffness matrix method.
6. Apply the concepts of plastic analysis in the analysis of steel structures.

Course Contents

Unit I: Fundamentals of structure and analysis of redundant beams. (07 Hours)

a)Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy.

b) Analysis of propped cantilever, fixed beam and continuous beams with indeterminacy up to second degree by strain energy method.

Unit II: Analysis of redundant pin jointed frames and multi-storied multi-bay 2-D rigid jointed frames. (07Hours)

a) Analysis of redundant trusses by unit load method for external loading, lack of fit, sinking of support and temperature changes (indeterminacy up to second degree).

b) Approximate methods of analysis of multi-storied multi-bay 2-D rigid jointed frames by Cantilever method and Portal method.

Unit III: Slope-Deflection Method. **(07 Hours)**

a) Slope-deflection equations, equilibrium equation of Slope-deflection method, application of Slope deflection method to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

b) Sway analysis of rigid joint rectangular single bay single storey portal frames using Slope-deflection method. (Involving not more than three unknowns)

Unit IV: Moment Distribution Method. **(07 Hours)**

a) Stiffness factor, carry over factor, distribution factor, application of Moment distribution method of analysis to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using Moment distribution method (Involving not more than three unknowns).

Unit V: Stiffness method. **(07Hours)**

a) Fundamental concepts of flexibility and stiffness, relation between them. Stiffness method of analysis- Structure approach only. Application to beams (Involving not more than three unknowns).

b) Application of Stiffness structure approach to rigid jointed rectangular portal frames (Involving not more than three unknowns).

Unit VI: Plastic Analysis of Structure. **(07Hours)**

True and idealized stress-strain curve for mild steel in tension, stress distribution in elastic, elasto-plastic and plastic stage, concept of plastic hinge and collapse mechanism, static and kinematic methods of analysis, upper bound, lower bound and uniqueness theorem. Plastic modulus of section, Plastic moment, shape factor. Plastic analysis of determinate and indeterminate beams, single bay single storied portal frame.

Books:

Text Books:

1. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company (P) Ltd.
2. Structural Analysis-I & II by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.
3. Structural Analysis: A Matrix Approach by G.S.Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Limited.

Reference Books:

1. Intermediate Structural Analysis by C. K. Wang, Tata McGraw Hill Education Pvt. Ltd.
2. Mechanics of Structures Vol. II (Theory and Analysis of Structures) by Dr. H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd.
3. Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill Education Pvt. Ltd.
4. Structural Analysis by R. C. Hibbler, Pearson Education.
5. The Plastic Methods of Structural Analysis by B. G. Neal, Champman& Hall.
6. Structural Analysis by AslamKassimali, Cengage Learning India Private Limited
7. Matrix Analysis of Framed Structures by William Weaver Jr. and James M. Gere, Springer

Tutorial: Every student should solve at least five problems on each unit covering all the topics listed in syllabus. The TW marks will be based on the tutorial.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201012 Project Management
Credit : 3

Teaching Scheme:
Theory:3hrs / week

Examination Scheme:
In-semester : 30 Marks
End-semester : 70 Marks

Prerequisites:
Fundamentals of Management, Indian Construction Industry, Economics.

Course Objectives:
Students will be able to:
1. **Describe** the various concepts involved in Project Management.
2. **Explain** scientific methods of planning and management
3. **Segregate** the materials as per their annual usage and **explain** process to find production rate of construction equipment
4. **Demonstrates** methods of manpower planning and **Use** various project monitoring methods.
5. **Discuss** engineering economics and different laws associated with project management.
6. **Differentiate** the methods of project selection and **recommend** the best economical project.

Course Outcomes:
On completion of the course, student will:
1. **Describe** project life cycle and the domains of Project Management.
2. **Explain** networking methods and their applications in planning and management
3. **Categorize** the materials as per their annual usage and also **Calculate** production rate of construction equipment
4. **Demonstrates** resource allocation techniques and **apply** it for manpower planning.
5. **Understand** economical terms and different laws associated with project management
6. **Apply** the methods of project selection and **recommend** the best economical project.

Course Contents:

UNIT I Introduction to Project Management (06 Hours)

Importance, Objectives & Functions of Management, Principles of Management, Categories of Project, Project Failure, Project--- Life Cycle Concept and Cost Components, Project Management Book of Knowledge {PMBOK} – Different Domain Areas, Project management Institute and Certified Project Management Professionals (PMP). Importance of Organizational Structure in Management- Authority / Responsibility Relation, Management By Objectives (MBO)

UNIT II Project Planning and Scheduling (06 Hours)

WBS – Work Breakdown Structure, Gantt / Bar chart & its Limitations, Network Planning, Network analysis, C. P. M.- . Activity on Arrow (A.O.A.), Critical Path and Type of Floats, Precedence Network Analysis (A.O.N.), Types of Precedence Relationship, P. E. R.T. Analysis

UNIT III Project Resources and Site Planning (06 Hours)

Objectives of Materials Management – Primary and Secondary Material Procurement Procedures -

Material Requirement - Raising of Indents, Receipts, Inspection, Storage, Delivery, Record Keeping – Use of Excel Sheets, ERP Software, Inventory Control - ABC Analysis, EOQ, Introduction to Equipment Management – Fleet Management, Productivity Studies, Site Layout and Planning, Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs

UNIT IV Project Monitoring and Control (06 Hours)

Resource Allocation – Resource Smoothening and Leveling, Network Crashing – Time- Cost – Resource Optimization, Project Monitoring - Methods, Updating and Earned Value Analysis, Introduction to Use of Project Management Software's – MS Project / Primavera, Case study on Housing Project Scheduling for a Small Project with Minimum 25 Activities.

UNIT V Project Economics (06 Hours)

Introduction to Project Economics - Definition, Principles, Importance in Construction Industry, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Cash flow Diagram, Annuities and its Types, Demand, Demand Schedule, Law of Demand, Demand Curve, Elasticity of Demand and Supply, Supply Schedule, Supply Curve, Elasticity of Supply Equilibrium, Equilibrium Price, Equilibrium Amount, Factors Affecting Price Determination, Law of Diminishing Marginal Utility, Law of Substitution, Concept of Cost of Capital, Time Value of Money, Sources of Project Finance.

UNIT VI Project Appraisal (06 Hours)

Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component], Study of Project Feasibility Report and Detailed Project Report (DPR), Role of Project Management Consultants in Pre-Tender and Post-Tender.

Books:

Text Books:

1.Project planning and Control with PERT and CPM by DR. B.C. Punmia and K.K.Khadelwal Publisher: Firewall Media, Laxmi publication New Delhi.

2.Project management Principles and Techniques by B.B. Goel Publisher: Deep and Deep publisher

Reference Books:

1. Project Management—Khatua—Oxford University
2. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Management and Planning by B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.
6. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
7. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.
8. Engineering Economics by R.Panneerselvam Publisher-PHI Learning; 2nd edition (2014)

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201013 Geotechnical Engineering-Lab

Credit : 01

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs / week	Oral : 50 Marks

List of Laboratory Experiments / Assignments

The term work shall consist of a journal giving details of at least 11 out of 13 of the following experiments.

1. Water content determination by any two methods a) Oven drying method, b) Infrared moisture method, c) calcium carbide method
2. Specific gravity determination by Pycnometer /density bottle.
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of Consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) Core cutter b) Sand Replacement and c) Clod method
6. Determination of coefficient of permeability by a) Constant head and b) Variable head method.
7. Direct shear test.
8. Unconfined compression test.
9. Vane Shear test.
10. Triaxial test
11. Standard Proctor test / Modified Proctor test.
12. Differential free swell test.
13. Swelling Pressure test
14. **Assignments on the following topics** (Any 2):
    a) Rebhann's and Cullman's graphical method for determination of earth pressure.
    b) Solution of problems on shear strength parameters using graph.
    c) Collection of sample soil investigation report for any construction project.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201014 : Surveying - Lab
Credit : 01

Teaching Scheme:	**Examination Scheme:**
Practical: 4 hrs / week	Practical : 50 Marks

List of Laboratory Experiments

a) Perform any Eight Experiments out of 1 to 10 and Any 02 assignments & projects are mandatory:

1. Measurement of magnetic bearings of sides of a triangle or quadrilateral, correction for local attraction and calculations of true bearings using prismatic compass.
2. Plane table survey consisting of both Radiation and Intersection method. Actual mapping of small structure like an area map from central commanding area / small building using combination of both methods.
3. Finding horizontal distance and vertical elevation using a Tacheometer.
4. Simple and differential levelling with at least three change points using digital level.
5. Measurement of horizontal angles (by repetition method) and vertical angles using 1" and 20" Vernier Transit Theodolite. Setting the required horizontal and vertical angles
6. Setting out a circular curve by Rankine's method of deflection angles.
7. Setting out a building from a given foundation plan (minimum six co-ordinates)
8. Study and use of nautical sextant and measurement of horizontal angles
9. Study of the instruments used in hydrographic surveying.
10. Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout.

Mandatory Assignments: (Minimum 02)

1. Spatial database creation by using GIS software like Google earth or any other.
2. Brief Introduction to City Survey.
3. Study of aerial photograph and finding out the scale of the photograph.
4. Determination of air base distance using mirror stereoscope.

b) Projects:(Minimum Two)

1. Road project using Auto level for a minimum length of 100 m including fixing of alignment, profile levelling, cross-sectioning, plotting of L section and Cross Section. (One full imperial sheet including plan, L-section and any three typical Cross-section.

2. Tachometric contouring project on hilly area with at least two instrument stations about 60 m to 100 m apart and generating contours using both methods, manual as well as using any suitable software such as Autodesk land desktop, Auto-civil, Foresight etc. (minimum contour interval 1 meter).

3. Total Station Traversing

Savitribai Phule Pune University, Pune

Second Year Civil Engineering (2019 Course)

201015 Concrete Technology - Lab

Credit : 01

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs / week	Term work : 25 Marks

List of Laboratory Assignments

The term work shall consist of a journal giving details of all the following experiments.

A] Cementitious materials:

1. Fineness of cement and fly ash (by sieve method)
2. Standard consistency Initial and final setting time and Soundness of cement.
3. Compressive strength of cement
4. Tensile strength of cement (**Optional**)

* Fineness of cement by Blains Air permeability method (**Video demo**)

* Soundness of cement by Autoclave method (**Video demo**)

B] Filler Materials (Fine & coarse aggregate)

1. Fineness modulus, Moisture content, silt content, bulk density and specific gravity of fine aggregate.
2. Fineness modulus, Moisture content, water absorption, bulk density and specific gravity of coarse aggregate.

C] Concrete

1. Concrete mix design by IS code method and DOE **using spread sheet/excel sheet**.
2. Workability of concrete with and without admixture by slump cone, compaction factor, and or Vee-BeeConsistometer apparatus.
3. Compressive strength test of concrete on cubes by destructive and non-destructive method rebound Hammer and Quality of concrete by ultra-sonic pulse velocity (**demo Video**).
4. Compressive strength test of concrete on cylinder (Stress –strain behavior- **demo Video**).
5. Indirect tensile strength and flexural strength of hardened concrete.
6. Site visit to RMC plant.

Savitribai Phule Pune University, Pune
Second Year Civil Engineering (2019 Course)
201017 Project Based Learning
Credits: 02

Teaching Scheme:
Practical : 04hrs/week

Examination Scheme:
Term Work: 50 Marks

Preamble:
Project Based Learning (PBL) was introduced in curriculum of First Year Engineering in Semester II (Course code- 110013) in 2019 course. In that course, students in group might have planned, managed and completed a task/ project/ activity which addressed the stated problem. In a continuation with this, PBL is introduced in core course of Civil Engineering. PBL demonstrates the power of student projects to develop college, community connections, applied research skills and higher levels of student thinking. PBL is a dynamic approach to teaching in which students explore real-world problems and challenges simultaneously developing 21st century Civil Engineering skills while working in collaborative groups. The aim of this course is to demonstrate the important attributes like communication, presentation, organization, time management, research, inquiry, self-assessment, group participation, leadership and critical thinking. Performance assessed on an individual basis and takes into account the quality of task/project/activity completed, the depth of content understanding demonstrated and the contributions made to the ongoing process of project realization. PBL allows students to reflect upon their own ideas and opinions and make decisions that affect project outcomes and the learning process in general.

Course Objectives:
1. To engage students in constructive learning environment and develop self-learning abilities.
2. To develop critical thinking and solving civil engineering problems by exploring and proposing sustainable solutions.
3. To integrate knowledge and skills from civil and other engineering areas.
4. To develop professional skills and project management.

Course Outcomes:
After completion of course the students will be able to
1. Identify the community/ practical/ societal needs and convert the idea into a product/ process/ service.
2. Analyse and design the physical/ mathematical/ ICT model in order to solve identified problem/project.
3. Create, work in team and applying the solution in practical way to specific problem.

Course Content
- Introduction to Project Based Learning, Traditional vs. Cognitive Learning, Why PBL? , Principles of Problem Design Seven Steps of Problem Design, Online PBL, Applications and Research Trends Case Studies in Civil Engineering.

Group Structure:

- Working in mentor – monitored groups. The students identify, plan, manage and complete a task/ project/ activity which address the stated problem related to civil engineering.
- There should be team/group of maximum four students.
- A supervisor / mentor faculty teacher assigned to individual groups.

Selection of Project/Problem:

At start of course revision of PBL, significance, guidelines and evaluation parameters should be discussed commonly at start of semester. In this session basics PBL, in brief research methodology points relevant to PBL, sample case studies related to civil engineering and brief information about patent, copy right and publications should be given.

Selection of project/problem related to any technical aspect of civil engineering is recommended or if any project/problem selected in first year engineering related to civil engineering can be continued if enough potential is there. Give preference to select project/problem related to solving any problem/ issue for which suitable model can be developed or software can be used. The project/problem selected could have different alternative solutions which could be theoretical, practical, working model, demonstration or software analysis. The project/problem selected may have multi-disciplinary approach to get the solution. Problem needs to refer back to a particular practical, scientific, or technical domain. It is recommended to include hands-on activities, organizational and field visits, expert consultation to make students aware with current use of technologies. Proper representation of project/problem, course work and report on the results and conclusion is important for assessment of course.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both students' performance and program effectiveness. Progress and review of PBL is monitored regularly on weekly basis. It is recommended to appoint one teaching faculty as a mentor per group/ batch and it will be duty of mentor to perform monitoring and continuous assessment of individual students as well as entire group for their performance. College/ Department is required to provide necessary assistance. It is the responsibility of students to follow guidelines of their group mentor, maintain self-discipline, authentic collaboration, peer learning and personal responsibility, motivation and adopt interactive learning environment. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes. Intermittent review and assessment of each group should be done after six weeks from the start of the semester. Each group has to submit their work at end of semester during the end review. Group may demonstrate their knowledge and skills through presentation by developing a model/product/poster and report. Individual assessment for each student (Understanding individual capacity, role and involvement in the project). Group assessment (roles defined, distribution of work, intra-team communication and togetherness).

Evaluation and Continuous Assessment:

Prepare "**PBL Log Book**" which includes record of activities performed and evaluation carried out with appropriate remarks. Maintain regular record on weekly basis. Records and documents must also be maintained at student level. Continuous assessment sheet must be prepared by each faculty

which consists assessment made on weekly basis also performance made during mid-review and end-review. PBL log book must be maintained as a record even after completion of semester. It will serve as document which will reflect the punctuality, accountability, technical writing ability and project workflow.

Recommended parameters for assessment, evaluation and weightage:

Evaluation criteria and respective percentage weightage for marks.

1. Idea Inception = 5%
2. Solution provided/ final product at end of course = 50% (Individual assessment and team assessment).
3. Documentation in the form of PBL report (typed, hard copy) = 15%
4. Presentation/ Demonstration of model/ PPT/ poster = 10%
5. Participation/ involvement in group activity =10%
6. Publication/ participation on technical platform = 10%

Course assessment rubrics can be prepared based on the given evaluation parameters for excellent, moderate, acceptable and not acceptable.

References:

1. M. Savin-Baden and C. Howell Major, Foundations of Problem-based Learning. McGraw-Hill Education, 2004
2. T. J. Newby, D. A. Stepich, J. D. Lehman and J. D. Russell, Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media. Englewood Cliffs, NJ: Merrill/Prentice-Hall, 1996
3. S. N. Alessi and S. R. Trollip, Multimedia for learning: methods and development. Needham Heights, MA: Allyn& Bacon, 2001
4. Guerra, Aida, Ulseth, Ronald, Kolmos, Anette, PBL in Engineering Education: International Perspectives on Curriculum Change, Springer, 2017
5. MahnazMoallemWoei Hung Nada Dabbagh, The Wiley Handbook of Problem-Based Learning, Wiley, 2019
6. Jane I. Krauss, Suzanne K. Boss, Thinking Through Project-Based Learning: Guiding Deeper Inquiry.
7. John Larmer, David Ross, John R. Mergendollar, Project Based Learning (PBL) Starter Kit.
8. William N. Bender, Project-Based Learning: Differentiating Instruction for the 21st Century.
9. Bob Lenz, Justin Wells, Sally Kingston, Transforming Schools Using Project-Based Learning, Performance Assessment, and Common Core Standards.
10. Suzie Boss with John Larmer (ASCD/Buck Institute for Education), Implementing Project-Based Learning Solutions by Suzie Boss

Website for references

1. www.pblwork.org
2. www.my.pblworks.org
3. www.swayam.gov.in/nd2_ntr20_ed12/preview
4. www.schoology.com

Format of PBL report: Sequence of pages:

i) Front Cover Page ii) Certificate iii) Acknowledgement iv) Synopsis v) Contents vi) List of

Figures vii) List of Tables vii) Notations

Chapter 1 Introduction (This consists of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives and 1.4 Scope of the Project Works, 1.5 Research Methodology, 1.6 Limitations of study, 1.7 Expected outcome.

Chapter 2 Literature Review (It shall include theoretical support, details regarding work done by various persons, methods established, any new approach.

Chapter 3 Planning Schedule/ Flow Chart for Completion of Project

Chapter 4 Conclusion

References and Bibliography (The references and bibliography shall include name of author/code/manual/book, title of paper/code/manual/book, name of the journal, month & year of publication, volume number/ISBN number, page number x-y. The references and bibliography shall be as per universal standards as mentioned in any international journal of professional body).

Report Printing details:

1. Report shall be typed on A4 size Executive Bond paper with single spacing preferably on **Both** sides of paper.
2. Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm.
3. Give page number at bottom margin at center.
4. Size of Letters: Chapter Number: 16 font size, Times New Roman in Capital Bold Letters, Chapter Name: 12 Font size in Capital Bold Letters, Main Titles (1.1, 2.5 etc): 16 Font size in Bold Letters Sentence case, Sub Titles (1.1.5, 4.5.1 etc): 14 Font size in Bold Letters Sentence case. All other matter: 12 Font size sentence case.
5. No blank sheet be left in the report.
6. Figure name: 12 Font size in sentence case Bold- Below the figure.
7. Table title -12 font size in sentence case- Bold-Above the table.

Savitribai Phule University of Pune

Third Year Civil Engineering

(2015 Course)

Semester I

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301001	Hydrology and water resource engineering.	03	--	02	30	70	--	50	--	**150**	03	01
301002	Infrastructure Engineering and Construction Techniques	03	--	--	30	70	--	--	--	**100**	04	--
301003	Structural Design-I	04	--	04	30	70	50	50	--	**200**	04	02
301004	Structural Analysis-II	04	--	--	30	70	--	--	--	**100**	03	--
301005	Fluid Mechanics-II	04	--	02	30	70	--	50	--	**150**	04	01
301006	Employability Skills development	--	--	02	--	--	50	--	--	**50**	--	01
Total		18	--	10	**150**	**350**	**100**	**150**		**750**	**18**	**05**

Semester II

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301007	Advanced Surveying	03	--	02	30	70	50	--	--	**150**	03	01
301008	Project Management and Engineering Economics	04	--	--	30	70	--	--	--	**100**	04	--
301009	Foundation Engineering	03	--	--	30	70	--	--	--	**100**	03	--
301010	Structural Design-II	04	--	04	30	70	50	50	--	**200**	04	02
301011	Environmental Engineering-I	04	--	02	30	70	--	--	50	**150**	04	01
301012	Seminar	--	--	01	--	--	--	50	--	**50**	--	01
Total		18	--	09	**150**	**350**	**100**	**100**	**50**	**750**	**18**	**05**

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

301001 Hydrology and Water Resource Engineering

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

Unit – I **(06 hours)**

Introduction to Hydrology:

Hydrological cycle, Application of hydrology

Precipitation:

Types of precipitation, measurement, Rain gauge network, Preparation of data-estimation of missing data, Consistency test, Presentation of rainfall data-mass rainfall curves, Hyetograph, Point rainfall, Moving average, Mean precipitation over an area- arithmetic mean method, Thiessen's polygon, isohyetel method, Concepts of depth-area-duration analysis, Frequency analysis - frequency of point rainfall and plotting position, Intensity-duration curves, Maximum Intensity-duration- frequency analysis

Abstractions of Precipitation: Intersection, Depression storage, Evaporation- Elementary concepts, factors affecting, Measurement of evaporation, Transpiration, Evapotranspiration- process and measurement, Infiltration –introduction, Infiltration capacity, Infiltrometer, Horton's method and infiltration indices

Stream Gauging:

Selection of site, various methods of discharge measurement (velocity-area method, dilution method, slope-area method), Advance techniques/equipments used in gauge discharge measurements such as Radar, Current meter, ADCP (Acoustic Doppler Current Profiler)

Unit – II **(06 hours)**

Introduction to Irrigation:

Definition, Functions, Advantages and Necessity, Methods of Irrigation, Surface Irrigation, Subsurface Irrigation, Micro-Irrigation

Water Requirements of Crops:

Soil moisture and Crop water relationship, Factors governing Consumptive use of water, Principal Indian crops, their season and water requirement, Crop planning, Agricultural practices, Calculations of canal and reservoir capacities – duty, delta, irrigation efficiency

Assessment of Canal Revenue:

Various methods (Area basis or crop rate basis, volumetric basis, seasonal basis, composite rate basis, permanent basis or betterment levy basis)

Unit III **(06 hours)**

Ground Water Hydrology:

Occurrences and distribution of ground water, Specific yield of aquifers, Movement of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well, Well Irrigation: Tube wells, Open wells and their construction

Unit – IV **(06 hours)**

Runoff:

Introduction, Factors affecting runoff, Rainfall-Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph- Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall,

Unit hydrograph theory, S-curve hydrograph, uses and limitations of Unit Hydrograph

Floods:

Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods

Unit – V **(06 hours)**

Reservoir Planning: Introduction, Term related to reservoir planning (Yield, Reservoir planning and operation curves, Reservoir storage, Reservoir clearance), Investigation for reservoir planning, Significance of mass curve and demand curves, Applications of mass curve and demand curves, Fixation of reservoir capacity from annual inflow and outflow, Fixation of reservoir capacity using elevation capacity curve and dependable yield, Reservoir regulation, Flood routing- Graphical or I.S.D method, Trial and error method, Reservoir losses, Reservoir sedimentation- Phenomenon, Measures to control reservoir sedimentation, Density currents Significance of trap efficiency, Useful life of reservoir, Costs of reservoir, Apportionment of total cost, Use of facilities method, Equal apportionment method, Alternative justifiable expenditure method

Unit VI **(06 hours)**

Water Management:

Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Cooperative water distribution systems, Introduction to auto weather station

Water Logging and Drainage:

The process of water logging**,** Causes of water logging, Effects of water logging, preventive and curative measures, Land drainage, Reclamation of water logged areas, Alkaline and saline lands.

Reference Books

1. Irrigation Engineering - S. K. Garg, Khanna Publishers
2. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House.
3. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Standard Publisher
4. Elementary Engineering Hydrology- M.J.Deodhar-Pearson Education

5. Engineering Hydrology. –Ojha—Oxford University Press
6. Engineering hydrology – K. Subramanyam Tata McGraw Hill.
7. Hydrology- Principles, Analysis and Desin, Raghunath, New Age International
8. Irrigation Engineering-Raghunath--Wiley
9. Groundwater Hydrology, 3ed—Todd--Wiley
10. Applied Hydrology – Chow, Maidment, Mays, McGraw-Hill
11. Principles of Hydrology- Ward and Robinson, Tata McGraw Hill
12. Irrigation Engineering - Bharat Singh

Term Work

Assignments (Hydrology and Water Resources Engineering)

Term work will consist of a journal giving the detailed report on assignments performed and visit report. **(any 8)**

1. Analysis of rainfall data (Double mass curve technique/Missing rainfall data).
2. Marking catchment area on a topo-sheet and working out average annual precipitation and determining yield by various methods.
3. Analytical method of measurement of infiltration
4. Flood frequency studies assuming Gumbel's extreme value distribution.
5. Determination of peak flood discharge in a basin using unit hydrograph technique.
6. Determination of storage capacity of a reservoir using mass curve of inflow and outflow.
7. Application of HEC-RAS for Hydrologic routing.
8. Site visit to Meteorological station
9. Measurement of / video demonstration of evaporation by Pan Evaporimeter
10. Measurement of / video demonstration of infiltration by Infiltrometer

Savitribai Phule Pune University TE Civil (2015 Course) w.e.f. June 2017 301002
Infrastructure Engineering and Construction Techniques

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I - Infrastructure Engineering (06 hours)

a) Meaning and scope of Infrastructure Engineering: Scope of infrastructure engineering in national and global development, Forthcoming infrastructure projects at national and global level, Necessity, advantages and disadvantages of PPP (Public Private Partnership), Salient features of smart city , Bus rapid transit system.

b) Railways: Permanent way, Track structure of BG, Functions of rail, Standard rail, Tilting of rail, Coning of wheels, Types of sleepers, Fastenings, Ballast, Modern development in railways- metro rails, mono rails, bullet train.

Unit II- Railways (06 hours)

Rail joints, types, evil effects, remedial measures, Welding of rails, Short and long welded rails, Types of gradients, Curves, Grade compensation on curves, Alignment, Super elevation, Equilibrium cant, Equilibrium speed, Maximum permissible limits for cant, Cant deficiency, Cant excess, Speed on curves, Safe speed on curves using Indian railways formula only for fully transition curves, Concept of negative cant, Points, crossings and turnouts- functions, Components, elements of points, Types of crossings and turnouts, Track maintenance: Regular and Periodic. **(Site visit is recommended to learn this topic)**

Unit III - Construction Techniques (06 hours)

Necessity of mechanization, Dredging techniques, Use of barges, Dewatering techniques- Well Point system, Vacuum dewatering, Electro osmosis, Underwater drilling and blasting, Grouting methods in soft and hard soil, Diaphragm walls- purpose and construction methods, Prefabrication – applications, advantages and disadvantages.

Unit IV – Tunneling (06 hours)

Tunneling, functions & types of tunnel, Criteria for selection of size & shape of tunnels. Pilot tunnel, shaft, addit and portal, Needle beam, NATM, TBM & earth pressure balance method of tunneling in soft soil, Drilling & blasting method of tunneling including various operations like mucking, Drainage in tunneling- Pre drainage and permanent drainage, Ventilation in tunneling-temporary and permanent, Micro tunneling and trenchless tunneling.

Unit V- Docks & Harbors (06 hours)

Introduction, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Various components of ports, Break waters- types, comparison, design criteria , methods of construction, Tetra pod, Tri bar, Hexapod, Quay wall, Wet & dry dock, Floating dock, Wharves, Jetties, Types of fenders, Dolphins, Marin railway.

Unit VI - Construction Equipments **(06 hours)**

Dozers, Power shovels, Excavators, Loaders, Scrapers, Dumpers, Drag line, Clamp shell, Compactors, Pavers, Factors affecting performance, selection of equipment, Various types of hoists and cranes and selection, Boom placers, Simple numerical problems on cycle time and production rate, Economic maintenance & repair of construction equipment.

Reference books

1. Construction Planning Methods & Equipment:Puerifoy –Tata MC Graw Hill
2. Construction Equipments & its Management: S.C Sharma,Khanna Publication
3. Railway Engineering, 2/E by Chandra—Oxford University Press
4. Railway Track Engineering: J.S.Mundrey,Tata McGraw Hill
5. Harbour,Dock & Tunnel Engineering:R. Srinivasan
6. Dock & Harbour Engineering:Hasmukh P.Oza & Gautam H.Oza-Charoter Book Stall
7. Construction Project Scheduling & Control, 2ed—Mubarak--Wiley

University of Pune---TE Civil (2015 Course)---w.e.f. June 2017

301003 Structural Design I

Teaching scheme	**Examination scheme**
Lectures: 4 hours/week	**In semester exam: 30 marks---1.5 hour Paper**
Practical: 4 hours/week	**End semester exam: 70 marks—3 hours Paper**
	Oral based on T.W. : 50 Marks
	Term Work: 50 Marks

Design shall be based on IS: 800-2007

Unit I **(08 hours)**

a) Types of steel structures, grades of structural steel, various rolled steel sections, relevant IS specifications such as IS:800-2007, IS:808-1989, IS:875 part I to III, SP: 6(1), SP: 6(6), SP38. IS:4000- 1992, codes for welded connections (mention code) . Philosophy of limit state design for strength and serviceability, partial safety factor for load and resistance, various design load combinations, classification of cross section such as plastic, compact, semi-compact and slender.

b) Tension member: various cross sections such as solid threaded rod, cable and angle sections. Limit strength due to yielding, rupture and block shear. Design of tension member: using single and double angle sections, connections of member with gusset plate by bolts and welds.

Unit II **(08 hours)**

a) Buckling classification as per geometry of cross section, buckling curves, design of struts in trusses using single and double angle section, connections of members with gusset plate by bolts and welds.

b) Design of axially loaded column using rolled steel section. Design of built-up column, lacing and battening, connection of lacing/battening with main components by bolts and welds.

Unit III **(08 hours)**

a) Design of eccentrically loaded column providing uniaxial and biaxial bending (check for section strength only).

b) Design of column bases: Design of slab base, gusseted base, and moment resistant base. (axial load and uni-axial bending)

Unit IV **(08 hours)**

a) Design of laterally supported beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure, low and high shear, check for web buckling, web crippling and deflection.

b) Design of laterally unsupported beams using single rolled steel section with and without flange plate, curtailment of flange plates, strength in flexure and shear, check for deflection.

Unit V **(08 hours)**

a) Secondary and main beam arrangement for floor of a building, design of beam to beam and beam to column connections using bolt / weld.

b) Design of welded plate girder: design of cross section, curtailment of flange plates, stiffeners and connections.

Unit VI **(08 hours)**

a) Design of gantry girder: Selection of gantry girder, design of cross section, check for moment capacity, buckling resistance, bi-axial bending, deflection at working load and fatigue strength.
b) Roof truss: assessment of dead load, live load and wind load, design of purlin, design of members of a truss, detailing of typical joints and supports

Term work

Term work will consists of the following.
A) Four full imperial size drawing sheet showing structural detailing of 16 sketches based on syllabus. (Hand drawn)
B) Design of industrial building including roof truss, purlin, bracings, gantry girder, column, column base and connections.
Three full imperial size drawing sheets. (Hand drawn)
C) Design of welded plate girder, design of cross section, curtailment of flange plates, stiffeners and connections. One full imperial size drawing sheets.
Site visit is recommended to learn this topic.
OR
C) Design of building including primary and secondary beams, column, column base and connections. One full imperial size drawing sheets. (Using suitable software)
D) Two site visits: Report should contain structural details with sketches.

Oral Examination shall be based on the above term work.

Note: 1. Maximum number of students in a group, if any, should not be more than three to five for the term work design assignments.
2. Draw any one sheet from (B) and (C) Using suitable software.

Reference Books

1. Design of Steel Structure by N Subramanian, Oxford University Press, New Delhi.
2. Limit state design of Steel Structure by V L Shah & Gore, Structures Publication, Pune
3. Limit state design in Structural Steel by M.R. Shiyekar, PHI, Delhi
4. Structural Design in Steel—Sarwar Alam ,Raz—New Age International Publishers
5. Analysis and Design: Practice of Steel Structures—Karuna Ghosh-- PHI Learning Pvt. Ltd .Delhi
6. Limit state design of steel structures by S K Duggal, Tata McGraw Hill Education, New Delhi.
7. Design of Steel Structures by K. S. Sai Ram, Pearson, New Delhi.
8 Fundamentals of structural steel design M L Gambhir, Tata McGraw Hill Education Private limited, New Delhi.
9. Limit state design of Steel Structure by Ramchandra & Gehlot, Scientific Publishers, Pune.
10. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S S, I.K. International Publishing House, New Delhi

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301004 Structural Analysis II

Teaching scheme	Examination scheme
Lectures:4 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I **(08 hours)**

a) Slope-deflection method of analysis: Slope-deflection equations, equilibrium equation of Slope-deflection method, application to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

b) Sway analysis of rigid jointed rectangular portal frames using slope-deflection method (Involving not more than three unknowns)

Unit II **(08 hours)**

a) Moment distribution method of analysis: Stiffness factor, carry over factor, distribution factor, application to beams with and without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram.

b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using moment distribution method (Involving not more than three unknowns).

Unit III **(08 hours)**

a) Fundamental concepts of flexibility method of analysis, formulation of flexibility matrix, application to pin jointed plane trusses (Involving not more than three unknowns).

b) Application of flexibility method to beams and rigid jointed rectangular portal frames (Involving not more than three unknowns).

Unit IV **(08 hours)**

a) Fundamental concepts of stiffness method of analysis, formulation of stiffness matrix, application to trusses by member approach. Application to beams by structure approach only, (Involving not more than three unknowns).

b) Application to rigid jointed rectangular portal frames by structure approach only (Involving not more than three unknowns).

Unit V **(08 hours)**

a) Finite Difference Method – Introduction, application to deflection problems of determinate beams by central difference method

b) Approximate methods of analysis of multi-storied multi-bay 2 - D rigid jointed fames by substitute frame method, cantilever method and portal method.

Unit VI **(08 hours)**

a) Finite element method: Introduction, discretization, types of elements-1D, 2D, 3D, isoparametric and axisymmetric, convergence criteria, Pascals triangle, direct stiffness method, principal of minimum potential energy, principal of virtual work. (No numerical)
b) Shape functions: CST elements by using polynomials, 1D, 2D elements by using Lagrange's method

Reference Books

1. Structural Analysis: Deodas Menon---Narosa Publishing House.
2. Structural Analysis: Thandavamoorthy---Oxford University Press.
3. Structural Analysis: A Matrix Approach by Pundit and Gupta, McGraw Hills.
4. Structural Analysis by Hibbler, Pearson Education.
5. Structural Analysis: M. M. Das, B. M. Das---PHI Learning Pvt Ltd. Delhi.
6. Fundamentals of Structural Analysis: 2nd ed---West---Wiley.
7. Theory of Structures: Vol. I & II by B. C. Punmia, Laxmi Publication.
8. Theory of Structures: Vol. I & II by Perumull & Vaidyanathan, Laxmi Publication.
9. Fundamentals of Structural Analysis: K. M. Leet, Vang, Gilbert—McGraw Hills
10. Matrix Methods for structural engineering.by Gere, Weaver.
11. Introduction to Finite element method, Dr. P.N. Godbole, New Age Publication, Delhi.
12. Finite element Analysis, S.S. Bhavikatti, New Age Publication, Delhi.
13. Basic Structural Analysis: Wilbur and Norris.

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

301005 Fluid Mechanics-II

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

Unit I **(8 hours)**

a) Fluid Flow around Submerged Objects: Practical problems involving fluid flow around submerged objects, Definitions and expressions for drag, lift, drag coefficient, lift coefficient, types of drag. Drag on sphere, cylinder, flat plate and Aerofoil, Karman's vortex street, Effects of free surface and compressibility on drag, Development of lifts, Lift on cylinder and Aerofoil, Magnus effect, Polar diagram.

B)Unsteady Flow: Types of unsteady flow; Flow through openings under varying head, Fluid compressibility, Celerity of elastic pressure wave through fluid medium; Water hammer phenomenon; Rise of pressure due to water hammer, Surge Tanks and their functions.

Unit -II **(08 hours)**

a) Introduction to Open channel flow: Classification of channels, and Channel flows. Basic governing equations of Channel flow viz. continuity equation, energy equation and momentum equation, One dimensional approach, Geometric elements of channel, Velocity distribution in open channel flow, Introduction to notches and weirs ((Rectangular, Triangular, Trapezoidal).

b) Depth-Energy Relationships in Open Channel Flow:

Specific energy, Specific force Specific energy diagram, Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Important terms pertaining to critical flow viz. section factor, concept of first hydraulic exponent; Critical flow computations; channel transitions

Unit –III **(08 hours)**

a) Uniform flow in open channels : Characteristics and establishment of uniform flow, uniform flow formulae :Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient; Important terms pertaining to uniform flow, viz. normal depth, conveyance, section factor, concept of second hydraulic exponent, Uniform flow computations. Most efficient channel sections (rectangular, triangular, trapezoidal and circular).

b) Hydraulic Jump-Phenomenon of hydraulic jump; Location and examples of occurrence of hydraulic jump; Assumptions in the theory of hydraulic jump; Application of momentum equation to hydraulic jump in rectangular channel: Conjugate depths and relations between conjugate depths. Energy dissipation in hydraulic jump; Graphical method of determination of energy dissipation, Classification of hydraulic jump; Practical uses of hydraulic jump, venture flume, standing wave flume

Unit -IV **(08 hours)**

a) Impact of Jet: Force and work done due to impact of jet on stationary and moving, flat and curved surfaces using linear momentum principle.

b) **Centrifugal Pumps**: General classification of pumps, Centrifugal pumps- Classification, theory working, Selection of pumps, Centrifugal head, Work done by impeller, Heads and efficiencies, minimum starting speed, Cavitation in centrifugal pumps, multistage pumping, Introduction to submersible pumps and reciprocating pumps,

Unit -V **(08 hours)**

a) Hydropower generation: Elements of hydropower plant; hydraulic turbines- Classification, heads and efficiencies, Design and governing of Pelton Wheel, Francis turbine-parts and working. Cavitation in hydraulic turbines- **Site visit is recommended to learn this topic.**

b) Performance of hydraulic turbines: Prediction of performance in terms of unit quantities and specific quantities, Specific speed, Characteristic curves, Dimensional analysis as applied to hydraulic turbines, selection of turbines

Unit-VI **(08 hours)**

a) Gradually Varied Flow in Open Channels-Definition and types of non-uniform flow; Gradually Varied Flow (GVF) and Rapidly Varied Flow (RVF); Basic Assumptions of GVF; Differential equation of GVF - Alternative forms; Classification of channel bed slopes, Various GVF profiles, their general characteristics and examples of their occurrence; Control section

b) **Gradually varied flow computations:** Methods of GVF computations. Direct Step method, Graphical Integration method, Standard Step method, VenTe Chow method.

Oral

The Oral is based on the term work which consists of a journal giving the detailed report on experiments and assignments performed and visit report.

List of Experiments

Following experiments and assignments shall be performed.

A) Experiments (All compulsory, Fluid Mechanics II)

1. Flow around a Circular Cylinder/Aerofoil
2. Study of Uniform Flow Formulae of Open channel.
3. Velocity Distribution in Open Channel Flow.
4. Calibration of Standing Wave Flume/Venturi flume
5. Study of Hydraulic Jump as Energy Dissipater. 6.
Impact of Jet on flat plate and curved vane
7. Characteristics of a Pelton Wheel
8. Characteristics of a Centrifugal Pump
9. Calibration of Notch

B) Assignments (All compulsory, Fluid Mechanics II):

(a) Graphical determination of energy loss in Hydraulic Jump.
(b) Assignment on GVF computation using Direct Step and VenTe Chow method.

C) Report on Site visit to Hydropower generation plant/Research Institute.

Reference Books

1. Engineering Fluid Mechanics by Garde, Mirajgaonkar, Scitech
2. Hydraulics and Fluid Mechanics by P. N. Modi & S. N. Seth Standard book house
3. Open Channel Flow by K Subranmanya, TMH, Third Ed.
4. Open Channel Hydraulics: Vente Chow - Tata McGraw Hill.
5. Open Channel Flow: K. G. RangaRaju - Tata McGraw Hill.
6. Fluid Mechanics- Fundamental and Applications by Cengel and Cimbala- McGraw Hill
7. Flow through Open Channels—Srivastava-- Oxford University Press
8. A test book of Fluid mechanics and Machinary by Bansal
9. Fluid Mechanics by Streeter, Wylie and Bedford – Tata McGraw Hill
10. Fluid Mechanics by White – Mc-Graw Hill
11. Fluid Mechanics-A.K.Mohanty- PHI Learning PvtLtd.Delhi
12. Open Channel Flow by M. M. Das - PHI Learning PvtLtd.Delhi

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

301006 Employability Skills Development

Teaching scheme	Examination scheme
Practical: 2 hours/week	Term Work: 50 Marks

How to handle this course? (02 hours)

This course has been introduced with the objective of enhancing the employability of the students through development of their skills. Following topics and their contents are expected to be explored through following 10 activities.

1. Expert lectures 2.Group discussions 3.Case study analysis 4.Group presentations 5.Company and corporate visits 6.Mock interviews and exercises 7.Demo presentations 8. Audio-video shows 9. Use of e-resources 10.Games.

The term work will consist of detailed report of any 8 out of above 10 activities. The activities which need to be performed in a group will have a group of not more than 6 students. However, the report for the term work will be prepared at individual level.

Unit I (02 hours)

a) What is Employability? What are Employability Skills? Focus on what skills do employers expect from graduates? Career planning with action plan.

Unit –II (02 hours)

b) Interpersonal Skills-Critical Thinking, Assertiveness, Decision Making, Problem Solving, Negotiation, Building Confidence, Time Management, Personal Presentation, Assertiveness, Negotiation, Avoiding Stress.

Unit –III (02 hours)

c) Presentation Skills-Presentation Skills What is a Presentation? Writing Your Presentation Coping with Nerves

Unit –IV (02 hours)

d) Communication Skills-Verbal Communication, Written Communication, Difference between C.V. Bio data and Resume

Unit –V (02 hours)

e) Commercial Awareness-Professional etiquettes and manners, Global negotiating and Persuading, Integrity. Global trends and statistics about civil engineering businesses.

Unit-VI **(02 hours)**

f) Personal skills-Leadership, Ability to work in a team, Conceptual ability, Subject Knowledge and competence, Analysing and investigating, Planning, Flexibility, Self, Lifelong Learning, ,Stress Tolerance, Creativity

Reference Reading

1. Cambridge English for Job Hunting—Colm Downes---Cambridge University Press(ISBN-978-0- 521-14470-4)
2. Polyskills--Foundation books-- Cambridge University Press—(ISBN 978-81-7596-916-2)
3. Global Business Foundation Skills-- Foundation books-- Cambridge University Press—(ISBN 978-81-7596-783-0)

E-Resources

www.skillsyouneed.com/general/employability-skills.html-
*www.kent.ac.uk/careers/sk/top-ten-skills.htm*www.skillsyouneed.com/general/employability-
www.fremont.k12.ca.us/cms/lib04/.../Domain/.../employability-skills.pdf

Savitribai Phule Pune University

TE Civil (2015 Course)---w.e.f. June 2017

301007 Advanced Surveying

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	TW: 50 Marks

Unit-I Geodetic Surveying & SBPS (06 hours)

a) Objects, Methods of Geodetic Surveying, Introduction to triangulation, Classification of triangulation systems, Triangulation figures, Concept of well-conditioned triangle, selection of stations, Intervisibility and height of stations.

b) Introduction to SBPS; Positioning with SBPS - Absolute & Differential methods, Use of SBPS in Surveying, SBPS Co-ordinates & heights, Factors governing accuracy in SBPS positioning, Different types of errors in SBPS positioning. Earth ellipsoid, Geodetic datum and Co-ordinate systems, Applications of GPS in civil engineering.

Unit-II Hydrographic Surveying (06 hours)

Objects, Applications, Establishing controls, Shore line survey, Sounding, Sounding equipment, Methods of locating soundings – conventional and using GPS, Reduction of soundings, Plotting of soundings, Nautical sextant and its use, Three point problem and its use, solution of three point problem by all methods, Tides and tide gauges, determination of MSL

Unit-III Remote Sensing and Geographical Information System (06 hours)

a) Remote Sensing introduction, Definition, Necessity, Importance and use; Basic concepts in Remote Sensing , Basic Laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter, Resolution in remote sensing, Satellite remote sensing, Problems confronting remote sensing system. Ideal and Real remote sensing systems. Space platforms for remote sensing: Imaging sensors and techniques. Image interpretation:- Visual image processing & Digital image processing. Applications of remote sensing. Introduction to LIDAR & Underground utility survey. Comparison between aerial photograph and satellite image.

b) Geographical Information System -Introduction, Definition, Objectives, Components (people, procedure, hardware, software & data) & functions (input, manipulation, management, querry & analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of aspatial data. Applications of GIS such as visibility analysis, Slope analysis, Watershed analysis & Preparation of thematic maps. Limitations of GIS,

Unit -IV Triangulation Adjustment (06 hours)

Kinds of errors, Laws of weights, Determination of most probable values (MPV) of conditioned and independent quantities, Method of least squares, Indirect observations, Probable error and its determination, Distribution of error to the field measurements, Normal equation, Method of correlates. Station and figure adjustment of geodetic quadrilateral without central station.

Spherical triangle, Calculations of spherical excess and sides of spherical triangle.

Unit – V Aerial Photogrammetry (06 hours)

Objects, Classification- qualitative & quantitative photogrammetry, Applications, comparison of Map and aerial photograph, Vertical, Tilted and Oblique photographs, Scale of vertical photograph, Relief displacement in vertical photograph, Flight planning, Stereoscopic parallax & its measurement by parallax bar.

Mirror stereoscope, Differential height from differential parallax, Ground control points (GCPs), Introduction to digital photogrammetry, different stereo viewing techniques in digital photogrammetry, Method of creation of elevation data, Different products of digital photogrammetry.

Unit –VI Trigonometric Levelling and Setting out works (06 hours)

a) Trigonometric Levelling :- Terrestrial refraction, Angular corrections for curvature and refraction, Axis signal correction, Determination of difference in elevation by single observation and reciprocal observations.

b) Setting out of Construction works:- Setting out of a bridge, Determination of the length of the central line and the location of piers. Setting out of a tunnel – Surface setting out and transferring the alignment underground.

Term work

Term work shall consist of the following practicals and project.

Geodetic Surveying and Trigonometrical levelling (any three)

1. Measurement of horizontal and vertical angles with 1" theodolite.
2. Determination of elevation of inaccessible objects by trigonometrical levelling.
3. Practical based on various special functions available in a total station such as remote elevation measurements, remote distance measurements and co-ordinate stakeout .
4. Establishing control station using single or dual frequency GPS receiver

1. Study and use of nautical sextant and measurement of horizontal angles
2. Plotting of river cross-section by hydrographic surveying
3. Solution to three point problem by analytical method

1. Study of aerial photograph and finding out the scale of the photograph.
2. Determination of air base distance using mirror stereoscope.
3. Determination of difference in elevation by parallax bar.

1. Study and applications of different RS data products available with National Remote Sensing Centre (NRSC)
2. Use of RS images and visual interpretation
3. Use of interface and tools in GIS software such as GRAM++ or QGIS or equivalent software.

Project: (Any one)

1. Adjustment of geodetic quadrilateral without central station by method of correlates.
2. Field survey (500 sq.m.) using Differential GPS (Control as well as mapping).

Reference Books

1. Surveying & Levelling, 2/E—Subramanian—Oxford University Press
2. Surveying: Vol. II. and III by Dr. B. C. Punmia : Laxmi Publication - New Delhi.
3. Surveying and Levelling Vol. II by T. P. Kanetkar and S. V. Kulkarni Pune Vidyarthi Publication.
4. GPS Sattelite Surveying—Alfred Leick—Wiley
5. Remote sensing and Geographical Information System, By A. M. Chandra and S. K. Ghosh, Narosa Publishing House.
6. Remote Sensing & GIS,2/E—Bhatta-- Oxford University Press
7. Principles of Geographical Information System—Burrough-- Oxford University Press
8. Surveying—M.D.Saikia—PHI Learning Pvt .Ltd.Delhi
9. Advanced Surveying -Total Station, GIS and Remote Sensing by SatheeshGopi, R.Sathikumar and N. Madhu , Pearson publication
10. Surveying Vol. 2 by S. K. Duggal, McGraw Hill Publication
11. Remote sensing & image interpretation, Lillesand& Kiefer, John wiley Pub.
12. Surveying &levelling by R. Subramanian, Oxford Publication.

Suggested Reading

Bureau Gravimetrique International (BGI)
International GPS Service for Geodynamics (IGS)
International Association of Geodesy (IAG)
International Federation of Surveyors (FIG)
Permanent Service for Mean Sea Level (PSMSL)
Commission X Global and Regional Geodetic Networks
www.nrsa.gov.in
www.iirs-nrsa.gov.in
www.surveyofindia.gov.in

Savitribai Phule Pune University

TE Civil (2015 Course) w.e.f. June 2017

301008 Project Management and Engineering Economics

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I **(8 hours)**

Introduction to project management

Importance, Objectives & Functions of Management , Principles of Management, Categories of Project, Project Failure, Project--- Life Cycle Concept and Cost Components, Project Management Book of Knowledge {PMBOK} – Different Domain Areas, Project management Institute and Certified Project Management Professionals (PMP). Importance of organizational Structure in Management- Authority / Responsibility Relation, Management by objectives (MBO)

Unit –II **(08 hours)**

Project planning and scheduling

WBS – Work Breakdown Structure, Gantt/Bar chart & its Limitations, Network Planning, Network analysis, C. P. M.- . Activity on Arrow (A.O.A.), Critical path and type of Floats, Precedence network analysis (A.O.N.), Types of precedence relationship, P. E. R.T. Analysis

Unit –III **(08 hours)**

Project Resources and Site Planning

Objectives of Materials Management – Primary and Secondary Material Procurement Procedures - Material requirement - raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping – Use of Excel Sheets, ERP Software, Inventory Control - ABC analysis, EOQ, Introduction to Equipment Management – Fleet Management, Productivity Studies, Equipment Down Time, Sizing - Matching , Site Layout and Planning, Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs

Unit –IV **(08 hours)**

Project Monitoring and Control

Resource Allocation – Resource Smoothening and Levelling, Network Crashing – Time- Cost – Resource optimization, Project Monitoring - Methods, Updating and Earned Value Analysis, Introduction to use of Project Management Softwares – MS Project / Primavera, Case study on housing project scheduling for a small project with minimum 25 activities.

Unit –V (08 hours) Project Economics

Introduction to Project Economics - Definition, Principles, Importance in Construction Industry, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Annuities, Demand, Demand Schedule, Law of Demand, Demand Curve, Elasticity of Demand, Supply, Supply Schedule, Supply Curve, Elasticity of Supply Equilibrium, Equilibrium Price, Equilibrium Amount, Factors affecting Price Determination, Law of Diminishing Marginal Utility, Law of Substitution, Concept of Cost of Capital, Time Value of Money, Sources of Project Finances –

Concepts of Debt Capital and Equity Capital. Types of Capital – Fixed and Working, Equity Shares and Debenture Capital, FDI in Infrastructure

Unit-VI **(08 hours)**

Project appraisal

Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component], Study of Project Feasibility report and Detailed Project Report (DPR), Role of Project Management Consultants in Pre-tender and Post-tender.

Reference Books

1. Project Management—Khatua—Oxford University
2. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Management and Planning by B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.
6. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
7. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

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301009 Foundation Engineering

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit-I

Subsurface Investigations for Foundations (06 hours) Purpose and planning of subsurface exploration. Methods of Investigation: Trial pits, borings, depth & number of exploration holes, core recovery, RQD, Core Log. Geophysical methods– Seismic refraction and Electrical resistivity method. Disturbed and undisturbed sampling, types of samplers, degree of disturbance of a sampler. Field tests- SPT, N value correction and significance, DCPT, SCPT and introduction of advanced testing techniques like Pressure meter test. **Site visit is recommended to learn this topic.**

Unit-II

Bearing capacity and Shallow Foundation (06 hours) Basic definitions, Modes of shear failure, bearing capacity analysis- Terzaghi's, Hanson's, Meyerhof's, Skempton's, Vesics equations and IS code method - Rectangular and Circular footings. Bearing Capacity evaluation: - Plate Load Test and SPT. Housel's perimeter shear concept. Bearing capacity of layered soil. Effect of water table on bearing capacity. Effect of eccentricity. Shallow foundation- Types and Applications. Floating foundation. Presumptive bearing capacity.

Unit-III **(06 hours)**

a) Settlement and Consolidation Settlement: - Introduction, Causes of settlement. Pressure bulb, Contact pressure, Significant Depth of foundation, Allowable settlement, Differential settlement - I.S. criteria, Types - Elastic settlement, Consolidation settlement. Use of Plate Load test and SPT in settlement analysis. Allowable soil pressure.

b) Consolidation - Introduction, spring analogy, Terzaghi's consolidation theory, Laboratory consolidation test, Determination of coefficient of consolidation- Square root of time fitting method and logarithm of time fitting method. Time factor. Rate of settlement and its applications in shallow foundation. Introduction of Normal consolidation, over consolidation and Preconsolidation pressure.

Unit-IV **(06 hours)**

Deep Foundations

Introduction, Pile classification, Pile installation-Cast in-situ, driven and bored pile, Load carrying capacity of pile by static method, Dynamic methods-Engineering news formula and Modified ENR formula. Pile load test and Cyclic Pile load test. Group action- Feld rule. Rigid Blocks method. Negative skin friction. Settlement of pile group in cohesive soil by approximate method. Piers and Caissons- Definition, Types and uses. Well foundation: components, sand Island method.

Unit V **(06 hours)**

Cofferdams and Foundation on Black Cotton Soils

a) Cofferdams: Types and concepts of Steel Sheet Piles and Precast Concrete Piles, Interlocking Circular Piles, RC Diaphragm wall method.

b) Foundation on Black Cotton Soils: Characteristics of black cotton soil, swelling potential and its evaluation methods, Engineering problems, Swelling pressure measurement, Foundations on black cotton soil: design principles, Construction techniques in B.C soils, under reamed piles-Design principles and its construction Techniques. Stone Columns prefabricated vertical Drains, Preloading technique, and vibro flotation technique.

Unit VI **(06 hours)**

Soil Reinforcement and Earthquake Geo-techniques

a) Soil Reinforcement: Basic components and Mechanism of reinforced soil. Geosynthetics: type's, functional properties and requirements. Geosynthetic Applications in Civil Engineering.

b) Earthquake Geo-techniques Introduction, Earthquake Terminology, Sources of earthquake, Seismic zones of India, Magnitude of an earthquake, Intensity of earthquakes, Effect of ground motion on structures, General principles of earthquake resistant design. Liquefaction Phenomenon.

Reference Books

1. Dr. B. J. Kasmalkar, "Foundation Engineering", Pune Vidyarthi Griha Prakashan, Pune
2. Gopal Ranjan and A. S. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, (2010)
3. Dr. B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publications.
4. Soil Mechanics- T.William Lambe--Wiley
5. J. E. Bowels, "Foundation Analysis and Design", McGraw-Hill
6. Foudation Enginnering- P. C. Varghese-- PHI Learning Pvt. Ltd.
7. Soil Mechanics and Foundation Engineering- V. N. S Murthy, Marcel Dekker, Inc. Newyork.
8. Soil Mechanics & Foundation Engineering - Rao --Wiley
9. A. K. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers, 2009.
10. Engineering in Rocks for Slopes. Foundations and Tunnels - T Ramamurthy - PHI Learning
11. Geotechnical Engineering by Conduto, PHI, New Delhi.
12. Foundation Design Manual: N V Nayak, Dhanpat Rai Publications.
13. International Steven Kramer, "Geotechnical Earthquake Engineering", Prentice Hall Publications.
14. Practical Handbook of Grouting: Soil-Rock and Structures---James Warner-- Wiley

15. IS 1892, 1893, 2911, 6403, SP36 (PART-II)

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301010 Structural Design –II

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1.5 hours Paper
Practical: 4 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Term Work: 50 Marks, Oral Based on T.W.: 50 Marks

Unit I **(8 hours)**

Introduction to various design philosophies R.C structures: Historical development, Working stress method, Ultimate load method and Limit state method.

a) Working stress method: Moment of resistance of singly reinforced rectangular R.C. sections, Under reinforced, Balanced and Over reinforced sections. Moment of resistance of doubly reinforced rectangular sections.

b) Limit state method: Limit state of collapse, Limit state of serviceability and Limit state of durability. Characteristic strength, Characteristic load, concept of Safety - Probabilistic approach, Semi probabilistic approach. Partial safety factors for material strengths and loads. Study of Structural Properties of Concrete.

Unit II **(8 hours)**

a) Assumptions of Limit State Method, Strain variation diagram, Stress variation diagram, Design parameters for singly reinforced rectangular R.C. section, Moment of resistance of under reinforced and balanced section, M.R. of doubly reinforced rectangular section and flanged section.

b) Design of slab: One way, Simply supported, Cantilever and Continuous slabs by using IS code coefficients.

Unit III **(8 hours)**

a) Design of slab: Two way slabs: Simply supported, Continuous and Restrained.

b) Design of staircase: Dog legged and Open well.

Unit IV **(8 hours)**

Design of flexural members: Simply supported, Continuous, Cantilever beams (singly reinforced, doubly reinforced and flanged) for flexure.

Unit V **(08 hours)**

Design of flexural members:

a) Design of flexural members: For Shear, Bond and Torsion.

b) Design of flexural members: Redistribution of moments in continuous reinforced concrete beam.

Unit VI **(08 hours)**

a) Column: Introduction, Strain and Stress variation diagrams, axially loaded Short Column with minimum eccentricity requirements. Design of Short Column for axial load, Uni-axial, Biaxial bending using interaction curves.

b) Design of Isolated Column footing for axial load and uni-axial bending .

Term work

Design Assignments

a) Design of G + 2 (Residential/Commercial/Public) building covering all types of Slabs, Beams, Columns, Footings and Staircase (first and intermediate flights).

i. Minimum plan area of each floor shall be more than 150 m^2.

ii. Design of all plinth and ground beams.

iii. Design of all slabs, beams of first floor.

iv. Design of three types columns for, (a) axial load, (b)axial load + uniaxial BM, (c)axial load + biaxial BM), from terrace level to footing along with detailed load calculations and footing for columns with (a) axial load (b)axial load + uniaxial BM

v. Design any one element by using spread sheet.

vi. Detailing of reinforcement should be as per SP-34 & IS 13920

vii. Full imperial drawing sheets in four numbers. Out of which only structural plan drawing sheet shall be drawn by using any drafting software.

b) Reports of two site visits. (Building under construction)

Oral Examination shall be based on the above term work.

Note: Maximum number of students for projects not more than Four

Reference Books

1. "Illustrated Reinforced Concrete Design" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications' , Pune 411009
2. "Illustrated Design of Reinforced Concrete Buildings (G+3)" by Dr. V.L.Shah and Dr. S.R. Karve, 'Structures Publications', Pune 411009.
3. "Design of Reinforced Concrete Structures" by Subramanian, 'Oxford University Press'.
4. "Limit State Analysis and Design" by P. Dayaratnram, 'Wheeler Publishing company', Delhi.
5. "Comprehensive Design of R.C. Structures" by Punmia, Jain and Jain, 'Standard Book House', New Delhi.
6. "RCC Analysis and Design" by Sinha, S, Chand and Co. New Delhi.
7. "Reinforced Concrete Design" by Varghese, PHI, New Delhi.
8. "Reinforced Concrete Design" by Pillai Menon, 'Tata McGraw Hill', New Delhi.
9. "Design of Concrete Structure" by J N Bandyopadhyay, PHI, New Delhi.

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301011 Environmental Engineering-I

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks--1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Practical Exam: 50 Marks

Unit-I **(08 hours)**

A) Noise Pollution: Sound measurements – Sound pressure, Intensity, Sound pressure level, Loudness, Equivalent noise level and Cumulative noise level.

B) Air Pollution: Atmospheric stability, Mixing heights, Meteorological parameters.

Air pollution control mechanism. Equipment for particulate contaminants. Principle and working of Settling chamber, Cyclone, Fabric filter, ESP. Gaseous contaminants control by adsorption and absorption technique.

C) Municipal Solid Waste: Concept of Municipal Solid waste management, Sources, Classifications, Treatment (composting &anaerobic digestion) Disposal (sanitary land fill)

Unit -II **(08 hours)**

A) Introduction to water supply scheme: Data collection for water supply scheme, Components and layout. Design period, Factors affecting design period.

B) Quantity: Rate of water consumption for various purposes like domestic, Industrial, Institutional, Commercial, Fire demand and Water system losses, Factors affecting rate of demand, Population forecasting.

C) Quality: Physical, Chemical, Radioactivity and Bacteriological Characteristics, Heavy metals. Standards as per IS: 10500 (2012)

Unit –III **(08 hours)**

A) Water treatment: Principles of water treatment operations and processes, Water treatment flow sheets.

B) Aeration: Principle and Concept, Necessity, Methods, Removal of taste and odour. Design of aeration fountain.

C) Sedimentation: Plain and chemical assisted - principle, efficiency of an ideal settling basin, Settling velocity, Types of sedimentation tanks, Design of sedimentation tank. Introduction & design of tube settlers.

Unit -IV **(08 hours)**

A) Coagulation and flocculation: Principle of coagulation, Common coagulants alum & ferric salts, Introduction to other coagulant aids like bentonite clay, Lime stone, Silicates and Polyelectrolytes, Introduction of natural coagulants, Mean velocity gradient "G" and Power consumption, Design of Flocculation chamber, Design of Clari-flocculator.

B) Filtration: Theory of filtration, Mechanism of filtration, Filter materials, Types: Rapid, Gravity, Pressure filter, Multimedia and dual media filters, Components, Under drainage system, Working and cleaning of filters, Operational troubles, Design of Rapid sand Gravity filters.

Unit -V **(08 hours)**

A) Disinfection: Mechanism, Factors affecting disinfection, Types of disinfectants, Types and methods of chlorination, Break point chlorination, Bleaching powder estimation.
B) Water softening methods and Demineralization : lime-soda, Ion-Exchange, R.O. and Electrodialysis
C) Fluoridation and defluoridation.

Unit-VI **(08 hours)**

A) Water distribution system: System of water supply- Continuous and intermittent system. Different distribution systems and their components. ESR- Design of ESR capacity. Wastage and leakage of Water- Detection and Prevention.
B) Rainwater harvesting: Introduction, need, methods and components of domestic rainwater harvesting system. Design of roof top rainwater harvesting system.
C) Introduction to Packaged WTP in townships, big commercial plants, necessity (On-site water treatment)

Term Work

Note- Any 8 out of 10 Practicals. (a ,b & c are compulsory.)

a) Practicals.

1. pH and Alkalinity of raw water, soft drinks & tea.
2. Total hardness and components of raw water.
3. Chlorides in water.
4. Chlorine demand and residual chlorine.
5. Sodium or Potassium or Calcium using flame photometer.
6. Turbidity and optimum dose of alum.
7. Fluorides or Iron contents in water.
8. Most Probable Number (MPN)
9. Ambient air quality monitoring for PM10/PM2.5,SO2 & NOx.
10. Measurement of noise levels at various locations using sound level meter, Calculate cumulative noise level at any one location.

b) Site visit to water treatment plant and Detailed Report.

c) Assignment 1. Study of Water intake structures.
2. Complete Design of WTP using appropriate software.

Text / Reference Books

Reference Books:

1. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications.
2. Optimal Design of Water Distribution Networks: P. R. Bhave, Narosa Publishing House.
3. Rain Water Harvesting: Making water every body's business by CSE (Centre for Science and Environment) www.cse.org
4. Harvesting Faith: Linda K. Hubalek. Published by Butterfield books.
5. CPHEEO Manual on Water Supply & Treatment.
6. Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association).

Text Books:

1.Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2.Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, DhanpatRai Publishing Company, New Delhi.
3 Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
4 Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications.
5. Theory and practice of water and waste water treatment--Wiley
6. Water Supply and Treatment Manual: Govt. of India Publication.
7. Waste Water Treatment-Concept Design and Approach---C.L.Karia,R.A.Christian--PHI
8. Environmental Remote Sensing from Regional to Global Scales—Ed.Giles Foody—Wiley
9. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.

Suggested Reading:

- Environmental Engineering by N. N. Barak , MGH
- Environmental Engineering by Venugopal Rao, PHI
- Environmental Engineering by Steel,McGhee , MGH
- Water Supply & Engineering by Pande andCarne , Tata McGraw Hill
- Water Supply Engineering by Harold Eaton Babbit & James Joseph Doland , MGH
- Principles of Water Treatment by Keny J. Howe, MWH.
- Water treatment : principles & Design 3rd edition by John C Crittenden R. Rhodes
- Water quality &Treatment : Handbook on Drinking Water 6th Edition by James K. Edzwald.
- Standard Methods, APHA,AWWA.
- Environmental Engineering Laboratory Manual by B. Kotain & Dr. N. Kumarswamy
- NEERJ Laboratory Manual

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301012 Seminar

Teaching scheme	Examination scheme
Practical: 1 hour/week	Oral Exam: 50 Marks

Oral examination shall be conducted based on a Seminar report to be prepared by each individual. The seminar report should contain the following.

1. Introduction of the topic, its relevance to the construction industry, need for the study, aims and subjunctives, limitations.
2. Literature review from books, journals, conference proceedings, published reports / articles / documents from minimum 8 references.
3. Theoretical chapter on the topic of study, advantages and limitations.
4. Photographs from web search / experiments done / projects visited / organizations visited for studying documents / procedures/ systems / materials/ equipment/ technologies used.
5. Ongoing research areas, information, about commercial vendors, information on benefit – cost aspects.
6. Concluding remarks with respect to commercial/ practical and social applications.
7. References in standard format.

Note:- In order to arouse the interest of students and engage them in active learning, mini-projects/ complex problems may be given in groups of maximum 4students, covering different aspects involved in Civil engineering so as to also enable the students to submit separate individual reports as required above.

Internal guides may prepare a continuous evaluation sheet of each individual and refer it to the external examiner for consideration.

The oral examination of each individual may then be conducted as per the practice adopted for other subjects.

SAVITRIBAI PHULE PUNE UNIVERSITY

Board of Studies in Civil Engineering

Structure and Syllabus for B.E. Civil 2015 Course (w. e. f. June, 2018)

SAVITRIBAI PHULE PUNE UNIVERSITY

Board of Studies in Civil Engineering

Structure for B.E. Civil 2015 Course (w. e. f. June 2018)

	Semester-I										
Subject code	**Subject**	**Teaching Scheme Hrs/Week**			**In-Semester Assessment**	**TW**	**Pract /Or**	**End-Semester Exam**	**Total**	**Credit**	
		Lect	**Tu**	**Pr**						**Th**	**Lab**
401 001	Environmental Engineering II	3	--	2	30	--	50	70	150	3	1
401002	Transportation Engineering	3	--	2	30	50	--	70	150	3	1
401 003	Structural Design and Drawing III	4	--	2	30	--	50	70	150	4	1
401 004	Elective I	3	--	2	30	50	--	70	150	3	1
401 005	Elective II	3	--	--	30	--	--	70	100	3	--
401 006	Project (Phase-I)	--	2	--	--	--	50	--	50	--	2
Total :		16	2	8	150	100	150	350	750	16	6
										22 Credits	

	Semester-II										
Subject code	**Subject**	**Teaching Scheme Hrs/Week**			**In-Semester Assessment**	**TW**	**Or**	**End-Semester Exam**	**Total**	**Credit**	
		Lect	**Tu**	**Pr**						**Th**	**Pr**
401 007	Dams and Hydraulic Structures	3	--	2	30	--	50	70	150	3	1
401008	Quantity Surveying, Contracts and tenders	3	--	2	30	--	50	70	150	3	1
401 009	Elective III	3	--	2	30	50	--	70	150	3	1
401 010	Elective IV	3	--	2	30	50	--	70	150	3	1
401 006	Project	--	6	--	--	50	100	--	150	--	6
Total :		12	6	8	120	150	200	280	750	12	10
										22 Credits	

Following will be the list of electives.

Semester I

Elective-I 401 004	Elective-II 401 005
1. Structural Design of Bridges	1. Matrix Methods of Structural Analysis
2. Systems Approach in Civil Engineering	2. Integrated Water Resources Planning and Management
3. Advanced Concrete Technology	3. TQM & MIS in Civil Engineering
4. Architecture and Town Planning	4. Earthquake Engineering
5. Advanced Engineering Geology with Rock Mechanics	5. Advanced Geotechnical Engineering

Semester-II

Elective-III 401 009	Elective-IV 401 010
1. Advanced Structural Design	1. Construction Management
2. Statistical Analysis and Computational Methods in Civil Engineering	2. Advanced Transportation Engineering
3. Hydropower Engineering	3. Advanced foundation Engineering.
4. Air Pollution and control	4. Coastal Engineering
5. Finite Element Method in Civil Engineering	**5. Open Elective**
6. Airport and Bridge Engineering	a) Plumbing Engineering
	b) Green Building Technology
	c) Ferrocement Technology
	d) Sub sea Engineering
	e) Geoinformatics

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BE Civil 2015 Course

Syllabus

Semester-I

401 001 Environmental Engineering – II

Teaching Scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme:
Paper In-sem : 30 Marks (1Hr.)
Paper End-sem : 70 Marks (2.5 Hrs.)
Oral : 50 Marks

Unit I **(6 Hrs.)**

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation (sewage and storm water quantification), design of storm water system, Design of circular sanitary sewers. Pumping of sewage, necessity, location. Effect of change of life style on sewage quality.

Characteristics of sewage: Methods of sampling, Physical, chemical and biological characteristics, Quality requirements for disposal and recycle/reuse of sewage as per CPCB norms.

Stream sanitation: Self-purification of natural streams, river classification as per MoEF & CC, Govt. of India; Oxygen Sag Curve, Streeter - Phelps equation and terminology (without derivation and numerical). National river cleaning plan.

Unit II **(6Hrs.)**

Sewage treatment: Pollution due to improper disposal of sewage, Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, Unit operation and Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.

Unit III **(6 Hrs.)**

Theory & design of secondary treatment units: Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, role of microorganism in wastewater treatment.

Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking & control, modifications in ASP. Operational problems and maintenance in ASP.
Concept of Sequential batch reactor (SBR) .

Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contactors.

Unit IV **(6 Hrs.)**

Low cost treatment methods for rural areas

Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated Lagoons, design of aerated lagoon.

Introduction and theory of Phytoremediation technology for wastewater treatment. Introduction and theory of root zone cleaning system.

Unit V **(6 Hrs.)**

Onsite Sanitation Treatment systems: Septic tank**,** up-flow anaerobic filter. and Package Sewage Treatment Plant- Working principle, advantages and disadvantages. Introduction to MBR, MBBR and FMBR.

Anaerobic digester: Principle of anaerobic digestion, stages of digestion, bio – gas production its characteristics & application, factors governing anaerobic digestion,. Dewatering of sludge by gravity thickener, sludge drying bed, decanters. Methods of sludge treatment and disposal, advantages & disadvantages. Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages.

Unit VI **(6 Hrs.)**

Industrial waste water treatment: Equalization and neutralization. Application of preliminary, primary and secondary treatment for industrial wastewater as per the CPCB norms.

Sources of waste water generation from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries: Sugar, dairy and distillery. Discharge standards as per CPCB norms.

Recycle & reuse of treated wastewater: Gardening, sewage farming, W.C. Flushing, reuse in industry.

Term Work:

A. Compulsory Assignment:

1. Brief report on Sewer materials, choice of materials, testing of sewer pipes, sewer appurtenances.
2. Design of septic tank.

B. Experiments:

The term work shall consist of a journal giving details of at least 8 out of 12 of the following experiments conducted in Environmental Engineering laboratory, of which, **Sr.No.12 is compulsory**.

Determination of

1. Solids -Total solids, suspended solids, volatile solids, settle able solids & non settle able solids.
2. Sludge Volume Index.
3. Dissolved oxygen.
4. Bio-Chemical Oxygen Demand.
5. Chemical Oxygen Demand.
6. Electrical Conductivity.
7. Determination of Phosphates by spectrophotometer.
8. Determination of Nitrates by spectrophotometer.
9. Determination of heavy metals like Cr6+ or Zn or Ni or Cd.
10. Determination of total nitrogen by Kjeldal method.
11. Visit to domestic / Industrial wastewater treatment plant & its detailed reports.

12. Computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment Plant (ETP) of Sugar or Dairy Industry using suitable software (C programming or any other suitable software).

Note: - Term Work should include a detailed analysis of practical interpretation, significance and application of test results.

Text Books:

1. Environmental studies by Rajgopalan- Oxford University Press.
2. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.
3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.
4. Waste Water Treatment – Rao & Dutta.

Reference Books:

5. Waste Water Engg. – B.C. Punmia & Ashok Jain - Arihant Publications.
6. Water Supply & Waste Water Engg.- B.S.N. Raju – TMH publication.
7. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.
8. Environmental Engg. – Davis - McGraw Hill Publication.
9. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India.
10. Standard Methods by APHA.

I.S. Codes:

I.S. 3025 (all parts).

e – Resources:

i) http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
ii) http://cpcb.nic .in
iii) http://moef.nic .in

401 002 Transportation Engineering

Teaching scheme
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
In-Sem Exam: 30 Marks 1 Hr.
End-Sem Exam: 70 Marks 2.5 Hrs.
Term work: 50 Marks

Unit I **(6 Hrs.)**

Highway Development & Planning:

History, Development Plans, Classification of roads, Road Patterns, road development in India - Vision 2021 & Rural Road Development Vision 2025, Current road projects in India; highway alignment and highway project report preparation (Planning surveys & Master Plans based on saturation system).

Unit II: **(6 Hrs.)**

Geometric design of highways:

Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems, Highway drainage, Importance of highway drainage, subsurface and surface drainage systems.

Unit III **(6 Hrs.)**

Traffic engineering & control:

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control devices (signs, signals, islands, road markings); Accident studies, types of road intersections; parking studies; highway lighting.

Unit IV **(6 Hrs.)**

Pavement materials:

Materials used in Highway Construction and related tests - Soil subgrade and CBR Test, Stone aggregates, bituminous binders, bituminous paving mixes, viscosity based gradation of bitumen, Modified Bitumen (Cutbacks, Emulsions, Crumbed Rubber Modified Bitumen – CRMB, Polymer Modified Bitumen-PMB, Foamed Bitumen), Marshall Stability Mix Design and Test (All 5 test parameters).

Unit V **(6 Hrs.)**

Pavement Design:

Introduction; flexible pavements – Computation of design traffic (Vehicle Damage Factor VDF, Lane distribution factor LDF, Traffic growth rate); stresses in flexible pavements; design guidelines for flexible pavements as per IRC 37-2012 (steps only); rigid pavements- components and functions; factors affecting design; stresses in rigid pavements (ESWL); design guidelines for concrete pavements as per IRC 58-2015 (steps only); joints in CC pavements, problems.

Unit VI **(6 Hrs.)**

A. Pavement Construction:

Construction process of GSB, WBM, WMM; Cemented base, Introduction to bituminous works such as prime coat, tack coat, seal coat, Built-up Spray Grout (BSG), Asphaltic Concrete (AC) or Bituminous Concrete (BC), Bituminous Macadam (BM), Dense Bituminous Macadam (DBM) and premix carpet, Dry lean Concrete (DLC), Pavement Quality Concrete (PQC).

B. Modern Trends in Highway Materials, Construction & Maintenance:

Mastic Asphalt, Cold Mix Asphalt Technology, Warm Mix Asphalt Technology, Recycled/Reclaimed Asphalt Pavement (RAP) (Manual Series - 2), Concept of Super pave Mix Design (Super pave Series 2), Non-Destructive Evaluation of Pavements (Falling Weight Deflectometer FWD).

Term work:

Term work shall consist of the following:

A. Practicals:

I. Tests on Aggregate (Any Five) :

1. Aggregate Impact Value Test
2. Aggregate Crushing Strength Test
3. Los Angeles Abrasion Test
4. Shape Test (Flakiness Index and Elongation Index)
5. Specific Gravity and Water Absorption Test by basket method
6. Stripping Value Test
7. Soundness Test

II. Tests on Bitumen (Any Five):

1. Penetration Test
2. Ductility Test
3. Viscosity Test (Tar Viscometer)
4. Softening Point Test
5. Flash Point & Fire Point Test
6. Specific Gravity Test
7. Bitumen Extraction Test

III. Tests on Aggregate Bitumen Combined:

1. Marshall Stability Test

IV. Tests on Soil Subgrade:

1. California Bearing Ratio Test (CBR Test)

B. Technical visits to:

1) Road Construction and/or RAP Site
2) Hot mix Plant with detailed report

Text Books:

1. Highway engineering – S.K. Khanna, C.E.G. Justo & A. Veeraragavan, Nem Chand and Brothers, Roorkee
2. Principles of Highway Engineering and Traffic Analysis (4^{th} edition) F. L. Mannering, Scott S. Washburn, Wiley India
3. Principles and practices of Highway engineering –Dr. L.R. Kadiyali, Khanna Publishers Delhi.

Reference Books:

1. A Course in Highway Engineering – S.P. Bindra, Dhanpat Rai and Sons, Delhi.
2. Principles of Transportation Engineering – G.V. Rao Tata MacGraw Hill Publication
3. Highway Engineering – Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
4. Principles of Transportation Engineering – Partha Chakraborty, Animesh Das, Prentice Hall of India Pvt. Ltd., New Delhi.
5. Highway and Bridge Engineering – B.L. Gupta, Amit Gupta Standard publishers Distributors, Delhi.

Other References:

1. National Cooperative Highway Research Program (NCHRP)
2. Federal Highway Authority (FHWA)

Codes:

1. I.S. 1201 TO 1220-1978, IS 73, IS 2386 PART I toV
2. I.R.C. 58- 2015, IRC 37-2012
3. Specifications for Road and Bridge works (MORTH) 5th Revision, New Delhi.

e – Resources:

1. www.nptel.iitm.ac.in/courses/iitkanpur
2. www.cdeep.iitb.ac.in/nptel
3. www.fhwa.dot

401 003 Structural Design and Drawing III

Teaching Scheme:
Lectures: 4 Hrs / week
Practical: 2 Hrs/week

Examination Scheme:
In Sem: 30 and End Sem : 70 Marks
Oral: 50 Marks
Duration: In-Sem: 1.5 Hrs.
End-Sem: 3 Hrs.

Unit 1 **(8 Hrs.)**

Prestressed concrete – Analysis:

Introduction, Basic concepts, materials, various Pre-tensioning and Post-tensioning systems, concept of losses, Stress calculations, and concept of cable profile.

Unit 2 **(8 Hrs.)**

Prestressed concrete – Design:

Design of post tensioned prestressed concrete simply supported rectangular and flanged sections for flexure and shear including end block.

Design of one way and two way post tensioned slabs (Single panel only).

Unit 3 **(8 Hrs.)**

Design of Flat slab:

Introduction to flat slab, Design of prestressed two way flat slab by direct design method.

Unit 4 **(8 Hrs.)**

Earth retaining structures:

Introduction, Functions and types of retaining walls, Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions.

Unit 5 **(8 Hrs.)**

Liquid retaining structures:

Introduction, types, function, codal provisions, methods of analysis, Design of circular, square, and rectangular water tanks resting on ground by working stress method, Introduction to limit state design of water tanks.

Unit 6 **(8 Hrs.)**

Introduction to vibration and earthquake analysis:

Introduction to single and multi-degree of freedom systems: free, forced, un-damped and damped vibration, Estimation of earthquake forces by seismic coefficient method, Estimation of combined effect of lateral forces and vertical loading on G+2 storied frames.

Note: Design based on above unit shall conform to latest versions of IS 456, IS 875, IS 1343, IS 3370, IS 1893, IS 13920.

Term Work:

Term work shall be based on the above syllabus. It consists of

1) Assignment on calculation of losses in prestress.
2) Assignment on stress calculation in prestressed structures.
3) Design and detailing of design of prestressed girder.
4) Design and detailing of prestressed flat slab by direct design method.
5) Design and detailing of retaining wall for various loading conditions.
6) Design and detailing of ground resting water tank.
7) Report on analysis and design of any one of the structures listed in the syllabus using software or computer program.
8) Two site visit reports, one each on RCC and Prestressed concrete structure.

Note:

(a) There should be separate design problem statement for a group of students not exceeding *four* in numbers.

(b) Minimum four full imperial sheets based on two projects on design of RCC and two projects on design of prestressed concrete structural elements.

Text Books:

1. Limit state theory and design of reinforced - Dr. V. L. Shah and Dr S. R. Karve - Structures Publications, Pune.
2. Fundamentals of Reinforced Concrete- N.C. Sinha, S.K. Roy – S. Chand & Co. Ltd
3. Advanced design of structures- Krishnaraju - Mc Graw Hill.
4. Design of Prestressed concrete structures- T. Y. Lin.
5. Prestressed Concrete- N. Krishna Raju – Tata Mc Graw Hill Publication Co.
6. Earthquake resistant design of structures- Agarwal, Shrikhande, PHI learning.

Reference Books:

7. Comprehensive RCC Design - Punmia, Jain & Jain - Laxmi Publications.
8. Design of design of reinforced Concrete structures- M. L. Gambhir –PHI.
9. Reinforced Concrete, Vol I- Dr.H J. Shah Charotar Publishing House
10. Prestressed Concrete – A Fundamental Approach- Edward Nawy – PHI..
11. Reinforced concrete design- Pillai and Menon TMH.
12. Elementary Structural Dynamics-Selvam, Dhanpatrai Publications.

I.S. Codes

1. IS: 456: Indian Standard code of practice for plain and reinforced concrete, BIS, New Delhi.
2. IS: 1343: Indian Standard code of practice for Prestressed concrete, BIS, New Delhi.
3. IS: 1893: Indian Standard Code of practice for criteria for Earthquake resistant design of structures, BIS, New Delhi.
4. IS: 3370-Indian Standard code of practice for concrete structures for storage of liquids, BIS, New Delhi.

401 004 Elective I: (1) Structural Design of Bridges

Teaching Scheme:
Lecture: 3 Hrs/week.
Practical:- 2 Hrs/week

Examination Scheme:
In-sem. Exam.: 30 Marks (1 Hr.)
End Sem. Exam.: 70 Marks (2.5 Hrs.)
Term work: 50 Marks.

Unit 1 **(6 Hrs.)**

Introduction to RC highway bridges and steel railway bridges: Types of bridges, classification, IRC codal provisions for RC highway bridges, IRS codal provisions for railway steel bridges, loading standards.

Unit 2 **(6 Hrs.)**

RC highway bridges: Slab culvert and T-beam deck slab bridges – Design of slab culvert, Deck slab: Structural configuration, Piegaud's method, analysis and design of deck slab.

Unit 3 **(6 Hrs.)**

RC highway bridges: T-beam deck slab bridges – Post tensioned girders: Load distribution on longitudinal and cross girders, methods of analysis, analysis and design of longitudinal and cross girders.

Unit 4 **(6 Hrs.)**

Railway steel bridges – Truss bridges: Structural configurations, loads and load combinations, analysis and design of truss elements, longitudinal and cross-girders, bracing systems.

Unit 5 **(6 Hrs.)**

Bearings: Function of bearings, types of bearings, design of steel bearings and elastomeric bearings.

Unit 6 **(6 Hrs.)**

Sub-structure: Function, loads, analysis and design of RC abutments and piers, design of well foundation.

Note: The designs should conform to the latest codal provisions.

Term Work:

a) One project on RC highway bridges which shall include - the design of deck slab, longitudinal girder, cross-girder, bearings and abutment and pier.

The detailing shall be shown in at least three full imperial sheets.

b) One project on railway steel bridges which shall include – the design of truss elements, longitudinal girder, cross-girder, and bearings.

The detailing shall be shown in at least two full imperial sheets.

c) The term work can be prepared in a group of not more than four students in a group.

d) Report of at least two site visits covering the contents of the syllabus.

e) The projects can be done using any drafting software.

Reference Books:

1. Design of Bridges, N. Krishna Raju, Oxford and IBH Publishing Company Pvt. Ltd.
2. Design of Bridge Structures, M.A. Jayaram Prentice-Hall Of India Pvt. Limited. Prestressed Concrete, N. Krishna Raju, Tata-McGraw Hill.
3. Design of Steel Structures, Ramachandra, Standard Publications New-Delhi.

401 004 Elective I (2) - Systems Approach in Civil Engineering

Teaching scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.
Term Work: 50 marks.

Unit 1: Introduction of systems approach (6 Hrs)

(A) Introduction to System approach, Operations Research and Optimization Techniques, Applications of systems approach in Civil Engineering.

(B) Introduction to Linear and Non linear programming methods (with reference to objective function, constraints), Graphical solutions to LP problems.

(C) Local & Global optima, unimodal function, convex and concave function.

Unit 2: Stochastic Programming (6 Hrs)

(A) Sequencing– n jobs through 2, 3 and M machines.

(B) Queuing Theory : elements of Queuing system and it's operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single channel Queuing theory : Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1) : (FCFS/ /).

(C) Simulation : Monte Carlo Simulation.

Unit3: Linear programming (A) (6 Hrs)

(A) The Transportation Model and its variants.

(B) Assignment Model, and its variants.

Unit 4: Linear programming (B) (6 Hrs)

(A) Formulation of Linear optimization models for Civil engineering applications. The simplex method.

(B) Method of Big M, Two phase method, duality.

Unit 5: Nonlinear programming (6 Hrs)

(A) Single variable unconstrained optimization: Sequential Search Techniques-Dichotomous, Fibonacci, Golden section.

(B) Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method.

(C) Multivariable optimization with equality constraints - Lagrange Multiplier Technique.

Unit 6: Dynamic programming, Games Theory & Replacement Model (6 Hrs)

(A) Multi stage decision processes, Principle of optimality, recursive equation, Applications of D. P.

(B) Games Theory – 2 persons games theory, various definitions, application of games theory to construction Management.

(C) Replacement of items whose maintenance and repair cost increase with time, ignoring time value of money.

Term Work :

1. One exercise/assignment on each unit. Out of these any one exercise/assignment to be solved using Computer.
2. One exercise on formulation of a problem applicable to any field of Civil Engineering, requiring use of LP/ NLP/ DP. Formulation of objective function and constraints (No solution).

Text Books :

1. Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).
2. Engineering Optimization: Methods and Application-- A. Ravindran, K. M. Ragsdell—Wiley India.
3. Engineering Optimization by S. S. Rao.
4. Operations Research by Hamdy A. Taha.
5. Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill) .
6. Operations Research by Pannerselvam, PHI publications.

Reference Books :

1. Topics in Management Science by Robert E. Markland(Wiley Publication).
2. An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen.
3. A System Approach to Civil Engineering Planning & Design by Thomas K. Jewell (Harper Row Publishers).

e - Resources

1. Mathematical Model for Optimization (MMO Software).
2. nptel.iitm.ac.in/courses/webcourse-contents/IISc-Bang/OPTIMISATION METHODS/New-index1.html.

401004 Elective I (3) - Advanced Concrete Technology

Teaching scheme
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination scheme
In semester exam: 30 Marks-1 Hr.
End semester exam: 70 Marks—2.5 Hrs.
Term Work: 50 Marks

Unit I **(6 Hrs.)**

Cement and its types: general, hydration of cement, alkali aggregate reaction. Grading curves of aggregates, Manufactured sand as fine aggregate, copper slag as fine aggregate.

Concrete: properties of concrete, w/b ratio, gel space ratio, Problems on maturity concept, aggregate cement bond strength, Green concrete, Guidelines for Quality control & Quality assurance of concrete, Effect of admixtures.

Unit II **(6 Hrs.)**

Structural Light weight concrete, ultra light weight concrete, vacuum concrete, mass concrete, waste material based concrete, sulphur concrete and sulphur infiltrated concrete, Jet cement concrete (ultra rapid hardening), gap graded concrete, high strength concrete, high performance concrete ,Self curing concrete, Pervious concrete, Geo polymer concrete .

Unit III **(6 Hrs.)**

Design of high strength concrete mixes, design of light weight aggregate concrete mixes, design of fly ash cement concrete mixes, design of high density concrete mixes, Design of pump able concrete mixes, Design of self-compacting concrete.

Advanced non-destructive testing methods: ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermographs**.**

Unit IV **(6 Hrs.)**

Historical development of fibre reinforced concrete, properties of metallic fibre, polymeric fibres, carbon fibres, glass fibres, Basalt fibres and naturally occurring fibres. Interaction between fibres and matrix (uncracked and cracked matrix), basic concepts and mechanical properties: tension and bending.

Unit V **(6 Hrs.)**

Properties of hardened frc, behavior under compression, tension and flexure of steel fibres and polymeric fibres, GFRC, SFRC, SIFCON,SIMCON -development, constituent materials, casting, quality control tests and physical properties.

Unit VI **(6 Hrs.)**

Ferrocement: Properties & specifications of ferrocement materials ,analysis and design of prefabricated concrete structural elements,manufacturing process of industrial concrete elements, precast construction, erection and assembly techniques.

Termwork / Labwork :

The Termwork / Labwork will be based on completion of assignments / practicals / reports of site visits, confined to the course in that semester.

1. Write a review on any recent research article from standard peer-reviewed journal.
2. Report on at least one patent (national/international)– on any topic related to concrete technology.
3. Concrete mix design and production in lab of any one – Self compacting concrete, Fiber reinforced concrete, light-weight concrete, high strength or ultra-high strength concrete . Comparison with traditional concrete mix is to be clearly stated in the report. 4. Cost analysis (material, labour, equipment, others) of any type of concrete for lab, in-situ and RMC production.
4. Perform any two Fresh (workability tests – Slump Flow Test, T-50, J-Ring, Visual Stability Index, Column Segregation, L-Box, U-box) and Hardened (Compressive, tensile, flexural) properties tests on any high performance concrete.
5. Any one experiment on any one of the topics – NDTs; Microscopic examination of cement/concrete; Performance study of any one admixture (Mineral/Chemical) in concrete.
6. Visit reports on minimum two site visits - exploring the field and practical aspects of concrete technology.

Note:

Term Work should include a detailed analysis of practical interpretation, significance and application of test results including above contents and site visit report in form of journal.

Text books:

1. Concrete Technology --M.S. Shetty, S. Chand Publications.
2. Concrete Technology -- A R Santhakumar, Oxford University Press.
3. Concrete technology -- M. L. Gambhir, Tata Mcgraw Hill Publications.
4. Fiber Reinforced Cement Composite- P.N.Balguru & P.N.Shah.
5. Concrete: Microstructure, Properties and Materials-- P. Kumar Mehta and P. S. M. Monteiro-- Tata Mc-Graw Hill Education Pvt. Ltd.

Reference Books:

1. Handbook on Advanced concrete Technology Edited by N V Nayak,A .K.Jain, Narosa Publishing House .
2. Design of concrete mixes by Raju N Krishna, CBS Publisher.
3. Properties of concrete by A. M. Neville, Longman Publishers.
4. Concrete Technology by R.S. Varshney, Oxford and IBH.
5. Concrete technology by A M. Neville, J.J. Brooks, Pearson.
6. Ferrocement Construction Mannual-Dr. D.B.Divekar-1030, Shivaji Nagar,Model Colony, Pune.
7. Concrete Mix Design-A.P.Remideos--Himalaya Publishing House (ISBN-978-81-8318-996-5
8. Concrete, by P. Kumar Metha, Gujrat Ambuja.
9. Learning from failures ---- R.N.Raikar.
10. Structural Diagnosis ---- R. N. Raikar.
11. Concrete Mix Design---Prof. Gajanan Sabnis.

General Reading suggested:

1) Codes : i) IS 456 ii) IS 383 iii) IS 10262-2009 iv) IS 9103.
2) Ambuja cement booklets on concrete Vol .1 to 158.
3) ACC booklets on concrete.

401 004 Elective I (4)- Architecture and Town Planning

Teaching scheme:
Lectures: 3 Hours/week
Practical: 2 Hrs/week

Examination scheme:
In semester exam: 30 marks-1 Hr.
End semester exam: 70 marks-2.5 Hrs.
Term Work: 50 marks

Unit I **(6 Hrs.)**

• Principles and elements of Architectural Composition.

• Qualities of Architecture: user friendly, contextual, ecofriendly, utility of spaces, future growth etc.

• Role of "Urban Planner and Architect" in planning and designing in relation with spatial organization, utility, demand of the area and supply.

Unit II: **(6 Hrs.)**

• Landscaping: importance , objectives, principles, elements, material (soft and hard).

• Urban renewal for quality of life and livability.

• Importance of sustainable architecture with case study.

Unit III: **(6 Hrs.)**

• Goals and Objectives of planning; components of planning; benefits of planning.

• Levels of planning: Regional plan, Development Plan, Town Planning Scheme.

• Neighborhood plan; Types of Development plans: Master Plan, City Development Plan, Structure Plan.

Unit IV: **(6 Hrs.)**

• Various types of civic surveys for DP: demographic, housing, land use, Water Supply & sanitation, etc.

• Planning agencies for various levels of planning. Their organization and purpose (CIDCO-MHADA-MIDC, MMRDA/ PMRDA etc).

• Traffic transportation systems: urban road, hierarchy, traffic management, Intelligent Transport Systems.

Unit V: **(6 Hrs.)**

• Legislative mechanism for preparation of DP: MRTP Act 1966.

• UDPFI guidelines (for land use, infrastructure etc.), SEZ, CRZ, Smart City Guidelines.

Unit VI : **(6 Hrs.)**

• Special townships, Land Acquisition Rehabilitation and Resettlement Act 2013.

• Application of GIS, GPS, remote sensing in planning.

Term Work: - 50 Marks

Sr. no. 1 and 2 are compulsory and any four from remaining.

1. Study and analysis of Development Plan with respect to land use, services, infrastructure, street furniture, housing etc. (group work).
2. Neighborhood- planning (group work).
3. Report on contribution of Engineers, Planners and Architects in post-independence India (individual work).
4. Report on any existing new towns and planned towns like new Mumbai, Gandhinagar, PCNTDA etc.(infrastructure, disaster management etc), (individual work).
5. Study of salient features of urban renewal schemes (group work).
6. Study of any existing town planning scheme (group work).
7. Smart City approaches (individual work).
8. Study of Special Townships: (site visit) (group work).
9. Study of urban housing and housing change (group work).

Text Books:

1. Town Planning By G K Hiraskar --Town Planning by S Rangwala.
2. Building Drawing and Built Environment- 5th Edition – Shah, Kale, Patki--Planning Legislation by Koperdekar and Diwan.
3. G. K. Bandopadhyaya, “Text Book of Town Planning”.
4. Climate Responsive Architecture – Arvind Krishnan.
5. Introduction to Landscape Architecture by Michael Laurie.

Reference Books:

- MRTP Act 1966.
- Manual Of Tropical Housing And Building By Koenigsbeger.

- Sustainable Building Design Manual.
- UDPFI Guidelines.
- "The Urban Pattern: City planning and design" by Gallion and Eisner.
- Design of cities by Edmond bacon.
- LARR Act 2013.
- MoUD By GoI.
- Web sites of NRSA, CIDCO, MHADA, MIDC, MMRDA, PMRDA.

401004 Elective-I (5) Advanced Engineering Geology with Rock Mechanics

Teaching Scheme:
Lecture: 3 Hrs/week
Practical: 2 Hrs/week

Exam. Scheme:
In Sem: 30 Marks (1 Hr.)
End Sem: 70 Marks (2.5 Hrs.)
Termwork: 50 Marks

Unit I: (6 Hrs.)

Indian Geology, Seismic Zones and Geological Studies in Engineering Projects.

Geological Map of India with special reference to Maharashtra. Distribution and Geological characters of Major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India. Engineering characters of major rock formations of India.

The study of Plate Tectonics and highlights of Seismic Zones of India. Importance of geological studies in engineering investigations.

Unit II (6 Hrs.)

Geohydrological characters of rock formations and Geological process of Soil formations

Geohydrological characters of major rock formations of India:

Geohydrological characters and factors controlling various characters of rocks. Introduction to morphometric analysis. Various water conservation techniques, effect of over exploitation of tube wells, bore wells and dug wells. Artificial recharge, rainwater harvesting, watershed development and necessity of geological studies. Relevant case studies highlighting success and failure of these techniques.

Geological Process of Soil formations:

Effect of climate on formation of soil. Soil profile of different states in India.

Rock weathering conditions favorable for decomposition, disintegration, residual and transported soils.

UNIT III (5 Hrs.)

Resource Engineering, Role of Geology in planning and development.

Resource Engineering:

Utility of various rock formations as construction material. Illustrative case studies.

Geological Hazards and mitigation.

Role of Geology in planning and development:

Influence of geological factors upon urban development & planning. Reclamation of abandoned grounds and mining regions, illustrative examples.

UNIT IV: (6 Hrs.)

Rock Mechanics and Geophysical techniques.

Rock Mechanics:

General principles of rock mechanics. Dependence of physical and mechanical properties of rocks on geological characters.

Analyzing and evaluating of core recovery, R.Q.D. and Joint Frequency Index.

Various Methods of Geomechanical classifications of rocks such as Terzahagi, U.S.B.M, R.M.R., R.S.R., Q- system, Deer and Miller, Bieniawaski's geomechanical classification etc.

Geophysical techniques :

Electrical Resistivity method and Seismic method of exploration. Evaluation and analyzing the data produced through electrical resistivity for the determination of thickness of overburden, locating ground water potential zones which leads for strengthening the major civil projects.

UNIT V (7 Hrs.)

Subsurface Geological Explorations for various projects; Foundation Treatments, Tail Channel Erosion.

Subsurface Explorations for Dams, Reservoir, Percolation Tanks:

The strength and water tightness of rocks found at the dam, reservoir and percolation tank site.

Case studies illustrating the success and failure of major projects owing to negligence of geological studies. Earthquakes occurring in the areas of some dams and RIS theories.

Geological Foundation Treatments for various Civil Engineering Projects:

Foundation investigation during construction of projects for assessing various geological defects in rocks and suggesting appropriate remedial measures by various methods of grouting.

Erosion of Tail Channels:

Geological reasons for selection of site for spillway, causes of erosion of tail channel. Relevant Case studies.

Unit VI: **(6 Hrs.)**

Geological exploration for Tunnels and Bridges

Geological exploration for Tunnels:

Variations in methodology of investigation for different types of tunnels for different purposes, location, spacing, angles & depths of drill holes suitable for different types of tunnels.

Difficulties introduced in various geological formation and their unfavorable field characters. Standup time of rock masses and limitations of it.

Dependence of protective measures such as guniting, rock bolting, shotcreting, steel fiber shotcreting, permanent steel supports, lagging concreting & grouting above permanent steel supports on geological conditions. Illustrative case studies.

Bridges Investigation for bridge foundation, difference in objectives of investigation of bridge foundation. Bridge foundation based on nature & structure of rock. Foundation settlements. Case studies.

Practical Work / Term Work

i. Study of Geological map and seismic zone map of India **(2 Practicals)**

ii. Study of Morphometric Analysis of river, (topsheet will be made available by the college) **(1 Practical)**

iii. Study of Soil Profile, weathering index and clay geology. **(1 Practical)**

iv. Use of electrical resistivity method for determining depth of bedrock. **(1 Practical)**

v. Engineering Classification of rocks and Computation of RQD & Joint Frequency Index **(1 Practical)**

vi. Interpretation of drill hole data. Logging of drill cover, preparation of Litho logs & interpretation of drill data. Preparing geological cross sections from drill hole data & using them for designing of civil engineering structures representing following case studies.

1. Dipping sedimentary formation.
2. Faulted region.
3. Folded region.
4. Locating spillway.
5. Tunnels in Tectonic areas.
6. Tunnels and open cuts in non-tectonic areas. **(6 Practicals)**

vii. A compulsory guided tour to study geological aspects of an engineering projects & writing a report based on studies carried out during visits to civil engineering projects.

Note:

Field visits will be made to different places around study area and one study tour to important geological places.

The practical journal will be examined as term work**.**

REFERENCE BOOKS AND TEXT BOOKS:

1. Jaeger J. C., Cook N. & Zimmerman R. – Fundamentals of Rock Mechanics, Blackwell Scientific Publications.
2. Goodman R. E. – Introduction to Rock Mechanics, John Wiley & Sons.
3. Bieniawski Z. T. - Engineering Classification of jointed Rock Masses.
4. M. B. Dobbrin - Introduction to Geophysical Prospecting, McGraw Hill Inc., USA.
5. B. P. Verma - Introduction to Rock Mechanics, Khanna Pub New Delhi.
6. Keller E A - Environmental Geology, Prentice – Hall Publication.
7. Subinoy Gangopadhyay - Engineering Geology, Oxford University Press.
8. Vasudev Kanithi – Engineering Geology, Universities Press.
9. Dr. J. B. Auden Commemorative Volume – Indian Soc. Of Engineering Geology, Culcutta.
10. Seminar on Engineering and Geological Problems in Tunneling (Part 1 & 2) – Indian Society of Engineering Geology, New Delhi.

Handbooks:

a. Gupte R. B. (1980) – P. W. D. Handbook Chapter –6, Part-II 'Engineering Geology Government of Maharashtra.
b. Tunneling India '94, "Central Board of Irrigation and Power", New Delhi.
c. Manual on Rock Mechanics, Central Board of Irrigation and Power, New Delhi, 1988.
d. Handbook of Geology in Civil engineering, Robert Fergussion, Legget, Mc- Graw hill.

I. S. Codes

a. IRC code of practice for Road Tunnels. IRC-78-2000; IS-12070; IS-1336 Part I and II.
b. I. S. 4453-1967 Code of practice for Exploration, pits, trenches, drifts & shaft.
c. I. S. 6926-1973 Code of practice for diamond drilling for site investigation river valley project.
d. I. S. 4078-1967 Code of practice for Logging and Storage of Drilling Core.
e. I. S. 5313-1969 Guide for core drilling observation.

e- Resources:

1. www.ebd.co.in/undergraduate/eng
2. www.library.iisc.ernet.in
3. www.iitb.ac.in
4. www.nptel.iitm.ac.in
5. Free online course-swayam-https//swayam.gov.in
6. Open source course management – https//moodle.org

401 005 Elective-II (1) Matrix Methods of Structural Analysis

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks (1 Hr.)
End semester exam: 70 marks (2.5 Hrs.)

Unit I: Computational Techniques **(6 Hrs)**

Review of matrix algebra, computer oriented numerical methods-Gauss elimination, Gauss Jordon and Gauss Seidel. Computer algorithm and flowcharts of above methods.

Unit II: Flexibility matrix method for beams and frame **(6 Hrs)**

Degree of static indeterminacy, flexibility, selection of redundant, flexibility matrix, analysis of indeterminate continuous beams and simple portal frames involving not more than three unknowns.

Unit III: Stiffness matrix method for bars and trusses **(6 Hrs)**

a) Degree of kinematic indeterminacy (degrees of freedom), local and global coordinate systems, stiffness matrices of a axially loaded bar members, global stiffness matrix, analysis of determinate/indeterminate bars involving not more than three unknowns using member approach.

b) Stiffness matrices of a truss member with four DOF, transformation matrix, global stiffness matrix, analysis of determinate/indeterminate trusses involving not more than three unknowns using member approach.

Unit IV: Stiffness matrix method for beams **(6 Hrs)**

a) Structure approach: Degree of kinematic indeterminacy, problems involving not more than three unknowns.

b) Member approach: Derivation of stiffness matrix for beam member, Global stiffness matrix, problems involving not more than three unknowns.

Unit V: Stiffness matrix method for frames **(6 Hrs)**

a) Structure approach: Degree of kinematic indeterminacy, problems involving not more than three unknowns.

b) Member approach: Derivation of stiffness matrix for plane and space frame member, transformation matrix, global stiffness matrix, problems involving not more than three unknowns.

Unit VI: Stiffness matrix method for grid structures (6 Hrs)

a) Structure approach: Degree of kinematic indeterminacy, problems involving not more than three unknowns.

b) Member approach: Derivation of stiffness matrix for grid member, transformation matrix, global stiffness matrix, problems involving not more than three unknowns.

Reference Books:

[1] Matrix Methods of Structural Analysis- Wang, C. K., International Textbook Co., 1970.

[2] Matrix Analysis of Framed Structures – Gere & Weaver- CBS Publications, Delhi.

[3] Matrix & Finite Element analysis of structures – A.H. Shaikh and Madhujit Mukhopadhyay.

[4] Numerical Methods for Engineering – S.C. Chapra& R.P. Canale Tata McGraw Hill Publication.

[5] Structural Analysis – A Matrix Approach – Pandit & Gupta - Tata McGraw Hill Publication.

[6] Matrix Methods of Structural Analysis – Meghre & Deshmukh- Charotar Publishing House, Anand.

401005 Elective-II (2) Integrated Water Resources Planning & Management

Teaching Scheme: Lectures: 3 Hrs / week

Examination Scheme:
Paper In-sem. 30 Marks (1 hr),
Paper End-sem : 70 Marks (2.5 hr)

Unit1: (6 Hrs)

a) Introduction :World water resources, water resources in India, water as finite resource, variability of water in time & space, history of water resources development, water infrastructure-problems and perspectives, present institutional framework for water management.

b) Water laws: Constitutional provisions, National Water Policy, riparian rights / ground water owner ship, prior appropriation, permit systems, acquisition and use of rights, scope for privatization. EPA 1986, MWRRA act.

Unit2: Economics & Paradigm shift in water management (6 Hrs)

a) Economics of water :Water as economic good, intrinsic value, principles of water pricing & water allocation, capital cost, opportunity cost, internal rate of return, benefit cost analysis, principles of planning and financing of water resources project : Discussion on any two case studies.

b) Paradigm shift in water management:

Global and national perspectives of water crisis, water scarcity, water availability and requirements for human and nature, concepts of 'blue water', 'Green water', and 'virtual water', and their roles in water management. Sustainability principles for water management, framework for planning a sustainable water future.

Unit 3: Basin scale flogy (6 Hrs)

a) Estimation of surface water, estimation of ground water draft/recharge import/export of water (inter basin water transfer, interlinking of national river), recycling and reuse and storage, control of water logging, salinity, & siltation of storages.

b) Flood & Drought management: causes of floods, structural and non-structural measures, mitigation plan, flood damage assessment, use of geoinformatics for flood management. Types of droughts, severity index, drought forecasting, damage assessment, mitigation plan, use of geoinformatics for drought management.

Unit 4: Water demand and supply based management (6 Hrs)

a) Consumptive & non consumptive demands, irrigation demand estimation, water utilization, irrigation efficiency, water management in irrigation sector.

b) Demand estimation in hydro/thermal/nuclear power sector, estimation & forecasting of water demands of domestic & industrial sector, navigation and recreational water demands.

Unit 5: Environmental and social aspects (6 Hrs)

a) Environmental management: protection of vital ecosystem, water requirements for environmental management, aquaculture, minimum flows, environmental flow, water quality management for various uses.

b) Social impact of water resources development: direct/ indirect benefits, employment generation, industrial growth, agro-industry, enhanced living standards, education & health, co-operative movement, management of rehabilitation & resettlement, interstate dispute of water sharing and tribunals, sectorial conflicts.

Unit6: Basin planning &Watershed management (6 Hrs)

a) Perspective plan for basin development & management, Decision support system for Integrated Water Resources Management (IWRM), use of data driven techniques like Artificial Neural Networks, Genetic programming, Model Tree in water resources planning, development & management.

b) Watershed Management:

Watershed definition, classification of watersheds, integrated approach for watershed management, role of RS & GIS in watershed management, soil and water conservation-necessity- soil erosion-causes- effects-remedial measures, contour bunding-strip cropping-bench terracing-check dams, farm ponds, percolation tank.

Text Books:

1) Water Resources Systems Engg, D. P. Loucks, Prentice Hall
2) Water Resources Systems Planning and Management, Chaturvedi, M.C. Tata McGraw Hill
3) Economics of Water Resources Planning, James L.D and Lee R.R, McGraw Hill
4) Water resources hand book; Larry W. Mays, McGraw International Edition
5) Design of Water Resources Systems, Arthur Mass, MacMillan 1962
6) Water resource system, Pramod .R. Bhave - Narosa Publication

Reference Books:

1. Economics of Water Recourses Planning, L. D. James & R.R.Leo, McGraw Hills, NY 1971.
2. Water Resources Systems Engineering, W. A. Hill & J. A. Dracup.
3. Water shed Management – B.M. Tideman
4. Watershed management –J. V. S. MURTY, new Age International Publisher.
5. Integrated Watershed Management Perspectives and Problems - Beheim, E., Rajwar, G.S., Haigh, M., Krecek, J. (Eds.) , Springer Publication.
6. Managing Water in River Basins: Hydrology, Economics and Institutions -- M. Dinesh
7. Kumar, Publisher: Oxford Universit Press
8. Water Resources Design Planning Engg. and Economic; Edward Kuiper, Butterworth & Co.
9. ANN in Hydrology; Govinda Raju & Ramachandra Rao; PHI
10. Integrated Water Resources Management in Practice: Better Water Management for Development - R. L. Lenton, Mike Muller , Publisher Earthscan.
11. Sustainability of Integrated Water Resources Management - Editors**:** Setegn, Shimelis Gebriye, Donoso**,** Maria Concepcion (Eds.) Publisher Springer International Publishing .
12. Integrated Water Resources Management in the 21st Century: Revisiting the paradigm -Pedro Martinez-Santos, Maite M. Aldaya, M. Ramón Llamas, Publisher CRC Press, Taylor & Francis Group.
13. Key Concepts in Water Resource Management: A Review and Critical Evaluation - Jonathan Lautze, publisher Routledge.
14. Water Management – Jasapal Singh, M.S.Achrya, Arun Sharma – Himanshu Publication.

e – Resources:

1. nptel.iitm.ac.in/courses /webcourse-contents / IISc-Bang/water resource management.

401 005 Elective II (3) TQM and MIS in Civil Engineering

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.

Unit I: Quality in Construction **(6 Hrs)**

a) Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges, Factors affecting quality of construction, Reasons for poor quality & measures to overcome, Contribution of various Quality Gurus(Juran, Deming, Crossby, Ishikawa).

b) Evolution of TQM- QC, TQC, QA, QMS, TQM.

Unit II: TQM & Six Sigma **(6 Hrs)**

a) TQM – Necessity, advantages , 7QC tools, Quality Function Deployment(QFD).

b) Six sigma – Importance, levels.

c) Defects & it's classification in construction. Measures to prevent and rectify defects.

Unit III: ISO & Quality Manual **(6 Hrs)**

a) Study of ISO 9001 principles.

b) Quality manual – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel reinforcement activity.

c) Corrective and Preventive actions, Conformity and NC reports.

Unit IV: Management Control & Certifications **(6 Hrs)**

a) Benchmarking in TQM, Kaizen in TQM.

b) Quality Circle.

c) Categories of cost of Quality.

d) CONQAS, CIDC-CQRA certifications.

Unit V: Techniques in TQM Implementation and awards **(6 Hrs)**

a) 5 'S' techniques.

b) Kaizen.

c) Failure Mode Effect Analysis (FMEA).

d) Zero Defects.

e) National & International quality awards- Rajeev Gandhi Award, Jamuna lal Bajaj Award, Golden Peacock Award, Deming Prize, Malcolm Baldrize award.

Unit VI: MIS **(6 Hrs)**

a) Introduction to Management Information systems (MIS) Overview, Definition.

b) MIS and decision support systems, Information resources, Management subsystems of MIS, MIS based on management activity whether for operational control, management control, strategic control.

c) Study of an MIS for a construction organization associated with building works.

Text Books:

1. Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra.
2. Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ. Company.
3. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar—Biztantra.
4. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Reference Books:

1. Juran's Quality Handbook – Juran Publication. Importance of quality on a project in the context of global challenges. Importance of quality on a project in the context of global challenges.
2. Management –Principal, process and practices by Bhat – Oxford University Press.
3. Financial management by Shrivastava- Oxford University Press.
4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co.
5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.

E- Sources:

www.nptel.ac.in , www.mobile.enterpriseappstoday.com

401 005 Elective II (4) Earthquake Engineering

Teaching scheme:
Lectures: 3 Hrs/week

Examination scheme:
In semester exam: 30 marks---1 Hr.
End semester exam: 70 marks—2.5 Hrs.

Unit I

Introduction to earthquakes: (6 Hrs.)

Geology of earth, configuration of tectonic plates in a globe, influence of Geology on earthquake, behavior of plates, their motion and effects, causes of earthquake and their Characteristics, Earthquake parameters, magnitudes, intensity, scales, classification of earthquake seismic zoning of India, seismic coefficients for different zones, .Lessons from past earthquake: - Study of damages caused due to past, earthquakes in/ outside India and remedial measures.

Unit II (6 Hrs.)

Theory of vibrations:

Vibrations - definition, causes, classifications. Single Degree of Freedom systems (SDOF) - Free, forced, damped, un-damped vibrations with basic examples. Introduction to Multi-degrees of Freedom systems (MDOF) - derivations of related equations and solutions to two degree and three degree of freedom systems.

Unit III (6 Hrs.)

Static analysis of earthquake forces:

Introduction to IS1893 (Part-I): Seismic design Philosophy, provision, Seismic coefficient method.

Unit IV (6 Hrs.)

Dynamic analysis of earthquake forces:

Response Spectra, estimation of story shear, effect of unsymmetrical geometry and masses, mass center and stiffness center, estimation of story shear for symmetrical and torsion for unsymmetrical buildings. Effect of infill masonry and shear walls.

Unit V **(6 Hrs.)**

Earthquake force calculation and analysis and design of frames

Estimation of combined effect of lateral forces and vertical loading on multi storeyed frames. Design any intermediate continuous beam of the frames for combined effect of loadings, Concept of ductile detailing, IS 13920 provisions for RC frame.

Unit VI **(6 Hrs.)**

Introduction of different control systems: Passive control: base isolation and active control: bracing system. Strengthening and Retrofitting techniques, methodology of retrofitting for walls, slabs roofs columns, foundations etc. for buildings in stones, bricks, RCC. Introduction to Disaster Management: Types of Disaster, Phases of disaster management, Disaster rescue, psychology and plan of rescue operations.

Notes:

Every design should confirm to latest versions of IS 1893, 4326, 13920, 13827, 13828, 13935

Text Books:

1. Earthquake resistance design of structure by Duggal- Oxford University Press.
2. Earthquake – Resistant Design of Building Structures-Dr. Vinod Hosur-- Wiley India.
3. Earthquake Tips NICEE, IIT, Kanpur.
4. Elements of Earthquake Engineering by Jaikrishna and Chandarsekaran.
5. Earthquake resistant design of structures- Agarwal, Shrikhande, PHI learning.

Reference Books:

1. Dynamics of structure by Clough R.W. and Penzin J. McGraw Hill Civil Engineering Series.
2. Dynamics of structure by Anil Chopra, Prentice Hall India Publication.
3. Dynamics of structure by Mario Paz, CBSPD Publication.
4. Geo-technical Earthquake Engineering by Kramer S. L. Prentice Hall India Publication.
5. Introduction to Structural Dynamics by John M. Biggs.
6. Mechanical Vibrations by V. P. Singh.
7. Relevant Latest Revisions of IS codes.

401 005 Elective II (5)- Advanced Geotechnical Engineering

Teaching scheme:
Lectures: 3 hours/week

Examination scheme:
In semester exam: 30 marks---1 hour
End semester exam: 70 marks—2.5 hours

Unit I **(6 Hrs.)**

(a) Soil classification Identification and classification, criteria for classifying soil - classification on the basis of grain size, plasticity, symbolic & graphic presentation. Classified soils and engineering properties. (b) Soil structure & clay minerals Clay minerals, clay water relations, clay particle interaction, soil structure & fabric, granular soil fabric.

Unit II **(6 Hrs.)**

(a) Earth pressure theory Earth pressure theories for calculation of active and passive pressure, Rankines and coulombs earth pressure theories, analytical and graphical methods. (b) Design of earth retaining structures Design of gravity and cantilever retaining walls, design - cantilever sheet pile walls, anchored sheet pile walls, timbering and bracing for open cuts.

Unit III **(6 Hrs.)**

(a) Geosynthetics Geosynthetics- types, functions, properties and functional requirements. Application of geosynthetics in geoenviroment. (b) Reinforced soil Mechanism, reinforcement soil – interaction. Applications – reinforcement soil structures with vertical faces, reinforced soil embankments. Reinforcement soil beneath unpaved roads, reinforcement of soil beneath foundations. Open excavation and slope stabilization using soil nails.

Unit IV **(6 Hrs.)**

(a) Soil behavior under dynamic loads Soil behavior under static and dynamic loads. Acceptable levels of strain under static and dynamic loading. Soil properties relevant for dynamic loading and its determination.

(b) Machine foundations: Types of machine foundations, design criteria, methods of analysis – elastic half space method, linear elastic weightless spring method. Evaluation of soil parameters. Design procedure for a block foundation for cyclic loading and impact loading.

Unit V **(6 Hrs.)**

Ground Improvement In-situ ground improvement by compaction piles, dynamic loads, sand drains, grouting, deep mixing, inserting reinforcement elements, freezing soil, and vibroflotation.

Unit VI **(6 Hrs.)**

Rheology Rheological elements, basic and composite rheological models. Examples of compound models used to explain different soil phenomena; such as secondary consolidation, creep etc.

Reference Books:

1. Physical and Geotechnical properties of soils- Joseph E. Bowels, Tata Mac-Grawhill.
2. Advance Soil Mechanics – Braja Mohan Das- Tata Mc- Grawhill.
3. Geotechnical Engineering by Shashi K. Gulati & Manoj Datta – Tata Mc-Grawhill.
4. Basic and Applied Soil Mechanics- Gopal Ranjan & A.S. Rao- New Age Publication.

Codes:

1. I.S .Codes 1. IS: 1892-1979 – "Code of Practice for Subsurface Investigation for Foundation".
2. 2. IS: 2131-1981 (Reaffirmed 1997), "Method for Standard penetration Test for Soils".

Handbooks:

1. Bolt, Bruce A.(1999),"Earthquakes", W. H. Freeman.
2. Baghi, A., (1994)" Design, Construction and Monitoring of Landfills." John Wiley & Sons.
3. Day. R.W.(2002),"Geotechnical Earthquake Engineering Handbook",McGraw Hill.

e -Resources:

1. Website www.nptel.iitm.ac.in

401006 Project Phase-I

Teaching Scheme: **Examination Scheme:**

Tutorial: 2 Hrs/week **TW: 50 Marks.**

Project phase I Term Work will be evaluated for an individual student based on the seminar presented on the work done in first semester and submission of the report. If the student fails to present the seminar and submit the report, he / she will be marked absent in project examination. The project work phase I shall be consist of any one of the following nature in Civil Engineering related subjects.

1. Experimental investigation.
2. Software development.
3. Benefits cost economic analysis.
4. Case study with own design.
5. Working model design and fabrication.
6. Case study with development of methodology using soft computing tools.

It is mandatory to present a seminar in presence of Internal and External Examiners and submit preliminary project report based on work done in first semester. The report shall contain finalization of topic, literature survey, planning schedule/ flow chart for completion of project. The report shall be typed or printed and hard/spiral bound. The project work to be taken up individually or in groups. The group shall not be of more than 4 students. References shall be mentioned at the end as per universal standards as mentioned in any international journal of professional body.

Format of project report: Sequence of pages:

i) Front Cover Page ii) Certificate iii) Acknowledgement iv) Synopsis v) Contents vi) Notations vii) List of Tables viii) List of Figures ix) List of Graphs.

Chapter 1 Introduction (This consists of: 1.1 Introduction of the Project Work; 1.2 Problem Statement, 1.3 Objectives and 1.4 Scope of the Project Works, 1.5 Research Methodology, 1.6 Limitations of study, 1.7 Expected outcome.

Chapter 2 Literature Review from minimum 10 articles (It shall include theoretical support, details regarding work done by various persons, methods established, any new approach. It should preferably highlight the development in the field of research chronologically as reflected from books, journals etc.).

Chapter 3 Planning Schedule/ Flow Chart For Completion of Project References and Bibliography (The references and bibliography shall include name of author/code/manual/book, title of paper/code/manual/book, name of the journal, month & year of publication, volume number/ISBN number, page number x-y. The references and bibliography shall be as per universal standards as mentioned in any international journal of professional body).

Report Printing details:

1. Report shall be typed on A4 size Executive Bond paper with single spacing preferably on Both sides of paper.
2. Margins: Left Margin: 37.5 mm, Right Margin: 25 mm, Top Margin: 25 mm, Bottom Margin: 25 mm.
3. Give page number at bottom margin at center.
4. Size of Letters: Chapter Number: 16 font size, Times New Roman in Capital Bold Letters, Chapter Name: 12 Font size in Capital Bold Letters, Main Titles (1.1, 2.5 etc): 16 Font size in Bold Letters Sentence case, Sub Titles (1.1.5, 4.5.1 etc): 14 Font size in Bold Letters-Sentence case. All other matter: 12 Font size sentence case.
5. No blank sheet be left in the report.
6. Figure name: 12 Font size in sentence case Bold- Below the figure.
7. Table title -12 font size in sentence case- Bold-Above the table.

Semester-II

Savitribai Phule Pune University Board of Studies in Civil Engineering B.E. Civil 2015 Course (w. e. f. June 2018)

401007 Dams and Hydraulic Structures

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme:
In-sem: 30 marks (1 Hour)
End-sem :70 marks (2.5 Hours)
Oral : 50 marks

Unit I **(4 Hrs.)**

a) Introduction to dams

Introduction, Historical development of dams, Different terms related to dams, Selection of site for dam, Factors governing selection of type of dam, Classification of dams, Classification based on purpose, Classification based on materials, Classification based on size of project, Classification based on hydraulic action, Classification based on structural action, Dams and earthquakes, Dams and social issues, Large dams verses small dams, Displacement and rehabilitation, Dams and climate change.

b) Dam Safety and Instrumentation

Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles and functions of instruments, Selection of Equipment's, Different Instruments, Piezometers, Porous tube piezometer, Pneumatic piezometer, Vibrating wire piezometer ,Settlement measurement system Vibrating wire settlement cell, Magnetic settlement system, Inclinometer, Joint meter, Pendulums, Inverted Pendulum, Hanging Pendulum, Automatic pendulum coordinator ,Vibrating wire pressure cell, Extensometer, Embedment strain gauge, Temperature gauge, distributed fiber optics temperature tool, seismograph.

UNIT 2 **(7 Hrs.)**

a) Gravity Dams

Introduction, Components of gravity dam, Conditions favoring gravity dams, Forces acting on gravity dam, Combinations of loading for design, Seismic analysis of dam, Terms related to seismic analysis, Determination of Seismic forces (Zangar's method) , Effect of horizontal earthquake acceleration, Effect of vertical earthquake acceleration, Stress analysis in gravity dam (Only concept, no derivations), Vertical or normal stress , Principal stresses, Shear

stress, Middle third rule, Modes of failure of gravity dam, Elementary profile of gravity dam, Concept of low and high gravity dams, Various Design methods of gravity dam (Introduction only)— Details of Gravity method or 2 D method, ,Construction of gravity dams, Colgrout masonry, Roller Compacted Concrete (R.C.C.),Temperature control in mass concreting, Crack formation in gravity dam, Control of crack formation in dams, Construction joints, Keys, Water seal, Retrofitting.

b) Arch Dam and Other Dams (Introduction only)

Introduction, Concept of Arch Dam, Conditions favoring an arch dam, Classification of an arch dam, Constant angle arch dam, Constant radius arch dam, Variable radius arch dam, Arch gravity dam, Double curvature arch dam, Buttress dams, Advantages of Buttress dams, Limitations of Buttress dams, Types of buttress dams.

Unit III **(7 Hrs.)**

a) Spillway and Gates [6 Lectures]

Introduction, Location of Spillway, Different key levels and heads in spillway, Spillway Capacity, Components of spillway, Approach channel, Control structure, Discharge channel, Energy dissipation device, Tail channel, Classification of spillway, Classification based on operation, Main or service spillway, Auxiliary spillway, Emergency spillway, Classification based on gates, Gated spillway, Ungated spillway, Classification based on features, Straight drop spillway(Free overflow spillway),Saddle spillway, Side channel spillway, Overflow or ogee spillway, Chute or open channel or trough spillway, Shaft or morning glory spillway, Siphon spillway, Conduit or tunnel spillway, Stepped spillway,

Design of Ogee spillway or overflow spillway, Shape of crest, Equations for spillway profile on upstream and downstream, Energy dissipation below spillway, Classification of energy dissipation devices, Energy dissipation in stilling basin, Stilling basin, Components of stilling basin, Types of stilling basins, Indian standard stilling basins, Energy dissipation through buckets, Solid roller bucket, Slotted roller bucket, Ski jump bucket, Correlation between jump height and tail water depth.

b) Spillway Gates

Introduction of Spillway gates , Classification of spillway crest gates, Classification based on function, Classification based on movement of gates, Classification based on special features, Introduction to automatic gates, Maintenance of gates, Inspection of gates.

Unit IV **(7 Hrs.)**

a) Earth Dam

Introduction, Conditions favoring an earth dam, Limitations of earth dam, Classification of earth dam, Classification based on---materials, method of construction, height; Selection of type of earth dam, Components of an earth dam, Requirements for safe design of earth dam, Hydraulic (Seepage) Analysis, Plotting of seepage line, Case 1: Homogeneous earth dam with horizontal drainage blanket, Determination of seepage discharge using phreatic line.

Case II: Composite earth dam with casing and hearting, Properties of phreatic line, Determination of seepage discharge through earth dam using flownet, Structural stability analysis of homogeneous and zoned earth dam, Forces acting on earth dam, Method of stability analysis of an earth dam, Procedure of analysis by Swedish slip circle method, Fellenius Method of Locating Centre of Critical Slip circle, Stability analysis for foundation, Failure of earth dam, Classification of failure of earth dams, Hydraulic Failure, Seepage failure, Structural failure, Seepage control in earth dams, causes of seepage, Seepage control measures, Construction of earth dam,

b) Diversion head works

Introduction, Function of diversion headworks, Selection of site for diversion headworks, Layout of diversion headworks, Components of diversion headworks, Design of weir on permeable foundation, Criteria for safe design of weir floor, Brief introduction to Bligh and Lane's theory, Khosla's theory based on potential theory approach, Khosla's theory of independent variables, Design criteria of weirs on permeable foundations, Checks for stability and safety of weirs.

Unit V **(6 Hrs.)**

a) Canals

Introduction, Classification of canals, Classification based on alignment, Classification based on soil, Classification based on source of supply, Classification based on discharge, Classification based on lining, Classification based on excavation, Components of canal , Data required for canal design, Selection of canal alignment, Design of stable canal in alluvial beds, Kennedy's theory, Design of canal by Kennedy's theory, Limitations of Kennedy's theory, Lacey's regime theory, Design of canal by Lacey's theory, Canal lining, Need of canal lining, Requirements of lining material, Classification of canal lining, Hard surface lining including Ferrocement lining, Soft surface lining, Burried lining, Advantages of canal lining, Design of lined canal, Benefit – cost analysis for canal lining.

b) Canal Structures

Canal falls Introduction, Necessity of canal fall, Selection of site for canal fall, Classification of canal fall, Types of falls, Free fall or open fall, Notch fall, Ogee Fall, Rapid Stepped fall, Straight glacis fall, Sarda fall, Semi pressure fall, Baffle or Englis Fall, Montague fall Siphon well or cylinder fall, Pressure or closed conduit fall, Shaft or Pipe fall, Selection of type of fall, **Canal outlets-** Introduction of Canal outlet or module, **Canal escapes-** Introduction of Escapes, Significance of canal escape, **Canal regulators--**Canal regulators.

Unit VI **(5 Hrs.)**

a) C. D. Works

Introduction, Necessity of cross drainage works, Selection of site for Cross Drainage work, Data required for design of Cross Drainage work, Classification of Cross Drainage works, Drain over canal-Siphon, Super passage, Canal over drain—Aqueduct, Siphon aqueduct, Canal and drain water mixed in each other--Level crossing, Inlet and Outlet, Selection of suitable type of C. D. works, Design considerations for cross drainage works.

b) River Training Structures

Introduction, Classification of rivers, Classification based on topography, regime, alignment, source, Behaviour of rivers, River training, Objectives of river training, Classification of river training, purpose, orientation, River training structures, Embankment or Levee, Guide banks, Groynes or spurs, Artificial cut off, Pitched island, Submerged sill or dykes, Closing dykes.

Term Work (A+B+C)

A) Analysis /Design Assignments. (Compulsory)

1) Stability analysis of gravity dam
2) Design of profile of spillway and energy dissipation device below the spillway
3) Stability analysis of zoned earthen dam
4) Analysis of weirs on permeable foundations.
5) Design of unlined and lined canal.

B) Site visits and reports with photographs (compulsory)

1. Gravity dam.
2. Earth dam.
3. D. work/ Canal structure(s)/Weirs/Barrage.

C) Review of any one case study of failure of hydraulic structure from the published literature or patent related to Hydraulic structures (in a group of five students).

Note:-

Visit report should consist of Name of project, date of visit , need and practical significance of project, salient features of project, technical details of project, detailed description and figures of different components of project, special features of project, the technical, social, financial and environmental impact of project on downstream and upstream, photographs of technical details of visit, if allowed . If not allowed for technical details, the photograph near board of project or site as a proof of visit.

Reference Books :-

1. Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.
2. Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.
3. Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
4. Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.
5. Roller Compacted Concrete Dams- MehrotraV.K- Standard Publishers Distributors, Delhi, 1st ed, 2004.
6. Irrigation, Water Resources and Water Power Engineering- Modi, P.N. - Standard Book House, New Delhi, 2nd ed, 1990.
7. Irrigation and Water Power Engineering - Punmia B.C. - Laxmi Publication.

I.S. Codes:

1. I.S. 8605 – 1977 (Reaffirmed 1998), Code of practice for construction of masonry in dams, third reprint, July 1999, B.I.S. New Delhi.
2. I.S. 6512-1984 (Reaffirmed 1998), Criteria for design of solid gravity dams, first revision, first reprint, September, 1998, B.I.S. New Delhi.
3. I.S. 457 – 1957 (Reaffirmed, 2005), Code of practice for general construction of plain and reinforced concrete for dam and other massive structures, sixth reprint, January 1987, B.I.S. New Delhi.

4. I.S. 10135 – 1985, Code of practice for drainage system for gravity dams, their foundations and abutments, first revision, B.I.S. New Delhi.
5. I.S. 14591 – 1999, Temperature control mass concrete for dams – guidelines, B.I.S.
6. I.S. 11223 – 1985 (Reaffirmed 2004), Guidelines for fixing spillway capacity, edition 1.2 (1991-09), B.I.S. New Delhi.
7. I.S. 6934 – 1998 (Reaffirmed 2003), Hydraulic design of high ogee overflow spillways – recommendations, first revision, B.I.S. New Delhi.
8. I.S. 11155- 1994, Construction of spillways and similar overflow structures – Code of practice, B.I.S. New Delhi.
9. I.S. 5186 – 1994, Design of chute and side channel spillway – criteria, first revision, B.I.S. New Delhi.
10. I.S. 10137- 1982 (Reaffirmed 2004), Guidelines for selection of spillways and energy dissipaters, B.I.S. New Delhi.
11. I.S. 4997 – 1968 (Reaffirmed 1995) Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron, sixth reprint, January, 1998, B.I.S. New Delhi.
12. I.S. 7365-1985, Criteria for hydraulic design of bucket type energy dissipaters, first revision, B.I.S. New Delhi.

01 008 Quantity Surveying, Contracts & Tenders

Teaching scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination scheme:
In semester exam: 30 Marks---1 Hr.
End semester exam: 70 Marks—2.5 Hrs.
Oral: 50 Marks

Unit I **(6 Hrs.)**

Introduction and Approximate Estimates:

a) Introduction to estimates and related terms: Definition of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum& prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R.

b) Approximate Estimates: Meaning, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation/ water supply, sanitary engineering, electrical works.(Theory & Numericals).

Unit-II **(6 Hrs.)**

Taking out quantities &Detailed estimate:

a) Detailed estimates: Factors to be considered while Preparing Detailed Estimate, Detailed estimate of R.C.C framed structures using IS 1200, Concept of Estimation of Load Bearing Structure (PWD & Centre Line Method).

b) **Bar Bending Schedule:** Preparing Bar Bending Schedule for all RCC members of building.

Unit-III **(6 Hrs.)**

Specifications and Rate Analysis:

a) Specifications: Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.

b) Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Task work or out turn, factors effecting task work. Working out Rate Analysis for the items mentioned in specifications above.

Unit IV **(6 Hrs.)**

Valuation:

a) Valuation: Purpose of valuation. Meaning of price, cost and value. Factors affecting 'Value'. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Methods of depreciation & obsolescence, Sinking Fund, Years Purchase.

b) Methods of Valuation of Building: Rental Basis, Land & Building basis, Direct Comparison Method, Profit based method, Belting of Land, Development method.

Unit V **(6 Hrs.)**

Tendering and Execution of Works:

a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT &Global Tendering, E-tendering.

b) Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Unit VI **(6 Hrs.)**

Contracts and Arbitration:

a) Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract Act (1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus. **Conditions of contract**: General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

b) Arbitration: Introduction to Arbitrations as per Indian Arbitration & Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator.

Term Work:

The following exercises should be prepared and submitted:

1. Report on contents, use of current DSR & Drafting detailed specification for major items of works.
2. Working out quantities using C-L and PWD method for a small single storied load bearing structure up to plinth and Preparing Abstract Sheet using DSR(Regional)
3. Detailed Estimate of a single storied R.C.C framed building using D.S.R.
4. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab by preparing bar bending schedule.
5. Working out rate analysis for the items as in the specifications of Assignment No. 1.
6. Preparing Valuation of a Residential building and writing report using O-1 form.
7. Estimating quantities for any one of the following using appropriate software.
   a) A Factory Shed of Steel Frame
   b) Underground Water Tank
   c) Pipe Culvert
   d) Road / Railway Track/ Runway
8. Drafting of tender notice, Preparation of Schedule A & B and Conditions of Contract regarding time, labour payment, damages for RCC Framed Structure (Assignment No. 3) and collecting minimum of 3 tender notices of Civil Engineering Works.

Oral Examination: Based on the Term Work.

Reference Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N Dutta - S. Dutta & Company, Lucknow.
2. Estimating, Costing Specifications & valuation in Civil Engineering: M. Chakraborty.
3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand.
4. Theory and Practice of Valuation: Dr. RoshanNamavati, Lakhani Publications.
5. Valuation Principles and Procedures: Ashok Nain, Dewpoint Publ.
6. Laws for Engineers : Dr. Vandana Bhat and Priyanka Vyas –Published by PRO-

CARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 procure@technolegal.org).

Handbooks:

1. Standard Contract Clauses for Domestic Bidding Contracts: Ministry of Statistics and Program Implementation, Government of India.
2. FIDIC Document: Federation International Des Ingenieurs Conseils i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
3. Indian Practical Civil Engineers' Handbook: P. N. Khanna, UBS Publi. Distri. Pvt. Ltd. (UBSDP).

Codes:

1. IS 1200 (Part 1 to 25): Methods of Measurement of Building & Civil Engg.Works.
2. IS 3861-1966: Method of Measurement of Areas and Cubical Contents of buildings.
3. D. S. R. (District Schedule of Rates) for current year.
4. PWD Redbooks, Vol 1 & 2.

e – Resources: nptel.iitm.ac.in

401 009 Elective III (1) Advanced Structural Design

Teaching Scheme
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme
Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Mark

Unit 1 **(6 Hrs.)**

Cold-formed light gauge steel structural members: Design of axially loaded compression members, tension members and beams (not more than two spans).

Unit 2 **(6 Hrs.)**

Frames: Uniqueness theorem, lower bound and upper bound theorems, mechanisms, analysis and design of frames (single story), design of connections.

Unit 3 **(6 Hrs.)**

Composite deck slab: Design of composite deck slab with cold form light gauge profile and shear connectors.

Unit 4 **(6 Hrs.)**

Yield line analysis and design of slabs: Yield line theory, yield lines, ultimate moment along a yield line, principle of virtual work, analysis and design of slabs of different geometry, support conditions and loading conditions.

Unit 5 **(6 Hrs.)**

Elevated water tanks: Analysis and design for gravity and earthquake loads (static analysis) for square, rectangular and circular water tanks (excluding Intze tank) supported on staging, design of staging and foundation system.

Unit 6 **(6 Hrs.)**

Shear walls: Function, types, analysis and design of cantilever type shear walls.

Note: The designs should conform to the latest codal provisions.

Term Work:

a) At least three plates showing the details of cold-formed light gauge steel sections used in compression, tension and flexural members

b) At least three plates showing the details based on yield line analysis and design of slabs

c) Sheet 1: Detailing of any one design problem from Unit 2 or Unit 3

d) Sheet 2: Detailing of any one design problem from Unit 5 or Unit 6

e) Report of two site visits covering the contents of the syllabus mentioned above.

References:

1). Design of Steel Structures, Ramachandra, Standard Publications New-Delhi

2). Structural and Stress Analysis, T.H.G. Megson, Butterworth-Heinemann

3). Design of Concrete Structures, J. N. Bandyopadhyay, PHI

4). Punmia, Reinforced Concrete Structures Vol. 1 and 2, Standard Book House NewDelhi.

5). Sinha and Roy., RCC Analysis and Design . S. Chand and Co. New-Delhi

6). Ramachandra, Design of Steel Structures Vol.-II Standard Publications New-Delhi.

7). Punmia,B. C. and Jain and Jain, Comprehensive Design of Steel Structures, Standard Book House

8) INSDAG publications

401009 Elective=III (2) Statistical Analysis and Computational Methods in Civil Engineering

Teaching Scheme
Lectures : 3 hours/week
Practical: 2 hours/week

Examination Scheme
In-sem : 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Mark

Unit I: **(6 Hrs.)**

Numerical methods: Bisection method, False Position method, Newton Raphson, Secant method.

Unit II: **(6 Hrs.)**

Numerical Integration Need and scope, trapezoidal rule, Simpsons 1/3rd rule, Simpsons 3/8th rule, Gauss Quadrature method.

Unit III: **(6 Hrs.)**

Optimization techniques: Introduction to optimization techniques-concepts and applications, direct solution of linear equations-Gauss elimination and Gauss Jordon method. Iterative solution of linear equations- Gauss Seidel method.

Unit IV: **(6 Hrs.)**

Statistical methods: Introduction, collection, classification and representation of data, measures of central value (mean, median, mode), measures of dispersion, sampling.

Unit V: **(6 Hrs.)**

Probability and Probability distributions including Binomial, Poisson, Normal, test of hypothesis, chi-square test.

Unit VI: **(6 Hrs.)**

Correlation analysis, regression analysis. Coefficient of correlation, probable error, single and multiple regression, curve fitting, Interpolation and extrapolation.

Term Work:

1. One exercise on each unit.
2. Any two problems to be solved using c, c++, excel or using softwares like SPSS, minitab, etc.
3. One exercise on formulation and solution of an optimization problem applicable to any field of Civil Engineering.

Reference Books:

1. Statistical methods – S.P.Gupta.
2. Probability and Statistics for Engineers – Richard A Johnson 3. Probability and Statistics for Science and Engineering – G Shankar Rao.
4. Numerical Methods – E Balagurusamy.
5. Numerical methods for Engineers – S. Chapra, R.P.Canale.
6. Higher Engg. Mathematics – B.S. Grewa.

401009 Elective III (3): Hydro Power Engineering

Teaching Scheme
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme
Theory Examination
In-sem: 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Marks

Unit I **(6 Hrs.)**

Energy Resources – Planning and Potential:

Power resources – Conventional and Nonconventional, Need and advantages, Overview of World Energy Scenario, energy and development linkage, Environmental Impacts of energy use, Green House Effect, Trends in energy use patterns in India, Hydropower development in India, Hydropower potential basin wise and region wise, investigation in hydropower plants.

Unit II **(6 Hrs.)**

Hydropower Plants:

Hydrological Analysis, Classification of hydropower plants based on hydraulic characteristics - Run of river plants, Storage or Valley dam plants, Pumped storage plants, Classification based on head, Classification based on operating function, Classification based on plant capacity, Classification based on nature of topography, Introduction to micro hydro, advantages and disadvantages, Principle Components of hydropower plants.

Unit III **(6 Hrs.)**

Load Assessment:

Estimation of electrical load on turbines. Load factor, Plant factor, peak demand and utilization factor, installed capacity, diversity factor, firm power, secondary power, load curve, load duration curve, Prediction of load and significance, Tariffs, Hydro-Thermal Mix, Combined Efficiency of Hydro-Thermal-Nuclear Power Plants.

Unit IV **(6 Hrs.)**

Water Conductor System and Powerhouse:

Water Conductor System – Alignment, Intake Structures- Location and Types, Trash Rack. Headrace tunnel/ Canal, Penstock and pressure shaft, Types of Powerhouses, Typical layout of powerhouse, Components, Power plant equipments, Instrumentation and control.

Unit V **(6 Hrs.)**

Turbines:

Classification, Principles and design of impulse and reaction turbines, Selection of Turbine, Specific Speed, Governing of turbines, Water hammer, Hydraulic Transients and Surge tanks, Draft tubes, Cavitation.

Unit VI **(6 Hrs.)**

Economics of Hydroelectric Power:

Hydropower - Economic Value and Cost and Total Annual Cost. Economic considerations – pricing of electricity, laws and regulatory aspects, Policies, Electricity act – 2003, Investment in the power sector, Carbon credits, Participation of private sector.

Term Work:

Minimum eight assignments as per the list given below. **Assignments 1 and 10 are compulsory.**

1. Calculating the electricity bill of upper middle class family that uses various electrical appliances.
2. Determination of power output for a run of river plant with and without pondage.
3. Justification of economics of Pumped storage plants.
4. Design of Kaplan / Francis / Pelton turbine.
5. Determination of diameter of penstock using different methods.
6. Design of surge tank.
7. Design of straight conical draft tube.
8. Use of any software to calculate water hammer pressure.
9. Case study of any hydropower project.
10. Report based on visit to any micro/small/mega hydropower project

Reference Books:

1. Water Power Engineering – M. M. Dandekar and K. N. Sharma, Vikas Publishing House.
2. Water Power Engineering – R. K. Sharma and T. K. Sharma, S. Chand and Co. Ltd.
3. Handbook of Hydroelectric Engineering – P.S. Nigam
4. Modern Power System Planning – Wang.
5. Hydropower Resources in India – CBIP.

6. Hydro Power Structures – R. S. Varshney.
7. Water Power Development – E. Mosonvi, Vol. I & II.
8. Hydro-electric Engineering Practice – G. Brown, Vol. I, II & III.
9. Hydro – Electric Hand Book – Creager and Justin.
10. Water Power Engineering – P. K. Bhattacharya, Khanna Pub., Delhi.
11. Water Power Engineering – M. M. Deshmukh, Dhanpat Rai Pub.
12. Manual of "Energy Group" of 'PRAYAS', an NGO.

401009 Elective-III: (4) Air Pollution and Control

Teaching Scheme:
Lectures: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme:
Paper In-sem. 30 Marks (1 hr),
Paper End-sem : 70 Marks (2.5 hrs)
TW : 50 Marks

Unit I **(6 hrs)**

Meteorological aspects: Zones of atmosphere, Scales of meteorology, Meteorological parameters, Temperature lapse rate, Plume behaviour. Gaussion diffusion model for finding ground level concentration, Plume rise, Types & quality of fuels, Formulae for effective stack height and determination of minimum stack height as per CPCB norms.

Unit II **(6 hrs)**

Ambient Air sampling and analysis: Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling of gases and particulates. Stack emission monitoring for particulate and gaseous matter, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Emission inventory and source apportionment studies. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009.

Unit III **(6 hrs)**

Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, factors affecting exposure to indoor air pollution, sick building syndrome. Investigation of indoor air quality problems, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Use of various plants to control indoor air pollution. Radon and its decay products in indoor air.

Odour pollution: Theory, sources, measurement and methods of control of odour pollution.

Unit IV **(6 hrs)**

Control of air pollution: By process modification, change of raw materials, fuels, process equipment and process operation. Control of particulate matters. Working principle and design of control equipment as Settling chamber, Cyclone, Fabric filter and Electro Static Precipitator. Control of gaseous pollutants. Combustion chemistry & control of air pollution from automobiles.

Unit V **(6 hrs)**

Land use planning: As a method of control. Economics of air pollution control: Cost/benefit ratio and optimization. Legislation and regulation: Air (Prevention and Control) Pollution Act, 1981. The Environment (Protection) Act 1986. Emission standards for stationary and mobile sources.

Unit VI **(6 hrs)**

Environmental impact assessment and management: Methodology for preparing environmental impact assessment (Identifying the sources of air pollution, calculating the incremental values, prediction of impacts and mitigation measures). Role of regulatory agencies and control boards in obtaining environmental clearance for project. Public hearing. Environmental impacts of thermal power plants, sugar and cement industry. Environmental management plan. The environmental rules 1999 (sitting of industries).

Term Work:

Term work shall consist of

A. One assignment on each unit.
B. Detailed industrial visit report on Sugar/Cement/Steel//Thermal/Rubber/Dairy industry with reference to air pollution Control device(s).

Reference Books:

1. Air Pollution – H. V. N. Rao and M. N. Rao, TMH, Pub.
2. Air pollution – KVSG Murali krishna.
3. Air Pollution – Perkins.
4. Environmental Engineering – Davis, McGraw Hill- Pub.
5. Environmental Engineering – Peavy H.S and Rowe D.R, McGraw Hill- Pub.
6. Air Pollution – Stern.
7. Air Pollution Control – Martin Crawford.
8. Air Pollution Control: its origin and control, K. Wark, C.F. Warner & W.T.Davis .
9. Fundamentals of Air Pollution-Richard W. and Donald L. Academic Press.

I.S. Codes:

1. I.S. 5182 (all parts), and
2. I.S. 15442 (2004)

e – Resources:

1. http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras.
2. http://cpcb.nic .in
3. http://moef.nic .in

401009 Elective III (5): Finite Element Method in Civil Engineering

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme:
Theory Examination:
In-sem: 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Mark

Unit I **(6 Hrs.)**

Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress, plane strain and axisymmetric problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems.

Unit II **(6 Hrs.)**

General steps of the finite element method, Applications and advantages of FEM, concept of finite element for continuum problems, discretisation of continuum, use of polynomial displacement function, Pascal's triangle, convergence criteria.

Principle of minimum potential energy, formulation of stiffness matrix for truss element using variational principles.

Unit III **(6 Hrs.)**

Displacement function for 2D triangular (CST and LST) and rectangular elements, Use of shape functions, Area co-ordinates for CST element, Shape functions in cartesian and natural coordinate systems, shape functions for one dimensional element such as truss and beam, shape functions of 2D Lagrange and serendipity elements.

Unit IV **(6 Hrs.)**

Introduction to 3D elements such as tetrahedron and hexahedron. Iso-parametric elements in 1D, 2D and 3D analysis, Jacobian matrix, Formulation of stiffness matrix for 1D and 2D Iso-parametric elements in plane elasticity problem.

Unit V **(6 Hrs.)**

Formulation of stiffness matrix, analysis of spring assemblage, member approach for truss and beam element, node numbering, assembly of element equations, formation of overall banded matrix equation, boundary conditions and solution for primary unknowns, applications to truss and beam not involving unknowns more than three.

Unit VI **(6 Hrs.)**

Formulation of stiffness matrix using member approach for portal frame and grid elements, transformation matrix, applications to frame and grid not involving unknowns more than three.

Termwork:

The Termwork shall be based on completion of assignments as given below.

1. At least one assignment on each unit.
2. One assignment based on FEM by using coding tools for
   a) Formulation of stiffness matrix for any 1-D element
   b) Formulation of stiffness matrix for any 2-D element
3. Finite Element Method -Software applications of any one of following cases using any standard available software.
   a) Truss/ grid problem
   b) Plane stress / plane strain problem

Reference Books

1. A first course in the finite element method-Daryl L. Logon, Thomson Publication.
2. Nonlinear finite element analysis by Reddy- Oxford University Press.
3. Introduction to the Finite Element Method – Desai & Abel, CBS Publishers & Distributors, Delhi
4. Introduction to Finite Elements in Engineering – T.R. Chandrupatla & A.D. Belegundu Prentice Hall of India Pvt. Ltd.
5. Matrix, Finite Element, Computer & Structural Analysis – M. Mukhopadhyay, Oxford IBH Publishing Co. Pvt. Ltd.
6. Finite Element Analysis – Theory & Programming – C.S. Krishnmoorthy, TATA McGraw Hill Publishing Co. Ltd.
7. An Introduction to the Finite Element Method – J.N. Reddy, TATA Mc Graw Hil Publishing Co. Ltd.
8. Theory & Problems – Finite Element Analysis – Gorge R. Buchanan, Schaum's Outline series. TATA Mc Graw Hill Publishing Co. Ltd.
9. The Finite Element Method – O.C. Zien kiewicz, TATA Mc Graw Hill Publishing Co. Ltd.
10. Finite Element Analysis – S.S. Bhavikatti, New Age International (P) Ltd.

401 0010 Elective III (6): Airport & Bridge Engineering

Teaching scheme
Lectures: 3 hours/week
Practical: 2 hrs

Examination Scheme
In-Sem Exam: 30 marks 1 hour
End-Sem Exam: 70 marks 2.5 hrs
Termwork: 50 marks

Unit 1: **(6 hrs)**

Introduction:

Advantages and limitations of air transportation. Aeroplane component parts and important technical terms, Organizations related to Air Transportation (ICAO, FAA, AAI) Roles and Responsibilities.

Airport planning:

Aircraft characteristics, which influence judicious and scientific planning of airports, Selection of sites, survey and drawings to be prepared for airport planning, Air Travel Demand forecasting, Airport classification by ICAO.

Unit 2: **(6 hrs.)**

Airport layout:

Characteristics of good layout, runway configuration, airport obstruction, location of terminal buildings, aprons and hangers. Zoning requirements regarding permissible heights of constructions and landing within the airport boundary, Airport landslide planning, Navigation and landing aids – ILS, Air Traffic Control (ATC).

Design of Runways and taxiways:

Runway orientation, wind coverage, use of wind rose diagram, basic runway length, corrections for elevation, temperature and gradient as per ICAO and FAA recommendation, Taxiways – Concept, types, design criteria.

Unit 3: **(6 hrs.)**

Structural Design of Runways and taxiways:

Runway pavement design criteria, aircraft loading, Design methods for flexible and rigid runways, Airport drainage.

Unit 4: **(6 hrs.)**

Heliports

Helicoptor characteristics, planning of heliports - site selection, size of landing area, orientation of landing area, Heliport marking and lighting, Vertical Takeoff and Landing (VTOL).

Unit 5: **(6 hrs.)**

Bridge engineering:

Introduction:

Classification of bridges, components of bridges, preliminary data to be collected during investigation of site for bridges, determination of discharge – empirical formula, direct methods, economical span, afflux, HFL, scour depth and clearance, locations of piers and abutments, factors influencing the choice of bridge super structure, approach roads.

Loads on bridges:

Brief specifications of different loads, forces, stresses coming on bridges, IRC load specification, requirements of traffic in the design of highway bridges.

Substructure:

Abutment, Piers, and wing walls with their types based on requirement and suitability.

Unit 6: **(6 hrs)**

Types of bridges

Various types of bridges:

Culvert: Definition, waterway of culvert and types.

Temporary bridges: Definition, materials used brief general ideas about timber, floating and pantoon bridges.

Movable Bridges: Bascule, cut boat, flying, swing, lift, transporter and transverse bridges, their requirement and suitability.

Fixed span bridges: Simple, continuous, cantilever, arch, suspension, bowstring girder type and rigid frame and cable stayed bridges, materials for super structure.

Bearing: Definition, purpose and importance. Types of bearings with their suitability.

Erection of bridge super structure and maintenance:

Introduction to different techniques of erection of bridge super structure and maintenance of bridges.

Term work:

Term work shall consist of: (Any eight)

1. Recent Trends in Airport planning and design (report expected)
2. Assignment on study and use of Windrose Type 1 and 2 diagram
3. Assignment on Runway Design for length and related corrections
4. Structural Design of Flexible or Rigid Runway
5. Selection of Bridge site, alignment and collection of design data
6. Assignment on conditional assessment of existing Bridges
7. Seminar on one topic each in Airport Engineering or Bridge Engineering
8. Report on Guest lecture in Airport Engineering or Bridge Engineering
9. Site visit to Bridge site or Airport site

Text Books:

1. Bridge engineering – S. Ponnuswamy, Tata Mc Graw – Hill publishing co. Ltd. New Delhi.
2. Airport planning and design – S.K. Khanna , M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee.
3. Airport Engineering - Rangawala, Charotar publishing House, Anand 388001 (Gujrat)
4. Essentials of Bridge Engineering – D. Johnson and Victor, Oxford and IBH publishing Co. Pvt. Ltd. , New Delhi.
5. Bridge engineering – Rangawala, Charotar Publishing House, Anand –388 001.
6. Principles and practice of Bridge Engineering – S.P. Bindra, Dhanpatrai and Sons, Delhi.

401 010 Elective IV (1): Construction Management

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme:
Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem:70 marks (2.5.Hours)
Term work: 50 Mark

Unit – I **(6 Hrs.)**

Overview of construction sector:

Role of construction industry in infrastructure development, components of infrastructure sector, construction industry nature, characteristics, size, structure, role in economic development, construction management – necessity, applications, project management consultants – role, types, selection and appointment process, project overruns and means to combat them, project monitoring and reporting systems, managerial correspondence and communications, generation and identification of project investment opportunities. (*At least 2 expert lectures by experts from field are to be conducted on above topics).

Unit – II **(6 Hrs.)**

Construction scheduling, work study and work measurement Construction scheduling. Construction project scheduling – purpose, factors affecting scheduling, time as a control tool, work breakdown structure, project work breakdown levels, line of balance technique, repetitive project management Work study and work measurement .

Definition, objectives, basic procedure of work study, symbols, activity charts, string diagrams, time and motion studies.

Unit – III **(6 Hrs.)**

Labour laws and financial aspects of construction projects Labour laws. Need and importance of labour laws, study of some important labour laws associated with construction sector-workmans compensation act 1923, Building and other construction workers act 1996, child labour act, interstate migrant workers act Financial aspects of construction projects. Capital investments: importance and difficulties, means of finance, working capital requirements, project cash flow projections and statements, project balance sheet, profit loss account statements.

Unit – IV **(6 Hrs.)**

Elements of risk management and value engineering. Risk management. Introduction, principles, types, origin, risk control, use of mathematical models: sensitivity analysis, break even analysis, simulation analysis, decision tree analysis, risk identification, analysis and mitigation of project risks, role of insurance in risk management. Value engineering Meaning of value, value analysis, value engineering and value management, energy resources, consumption patterns, energy cost escalation and its impact.

Unit – V **(6 Hrs.)**

Materials management and human resource management . Materials management Materials flow system, role of materials management in construction management and its linkage with other functional areas, vendor networking, buyer-seller relationships, eoq model and its variations, material codification and classification, concept of logistics and supply chain management, role of ERP in materials management – material resource information systems Human resource management. Human Resource in Construction Sector, Staffing policy and patterns, Human Resource Management Process, Human Resource Development Process, Performance Appraisal and Job Evaluation, Training and Career planning, Role of ERP in Human Resource Management – Human Resource Information System (HRIS).

Unit – VI **(6 Hrs.)**

Introduction to artificial intelligence technique. Basic terminologies and applications in civil engineering (a) Artificial neural network (b) Fuzzi logic (c) Genetic algorithm.

Term Work:

1. Site Visit to a Construction project to study following documents and preparing a report –

a. Project Cash Flow Analysis.

b. Project Balance Sheet.

c. Work Break Down Structure.

d. Materials Flow System in the Project.

2. Scheduling of a Construction Project using Line of Balance Technique.

3. Assignment on Work Study on any two Construction Trades.

4. Assignment on EOQ Model and its variation.

5. Assignment on application of AI techniques in Civil Engineering.

6. Seminar on any one topic from above syllabus.

Reference Books:

1. Projects – Planning, Analysis, Selection, Implementation and Review, Prasanna Chandra, Tata McGraw Hill Publications.
2. Construction Management and Planning – B. Sengupta and H. Guha, Tata McGraw Hill Publications.
3. Civil Engineering Project Management – C. Alan Twort and J. Gordon Rees, Elsevier Publications.
4. Total Project Management – The Indian Context – P. K. Joy, MacMillian Publications.
5. Materials Management–Gopalkrishnan & Sunderasan,Prentice Hall Publications.
6. Human Resource Management – Biswajeet Pattanayak, Prentice Hall Publishers.
7. Laws for Engineers : Dr. Vandana Bhat and PriyankaVyas –Published by PROCARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 (procure@technolegal.org).
8. Labour and Industrial Laws – S. N. Mishra, Central Law Publications.
9. Artificial Neural Network – Veganarayanan – Prentice Hall.
10. Genetic Algorithm – David & Goldberg.
11. Fuzzi Logic & Engg Applications – Ross.
12. Principles of Construction Management by Roy Pilcher (McGraw Hill)

e-Resourses:

1. ERP Software-Builders Management Software.
2. Project mates Construction Software.

401 0010 Elective IV (2): Advanced Transportation Engineering

Teaching scheme
Lectures: 3 hours/week
Practical: 2 hrs

Examination Scheme
In-Sem Exam: 30 marks 1 hour
End-Sem Exam: 70 marks 2.5 hrs
Termwork: 50 marks

Unit I **(6 hrs.)**

Transport System Planning: Transportation planning process and types of surveys. Travel demand forecasting - trip generation, modal spilt analysis, trip distribution and route assignment analysis, Transportation System Management (TSM), application in Comprehensive Mobility Plan (CMP) and DPR.

Unit II **(6 hrs.)**

Urban Transport Technology: Classification- light, medium, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS) and its components, Public Transport Policy. Introduction to BRT, Mono rail, Metro rail, Bullet train and Hyperloop. Concept of Integrated Inter Model Transit System and freight transportation.

Unit III **(6 hrs.)**

A. Transport Economics & Financing: Road user cost - Vehicle operations cost, running cost, value of travel time, road damage cost, accident cost. Economic evaluation – Benefit cost method, Net present value method, First year rate of return method, Internal rate of return method & comparison of various methods.

B. Environmental Impact Assessment: EIA requirement of highway projects, procedure and guidelines, pollution cost and concept of congestion pricing.

Unit IV **(6 hrs.)**

Traffic Engineering: Traffic studies, basic traffic theory, traffic analysis process, level of service, intersection studies- turning movements, grade separated intersection, signal design- IRC method and Webster's method, parking study and analysis, bicycle and pedestrian facility design, instrumentation of traffic monitoring.

Unit V **(6 hrs.)**

Study of flexible pavement: Philosophy of design and design criteria, design of flexible pavement using IRC 37-2012, Distresses in flexible pavement, evaluation of pavement – Benkelmen beam, Falling Weight Deflectometer (FWD), Pavement Management Systems (PMS).

Unit VI **(6 hrs.)**

a) Study of rigid pavement: Philosophy of rigid pavement, comparison of rigid pavement over flexible pavement, types of rigid pavements, design of rigid pavement using IRC 58-2015 including design of joints, distresses in rigid pavement.

b) **Overlay types and their design as per IRC:** Types of overlays, design of overlay using IRC 81-1997.

Term work:

1. Traffic counts using Manual Methods.
2. Design of a flexible pavement using IRC: 37-2012 using IITPAVE.
3. Design of rigid pavement using IRC: 58-2015.
4. Road deflections measurement using Benkelmen Beam method.
5. Design of an overlay using IRC: 81-1997.
6. Conduct of distress surveys on a flexible pavement or a rigid pavement and determining its condition index (PCI).
7. Study of any two softwares related to transportation engineering.
8. Study of format of household survey and recording sample measurements.
9. Parking survey and analysis.

Reference Books:

1. Highway Engineering - Laurence I Hewes & Clarkson H Oglesby
2. Traffic Engineering and Transport Planning - L R Kadiyali, Khanna Publishers.
3. The Design and Performance of Road Pavements - David Croney, Paul Croney.
4. Understanding Traffic System -Michel A Taylor, William Young, PeterW Bonsall.
5. Principles of Urban Transport Systems Planning - B. G.Hutchinson.
6. Introduction to transport planning - M. J. Bruton.

7. Transportation Engineering An Introduction – C. Jotin Khisty, B. Kent Lall, Pearson Publication.
8. Transportation Engineering & Planning – C. S. Papacostas, P. D. Prevedouros, Pearson Publication.
9. Principles of Pavement Design - E.F. Yoder (John Wiley & Sons, lnc USA).
10. Fundamentals of Transportation Engineering - C. S. Papacostas.
11. Pavement analysis and Design – Huang Y H, Prentice Hall, Englewood Cliff, New Jersey.
12. Introduction to Transportation Engg. and Planning – Morlok E K, McGraw-Hill company.
13. Fundamentals of Traffic flow Theory – Drew, McGraw-Hill book Co.
14. A course in Traffic Planning and design-Saxena Subhash,Dhanpat Rai & sons,Delhi
15. Traffic analysis (New technologies new solutions)-Taylor M P ,Hargreen Pub.Co. New Delhi.

Codes:

1. IRC 37-2012
2. IRC 58-2015
3. IRC 81-1997
4. IRC 82-2015
5. IRC 115-2014

Hand Books:

Handbook of Road Technology _Lay M. G.Gorden Breach Science Pub.Newyork.

e-Resources:

1) www.nptel.iitm.ac.in/courses/iitkanpur

2) www.cdeep.iitb.ac.in/nptel

401 010 Elective IV (3): Advanced Foundation Engineering

Teaching Scheme
Lectures: 3 Hours/week
Practical: 2 Hours/week

Examination Scheme
Theory Examination:
In-sem : 30 marks (1 Hr.)
End-sem:70 marks (2.5Hrs.)
Term work: 50 Mark

Unit I **(6 Hrs.)**

IS code provision in respect of subsoil exploration for dams, canals, tunnels, off shore structure, air ports and bridges. IRC, provisions for exploration in respect of roads. Case studies of failures of foundation.

Unit II **(6 Hrs.)**

Design of pile based on cyclic load test. Study of provision made in different IS codes related to deep foundation, various types of pile. Design of Racer piles & piles subjected to lateral load. Testing and Design of piles subjected to tensile loads.

Unit III **(6 Hrs.)**

Design of under reamed pile foundation subjected to tensile loads. Design of sand drains and stone columns.

Unit IV **(6 Hrs.)**

Design of shallow foundations subjected to inclined loads. Design of Raft foundation on different types of soil. Design of combined and isolated footing based on field test including calculation of settlement. Introduction to software available for geotechnical foundation design.

Unit V **(6 Hrs.)**

Study of various provisions made as per IRC and as per IS in respect of design of well foundation. Case studies of failure of well foundation. Design of Rock fill coffer Dams.

Unit VI **(6 Hrs.)**

Stress distribution in the shaft, tunnels, underground conduits, classification, load on ditch conduits, positive and negative projecting conduits, and Imperfect ditch conduits.

Term Work:

Term work will consist of

A) Any Four of following 6 assignments.

1) Comparative study of provisions made for the extent of exploration in IS, IRC codes adapted by Indian railways, and PWD.
2) Detailed study of any two Geophysical methods of exploration.
3) Computations of Bearing capacity and Settlement of a Shallow Foundation involving inclined loads.
4) Design of Pile foundations subjected to inclined load and tensile load.
5) Design of Sand Drains.
6) Comparative study of provisions for well Foundation as per IS, IRC and code adapted by Indian railways.

B) Computer Modeling:

Design of any one type of Deep foundation using computer software.

C) Site visit and Case study:

1) One site visit to any important deep foundation and submission of report on the same giving details of design and construction.
2) Any one case study of failure of foundation from the published literature.

Reference Books:

1. Foundation Analysis and Design- Joseph E. Bowels, TATA Mc-Graw hill.
2. Design Aids in Soil Mechanics and Foundation Engineerimg-Shenbage R Kaniraj, TATA Mc-Grawhill.
3. Foundation Design & Construction (4th Ed.)- M.J.Tamlinson, ELBS publication.
4. G. A. Leonards, Foundation Engineering, McGraw-Hill, 1962.
5. R.B. Peck, W.E. Hanson and T.H. Thornburn, Foundation Engineering, 2nd Edition, John Wiley and Sons, 1974.
6. "Principles of Foundation Engineering" by B.M. Das.
7. Theory and Practice of Pile Foundations Wei Dong Guo CRC Press.

I.S .Codes:

IS: 1892-1979 – "Code of Practice for Subsurface Investigation for Foundation".

IS: 2131-1981 (Reaffiemed 1997), "Method for Standard penetration Test for Soils".

IS: 6403-1981 – “Code of Practice for Determination of B.C. of Shallow Foundation”.

IS: 8009 (Part-1) 1976, “Code of Practice for Calculation of settlements of foundations”.

IS: 1904-1986, “Code of Practice for Design and Construction of Foundations in Soils, general Requirements”.

IS: 2911-1979, “Code of Practice for Design and Construction of Pile Foundation”.

Handbooks:

1. Fang , H.Y.,(1991),” Foundation Engineering Handbook”, Chapman & Hall, NY.

2. Teng .W.C.(1962), Foundation Design , Prentice Hall International.

3. Foundation Design Manual by Narayan V. Nayak, Dhanpat Rai & Sons.

401 0010 Elective IV (4): Coastal Engineering

Teaching Scheme
Lectures: 3 Hours/week
Practical: 2 Hours/week

Examination Scheme
Theory Examination:
In-sem: 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Termwork : 50 marks

Unit I **(6 Hrs.)**

Basics of Ocean Waves:

Generation ,classification, Basic understanding of wave mechanics including wave propagation,wave theories,, wave diffraction , wave refection, wave breaking. Waves of unusal character-currents, giant waves , tsunami etc.

Unit II **(6 Hrs.)**

Tides:

Tide producing forces- earth moon and earth sun system , dynamic theory of tides-; types of tides- tides and tidal current in shallow sea, storm surges, tides in rivers and estuaries ,tidal power.

Unit III **(6 Hrs.)**

Coastal Processes:

Coastal process- Erosion/accretion due to waves, bed forms, long shore transport (Littoral drift) estimate of wave induced sediment, budget. Tides, effect of Tides, stability of inlets. Effect of construction of coastal structures on stability of shoreline / beaches.

Unit IV **(6 Hrs.)**

Design of Marine Structures:

Design of Marine Structures: Seawalls, Revetments, Breakwater rubble mound, composite, floating and pneumatic types, and jetties. Offshore structures, Oil Production platform, sub marine pipelines. Model studies.

Unit V **(6 Hrs.)**

Design Technology:

Dredging Technology: Types of dredgers, design of disposal methods of dredged materials
Environmental aspect of dredging , studies for feasibility of dumping ground for dredged material.

Unit-VI **(6 Hrs.)**

Coastal Management:

Pollution in Coastal zone, disposal of waste/dredged spoils, design criteria of coastal outfall inlets and system. Oil spills and contaminants, coastal zone management: activities in coastal zone, CRZ, Issues related to Integrated coastal zone management. Coastal regulation zone.

Reference Books:

1. Brunn Per ,B. U. Naik, “Shore Protection Manual”, NIO Goa.
2. Quinn A. D., “Port Planning”, Mc Grow Hill Book Co. New York.
3. Richard Silvester, “Coastal Engineering”, Vol-I-II, University of Western Australia.
4. Shore Protection Manual-U.S.Waterways Experiment Station Corps of Engineer.
5. Costal Engineering Research Center, Vickburg andU.S.A.1984.Coastal Protection Manual 2002.
6. Harbour and Coastal Engineering”, Vol. I&II, Ocean and Coastal Engineering Publication, NIOT, Chennai.

Term work-

One assignment on each unit.

401 010 Elective IV: Open Elective : 5 (a): Plumbing Engineering

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Theory Examination Scheme:
In-sem : 30 marks (1 Hour)
End-sem :70 marks (2.5 Hours)
Term work: 50 Marks

Unit I **(6Hrs.)**

Introduction to plumbing engineering Definition- plumbing engineering/public health engineering, Indian plumbing industry, Roles of plumbing contractor, plumber, plumbing consultant, plumbing terminology, Principles of plumbing,

a) Introduction to codes and standards:

Introduction to UPC-I and ITM, Green plumbing code supplement-India (GPCS-I) and other codes applicable in plumbing, Approvals of authority having jurisdiction, General regulations, Testing and labeling, Alternative materials, workmanship and minimum standards, Prohibited fittings and practices, Local laws related to plumbing.

b) Architectural and structural coordination, plumbing shafts, Sunken toilet floors, Ledge walls.

Unit II **(6 Hrs)**

Water Supply, fixtures and fittings.

a) Water Supply**:** Types of water supply pipes Fittings and joints, Galvanized iron, Copper, Stainless steel, HDPE, MDPE, Rigid PVC, CPVC, PPR, Composite pipes, (PE-AL-PE), PEX, Joints, Jointing methods and materials, Tools etc. Water hammering, Pipe protection, Velocity, pressure, temperature limitations, Water Supply Fixture Unit (WSFU), Sizing, testing, Valves and regulators, Backflow prevention, Commissioning, Water tanks.

b) Plumbing fixtures, Water conserving fixtures, Rating system for water efficient products, (WEP-I), Water closets, Bidets, Urinals, Flushing devices, Lavatory and bath units, Kitchen sinks, Water coolers, Purifiers, Drinking water fountain, Cloth washers, Mop sinks, Dish washers, Receptors Overflows, Strainers, Standard heights. Prohibited fixtures, Floor slopes, Minimum spacing.

Unit III **(6Hrs.)**

Sanitary system and Storm water Drainage:

a) Sanitary system: Fixtures, Appliances and appurtenance, Classification of fixtures, Soil and waste and grey water, Soil fixtures, Bathroom fixtures, Accessories, Indirect waste connections, Food handling establishments, Fixtures below invert level.

b) Building Drains:

Introduction, Four systems of plumbing, One pipe and two pipe system, Air admittance valves and solvents, Comparison of systems, Vent pipe, Symphonic action, Antisyphon and vent pipes, Loop, Circuits, Types of building drainage pipes, Fittings and jointing methods, Clean outs, Drainage fixture units (DFU), Sizing, Testing, Case study

Unit IV Traps and Interceptors **(6Hrs.)**

Traps-Purpose, Fixture traps and floor traps, Prohibited traps, Trap arm, Developed length, Trap seal, Trap seal protection, Venting of traps, Trap primers, Building traps, Clarifiers, Grease interceptors, Sizing, oil and sand interceptors.

b) Vents:

Vent requirement, Parts of vent system. Parts of vent system, Materials, Sizing, Vent connections, Flood rim level, Island sink venting, Venting of interceptors, Water curtain and hydraulic jump, Termination of vent stacks, Stack venting, Yoke vent, Wet venting.

Unit V **(6Hrs.)**

a) Building Sewers:

DFU, Change in direction of flow, Hydraulic jump,Sudsing stack, Cleanouts, Pipe grading, pipes and fittings suitable for building sewers, RCC, PVC, Nu-Drain, Stoneware., Sizing, testing, Types of traps, Gully, Chambers and manholes, Materials, Venting, Sizing, Testing, Sumps, Pumps, Sewage disposal, Septic tanks.

b) Plumbing in high rise buildings:

Definition of high rise building, Multiple storage tanks, Plumbing shafts, Break pressure tanks, Water supply, Hydro pneumatic system, Pressure reducing valves, Building drainage system, Rain water system, Sizing, Testing, Case study, Introduction to centralized hot water supply, Principles of design.

Unit VI **(6 Hrs)**

Design Parameters & Case Study

Introduction, Plumbing Drawings & Layouts, Water Supply Design Consideration, Sewer Network design consideration, Storm water design consideration as per CPHEEO manuals, Case study on each.

Term work

Term work will consist of 8 assignments with necessary plans /sketches.

1. Introduction of available codes in plumbing
2. Introduction of associations in plumbing in India and outside India
3. Detailed hydraulic design for High rise structure OR G+1 Bungalow by using software.
4. Compilation of rules and regulations of local governing bodies.
5. Roles of plumbing contractor and plumbing consultants.
6. Report on Plumbing fixtures and fittings and explain any ten.
7. Report on materials for water supply and drainage.
8. Report on necessity of traps, intercepts and vents

Books:

1. "Plumbing Engineering" by Deolalikar.
2. "Plumbing, Sanitation and Domestic Engineering" Volume – 1to 4 by G. S. Williams, Mc Graw Hill.
3. "Plumbing, Sanitation and Domestic Engineering, Data Sheets & Wall Charts" by G. S. Williams, Mc Graw Hill
4. "Plumbing Engineering, Theory and Practice" by Subhsh Patil. SEEMA Publishers Mumbai
5. "National Plumbing Codes Handbook", by R. Dodge Woodson.
6. "Central Public Health and Environmental Engineering Organisation Manual (CPHEEO)".

Codes:

1. Uniform Plumbing Code- India (UPC-I), 2008
2. Illustrated Training Manual (ITM), 2008.

401 010 Elective IV: Open Elective: 5 (b): Green Building Technology

Teaching Scheme:
Lectures: 3 Hours/week
Practical: 2 Hours/week

Examination Scheme:
Theory Examination:
In-sem : 30 Marks (1 Hour)
End-sem:70 Marks (2.5 Hours)
Term work: 50 Marks

Unit I: (6 Hrs.)

Materials and Its Applicability, Indoor Environmental Quality, Reuse and Recycle of Construction Waste.

A) Eco Friendly/ Green Building Materials: To understand Environmental impact of building materials. Eco Friendly building materials, their composition, availability, production, physical properties etc. Application of the Eco Friendly/ Green Building materials for different components of the buildings at different level, both internally and externally.
B) Indoor environmental quality, Low VOC materials: Adhesives - Sealants, Paints- Coatings etc.
C) Construction Waste as a Resource- Resource Economics, Disposable Materials, Recovery, Recycling, Collection, Processing, Governmental Role in Waste Management, Potential for Reuse.

Unit II (6 Hrs.)

Site / Building Planning

A) Sustainable Site planning: wind / sun path, water management , material use, landscape, topography.
B) Climate Responsive Architecture: orientation, solar- wind, Building envelope.
C) Thermal comfort indices. Heat flow through building materials. Thermal properties of common building materials available in India. Thermal performance of building envelope. Air movement and buildings. Ventilation and buildings. Wind an Stack effect. Mechanical ventilation. HVAC System, Day lighting. Passive and sustainable architecture. Passive and active systems.

Unit III (6 Hrs.)

Embodied Energy, Life Cycle Assessment, Environmental Impact Assessment, Energy Audit and Energy Management.

A) Embodied energy of various construction materials. Introduction to the Concept: "Life Cycle assessment of materials".

B) EIA : Introduction to EIA., Process of EIA and its application through a case study., EIA as a strategic tool for sustainable development.

C) Energy Management.

Unit IV **(6 Hrs.)**

Appropriate Technologies / Approaches for:

A) Water conservation / efficiency.

B) Sanitation (Grey water, black water management, SWM)

C) Treatments.

D) Biogas.

E) Composting.

F) Solar energy and its applicability through panels, photovoltaic cells etc.

G) Use of "LED, CFL, Fresnel Lens" etc.

H) Wind energy and its use.

I) Orientation aspects in site planning to achieve maximum daylight and natural ventilation.

UNIT V: **(6 Hrs.)**

A) Clean Development Mechanism.

B) Kyoto Protocol.

C) Energy Conservation Building Code.

UNIT VI **(6 Hrs.)**

Rating Systems: - Leadership in Energy and Environmental Design (LEED), Green Globes, National Association for Home Builders (NAHB) – For Homes, Building Research Establishment Environmental Assessment Method (BREEAM), Green Star by Green Building Council Australia (GBCA), LEED India, Comprehensive Assessment System for Built Environment Efficiency (CASBEE), Estimada -Abu Dhabi Urban Planning Council (UPC) etc.

Term Work:

Any Eight of the following:

A) To study: Innovative Materials Developed by CBRI, SERC.

B) To study: Environmental Audit of any existing building and prepare a report.

C) To study, analyze present scenario of organic waste collection and management of any of the premise; preferably hotels.

D) To compare the benefits under different rating systems.

E) To prepare detailed plan for a hypothetical site indicating utility of solar path, wind direction, rainfall intensity etc. to make it sustainable.

F) To prepare a report on carbon credit.

G) To prepare a report on energy efficient buildings in India.

H) To study sustainable planning aspects for urban housing.

I) Study of Design of On Site Sanitation Systems for Indian conditions developed by Appasaheb Patwardhan Safai V Paryavaran Tantraniketan, Dehugaon .

J) To study the benefits given by Municipal Corporations to Green Buildings.

Reference Books and Additional Reading material:

1. Manual of Tropical housing and climate by Koenisberger.
2. Climate responsive architecture by Arvind Krishnan.
3. Manual of solar passive architecture - by Nayak J.K. R. Hazra J. Prajapati.
4. Energy Efficient Buildings in India by Milli Mujumdar.
5. Green Building Materials by Ross Spiegel and Dru Meadows.
6. Publications from - CBRI – Roorkee, - IDC – Mumbai, NID – Ahmedabad.
7. Solar Energy in Architecture and Urban Planning by Herzog Thomas.
8. Solar Heating, Design Process by Kreider Jan F.
9. Energy - Manual for college teachers (CEE publications).
10. Renewable Energy & Environment - A policy analysis for India (CEE publications).
11. Sustainable Building Design Manual-Volume I and II –TERI Publication.
12. Mechanical and Electrical Systems in Construction and Architecture-by Frank R Dagostino.

Principles of Air conditioning-By V. Paul Lang:

1. Heating, Cooling and lighting design methods for architecture. By Lechor Worbert.
2. LEED Manual.
3. Green Globes Manual.
4. Florida Green Building Coalition Manual.
5. The green building process.
6. Green building codes and standards.
7. International Green Construction Code.
8. ASHRAE 189P.
9. ANSI/GG 01, TERI, BREEAM etc.

401 010 Elective IV: Open Elective: 5 (c): Ferrocement Technology

Teaching Scheme:
Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme:
Theory Examination:
In-sem : 30 marks (1 Hour)
End-sem:70 marks (2.5 Hours)
Term work: 50 Mark

Unit 1 **(6 Hrs.)**

What is Ferrocement?

a) Definition, Basic concept like bond increase. Comparison with concretes like RCC, Prestressed, Asbestos cement, Fiber reinforced, Polymer concretes. Composition of ferrocement. Special types of ferrocement. Ferrocement as substitute for conventional building materials. Typical characteristics and their applications.

b) Raw materials, skills, tools and plants. Ferrocement as material of construction. Forming a ferrocement structure. Properties and specifications of raw materials. Proportioning of cement mortar. Job requirements of required skills. Tools and plants.

Unit 2 **(6 Hrs.)**

Mechanical properties and construction methods:

a) Mechanical properties and typical features affecting design. Properties under static and dynamic loading. Shrinkage and creep. Testing of ferrocement.

b) Methods of constructing ferrocement structures. Standardizing method of construction. Planning the work. Fabricating skeleton, tying meshes and mortaring. Curing. Maintenance. Protective surface treatments. Damage to ferrocement structures.

Unit 3 **(6 Hrs.)**

Strength through shape and design:

a) Strength through shape. Design of structure based on form and shape. Forms in nature, various structural forma and their behavior. Typical strengths of different materials. Comparative study of various forms.

b) Design of ferrocement structures. Design, analysis and optimization. Special design considerations for ferrocement. Typical features of ferrocement affecting design. Conventional design methods like working stress, load factor, applied to ferrocement. Design based on equivalent area method for compression, tension and flexural members. Specific surface method and crack control method, Design of structures subjected to membrane stresses. Design of

shaped structures in ferrocement like stiffened plates, arch faced walls, stiffened cavity walls and hollow floors and beams, Design of forms like 'T' 'U' 'T' '+' 'L'

Unit 4 **(6 Hrs.)**

Cost analysis and ferrocement in Building construction.

a) Cost analysis : Factors governing cost analysis. Special considerations for ferrocement structures. Cost comparison with conventional construction. Specifications for ferrocement structures. Quantity analysis of material and labour for ferrocement items. Cost and value of ferrocement construction.

b) Ferrocement in building construction. Ferrocement in foundations, walls, floors roofs. Ferrocement single wall construction. Design and construction of houses with cavity walls, hollow floors and hollow beams. Staircases and other building accessories. Earthquake resisting structures. Special characteristics of ferrocement to resist shock loading design and construction of quake proof structures.

Unit 5 **(6 Hrs.)**

Hydraulic and soil retaining structures in ferrocement :

a) Hydraulic structures. Why ferrocement? Water retaining structures, Storage tanks of various types. Structures across streams. Ferrocement in layered form used for lining, water proofing and surface coating.

b) Soil retaining structures. Types of retaining walls and their comparison with ferrocement arch faced wall. Design and method of fabrication and casting. Ferrocement counterfort retaining wall. Ferrocement containers for storing granular materials.

Unit 6 **(6 Hrs.)**

Space structures and precast products:

a) Ferrocement large size special purpose structures. Space structures like shells, pyramids, domes corrugated catenaries.

b) Precast ferrocement products : Why ferrocement for precasting? Methods of precasting. Design of precast elements. Ferrocement precast walling and flooring panels. Joints in precast ferrocement elements.

Term Work :

Minimum 02 site visits with detailed reports and one assignment based on each unit (Journal consisting of total 6 assignments + 2 visit reports).

Books Recommended:

1) Ferrocrete Technology- A Construction Manual. -- Dr. B. N. Divekar Published by the Author.

2) Ferrocement --- : B. R. Paul and R. P. Pama.Published by International Ferrocement Information Centre. A.I.T. Bangkok, Thailand.

3) Ferrocement and laminated cementitious composites --: A.E. Naaman. Publisher : Techno-press, Ann Arbor, Michigan, USA.

4) Ferrocement - Materials and applications; Publication SP 61, A C I Detroit. USA

5) State of the art report and guide for design, Construction and repairs of Ferrocement; ACI Committee Report. No. ACI 549R-88 and ACI 549.1R.88. Published by American Concrete Institute, Detroit, USA.

6) Chapter 1 titled 'Ferrocement' by S. P. Shah and P. N. Balaguru in book 'Concrete Technology and Design Vol. II, Editor; R. N. Swamy.

7) Proceedings of International Symposiums on 'Ferrocement and thin reinforced composites – Ferro 1 to Ferro 10. Available with International Ferrocement Information Centre, A I T Bangkok, Thailand.

8) Ferrocement Conference Proceedings of Ferrocement Society, India--FS 2011, F.S.2013, F. S. 2015.

401 010 Elective IV: Open Elective: 5 (d): Sub Sea Engineering

Teaching Scheme
Lectures: 3 hours/week
Practical 2 hours/week

Examination Scheme
Theory Examination
In-sem: 30 marks (1 Hour)
End-sem: 70 marks (2.5.Hours)
Termwork: 50 Marks.

Unit1 **(6 Hrs.)**

Introduction to oil and gas industry: general view of oil and gas industry, technological challenges and future developments. Overview of deep water developments: introduction, deep water areas and potential, challenges, route for development Metaocean and environmental conditions: Overview of the determination of Metaocean conditions (meteorological and oceanographic) and the influence of wave, wind, tide and current on marine operations. Introduction to marine ecology and its impact on marine operations.

Unit 2 **(6 Hrs.)**

Introduction to subsea infrastructure development: Summarize the current state of the art and highlights the design challenges. Outlines the way in which water depth influences the architecture and technology of Oil and Gas infrastructure.

Flow assurance: overview of flow assurance and the fundamentals of flow management for subsea production systems, Introduction to flow assurance issues like paraffin deposition; hydrate formation and blockage; Asphaltene precipitation; emulsions; experimental methods, flow assurance assessment methods; prevention, mitigation and remediation tools for flow assurance issues; thermal management and insulation materials.

Unit 3 **(6 Hrs.)**

Subsea installation and intervention: Overview of the installation of subsea plant, risers and pipelines and the main intervention methods including AUVs, ROVs and divers.

Subsea operations and control: An overview of the principle methods of subsea control including electrical, acoustic and hydraulic systems.

Subsea processing and artificial lift: introduction the analytical and numerical models used to design subsea processing systems for sustained recovery of hydrocarbons.

Unit 4 **(6 Hrs.)**

Reliability and integrity management: Introduction to Risk Assessment, FMECA and HAZOPS, Monitoring, Intervention and Inspection Methods, Data Management Construction management of oil field, future challenges.

Unit 5 **(6 Hrs.)**

Subsea field equipment, structures and architectures: scale of operations, environmental factors, A description of each of the pieces of the subsea infrastructure, their use and interconnection including subsea trees, flow lines, umbilicals, risers, moorings and pipelines Materials and corrosion. Types of corrosion found in the oilfield with emphasis on the effects of acid gases (CO_2 and H_2S).

Unit 6 **(6 Hrs.)**

Pipelines and design: Introduction to pipeline engineering, the main pipeline design challenge in deep water. Analysis and design methods of pipelines that address stress analysis, buckling and collapse of deep water pipelines. Limit state based strength design methods. Geotechnical aspects of pipeline design and its installation.

Deepwater risers: different design options available for deep water risers, and defines the key design drivers for each. General principles of stress analysis: An introduction to the principles of stress analysis and the principles of reliability based design, finite element analysis.

Termwork:--Shall consist of one assignment per unit.

References:

1. A Primer of Offshore Operations by Petex
2. Subsea Engineering Handbook Hardcover by Yong Bai (Editor), Qiang Bai (Editor)
C. Norsok standard Common requirements Subsea structures and piping system U-cr-001 Rev. 1, January 1995.
D. Norsok codes, DNV codes : Design specifications for subsea system.

401 010 Elective IV : Open Elective : 5 (e): (Geoinformatics)

Teaching Scheme:
Lectures: 3 Hrs/week

Examination Scheme:
Paper In-sem. 30 Marks (1 Hrs),
Paper End-sem : 70 Marks (2.5 Hrs.)

Unit I **(6 Hrs.)**

Introduction to Remote Sensing GIS and SBPS:

Electro-magnetic radiations **(**EMR) - atmospheric scattering, Raleigh scattering, Mie scattering, non-selective scattering -atmospheric absorption - atmospheric windows, refraction - interaction of EMR earth‘s surface - reflection - transmission - spectral signature - Reflectance characteristics of Earth‘s cover type: Vegetation, water, soil

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - Types of data – Spatial, Attribute data- types of attributes – scales/ levels of measurements. Introduction to SBPS, Segments and errors in GPS.

Unit II **(6 Hrs.)**

THERMAL REMOTE SENSING: Thermal radiation principles – Thermal interaction sensors and characters – thermal image characters – image degradation sources & correction – interpretation of thermal images – Application and Case studies.

MICROWAVE REMOTE SENSING: Introduction-Plane waves-Interference, Radar remote sensing - Radar basics- Antenna Systems -Real aperture radar - Radar frequency bands - SLAR Imaging Geometry, Resolution Concepts - Geometric Distortions, SAR – Concepts - Doppler principle & Processing. RADAR Interaction with earth surface- RADAR equation.

Unit III Unit II **(6 Hrs.)**

DIGITAL IMAGE PROCESSING :

Fundamentals of Image Processing, sensors model and pre processing, image enhancement, image classification, object recognition.

Unit IV **(6 Hrs.)**

OPEN SOURCE GIS:

DESKTOP GIS WITH OPEN SOURCE GIS : View Graphics – Data exchanges- portability and interoperability – Raster handling and Image analysis – vector data management –Rater and vector analysis - 2D/3D vectors with topology, 3D Voxel, 2D Raster.

OPEN SOFTWARE AND WEB MAPPING : Open Source Software : GRASS, QGIS, OSSIM, PostopesSQL and (R) Environment – WEB Mapping Architecture and components – WEB mapping servers- Thin clients in WEB mapping - WMS,WFS, WCS,WPS and other web services- Open Server standards.

Unit V **(6 Hrs.)**

MAP PROJECTION:

Concepts of sphere, ellipsoid and geoid - latitudes, longitudes and graticules –map projections– shape, distance, area and direction properties - role of aspect, development surface, secant and light source / view points – perspective and mathematical projections – Indian maps and projections – Map co-ordinate systems – UTM and UPS references – common projections and selections– projections for hemispheres and the world maps , Map projection for cadastral maps.

Unit VI **(6 Hrs.)**

FUNDAMENTALS and GEOMETRIC GEODESY:

Definitions- Classifications, Problem of Geodesy and purpose of Geodesy Historical development and Organization of Geodesy. Reference Surfaces and their relationship. Applications, Engineering, Lunar, Planetary and interferometric Synthetic aperture radar Geodesy – Local and International Spheroid.

Geomentry of ellipsoid, fundamental mathematical relationship of ellipsoid, Geodetic, Geocentric and Reduced latitudes and their relationship. Ellipsoidal Co-ordinates in terms of Reduced, Geodetic and geocentric latitude. Radius of curvature in the meridian & prime vertical and their relationship. Mean Radius of curvature in any azimuth, Length of the meridian arcs and arcs of parallel and Area of trapezium on the ellipsoid. Curves on the ellipsoid, properties of Geodesic.

Reference Books:

1. Wolfgang Torge, Geodesy, Walter De Gruyter Inc., Berlin, 2001
2. Lillesand, T.M. and Kiefer R.W. Remote Sensing and Image interpretation, John Wiley and Sons, Inc, New York, 2002.
3. Neteler M, Helena M (2008) _Open source GIS: A GRASS GIS approach', 3rd edn, Springer, New York
4. Kang-Tsung Chang, Introduction to Geographic Information Systems, Mc-Graw Hill Publishing, 2nd Edition, 2011.
5. John, R. Jensen, Introductory Digital Image Processing, Prentice Hall, New Jersey,2005 3rd edition
6. R.W. Anson and F.J. Ormeling, Basic Cartography for students and Technicians. Vol.I, II and III, Elsevier Applied Science Publishers, 3rd Edition, 2004.

401006 Project work

Teaching Scheme:
Tutorial: 6 Hrs/week

Examination Scheme:
TW : 50 Marks.
Oral : 100 Marks.

Project Work will be evaluated for an individual student based on the presentation of the work done in a year(I Sem + II Sem) and submission of the report .The student may work in a group during project work, if any.

The project work shall consist of any one of the following nature in Civil Engineering related subjects.

1. Experimental investigation.
2. Software development.
3. Benefit : Cost economic analysis.
4. Case study with own design.
5. Working model design and fabrication.
6. Case study with development of methodology using soft computing tools.

The details of report writing and preparation of report will be similar to that of as mentioned in syllabus of Project Phase I in first semester.

Evaluation of Project work in final exam. Will be done by the pair of internal guide having minimum 3 years approved experience as teacher and external guide.

It is recommended to promote the students to present a paper based on project work in appropriate conference / journal.