PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code:	Course Title: Geotechnical Engineering
Semester: 4th	Credits: 3
Periods Per Week: **(L: 3, T: 0, P:0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

- To understand and determine physical and index properties and classification of soil
- To estimate permeability and shear strength of soil
- To know the load bearing capacity of soil
- To learn various soil stabilization and compaction methods

COURSE CONTENT

Unit – I Overview of Geology and Geotechnical Engineering (6 hrs)

1.1 Introduction of Geology, Branches of Geology, Importance of Geology for civil engineering structure and composition of earth, Definition of a rock: Classification based on their genesis (mode of origin), formation. Classification and engineering uses of igneous, sedimentary and metamorphic rocks.

1.2 Importance of soil as construction material in Civil engineering structures and as foundation bed for structures.

1.3 Field application of geotechnical engineering for foundation design, pavement design, design of earth retaining structures, design of earthen dam.

Unit– 2 Physical and Index Properties of Soil (8 hrs)

1.1 Soil as a three phase system, water content, determination of water content by oven drying method as per BIS code, void ratio, porosity and degree of saturation, density index. Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight. Determination of bulk unit weight and dry unit weight by core cutter and sand replacement method, Determination of specific gravity by pycnometer.

2.2 Consistency of soil, Atterberg limits of consistency: Liquid limit, plastic limit and shrinkage limit. Plasticity index.

2.3 Particle size distribution test and plotting of curve, Determination of effective diameter of soil, well graded and uniformly graded soils, BIS classification of soil.

Unit– 3 Permeability and Shear Strength of Soil (8 hrs)

2.1 Definition of permeability, Darcy's law of permeability, coefficient of permeability, factors affecting permeability, determination of coefficient of permeability by constant head and fall- ing head tests, simple problems to determine coefficient of permeability. Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines, application of flow net, (No numerical problems).

3.2 Shear failure of soil, concept of shear strength of soil. Components of shearing resistance of soil – cohesion, internal friction. Mohr-Coulomb failure theory, Strength envelope, strength equation for purely cohesive and cohesion less soils. Direct shear and vane shear test –laboratory methods.

Unit– 4 Bearing Capacity of Soil (10 hrs)

3.1 Bearing capacity and theory of earth pressure. Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure. Introduction to Terzaghi's analysis and assumptions, effect of water table on bearing capacity.

4.2 Field methods for determination of bearing capacity – Plate load and Standard Penetration Test. Test procedures as per IS:1888 & IS:2131.

4.3 Definition of earth pressure, Active and Passive earth pressure for no surcharge condition, coefficient of earth pressure, Rankine's theory and assumptions made for non-cohesive Soils.

Unit– 5 Compaction and stabilization of soil (12 hrs)

4.1 Concept of compaction, Standard and Modified proctor test as per IS code, Plotting of Compaction curve for determining: Optimum moisture content(OMC), maximum dry density(MDD), Zero air voids line. Factors affecting compaction, field methods of compaction – rolling, ram- ming and vibration. Suitability of various compaction equipments-smooth wheel roller, sheep foot roller, pneumatic tyred roller, Rammer and Vibrator, Difference between compaction and consolidation.

5.2 Concept of soil stabilization, necessity of soil stabilization, different methods of soil stabiliza- tion. California bearing ratio (CBR) test - Meaning and Utilization in Pavement Construction

5.3 Necessity of site investigation and soil exploration: Types of exploration, criteria for deciding the location and number of test pits and bores. Field identification of soil – dry strength test, dilatancy test and toughness test.

Suggested learning resources:

- Punmia,B.C., Soil Mechanics and Foundation Engineering, Laxmi Publication, Delhi.
- Murthy, V.N.S., A text book of soil mechanics and foundation Engineering, CBS Publishers &Distributors Pvt. Ltd., New Delhi.
- Ramamurthy, T.N. & Sitharam,T.G., Geotechnical Engineering(Soil Mechanics), S Chand and Company LTD., New Delhi.
- Raj, P. Purushothama, Soil Mechanics and Foundation Engineering, Pearson India, New Delhi.
- Kasamalkar, B. J., Geotechnical Engineering, Pune Vidyarthi Griha Prakashan, Pune.
- Arora K R, Soil Mechanics and Foundation Engineering, Standard Publisher.

Course outcomes:

After completing this course, student will be able to:

1) Identify types of rocks and sub soil strata of earth.
2) Interpret the physical properties of soil related to given construction activities.
3) Use the results of permeability and shear strength test for foundation analysis.
4) Interpret soil bearing capacity results.
5) Compute optimum values for moisture content for maximum dry density of soil through va ious tests.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: PC406	Course Title: **Geotechnical engineering Lab**
Semester: **IV**	Credits: **1**
Periods Per Week: **2(L: 0, T: 0, P: 2)**	

PRACTICAL EXERCISES:

Course Objectives:

Following are the objectives of this course:

- To understand and determine physical and index properties of soil.
- To estimate the permeability and shear strength of soil.
- To know the procedure for performing C.B.R test.
- To learn various compaction methods for soil stabilization.

List of Practicals to be performed:

1) Identification of rocks from the given specimen.
2) Determine water content of given soil sample by oven drying method as per IS: 2720 (Part-II).
3) Determine specific gravity of soil by pycnometer method as per IS 2720 (Part-III).
4) Determine dry unit weight of soil in field by core cutter method as per IS 2720 (Part- XXIX).
5) Determine dry unit weight of soil in field by sand replacement method as per IS 2720 (Part-XXVIII).
6) Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample as per IS2720 (Part- V).
7) Determine Shrinkage limit of given soil sample as per IS 2720 (Part- V).
8) Determine grain size distribution of given soil sample by mechanical sieve analysis as per IS2720 (Part- IV).
9) Use different types of soil to identify and classify soil by conducting field tests-Through Visual inspection, Dry strength test, Dilatancy test and Toughness test.
10) Determine coefficient of permeability by constant head test as per IS 2720 (Part-XVII).

11)Determine coefficient of permeability by falling head test as per IS 2720 (Part-XVII).

12)Determine shear strength of soil by direct shear test as per IS 2720 (Part-XIII).

13)Determine shear strength of soil by vane shear test as per IS 2720 (Part-XXX).

14)Determine MDD and OMC by standard proctor test of given soil sample as per IS 2720 (Part-VII).

15)Determination of CBR value on the field as per IS2720 (Part - XVI).

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	20
4	10	25
5	12	25
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC402**	Course Title: Advanced Surveying
Semester: **IV**	Credits: 3
Periods Per Week: **4 (L: 3, T: 1, P: 0)**	

COURSE OBJECTIVE:

The objectives of this course are to introduce fundamental knowledge of land measurement and modern survey application. After completion of this course students will be able to implement modern survey techniques in map making and its applications in relevant to Civil Engineering projects.

COURSE CONTENT

1. Theodolite Surveying: (10 hrs)

Working of a transit vernier theodolite axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases

2**. Tacho-metric surveying** (06 hrs)

Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problem

3. **Curves:** (10 hrs)

3.1 Simple Circular Curve:
Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of

intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:

a) By linear measurements only:
- Offsets from the tangent
- Successive bisection of arcs
- Offsets from the chord produced

b) By tangential angles using a theodolite

3.2 Transition Curve:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

3.3 Vertical curve

Setting out of a vertical curve

4. Advanced Surveying Equipment's: (06 hrs)

4.1 Principle of Electronic Distance Meter (EDM)
- 4.1.1 Its component parts and their functions
- 4.1.2 Use of EDM

4.2 Use of
- 4.2.1 Micro Optic Theodolite
- 4.2.2 Electronic Digital Theodolite

4.3 Use of Total Station
- 4.3.1 Use of function keys
- 4.3.2 Measurement of horizontal angles, vertical angles
- 4.3.3 Distances and coordinates using Total Station
- 4.3.4 Traversing, Profile survey and Contouring with Total station

5. Remote Sensing, GPS and GIS: (08 hrs)

5.1 Remote Sensing
- 5.1.1 Overview
- 5.1.2 Remote Sensing System
- 5.1.3 Application of Remote Sensing in Civil Engineering
- 5.1.4 Land use/ Land Cover
- 5.1.5 Mapping, Disaster Management

5.2 Use of Global Positioning System (G.P.S.) instruments

5.3 Geographic Information system (GIS)

5.3.1 Overview
5.3.2 Components
5.3.3 Applications
5.3.4 Name of common software for GIS

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS "Text Book of Surveying";, S Chand and Co Ltd., New Delhi
2. Deshpande, RS "A Text Book Surveying and Levelling"; United Book Corporation, Pune,
3. Kocher, CL; "A Text Book of Surveying"; Katson Publishing House Ludhiana,
4. Kanetkar,TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, Pune
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" AVG Prakashan, Pune
6. Punima, BC; "Surveying and Leveling ", Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant "Remote Sensing and Image Interpretation"
9. Mahajan, Sanjay, "Surveying-II", Satya Prakashan, Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	6	15
3	10	25
4	6	20
5	6	20
Total	**38**	**100**

COURSE OUTCOME

After completion of the course the student is able to:

Unit 1: To measure vertical and horizontal angles and finding level differences.
Unit 2: To prepare contoured maps or plans requiring both the horizontal as well as vertical control.
Unit 3: Setting out the curve by different methods.
Unit 4: Prepare plans by using Advanced Surveying Equipment
Unit 5: To know the concept of Remote Sensing, G.P.S. and G.I.S.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: **PC407**	Course Title: Advanced Surveying lab
Semester: **IV**	Credits: 1
Periods Per Week: **(L: 0, T: 0, P: 2)**	

COURSE OBJECTIVES:

The objective of the course is to determine horizontal and vertical angles by using theodolite, setting out the curves, measure horizontal distance by using EDM/Total Station and to locate coordinates of a station with the use of G.P.S.

LIST OF PRACTICAL TO BE PERFORMED:

1. Reading the vernier of transit Theodolite and working out the least count.
2. Use of Transit theodolite/ Digital theodolite measurement of horizontal angles by direct, repetition and reiteration methods
3. Use of Transit theodolite/Digital theodolite measurement of vertical angles.
4. Height of objects with and without accessible bases by using of theodolite.
5. Use Theodolite as a tacheometer to compute reduce level and horizontal distances.
6. Setting out of a simple circular curve with given data by the following methods
    a) Offsets from the chords produced
    b) One theodolite method
7. Use EDM to measure horizontal distances.
8. Use Total Station to measure horizontal distances.

9. Use Total Station to carry out survey projects for closed traverse for minimum five sides.

10. Use GPS to locate the coordinates of a station.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: PC403	Course Title: **Water Resource Engineering**
Semester: **IV**	Credits: **3**
Periods Per Week: **(L: 3, T: 0, P: 0)**	

COURSE OBJECTIVES:

Following are the objectives of this course:

To learn estimation of hydrological parameters.

To understand water demand of crops and provisions to meet the same.

To know planning of reservoirs and dams.

To design irrigation projects, canals and other diversion works.

COURSE CONTENT:

1. Introduction to Hydrology
    - 1.1 Hydrology: Definition and Hydrological Cycle
    - 1.2 Rain Gauge
        - 1.2.1 Symons Rain Gauge
        - 1.2.2 Automatic Rain Gauge
    - 1.3 Methods of Calculating Average Rainfall
        - 1.3.1 Arithmetic Mean
        - 1.3.2 Isohyetal
    - 1.4 Runoff
        - 1.4.1 Factors affecting run off
        - 1.4.2 Computation of Run off
2. Crop Water Requirement and Reservoir Planning
    - 2.1 Irrigation and its Classification
    - 2.2 Crop Water Requirement
        - 2.2.1 Cropping Seasons
        - 2.2.2 Crop Period
        - 2.2.3 Base Period
        - 2.2.4 Duty
        - 2.2.5 Delta
        - 2.2.6 CCA
        - 2.2.7 GCA
        - 2.2.8 Intensity of Irrigation
        - 2.2.9 Factors Affecting Duty
        - 2.2.10 Problems on Water Requirement and Capacity of Canal
    - 2.3 Methods of Application of Irrigation Water and its Assessment
3. Dams and Spillways

- 3.1 Dams and its Classification
  - 3.1.1 Earthen Dams
  - 3.1.2 Gravity Dams (masonry and concrete)
- 3.2 Earthen Dams
- 3.3 Spillways
  - 3.3.1 Definition
  - 3.3.2 Energy Dissipaters

4. Minor and Micro Irrigation
   - 4.1 Lift Irrigation Scheme
     - 4.1.1 Components and their Functions
     - 4.1.2 Lay Out
   - 4.2 Drip and Sprinkler Irrigation
     - 4.2.1 Need
     - 4.2.2 Components and Layout
   - 4.3 Well Irrigation
     - 4.3.1 Types and Yield of Wells
     - 4.3.2 Advantages and Disadvantages of Well Irrigation

5. Diversion Head Works & Canals
   - 5.1 Weirs
     - 5.1.1 Components
     - 5.1.2 Parts
     - 5.1.3 Types
     - 5.1.4 K.T. Weir: Components and Construction
   - 5.2 Diversion Head Works
     - 5.2.1 Layout
     - 5.2.2 Components and their functions
   - 5.3 Barrages
     - 5.3.1 Components and their functions
     - 5.3.2 Difference between Weir and Barrage
   - 5.4 Canals
     - 5.4.1 Classification according to Alignment and Position in the Canal Network
     - 5.4.2 Cross section of Canal in Embankment and Cutting
     - 5.4.3 Partial Embankment and Cutting
   - 5.5 Canal lining
     - 5.5.1 Purpose
     - 5.5.2 Material used and its properties
     - 5.5.3 Advantages
   - 5.6 Cross Drainage Works
     - 5.6.1 Aqueduct
     - 5.6.2 Siphon Aqueduct
     - 5.6.3 Super Passage
     - 5.6.4 Level Crossing
   - 5.7 Canal Regulators
     - 5.7.1 Head Regulator

5.7.2 Cross Regulator
5.7.3 Escape
5.7.4 Falls and Outlets

COURSE OUTCOMES

After completing this course, student will be able to:

1. Estimate hydrological parameters.
2. Estimate crop water requirements of a command area and capacity of canals.
3. Execute Minor and Micro Irrigation Schemes.
4. Select the relevant Cross Drainage works for the specific site conditions.
5. Design, construct and maintain simple irrigation regulatory structures.

SUGGESTED LEARNING RESOURCES

1. Punmia, B.C., Pande, B, Lal, Irrigation and Water Power Engineering, Laxmi Publications
2. Subramanayan, Engineering Hydrology, McGraw Hill.
3. Mutreja K N, Applied Hydrology, McGraw Hill
4. Sharma, R.K. and Sharma, T.K., Irrigation Engineering, S.Chand
5. Basak, N.N., Irrigation Engineering, McGraw Hill Education
6. Asawa, G.L., Irrigation and water resource Engineering, New Age
7. Dahigaonkar, J.G., Irrigation Engineering, Asian Book Pvt. Ltd., New Delhi.
8. Garg, S K, Irrigation and Hydraulic Structures, Khanna Publishers, Delhi.
9. Priyani V.B., Irrigation Engineering, Charotar Book Stall, Anand.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	15
2	08	15
3	08	25
4	08	20
5	10	25
Total	**40**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code:PC404	Course Title: PHE Engineering
Semester: 4th	Credits:
Periods per week: 6(L:4, T:0, P:2)	

COURSE OBJECTIVE:

The rationale of PHE Engineering revolves around safeguarding public health, meeting the basic human needs, conserving water resources, promoting sustainable development and complying with regulatory frameworks. The subject aims at providing the basic knowledge and skills in the field of waters supply and waste water engineering and thus contributing towards the sustainable management of water resources and the well-being of communities.

COURSE CONTENT:

(A) WATER SUPPLY ENGINEERING

UNIT 1:

1.1 Introduction (02hrs)

1.1.1 Necessity and brief description of water supply system.

1.2 Quantity of Water (05 hrs)

1.2.1 Water requirement

1.2.2 Rate of demand and variation in rate of demand

1.2.3 Per capita consumption for domestic, industrial, public and fire fightinguses as per BIS standards (no numerical problems)

1.2.4 Population Forecasting

1.3 Quality of Water (05 hrs)

1.3.1 Meaning of pure water and methods of analysis of water

1.3.2 Physical, Chemical and bacteriological tests and their significance

1.3.3 Standard of potable water as per Indian Standard

1.3.4 Maintenance of purity of water (small scale and large scale quantity)

UNIT 2:

2.1Water Treatment (brief introduction) (08 hrs)

**2.1.1 Sedimentation - purpose, types of sedimentation tanks
**2.1.2 Coagulation floculation - usual coagulation and their feeding
**2.1.3 Filtration - significance, types of filters, their suitability
2.1.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine. Flow diagram of different treatment units, functions of (i) Areation fountain (ii) mixer (iii) floculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.

2.2 Conveyance of water (08 hrs)

**2.2.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types Conveyance of Water of pipes.

2.2.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses

2.2.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes

2.2.4 Systems of water supply - Intermittent and continuous servicereservoirs - types, necessity and accessories.

2.2.5. Wastage of water - preventive measures

2.2.6 Maintenance of distribution system

2.2.7 Leakage detection

2.3 Building Water Supply (02 hrs)

2.3.1 Connections to water main (practical aspect only)

2.3.2 Water supply fixtures and installations and terminology related to plumbing

B. WASTE WATER ENGINEERING

UNIT 3:

3.1 Introduction (05 hrs)

3.1.1 Purpose of sanitation

3.1.2 Necessity of systematic collection and disposal of waste

3.1.3 Definition of terms in sanitary engineering
3.1.4 Collection and conveyance of sewage
3.1.5 Conservancy and water carriage systems, their advantages and Disadvantages
3.1.6 (a) Surface drains (only sketches) : various types, suitability
(b) Types of sewage: Domestic, industrial, storm water and its seasonal variation

3.2 Sewerage System (05hrs)

3.2.1 Types of sewerage systems, materials for sewers, their sizes and joints
3.2.2 Appurtenance: Location, function and construction features. Manholes, drop manholes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts, Traps, seals, causes of breaking seals

UNIT 4:

4.1 Sewage characteristics: (4hrs)

4.1.1 Properties of sewage and IS standards for analysis of sewage
4.1.2 Physical, chemical and bacteriological parameters

4.2 Natural Methods of Sewerage Disposal (5hrs)

4.2.1 General composition of sewage and disposal methods
4.2.2 Disposal by dilution
4.2.3 Self purification of stream
4.2.4 Disposal by land treatment
4.2.5 Nuisance due to disposal

UNIT 5:

5. 1Sewage Treatment (8 hrs)

5.1.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plainsedimentation tanks, primary clarifers, secondary clarifers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant)

** A field visit may be planned to explain and show the relevant things.

LIST OF PRACTICALS

1) To determine turbidity of water sample
2) To determine dissolved oxygen of given sample
3) To determine pH value of water
4) To perform jar test for coagulation
5) To determine BOD of given sample
6) To determine residual chlorine in water
7) To determine conductivity of water and total dissolved solids
8) Study of water purifying process by visiting a field lab.

REFERENCES

1. Duggal, KN; "Elements of Public Health Engineering";, S. Chand and Co. New Delhi
2. Rangwala, SC; "Water Supply and Sanitary Engineering"; Anand Charotar Book Stall
3. Hussain, SK; "Text Book of Water Supply and Sanitary Engineering"; Oxford and IBH Publishing Co, New Delhi,
4. Garg, Santosh Kumar; "Water Supply Engineering"; Khanna Publishers, Delhi
5. Garg, Santosh Kumar; "Sewage and Waste Water Disposal Engineering"; KhannaPublishers, Delhi
6. Duggal, Ajay K and Sharma, Sanjay, "A Laboratory Manual in Public Health Engineering", , Galgotra Publications, 2006, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

UNIT No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	21
2	18	32
3	10	15
4	09	16
5	08	16
Total	**57**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course code:PC405	Course Title: Fluid Mechanics & Hydraulic
Semester: 4th	Credits: 3
Periods per week: 3(L:3, T:0, P:0)	

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses

COURSE OUTCOMES

After completing this course, student will be able to:

1. Measure pressure and determine total hydrostatic pressure for different conditions.
2. Understand various parameters associated with fluid flow
3. Determine head loss of fluid flow through pipes.
4. Find the fluid flow parameters in open channels.
5. Select relevant hydraulic pumps for different applications

COURSE CONTENT

1. Pressure Measurement and Hydrostatic Pressure

1.1. Technical terms used in Hydraulics:

1.1.1. Fluid, Fluid Mechanics

1.1.2. Hydraulics, Hydrostatics and Hydrodynamics

1.1.3. Ideal and Real Fluid 1.1.4. Application of Hydraulics

1.2. Physical Properties of Fluid:

1.2.1. Density-Specific Volume

1.2.2. Specific Gravity

1.2.3. Vapour pressure, Surface Tension, Capillarity

1.2.4. Viscosity - Newton's Law of Viscosity, Dynamic and Kinematic viscosity

1.3. Various Types of Pressure:

1.3.1. Atmospheric Pressure

1.3.2. Gauge Pressure

1.3.3. Absolute Pressure

1.3.4. Vacuum Pressure

1.4. Concept of Pressure Head and its unit

1.5. Pascal's law of fluid pressure and its uses

1.6. Measurement of Differential Pressure

1.6.1. Manometers

1.6.1.1 Piezometer - its limitation

1.6.1.2 U-tube - simple, differential, inverted

1.6.1.3 Micro-manometers

1.7. Variation of Pressure with Depth:

1.7.1. Pressure Diagram

1.7.2. Hydrostatic Pressure

1.7.3. Center of Pressure on immersed surfaces and on tank walls

2. FLUID FLOW PARAMETERS

2.1 Types of flow

2.1.1 Gravity and Pressure Flow

2.1.2 Laminar, Turbulent

2.1.3 Uniform, Non-uniform

2.1.4 Steady, Unsteady flow

2.2 Reynolds Number

2.3 Discharge and its unit

2.4 Continuity Equation of Flow

2.5 Energy of flowing Liquid

2.5.1 Potential

2.5.2 Kinetic

2.5.3 Pressure Energy

2.6 Bernoulli's Theorem: Statement, Assumptions, Equation

3. FLOW THROUGH PIPES

3.1 Major Head Loss in Pipe

3.1.1 Frictional loss and its computation by Darcy's Weisbach Equation

3.2 Minor Losses in Pipe

3.2.1 Loss at Entrance, Exit

3.2.2 Sudden Contraction, Sudden Enlargement

3.2.3 Fittings

3.3 Flow through Pipes

3.3.1 Pipes in Series

3.3.2 Pipes in Parallel

3.4 Hydraulic Gradient Line and Total Energy Line

3.5 Water Hammer in Pipes: Causes and Remedial measures
3.6 Discharge measuring device for Pipe Flow: Venturimeter
3.7 Discharge measurement using Orifice.

4. FLOW THROUGH OPEN CHANNEL

4.1 Geometrical properties of channel section
- 4.1.1 Wetted Area
- 4.1.2 Wetted Perimeter
- 4.1.3 Hydraulic Radius for Rectangular and Trapezoidal Channel Section

4.2 Determination of discharge by Chezy's equation and Manning's equation
4.3 Conditions for Most Economical Rectangular and Trapezoidal Channel Section
4.4 Discharge measuring devices:
- 4.4.1 Triangular Notch
- 4.4.2 Rectangular Notch

4.5 Velocity measurement devices
- 4.5.1 Current Meter
- 4.5.2 Floats
- 4.5.3 Pitot's Tube

4.6 Froude Number

5. HYDRAULIC PUMPS

5.1 Concept of Pump
5.2 Types of Pump
- 5.2.1 Centrifugal
- 5.2.2 Reciprocating
- 5.2.3 Submersible

5.3 Suction Head, Delivery Head, Static Head, Manometric Head
Selection and choice of pump

SUGGESTED LEARNING RESOURCES

1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
2. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
3. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, Dhanpat Rai Publishing Company, New Delhi.
4. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
5. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.

6. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	25
2	10	20
3	10	20
4	12	25
5	06	10
Total	**50**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG / CIVIL (PHE) / QSCM	
Course code:PC408	Course Title: Fluid Mechanic & Hydraulic Lab
Semester: 4th	Credits: 1
Periods per week: 2(L:, T:0, P:2)	

COURSE OBJECTIVES

Following are the objectives of this course:

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

Course Outcomes

After completing this course, student will be able to:

1. Measure pressure and determine total hydrostatic pressure for different conditions.
2. Understand various parameters associated with fluid flow.
3. Determine head loss of fluid flow through pipes.
4. Find the fluid flow parameters in open channels.
5. Select relevant hydraulic pumps for different applications.

LIST OF PRACTICALS TO BE PERFORMED

1. Use Piezometer to measure Pressure at a given point.
2. Use U tube Differential Manometer to measure Pressure Difference between two given points.
3. Use Reynold's Apparatus to determine type of flow.
4. Use Bernoulli's Apparatus to apply Bernoulli's Theorem to get Total Energy Line for a flow in a closed conduit of varying cross sections.
5. Use Current meter to measure the velocity of flow of water in Open Channel.
6. Use Pitot Tube to measure the velocity of flow of water in Open Channel.

Elective-1

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG / CIVIL (PHE) / QSCM	
Course code	Course Title: Construction Quality Control
Semester 4th	Credits 2
Period Per Week 2(L:2,T:1,P:0)	

COURSE OUTCOMES The theory should be taught and exercises should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes. i. Apply total quality management in civil construction. ii. Check the quality in civil construction works. iii. Identify the variations in quality of civil works. iv. Use various standard codes in civil construction works. v. Design energy efficient buildings

COURSE CONTENT

Unit-I

Total Quality Management (TQM) in Construction. Concept of quality control, Quality assurance, Quality management. Aims of TQM. Development and design Concept of TQM. Accuracy and precision in observation, reading theodolite, digital theodolite, total station, calibration, etc. Accuracy in calculation, finding area, volume, etc.

Unit-II

Construction Quality Control Inspection Program. Duties, responsibilities, qualification of staff in organization. Checklists for - Quality of Materials - Masonry - Plastering, - Concrete construction- Batching, Mixing, Transporting, Placing, Compaction, Finishing, Curing - Reinforcement Work - Formwork - Timber & steel construction, - Doors & windows, - Plumbing & drainage.

Unit-III

Quality standards in construction related to Building materials and other inputs for construction processes. Quality standards for Construction outputs, products and services. Indian Standard Code (a) Methods of referring it (b) Use of IS for quality references. National Building code (NBC 2005) (a) Why to refer & How to refer (b) Methods of referring it & application. Study of International Organization for Standardization (ISO) (a) ISO-9000, ISO14000 & certification procedures.

Unit-IV

Green building – Definition – Green Building, Green Construction, Sustainable building. Goals of Green building. Advantages and disadvantages. Strategies Certification Agencies – GRIHA, LEED (Highlights & Criteria). Life cycle assessment (LCA). Siting and structure

design efficiency. Energy efficiency Water efficiency. Materials efficiency. Indoor environmental quality enhancement. Operations and maintenance optimization. Waste reduction

Unit	Time	Marks
Unit I	8	25
Unit 1I	7	25
Unit 1II	6	25
Unit IV	6	25
Total	**27**	**100**

Refrences

1.Total Quality Management;G.Kanji; Springer Science &Business Media
2.Fundamentals of Quality Control and improvement:Amitva Mitra : Wiley India Private Limited.
3.Manual on Quality Control
4. Ambuja Technical Literature Series.
5. National Building Code.

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: PE409	Course Title: Rural Construction Technology
Semester: 4th	Credits: 2
Periods Per Week: **(L: 2, T: 0, P:0)**	

Course Objectives:

Following are the objectives of this course:

- To learn development and planning of low cost housing infrastructure.
- To know about different government schemes for rural development.
- To understand techniques for rural road construction as per IRC stipulations.
- To learn rural irrigation techniques and watershed management.

Course Contents:

Unit I - Rural Development and Planning (4 hrs)

1.1 Scope; development plans; various approaches to rural development planning.

1.2 Significance of rural development.

1.3 Rural development programme/projects.

Unit 2 -Rural Housing (12 hrs)

2.1 Low cost construction material for housing

2.2 Composite material- ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls.

2.3 Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry, rat-trap bond for walls; Panels for roof, ferro-cement flooring/roofing units.

2.4 Biomass - types of fuels such as firewood, agricultural residues, dung cakes.

2.5 Renewable energy and integrated rural energy program - Objectives, Key elements, Imple-mentation, Financial provisions, sources of renewable energy.

2.6 Working of gobar gas and bio gas plants.

Unit 3 Water Supply and Sanitation for Rural Areas (12 hrs)

3.1 Sources of water: BIS & WHO water standards.

3.2 Quality, Storage and distribution for rural water supply works.

3.3 Hand pumps-types, installation, operation, and maintenance of hand pumps.

3.4 Conservation of water - rainwater harvesting, drainage in rural areas.

3.5 Construction of low cost latrines: Two pit pour flush water seal, septic tank etc.

3.6 Low cost community and individual Garbage disposal systems, Ferro-cement storage tanks.

Unit 4 - Low Cost Rural Roads (7 hrs)

4.1 Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases.

4.2 Guidelines for Surfacing of Rural Road as per relevant IRC codes.

4.3 Pradhan Mantri Gram Sadak Yojna (PMGSY)- Highlights of Scheme.

Unit 5 - Low Cost Irrigation (7 hrs)

5.1 Design consideration and construction of tube-well, drip & sprinkler irrigation systems.

5.2 Watershed and catchment area development –problems and features of watershed manage- ment.

5.3 Watershed management structures - K. T. weir, Gabian Structure, Cement Plug, Contour Bunding, Farm pond, Bandhara system.

Suggested learning resources:

- Madhov Rao A G, and Ramachandra Murthy, D S, Appropriate Technologies for low cost Housing Oxford and IBH Publishing Co. Pvt. Ltd.
- CBRI, Roorkee, Advances in Building Materials and Constriction.
- Desai,Vasant , Rural Development in India: Past, Present and Future : a Challenge in the Crisis, Himalaya Publishing House, Delhi.
- Rastogi, A.K.Rural Development Strategy, Wide Vision, Jaipur.
- Singh, Katar, Rural Development Principles, Policies and Management, Sage Publications In- dia Pvt Ltd.
- Gaur, Keshav Dev, Dynamics of Rural Development, Mittal Publications, Delhi.
- Document Published by Ministry of Rural development, Govt. of India, Ministry of Rural de- velopment.

Course outcomes:

After compeleting this course, student will be able to:

1. Plan low cost housing using rural materials.

2. Make use of relevant government schemes for construction of roads and housing.
3. Use guidelines for rural road construction.
4. Implement different irrigation systems for rural areas.
5. Identify the need of watershed management in rural areas.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	04	10
2	12	25
3	12	25
4	07	20
5	07	20
Total	**42**	**100**

Open Elective -1

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: OE410	Course Title: Renewable Energy Technologies
Semester: 4th	Credits: 2
Periods Per Week: **2(L: 2, T: 0, P:0)**	

Course objectives

- To understand energy scenario, energy sources and their utilization.
- To explore society's present needs and future energy demands.
- To Study the principles of renewable energy conversion system.
- To exposed to energy conservation methods.

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective 1. Use pie chart showing distribution of renewable energy sources 2. Use wind turbine models 3. Use sun path diagrams Mo

Chapter -1

Introduction: (5 hrs)

Principles of renewable energy; energy and sustainable development, fundamentals and social implications worldwide renewable energy availability, renewable energy availability in India, brief descriptions on solar energy, wind energy, tidal energy, wave energy, ocean thermal energy, biomass energy, geothermal energy, oil shale. Introduction to Internet of energy (IOE)

Chapter -2 (6hrs)

Solar Energy:

Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Solar radiation Measurements- Pyrheliometers, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; Solar distillation;

Solar Pond electric power plant.

Solar electric power generation- Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system

Chapter-3 **(6hrs)**

Wind Energy: Properties of wind, availability of wind energy in India, wind velocity and power from wind; major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system. Vertical axis- Savonius and darrieus types.

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies-fixed dome; Urban waste to energy conversion; Biomass gasification (Downdraft)

Chapter- 4 **(6hrs)**

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

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

Chapter – 5 **(6hrs)**

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy Concepts. Benefits of hydrogen energy, hydrogen production technologies (electrolysis method only), hydrogen energy storage, applications of hydrogen energy, problem associated with hydrogen energy

Course outcome (Course Skill Set)

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

Chapter-1 Describe the environmental aspects of renewable energy resources.

In Comparison with various conventional energy systems, their prospects and limitations.

Chapter-2 Describe the use of solar energy and the various components used in the energy production with respect to applications like-heating, cooling, desalination, power generation.

Chapter-3 Understand the conversion principles of wind and tidal energy

Chapter-4 Understand the concept of biomass energy resources and green energy.

Chapter-5 Acquire the basic knowledge of ocean thermal energy conversion and hydrogen energy

UNIT WISE TIME AND MARKS DISTRIBUTION

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	20
2	6	20
3	6	20
4	6	20
5	6	20
Total	**29**	**100**

PROGRAM: THREE YEARS DIPLOMA IN CIVIL ENGINEERING	
Course Code: **OE 409**	Course Title: **Introduction to E-Governance**
Semester: **4th**	Credits:**2**
Periods Per Week: **2(L:2, T:0, P:0)**	

COURSE OBJECTIVE:

To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency. To develop the basic understanding on the topic of E-Governance and learn the fundamentals involved in the subject.

COURSE CONTENT:

1. **Introduction: (10 Hours)**

   1.1. Definition,
   1.2. Needs of E-Governance,
   1.3. Evolution of E-Governance,
   1.4. Its scope and content,
   1.5. Basic Structure of e- Governance,
   1.6. Advantages of e-governance

2. **E-governance approaches in India-The National e-Governance plan:(8 Hours)**

   2.1. Introduction to NeGP (National e-Governance Plan)
   2.2. NeGP Vision
   2.3. The framework for e-Governance
   2.4. Infrastructure pillars of NeGP
   2.5. Capacity Building initiatives under NeGP

3. **E-Governance Project Development And Management (10 Hours)**

   3.1. Introduction to e-Government Project Development
   3.2. Conceptualization Phase
   3.3. Architect Phase, Define Phase, Support Phase
   3.4. e-Government Project Management Phase.
   3.5. Public Private Partnership for e-Government.

4. Government Process Re-Engineering (8 Hours)

4.1. Process Reforms for e-Governance Projects,
4.2. Tools and techniques for Government Process Re-engineering,
4.3. Legal Reforms
4.4. Technology Management and Enterprise Architecture for e-Governance,

5. Capacity Building and change Management: (8 Hours)

5.1. Capacity Building for e-Governance,
5.2. Focusing on Indian initiatives and their impact on citizens
5.3. Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context.
5.4. Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc)

COURSE OUTCOME:

After the completion of the course the student will be able to:

- Understand and appreciate the essence of e-Governance.
- Know the scope and basic structure of e-Governance
- Understand the National- Governance Plan
- Develop and manage e-Governance projects

RECOMMENDED BOOKS:

1. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning,2012.

2. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.

3. C.S.R.Prabhu : E-Governance: Concepts and Case Studies, Prentice Hall of India Pvt. Limited (2004).

4. Implementing and managing e-Government, Richard Heeks, 2006.

5. Managing Transformation –Objectives to Outcomes. J Satyanarayana, Prentice Hall India.

UNIT WISE TIME AND MARKS DISTRIBUTION

Unit	Time Allotted(Hrs)	Marks Allotted(%)
1	10	25
2	8	20
3	10	20
4	8	15
5	8	20
Total	**44**	**100**

PROGRAM: THREE YEARS DIPLOMA PROGRAMME IN CIVIL ENGG	
Course Code: OE410	Course Title: Artificial Intelligence
Semester: 4th	Credits: 2
Periods Per Week: **2(L: 2, T: 0, P: 0)**	

Course Objectives:

Have a thorough understanding of classical and modern AI applications. Be able to implement aWide range of AI concepts using Prolog. Understand non-classical AI approaches such as genetic Algorithms and neural networks. Be able to assess the potential of AI in research and real-world Environments

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Course Content:

UNIT-1 : Introduction (10 hrs)

1.1 History and foundations of AI, Problem solving: Uninformed and informed Search; Constraint Satisfaction Problems and Constrained Optimization problems (complete and incomplete techniques).

UNIT-2 : Adversarial Search (10 hrs)

2.1 Two players games, games with uncertainty; Decision support systems and technologies; Knowledge representation, Reasoning, Expert systems Contents (2/2), Planning
(basics).

UNIT-3 : Machine learning Basics (10 hrs)

3.1 Decision trees, Ensemble learning, Reinforcement learning, Evolutionary computation, Neural networks, Problems, data, and tools; Visualization;

UNIT-4 : Linear regression (10 hrs)

4.1 SSE; gradient descent; closed form; normal equations; features, Over fitting and complexity; training, validation, test data, and introduction to Matlab.

References:

1. Russell, Norvig, Artificial intelligence: A modern approach, 2nd edition. Pearson/Prentice Hall.

2. M.C. Trivedi, A classical approach to Artificial Intelligence, Khanna Publishing House, New Delhi (2018)

3. V.K. Jain, Machine Learning, Khanna Publishing House, New Delhi (2018)

4. Ethem Alpaydin, Introduction to Machine Learning, Second Edition, http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012.

Course outcomes:

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

1. Identify problems that are amenable to solution by AI methods.
2. Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.
3. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
4. able to design and implement various machine learning algorithms in a range of real-world applications.
5. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	25
2	10	25
3	10	25
4	10	25
Total	**40**	**100**