SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY
"DNYANTEERTH", VISHNUPURI, NANDED

PROPOSED CURRICULUM FOR
T.E. (CIVIL ENGINEERING)
(CGPA Revised)
w.e.f. 2020-21

SRTMU NANDED
Syllabus for CGPA (REVISED)
Semester V (Third year] Branch/Course Civil Engineering

Sl. No.	Category	Code	Course Title	Hours per week			Credits	Marking Scheme					Theory Total
				L	T	P	C	PR	OR	TW	MSE	ESE	
1	Professional Core courses	PCC-CE501	Structural analysis-I	3	0	0	3	-	-	-	30	70	100
2	Professional Core courses	PCC-CE502	Water Resources Engineering –I	3	0	2	4	-	-	25	30	70	125
3	ProfessionalCoreCourses	PCC-CE503	Foundation Engineering	3	0	0	3	-	-	-	30	70	100
4	Professional Core courses	PCC-CE504	Environmental Engineering	3	0	2	4	25	-	25	30	70	150
5	Professional Core courses	PCC-CE505	Transportation Engineering –I	3	0	0	3	-	-	25	30	70	125
6	Professional Core Courses	PCC-CE506	Structural Engineering-I (Steel)	3	1	0	4	-	-	25	30	70	125
7	Mandatory courses (non-credit)	MC507	Constitution of India/ Essence of Indian TraditionalKnowledge	-	1	0	0	-	25@	-	-	-	25
8	Humanities and Social Sciencesincluding Management courses	HSMC508	Technical Seminar-II	0	0	2	0	-	25@	-	-	-	25
9	Professional Core courses	PCC-CE509	NPTEL Course – I	0	0	2	1			25			25
Total				**18**	**02**	**08**	**22**	**25**	**50**	**125**	**180**	**420**	**800**
Grand Total				**28**									

Symbols to remember: -@ - Internal Assessment, # - External Assessment

T – Theory , P– Practical, T – Tutorial , CR – Credit , OR – Oral , TW – Term work, MSE – Minor Semester Examination, ESE – End Semester Examination

Dr. M. L. Waikar,	**Dr. N. H. Kulkarni**	**Dr. P. B. Ullagaddi,**	**Dr. Vijay Pawar**	**Prof. ZakerUllah Khan**
	Head of the Department		**Gramin College of**	**Gramin College of**
SGGS I.E&T	**SGGS I.E&T**	**SGGS I.E&T**	**Engineering (GRACE)**	**Engineering (GRACE)**
Vishnupuri, Nanded.	**Vishnupuri, Nanded.**	**Vishnupuri, Nanded.**	**Vishnupuri, Nanded.**	**Vishnupuri, Nanded.**
(Chairman)	**(Member)**	**(Member)**	**(Member)**	**(Member)**

Dean Engineering
SRTM University Nanded

Semester VI (Third year] **Branch/Course Civil Engineering**

Sr. No	Category	Code	Course Title	Hours per week			Credits	Marking Scheme					Theory Total
				L	T	P	C	PR	OR	TW	MSE	ESE	
1	Professional Core courses	PCC-CE601	StructuralEngineering-II (RCC)	3	1	0	4	-	-	25	30	70	125
2	Professional Core courses	PCC-CE602	Engineering Economics, Estimation & Costing	2	0	4	4	25#	-	25	30	70	150
3	Professional Elective courses	PEC-CEEL603	Structural Analysis-II	3	0	0	3	-	-	-	30	70	100
4	Professional Core Courses	PCC-CE604	Water Resources Engineering -II	3	0	2	4	-	-	25	30	70	125
5	ProfessionalElective courses	PEC-CEEL605	Elective-I A. Building Construction Practices B. Materials, Testing & Evaluation	3	0	2	4	-	25@	25	30	70	150
6	Open Elective courses	OEEL606	Open Elective-II (Humanities) A. Soft skills and interpersonal communication B. ICT for Development	0	0	2	1	-	25@	25	-	-	50
7	Humanities and Social Sciencesincluding Management courses	HSMC607	Technical and Competitive Exams Skills	0	0	2	0	-		25	-	-	25
8	Professional Course	PCC-CE608	Practicing on Building Drawing / Estimation / Water Analysis Software	0	0	2	1	25#	-	25	-	-	50
9	Professional Core courses	PCC-CE609	NPTEL Course – II	0	0	2	1			25			25
Total				**14**	**1**	**16**	**22**	**50**	**75**	**175**	**150**	**350**	**800**
Grand Total				**31**									

Symbols to remember: -@ - Internal Assessment, # - External Assessment
T –Theory ,P– Practical,T –Tutorial ,CR –Credit ,OR –Oral ,TW –Term work,MSE –Minor Semester Examination,ESE - End SemesterExaminationInternship of 6 weeks duration after VIth Semester Examination.

Dr. M. L. Waikar,	**Dr. N. H. Kulkarni**	**Dr. P. B. Ullagaddi,**	**Dr. Vijay Pawar**	**Prof. ZakerUllah Khan**
	Head of the Department		**Gramin College of**	**Gramin College of**
SGGS I.E&T	**SGGS I.E&T**	**SGGS I.E&T**	**Engineering (GRACE)**	**Engineering (GRACE)**
Vishnupuri, Nanded.	**Vishnupuri, Nanded.**	**Vishnupuri, Nanded.**	**Vishnupuri, Nanded.**	**Vishnupuri, Nanded.**
(Chairman)	**(Member)**	**(Member)**	**(Member)**	**(Member)**

Dean Engineering
SRTM University Nanded

CURRICULUM

For

UNDERGRADUATE DEGREE COURSES IN

CIVIL ENGINEERING

(Engineering & Technology)

[Proposed from 2020-21]

For

Swami RamanandTeerthMarathwada University Nanded

Curriculum for
Undergraduate Degree Courses in Engineering & Technology

CIVIL ENGINEERING

PCC-CE501	Structural Analysis-I	3L:0T:0P	3 credits

Objectives:

1) Equip students with comprehensive Methodsof structural Analysis with emphasis on Analysis of elementary structures.
2) To understand the basics configuration and classification of structures.
3) To analyze the determinate and indeterminate structures.

Content

Module 1: (7Hrs)

Deflection of beams;Slope and deflection in statically determinate beams subjected to point loads, uniformly distributed load and couples by Macaulay's method, moment area method, conjugate beam method.

Module 2: (6Hrs)

A) Deformation and Strain covering Stability of dams, retaining walls and chimneys;
B) Strain Energy;Resilience of beam in bending, deflection of beams from strain energy, Castigliano's theorem and its application to beams and pin jointed trusses. (6 Lectures)

Module 3: (6Hrs)

Fixed Beams;analysis of fixed beams for shear force and bending moment, effect of sinking of support.

Module 4: (6 Hrs)

Continuouse Beams: Clayperon's theorem of three moments, analysis of continuouse beams for shear force and bending moments. Effect of sinking of support

Module 5: (6 Hrs)

A) Three hinged arches – Concepts, types of arches, analysis of parabolic arch with supports at same and different levels, semicircular arches with support at same level, determination of horizontal thrust, radial shear and normal thrust for parabolic and circular arch.(04 hours)
B) Two hinged arches – analysis of parabolic and semicircular arches with supports at same level, determination of horizontal thrust, radial shear and normal thrust. (03 hours)

Module 6: (5Hrs)

Influence Line Diagram. Basic concept, Muller: Braslau's principle, influence line diagram for reaction, shear and moment to simply supported and overhanging beams, application of influence line diagram to determine reaction, shear and moment in beams.

Outcomes:

At the end of the course, the student will have

CO1. an ability to apply knowledge of mathematics, science, and engineering

CO2. an ability to design a system, component, or process to meet desired needs

CO3. an ability to identify, formulate, and solve engineering problems.

CO4. Understand the basic concept of static and kinematic indeterminacy, slope and deflection of determinate and indeterminate beams for analysis of structures.

CO5. Evaluate determinate and indeterminate trusses and its application in the field.

CO6. Analyze two and three hinged arches and its application.

CO7. Apply influence line diagrams for the analysis of structures under moving load.

Text/Reference Books:

2. Norris, C.H. and Wilber, J. B. and Utku, S. "Elementary Structural Analysis" McGraw Hill, Tokyo, Japan.
3. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
4. Kazmi, S. M. A., 'Solid Mechanics" TMH, Delhi, India.
5. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
6. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
7. Gere, J. M., and S. P. Timoshenko. Mechanics of Materials. 5th ed. Boston: PWS Kent Publishing, 1970.
8. Ashby, M. F., and D. R. H. Jones. Engineering Materials, An Introduction to their Properties and Applications. 2nd ed. Butterworth Heinemann.
9. Collins, J. A. Failure of Materials in Mechanical Design. 2nd ed. John Wiley & Sons, 1993.
10. Courtney, T. H. Mechanical Behavior of Materials. McGraw-Hill, 1990.
11. Hertzberg, R. W. Deformation and Fracture Mechanics of Engineering Materials. 4th ed. John Wiley & Sons, 1996.
12. Nash, W. A. Strength of Materials. 3d ed.Schaum's Outline Series, McGraw-Hill, 1994.
13. Strength of Material by R. Ranamuruthi
14. Theory of structure by R. Ramamuruthi
15. Mechanics of Structure by H. J. shah

PCC-CE502	Water Resources Engineering-I	3L:0T:2P	4 credits

Objectives: Students will be able :

1. To comprehend basic concepts of the water cycle and hydrology.
2. To be able to perform engineering hydrology computations
3. To learn aquifer properties
4. To understand hydroelectric generation process.

Module 1: Introduction –

Hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data. (2 Hours)

Module 2: Precipitation –

Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, deptharea-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

(5 Hours)

Module 3: Abstractions from precipitation –

Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices. (6 Hours)

Module 4: Runoff –

Runoff volume, SCS-CN method of estimating runoff volume, flowduration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows.

(4 Hours)

Module 5: Ground water and well hydrology –

Forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests, introduction to integrated approach, Conjunctive use of water resources.

(4 Hours)

Module 6: Water withdrawals and uses –

Water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation. (5 Hours)

List of Practicals: (All Practicals are compulsory)

1. To determine rate of infiltration and infiltration capacity using double ring Infiltrometer
2. Measurement of rainfall.
3. Estimation of flood using unit hydrograph.
4. Neat sketch of Dam
5. Neat sketch of all types of spillway
6. Stability analysis of gravity Dam without earthquake force
7. Stability analysis of gravity Dam with earthquake force
8. Design of free overfall spillway.
9. Design of ogee spillway.
10. Design of shaft spillway.
11. Numerical SCS-CN method of estimating runoff volume.
12. Make Working Model of Irrigation System which may include Sprinkler irrigation system ,

Drip IrrigationSystems, etc., on atleast5m X 5m Area.

Outcomes:

At the end of the course, students must be in a position to:

CO1. Understand the interaction among various processes in the hydrologic cycle

CO2. Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering

CO3. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures

CO4. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions

CO5. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources

CO6. Apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering

Text Books:

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.

Reference Books:

1. K Subramanya, Water Resources Engineering through Objective Questions, Tata McGraw Hill.
2. G L Asawa, Irrigation Engineering, Wiley Eastern
3. L W Mays, Water Resources Engineering, Wiley.
4. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.
5. Hydrology and water Resources Engineering, Water supply and Sanitary Engineering by G. S. Birde, J. S. Birde
6. Water Supply and Sanitary Engineering by Rangwala
7. Irrigation Engineering NiraliPrakashan V. S. Sonarkar, S. B. Nimbalkar D. J. Khamkar, S. M. Rangwar
8. Irrigation and Water Power Engineering Dr. B. C. Punmia, Dr.Pande B. B. Lal
9. Irrigation Engineering and Hydraulic Structure S. R. Sohasrabudhe.

PCC-CE503	Foundation Engineering	3L:0T:0P	3 credits

Course Objective:

Foundation is an important component of any civil engineering structure which must be safe, stable, and economically designed. The course on Foundation Engineering provides the students necessary geotechnical engineering skills to analyse and design shallow and deep foundation systems under different loading and soil conditions.

Module 1: (6Lectures)

Bearing Capacity Analysis - Failure Modes, Terzaghi'sAnalysis,Specialization of Terzaghi's Equations, Skempton Values for Nc, Meyerhof's Analysis,I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure,

Module 2: (6 Lectures)

Settlement analysis-Causes and control of settlement, Immediate settlement, Consolidation settlement, Differential settlement, Prediction of foundation settlement from plate load test, Settlement tolerance of super structures, proportioning of footings for equal settlement.

Module 3: (5Lectures)

Foundations for Difficult Soils - Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative Measures for Expansive Soils, Modification of Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: for general considerations, for Cohesive Soils, for Cohesionless Soils,

Module 4: (5 Lectures)

Shallow Foundations: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of Isolated, Combined, Strap Footing (Rigid analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation

Module 5: (6 Lectures)

Deep foundations: Pile Foundation: Classification, Pile Driving, Load Carrying Capacity of Piles, Single Pile Capacity, Dynamic Formulae, Static Formulae, Pile Load Tests, Penetration Tests, Negative skin Friction, Under Reamed Piles, Group Action of Piles,

Module 6: (6 Lectures)

Caissons Foundations: Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties And Remedial Measures Sheet Piles: Classification, Design of Cantilever Sheet Pile in Cohesionless and Cohesive soils. Design of Anchored Sheet Pile by Free Earth Support Method, Cellular Cofferdams: Types, Cell Fill Stability Considerations

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

CO1-To predict soil behavior under the application of loads and come up with appropriate solutions to
foundation design queries.

CO2-Analyze the stability of slope by theoretical and graphical methods.

CO-3Analyze the results of in-situ tests and transform measurements and associated uncertainties into
relevant design parameters.
CO-4Synthesize the concepts of allowable stress design, appropriate factors of safety, margin of safety, and reliability.

Text Books

• Kasamalkar, B.J., " Foundation Engineering", Pittsburgh vintage Grand Prix
• Murthy V.N.S., " Soil Mechanics and Foundation Engineering", CRC Press 2002
• Arora K.R., " Soil Mechanics and Foundation Engineering", Standard publication 2009
• Punmia B. C., " Soil Mechanics And Foundation Engineering", Laxmi publication 16th 2017
• Nayak N.V., " Foundation Design Manual", DhanpatRai And Sons
• Brahma S.P., " Foundation Engineering", Tata McGraw-Hill 5th Edition
• Braja Das, " Principles of Geotechnical Engineering", Engage Learning 9th edition
• Bowles J.E., " Foundation analysis & Design", McGraw-Hill Higher Education 5th edition

References Books

• Teng W.C., " Foundation Design", Prentice-Hall Inc
• Tomlinson M.J., " Foundation Design & Construction", Prentice-Hall; 7th edition
• Lee, " Sheet Piles" Concrete Publication,1961
• Relevant Publications by Bureau of Indian Standards, New Delhi
• IS 6403:1981, IS 1904:1986, IS 4091:1979

PCC-CE504	Environmental Engineering	3L:0T:2P	4 credits

Objective:

1.To understand drinking water quality standards and demand of water.
2.Study of various units of water treatment plant, process .
3.Prepare the design of water treatment plant.
4.Give the distribution system using appropriate method.
5.To learn concept ,disposal method of solid waste and e waste .
6.Understand the different techniques for treatment of water.

Module 1: (06 hrs.)

Water supply scheme: Data collection for water supply scheme, Components and layout, Design period, Factors affecting design period.

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. design capacity for water supply components,

Quality: quality of water: Physical, chemical, biological characteristics, Indian standard for drinking water quality standards.

Module 2: (5 hrs.)

Water treatment: Principles of water treatment operations and processes, Water treatment flow sheets.

Aeration: principle and concept, Necessity, methods, removal of taste and odour, design of aeration fountain.

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 settler ,plate setter.

Module 3: (6 hrs.)

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 Clari- flocculator.

Filtration: Theory of filtration, Mechanism of filtration, Filter materials, Slow sand,rapid sand, pressure filters-operation, design of Rapid sand Filter.

Disinfection – types of disinfectants , factors affecting disinfection , efficiency of disinfection, , break point chlorination, bleaching powder estimation ,residual chlorine.

Module 4: (6 hrs.)

Water distribution system: System of water supply- Continuous and intermittent system. Different distribution systems and their components ,Wastage and leakage of Water-detection and prevention.

Air Pollution: Definition, sources of air pollution, types air pollutants, atmospheric stability, , Equipment for particulate contaminants ,effects of air pollution, Air pollution control mechanism, Principle and working of Settling chamber.

Module 5: (5 hrs.)

Solid waste –types ,Sources ,characteristics of solid waste , effect of improper solid waste management , collection , process techniques, disposal methods of solid waste-compositing, incineration ,pyrolysis, sanitary landfilling , concept of hazardous and non-hazardous, e-waste disposal.

Module6: (6 hrs.)

Treatment of Waste Water : Sources of wastewater flows, components of wastewater flows, wastewater constituents, characteristic of municipal waste water , necessity of treatment of waste water, sewerage systems, concept of sewage, sullage , storm water, introduction of preliminary treatment, primary treatment, secondary treatment. introduction to tertiary or advanced treatment fundamentals of anaerobic treatment.

Practical Work: List of Experiments(Minimum 12 Practical out of 15)

1. Turbidity.
2. pH Value.
3. Total Solids, Dissolved Solids & Suspended Solids Alkalinity
4. Hardness: total hardness, calcium and magnesium hardness
5. Acidity.
6. Chloride and residual chlorine.
7. Optimum coagulant dose of alum
8. Study of softeners and contents of mineral water.
9. Visit water treatment plant and write a report on it.
10. Chemical Oxygen Demand (COD)
11. Dissolved Oxygen (D.O)
12. Biochemical Oxygen Demand (BOD)
13. Fluorides and Iron
14. Analysis of ions: copper, and sulphate.
15. Visit sewage treatment plant and write a report on it.

Outcomes:

After successfully studying this course, students will:

CO1. Prepare basic process designs of water and wastewater treatment plants.
CO2. Understand the impact of humans on environment and environment on humans
CO3. Be able to plan strategies to control, reduce and monitor pollution.
CO4. Apply the water treatment process and concept .
CO5. Describe methods of disposal ,sources and types of solid waste
CO6. Be able to select the most appropriate technique for the water treatment and waste water.

Text/Refrence Books:

1.Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications.
Garg S. K., "Water Supply Engineering" ,Khanna Publishers, New Delhi
3.Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, DhanpatRai Publishing Company, New Delhi.
4. Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
5. Water Supply and Treatment Manual: Govt. of India Publication.
6.Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
7.Environmental Engineering: Peavy and Rowe, McGraw Hill Publications

8. MetCalf and Eddy. *Wastewater Engineering, Treatment, Disposal and Reuse*, Tata McGraw-Hill, New Delhi.
9.Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
10. Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association).
11.Water treatment : principles & Design 3rd edition by John C Crittenden R. Rhodes
12. Water quality &Treatment : Handbook on Drinking Water 6th Edition by James K. Edzwald.
13.Solid waste management- Dr. A.D.Bhide
14.handbooks and solid waste disposal-Techabonglaus

PCC-CE505	Transportation Engineering- I	3L:0T:0P	3 credits

Course objectives:

1. To introduce the principles and practice of Highway Engineering.
2. To enable students to have a strong analytical and practical knowledge of geometric design ofhighways.
3. To introduce pavement design concepts, material properties, construction methods and todesign highway pavements.
4. To understand the principles of traffic engineering and apply this for efficient management oftransportation facilities.

Highway Engineering

Module 1: (6 Hrs)

Introduction: Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport.Highway Development & Planning: Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys.

Module 2: (7 Hrs)

Highway Alignment: Requirements, Alignment of Hill Roads, Engineering Surveys.

Highway Geometric Design: Cross Section Elements, Carriageway, Camber, Sight Distances, Horizontal Curves, Extra-widening, Super-elevation, Vertical Curves.

Module 3: (9 Hrs)

Highway Materials: Properties of Sub-grade and Pavement Component Materials, Tests on Sub-grade Soil, Aggregates and Bituminous Materials.

Highway Construction: Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements.

Module 4: (8 Hrs)

Highway Drainage and Maintenance: Importance of drainage and maintenance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas, Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures.

Highway Economics & Financing: Total Transportation Cost, Economic Analysis, Sources of Highway Financing.

Traffic Engineering

Module 5: (6 Hrs)

Traffic Characteristics: Road User Characteristics, Driver Characteristics, Vehicular Characteristics. Traffic Studies: Volume Studies, Speed Studies, O-D Survey, Parking Study.

Module 6: (6 Hrs)

Traffic Safety and Control Measures: Traffic Signs, Markings, Islands, Signals, Cause and Type of Accidents, Use of Intelligent Transport System.

Traffic Environment Interaction: Noise Pollution, Vehicular Emission, Pollution Mitigation Measures.

Course Outcomes:

The students will be able to

CO1: Design various geometric elements of a highway.

CO2: Determine the characteristics of pavement materials and design flexible pavements .

CO3: Conduct traffic engineering studies and analyze data for efficient management of roadway facilities, Plan and design basic airport facilities.

Text/Refrence Books:

1. Khanna S.K., and Justo, C.E.G. “Highway Engineering”, Nem Chand and Brothers, Roorkee, 1998.

2. Kadiyali, L.R. “Principles and Practice of Highway Engineering”, Khanna Publishers, New Delhi, 1997.

3. Flaherty, C.A.O. “Highway Engineering”, Volume 2, Edward Arnold, London, 1986.

4. Sharma, S.K. “Principles, Practice & Design of Highway Engineering”, S. Chand & Company Ltd., New Delhi, 1985.

5. Mannering, “Principles of Highway Engineering & Traffic Analysis”, Wiley Publishers, New Delhi.

PCC-CE 506	Structural Engineering-I (STEEL)	3L:1T:0P	4 credits

Course objectives:

The objectives of this are to learn the behavior and design of structural steel components (members and connections in two - dimensional (2D) truss and frame structures) and to gain an educational and comprehensive experience in the design of simple steel structures.

Course Contents

Module 1:*Introduction;* ***(5 Hrs)***

Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations.

Module 2: ***(6 Hrs)***

Connections Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible Stresses, Design of connections, failure of joints.

Module 3: ***(5 Hrs)***

Axially Loaded Members Tension members: Common sections, net effective area, load carrying capacity, connection using weld / bolts, design of tension splice.

Module 4: ***(7 Hrs)***

A) Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt

B)Columns; Simple and built up section, lacing, battening, column subjected to axial force and bending moment, column splices. Column bases: Slab base, gusseted base and moment resisting bases, design of anchor bolt.

Module 5:*Beams*; ***(5 Hrs)***

Laterally supported & unsupported beams, design of simple beam, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections

Module 6: ***(7 Hrs)***

A) Gantry girder: Forces acting on a gantry girder, commonly used sections, design of gantry girder as laterally unsupported beam, connection details Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge& roller supports.

B) Introduction to IS 800-2007 Provisions of recent approaches in Steel Structure design based on Plastic Analysis Method and Limit State Approach

Note: Use of IS 800, IS 875, IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

Course Outcomes: On completion of the course, the students will be able to:
CO1: Identify and compute the design loads and the stresses developed in the steel member.
CO2: Analyze and design the various connections and identify the potential failure modes.
CO3: Analyze and design various tension, compression and flexural members.
CO4: Understand provisions in relevant BIS Codes.
CO5: Design of structural systems such as roof trusses, gantry girders.

Text/Ref. Books

• Duggal S. K., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
• Chandra Ram, "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi
• Dayaratnam P., "Design of Steel Structures", Wheeler Publishing, New Delhi
• Subramanian N., "Steel Structures: Design and Practice" Oxford Univ. Press, Delhi Reference Books
• Arya A. S. and Ajamani J.L., "Design of Steel Structures", Nemchand and Brothers, Roorkee
• Vazirani&Ratwani, "Design of Steel Structures", Standard Book House, New Delhi
• Publications of Bureau of Indian Standards, New Delhi, IS 800:1984, 2007, IS 875 (Part I to V)
• Gaylord E.H. and Gaylord C.N., "Design of Steel Structures" McGraw Hill, New York
• Lothers J.E., "Design in Structural Steel" Vol.-I, Prentice Hall New Jersy 29
• Salmon and Johnson, "Steel Structures: Design and Behaviour", Harper and Row, New York
• Steel Designers Manual.

MC507	Constitution of India/ Essence ofIndian TraditionalKnowledge	0L:1T:0P	0 credits

Objectives:

To understand the,

- Rigidity and flexibility in the constitution
- Parliamentary system of government.
- Federal system with a unitary bias.
- Fundamental rights and fundamental duties.
- Directive principles of state policy.
- Secularism.
- Independent judiciary.

Module 1: Introduction Constitution - meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

Module 2: Union Government and its Administration - Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha

Module 3: State Government and its Administration - Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions

Module 4: Local Administration - District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Module 5: Election Commission Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

Module 6: Astronomy, Chemistry, Mathematics and Metallurgy in India –Siddhantik and Post siddhantik development of Astronomy, Early Chemical Techniques, Atomism in Vaiśeṣika, Chemistry in Early Literature,First Steps, Early Historical Period, The Classical Period, The Classical Period, post-Āryabhaṭa, The Kerala School of Mathematics, Features of Indian MathematicsMetallurgy before and during the Harappan Civilization, After the Harappans, iron metallurgy, wootz steel, other iron pillars and beams, zinc, social context

Module 7: Medical Sciences in India: The Principles of Ayurvedic Healing, Treating diseases to restore health.

Module 8: Music, Theater and Drama in India -Origin, classification accompanied instrument, Bharata'sNāṭyaśāstra, New era, Medieval period, modern era, aesthetics of Indian classical music, forms of composition: Dhrupada, thumari, gazal, tarana, tappa, folk music, film musicTheater and Dram Its Beginnings, Classical Period, Major Indian Dramatists: Bhāsa, Kālidāsa, Bhavabhūti, Medieval Period, Kuṭiyaṭṭam, Yakṣagāna, Bhavāī, Jātrā, Nautaṅkī, Swāṅg, Rāmalīlā, Tamāśā, Nāchā, Pāṇḍavānī, Modern Era

Outcomes:

Students will be able to:

CO 1 Outline the sources and evolution of key Indian institutions and ideals.
CO 2 Explain the historical origins, philosophical foundations, and core principles of the Indian Constitution.
CO 3 Trace the sources and development of Indian intellectual traditions and cultural institutions.
CO 4 Understand the principles of constitutional government as practiced in the India.

Reference Books:

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by SubhashKashyap
3. 'Indian Constitution' by D.D. Basu
4. Āryabhaṭa
5. Vātsyāyana, Nāgārjuna, Al-Bīrūnī', Vāgbhaṭa
6. TaittīriyaBrāhmaṇa, YājñavalkyaSmṛti, ViṣṇuPurāṇa, SkandaPurāṇa,
7. Nātyaśāstra, Viṣṇudharmottarapurāṇa-Khaṇḍa III, Bhakti Movement

HSMC-508	**TECHNICAL SEMINAR-II**	**0L:0T:2P**	**0 credits**

Seminar based on curriculum of semester V.

PCC-CE509	NPTEL Course - I	0L:0T:2P	1 credits

- Students have to complete minimum four weeks NPTEL web and video course from Civil Engineering Department which is available on portal nptel.ac.in. It is preferred that student should attend any one course related to subjects of Fifth semester.
- Certification courses are offered twice a year (Jan-Jun, Jul-Dec). Joining a course is free. Learning can be done by watching videos and this is tested by the weekly assignments, which are to be submitted online within the prescribed deadline.
- There is a certification examination that the student can take for a nominal fee at the end of the course to earn certificates from the IITs.

To earn credits of this course students have to produce the NPTEL course completion certificate and online submitted assignments to the department before end semester practical examination.

PCC-CE601	Structural Engineering-II (RCC)	3L:1T:0P	4 credits

Objectives:

This course aims at providing students with a solid background on principles of structural engineering design. Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels. Hands-on design experience and skills will be gained and learned through problem sets and a comprehensive design project. An understanding of real-world open-ended design issues will be developed. Weekly recitations and project discussions will be held besides lectures.

Module 1: (6 Hours)

Introduction- concepts of energy principles, safety, sustainable development in performance; what makes a structure; principles of stability, equilibrium; what is a structural engineer, role of engineer, architect, user, builder; what are the functions' what do the engineers design, first principles of process of design.

Module 2: (5 Hours)

Planning and Design Process; Materials, Loads, and Design Safety; Behaviour and Properties of Concrete and Steel; Wind and Earthquake Loads

Module 3: (6 Hours)

*Limit state of Collapse and shear for beams:*approximate analysis method as a basis of design; design of RCC beam for flexure, design of reinforced concrete beams for shear, anchorage and serviceability.

Module 4:(5 Hours)

Design of Structural Elements; RCC concrete slab, one way two way and cantilever:

Module 5: (6 Hours)

Analysis and design of RCC column; axially loaded, bi-axial.

Module 6: (6 Hours)

Analysis and design of RCC column footing; box, isolated and combined.

Outcomes:

CO1. The students will be able to apply their knowledge of structural mechanics in addressing Design problems of structural engineering

CO2. They will possess the skills to solve problems dealing with different loads and Concrete and Steel

CO3. They will have knowledge in Structural Engineering

Tutorials

1. Analysis of design of G+3 RCC Structure of residential building of min. 120 m^2 area, analysis frame manually.

i. Load analysis of G+3 RCC framed structure.

ii. Analysis of any two frames of structure

iii. Design of one way slabs at different floor levels.
iv. Design of two way slabs at different floor levels.
v. Design of cantilever one way slabs at different floor levels.
vi. Design of stair slab.
vii. Design of singly reinforced beams.
viii. Design of doubly reinforced beams.
ix. Design of flanged beams
x. Design of columns.
xi. Design of square isolated footing.
xii. Design of rectangular box footing
xiii. Design of combined footing.
2. Use Auto Cad for drawing & detailing of reinforcement
i. Detailed submission drawing of proposed building.

Text/Reference Books:

1. Nilson, A. H. *Design of Concrete Structures.* 13th edition. McGraw Hill, 2004
2. MacGregor, J. G., *Reinforced Concrete: Mechanics and Design*, 3rd Edition, Prentice Hall, New Jersey, 1997.
3. Nawy, E. G., *Reinforced Concrete: A Fundamental Approach*, 5th Edition, Prentice Hall, New Jersey.
4. Wang C-K. and Salmon, C. G., *Reinforced Concrete Design*, 6th Edition, Addison Wesley, New York.
5. Nawy, E. G. *Prestressed Concrete: A Fundamental Approach*, Prentice Hall, NJ, (2003).
6. Related Codes of Practice of BIS
7. Smith, J. C., *Structural Analysis*, Harpor and Row, Publishers, New York.
8. W. McGuire, R. H. Gallagher and R. D. Ziemian. "Matrix Structural Analysis", 2nd Edition, John Wiley and Sons, 2000.
9. NBC, *National Building Code*, BIS (2017).
10. ASCE, *Minimum Design Loads for Buildings and Other Structures, ASCE 7-02*, American Society of Civil Engineers, Virginia, 2002.
11. Illlustrati design of G +3 RCC building by Shah &Karve.

PCC-CE602	Engineering Economics, Estimation & Costing	2L:0T:4P	4 credits

Objectives:
In civil engineering field infrastructure creation and construction of wide range of structure is one of the primary activities. For this it is intended that a students shall be given adequate opportunity to study and imbibe various aspect of professional practice as a core subject. So this syllabus aims to provide that necessary platform to gain the required knowledge of this subject.

Module1: (3Hours)

Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.

Module 2: **(3Hours)**

Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets.Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

Module 3: (3Hours)

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial.Case Study Method.

Module 4: (2Hours)

Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized,
Unorganized, Public, Private.Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

Module 5: (7Hours)

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

Module 6: (6Hours)

Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

Course Outcomes:

CO1-Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
CO2-Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
CO3-Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
CO4-Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
CO5-Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
CO6-Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

Term Work Assignments may include:

1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
    a. Ground plus three storied RCC Framed structure building with blockwork walls
    b. bridge with minimum 2 spans
    c. factory building
    d. road work
    e. cross drainage work
    f. Ground plus three storied building with load-bearing walls g Cost of finishes, MEP works for (f) above
3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of bar bending schedule.
7. Prepared a approximated estimate for single story building with minimum four room with flat roof and stair case.
8. Prepare a detailed estimate of road of minimum 1km length of rigid pavement (CC road)
9. Prepared a detailed estimate for culvert.
10. Prepare detailed estimate of septic community well.
11. Prepare detailed estimated of septic tank for colony.
12. Taking out quantities of the earth work for a road profile of 500m length by using excel or any other software available.
13. Study of various software available for detailed estimate of building
14. Prepare detailed estimate of RCC G+4 residential building.
15. Understand brief specification & collection of market rate for various civil Engineering construction materials.
16. Prepare a specification for different items of civil Engineering work.

17. Prepare rate analysis to different items of civil Engineering work.
18. Read interpret civil engineering drawing prepare a check list for all item of works for detailed estimation & understand the unit of measurement.
19. Understand the importance of estimating & costing type of estimate & need of estimate.

Text/Reference Books:

1. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill
3. Misra, S.K. and Puri (2009), Indian Economy, Himalaya
4. PareekSaroj (2003), Textbook of Business Economics, Sunrise Publishers
5. M Chakravarty, Estimating, Costing Specifications & Valuation
6. Joy P K, Handbook of Construction Management, Macmillan 7.B.S. Patil, Building & Engineering Contracts 8.Relevant Indian Standard Specifications.
9. World Bank Approved Contract Documents.
10. FIDIC Contract Conditions.
11. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
12. Typical PWD Rate Analysis documents.
13. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016
14. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016
15. Contracts and Estimations; B. S. Patil Universities Press.
16. Estimate & Costing; M. N. Gangrade; NiraliPrakashan
17. Estimation & Costing; UBS Publishers.
18. Estimating Costing; Rangwala; Charotor Publishing House ltd. Valution.

PCC-CE603	Structural Analysis-II	3L:0T:0P	3 credits

Objectives:
To equip the students with the force and displacement method of structural analysis with emphasis of analysis of rigid frame and trusses.

Module 1: (6Hrs)

Moving Loads and Influence Lines Introduction to moving loads, concept of equivalent UDL, absolute maximum bending moment and shear force, concept of influence lines, influence lines for reaction, shear force, bending and deflection of determinate beams, influence line diagram (ILD) for forces in determinate frames and trusses, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than span.

Module 2: (6Hrs)

Moment Distribution Method Analysis of continuous beams propped cantilevers, portal frames with and without sway

Module 3: (6Hrs)

Slope Deflection Method Analysis of continuous beams, analysis of rigid frames, Simple frames without sway and with sway, with settlement effects.

Module 4: (6Hrs)

Analysis of beams and frames by Kani's method.()

Module 5: (6Hrs)

Cables, Suspension Bridges and Arches Analysis of forces in cables, suspension bridges with three hinged and two hinged stiffening girders, theory of arches, Eddy's theorem, concept of radial shear force and axial thrust, analysis of three hinged and two hinged arches, effect of yielding of supports, rib shortening and temperature changes, tied arches.

Module 6: (6 Hrs)

Analysis of Indeterminate Structures by Flexibility Method Fundamental concepts of flexibility method of analysis, flexibility coefficients and their use in formulation of compatibility equations, application of above methods to propped cantilevers, fixed beams, continuous beams, and simple pin jointed frames including effect of lack of members.

Course Outcomes: On:
CO1: Describe the concept of structural analysis, degree of indeterminacy.
CO2: Identify determinate and indeterminate trusses and calculate forces in the members of trusses perform the distribution of the moments the in continuous beam and frame

CO3: Calculate SF and BM by slopes and deflection method and MDMfor different types of beams.
CO4: Analyze of beams and frames by Kani's method.
CO5: Calculate SF and BM of suspension bridges and cables.

Text Books

• Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill,3rd edition 2010
• Wang C.K., "Statically Indeterminate Structures", McGraw Hill
• Vazirani and Ratwani, "Theory of Structures", Standard Publishers
• Khurmi R.S., "Theory of Structures", S Chand, Delhi
• Punmia B.C., "Structural Analysis", Laxmi Publications Reference Books
• Timoshenko and Young, "Theory of structures", McGraw Hill
• Norris C. H. and Wilbur J. B., "Elementary Structural Analysis", McGraw Hill
• Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
• Hibbler R. C., "Structural Analysis", Pearson Publications
• Schodek, "Structures", Pearson Education
• Ramamrutham S. and Narayanan R., "Theory of Structures" DhanpatRai Publishers, Delhi

PCC-CE604	Water Resources Engineering-II	3L:0T:2P	4 credits

Objectives:

1. Introduce the types of irrigation systems
2. Introduce the concepts of planning and design of irrigation systems
3. Discuss the relationships between soil, water and plant and their significance in planning an irrigation system.
4. Understand design methods of erodible and non-erodible canals
5. Know the principles of design of hydraulic structures on permeable foundations.
6. Know the concepts for analysis and design principles of storage and diversion head works.
7. Learn design principles of canal structure

Module-I: Irrigation:

Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation. (6 hours)

Module-II : Canals:

Classification, design of non-erodible canals – methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting. (6 hours)

ModuleIII: Canal Structures:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall. Regulators: Head and cross regulators, design principles Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage. Outlets: types, proportionality, sensitivity and flexibility River Training: Objectives and approaches. (6 Hours)

Module-IV: Diversion Head Works:

Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient. (6 hours)

Module-V: Reservoir Planning:

Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation. Dams: Types of dams, selection of type of dam, selection of site for a dam. Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries, grouting. (8 hours)

Module-VI: Earth Dams:

Types, causes of failure,criteria for safe design, seepage, measures for control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions. Spillways: Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances. (8 Hours)

List of Experiments. (All practicals are Compulsory)

1. Determination of Soil Bulk Density by Field Method
2. Soil Suction Measurements with Tensiometer
3. Determination of Soil Intake Characteristics using Cylinder Infiltrometer
4. Measurement of Canal Seepage Loss by Ponding Method
5. Abstraction from a Single Well in an Unconfined Aquifer
6. Irrigation Scheduling by Book Keeping Method
7. Design of Branch Canal in an Irrigation Project
8. Determination of Coefficient ofPermeability of Soil using Drain Permeator
9. Frequency Analysis of Hydrologic Data by Gumbel's Method
10. HydroghaphAnalysis.
11. Numerical on Diversion Head Work.
12. Numerical on Earth Dams.

Course Outcomes

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

CO1. estimate irrigation water requirements
CO2. design irrigation canals and canal network
CO3. plan an irrigation system
CO4. design irrigation canal structures
CO5. plan and design diversion head works
CO6. analyse stability of gravity and earth dams
CO7. design ogee spillways and energy dissipation works

Text Books.

- 'Irrigation and Water Power Engineering'byPunmia B C,P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi.
- 'Irrigation and Water Resources Engineering'byAsawa G L (2013), New Age International Publishers.
- 'Irrigation Engineering'byRaghunath H.M (2012), Wiley India.
- 'Irrigation Water Resources and Water Power Engineering'byModi P N (2011), Standard Book House, New Delhi.

References Books.

- 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
- 'Irrigation Engineering' by Sharma R.K. and Sharma, T.K (2012), S.Chand& Co Publishers.
- 'Water Resources Engineering'bySatyanarayana Murthy Challa (2008), New Age International Publishers.

Elective-I

PEC –CEEL605	**A. BUILDING CONSTRUCTION PRACTICES**	**2L:1T:2P**	**4 CREDITS**

Objectives:

Students are able to understand the property, use advantage and disadvantage of diffent material used in construction, Students are able to understand the component of building with their function, and Students are able to understand construction procedure of different components.

Module 01:-Building Construction Practice. (5 Hours)

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection; Sub Structure Construction- Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation; Super Structure Construction- Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors Erection of articulated structures, braced domes and space decks; Prerequisite:

Module 02:- Concrete Materials. (6Hours)

Examines the influence of constituent materials (cements, aggregates and admixtures) on the properties of fresh and hardened concrete; Recycled aggregates recovered from construction and demolition wastes; M-Sand; Light-weight aggregates; Use of Fly Ash in concrete; Fibre-reinforced concrete with various types of metallic and nonmetallic fibres; various types of concrete such as Self Compacting Concrete, High Performance Concrete, etc.; mix design; handling and placement of concrete; Effect of revibration of concrete; behavior of concrete under various types of loading and environment.

Module 03:- Contract Management – **(6Hours)**

Introduction, Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management; Types of Contracts, Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods. Various Acts governing Contracts; Contract Administration and Payments- Contract Administration, Payments; Contract Management in Various Situations- Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods-Design, Supply and Installation Contracts, Contract Management in Consultancy,; Managing Risks and Change- Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review; Legal Aspects in Contract Management-

Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance- Introduction, Monitoring and Measurement

Module 04:-Construction Project Planning& Systems. (6Hours)

Definition of Projects; Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks.PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion. Allocation of Resources-materials, equipment, staff, labour and finance; resource levelling and optimal schedules; Project organisation, documentation and reporting systems. Control & monitoring; Temporary Structures in Construction;

Module 05:- Construction Methods for various types of Structures (5Hours)

Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management; Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and levelling. Common Good Practices in Construction;

Module 06:- Project Monitoring &Control- (5Hours)

Supervision, record keeping, periodic progress reports, periodical progress meetings.Updating of plans: purpose, frequency and methods of updating.Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

List of Practicals

1- Mix design of concrete.
2- Test of concrete under different loading and environment.
3- Test on High performance concrete.
4- Problems on CPM and PERT.
5- Problems on determining three time estimates.
6- Contract management regulatory acts
7- Examples on Histograms and S-Curves.
8- Resource Scheduling
9- Making BIM in construction management techniques

10- Making detailed report on project monitoring and control.

Course Outcomes:

1. Students will be able to understand the property, use advantage and disadvantage of diffent material used in construction.
2. Students will be able to understand the component of building with their function.
3. Students will be able to understand construction procedure of different components.
4. Students will be able to understand the property, use advantage and disadvantage of diffent material used in construction.
5. Students will be able to understand the component of building with their function.
6. Students will be able to understand construction procedure of different components.

Text / ReferenceBook:

1) Building construction by S. P. Arora, Bindra
2) Building Material by P. C. Uarghese
3) Building Construction by Rangwala
4) Building Material and construction (NiraliPrakashn) Dr. R. K. Jain V. R. Phadke, M. V. Jadhav
5) Building construction by S. S. Bhavikatti
6) Contracts and Estimated – B. S. Patil

Elective-I

PEC –CEEL605	B. Materials, Testing & Evaluation	2L:1T:2P	4 CREDITS

Course Objectives: The objective of this Course is to deal with an experimental determination and evaluation of mechanical characteristics and advanced behaviour of metallic and non-metallic structural materials. The course deals with explanation of deformation and fracture behaviour of structural materials. The main goal of this course is to provide students with all information concerning principle, way of measurement, as well as practical application of mechanical characteristics.

- Make measurements of behaviour of various materials used in Civil Engineering.
- Provide physical observations to complement concepts learnt
- Introduce experimental procedures and common measurement instruments, equipment, devices.
- Exposure to a variety of established material testing procedures and techniques
- Different methods of evaluation.

Proposed Syllabus

Module 1: (4 Hour)

Introduction to Engineering Materials covering, A) Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories,

Module 2: (4 Hour)

Introduction to Engineering Materials covering, B) Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geotextiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these

Module 3: (5 Hour)

A) Introduction to Material Testing covering, What is the "Material Engineering"?; Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test;

Module 4: (5 Hour)

B) Introduction to Material Testing covering,strength of ceramic; Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

Module 5:(4 Hour)

Standard Testing & Evaluation Procedures covering, A) Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals;

Module 6: (5 Hour)

Standard Testing & Evaluation Procedures covering, B) Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep.

Tutorials from the above modules covering, understanding

i) Tests & testing of bricks,
ii) Tests & testing of sand,
iii) Tests & testing of concrete,
iv) Tests & testing of soils,
v) Tests & testing of bitumen & bituminous mixes,
vi) Tests & testing of polymers and polymer based materials,
vii) Tests & testing of metals &
viii) Tests & testing of other special materials, composites and cementitious materials. Explanation of mechanical behavior of these materials.

Practicals:

1. Gradation of coarse and fine aggregates
2. Different corresponding tests and need/application of these tests in design and quality control
3. Compressive strength test on aggregates
4. Direct Shear - Frictional Behaviour
5. Concrete I - Early Age Properties
6. Concrete II - Compression and Indirect Tension
7. Compression – Directionality
8. Soil Classification
9. Consolidation and Strength Tests
10. Tension III - Heat Treatment
11. Torsion test
12. Hardness tests (Brinnel's and Rockwell)
13. Tests on closely coiled and open coiled springs
14. Theories of Failure and Corroboration with Experiments
15. Tests on unmodified bitumen and modified binders with polymers
16. Bituminous Mix Design and Tests on bituminous mixes - Marshall method
17. Concrete Mix Design as per BIS

Measurable Outcomes: One should be able to:

CO.1 Calibrate electronic sensors.
CO.2 Operate a data acquisition system
CO.3 Operate various types of testing machines
CO.4 Configure a testing machine to measure tension or compression behavior
CO.5 Compute engineering values (e.g. stress or strain) from laboratory measures
CO.6 Analyze a stress versus strain curve for modulus, yield strength and other related attributes
CO.7 Identify modes of failure

CO.8 Write a technical laboratory report

Text/Reference Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. ButterworthHeinemann
2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
4. KyriakosKomvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
5. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
6. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)
7. Related papers published in international journals

Elective-I

PEC –CEEL605	C. Ground Water Engineering	2L:1T:2P	4 CREDITS

Course Objective :
Quality water demand has been becoming a major human life factor across the world. Water quantity and quality are depleting at alarming rate compelling the experts to adopt corrective measures. Ground water harnessing shall be accomplished without disturbing environmental balance.The proposed syllabus enables the students to study the subject to promote the desired goals.

Module- I :
Introduction :
Ground water extent and potential in India ; Ground water exploitation methods and investigations ;
Hydrology ; Water bearing properties of rocks ; Site selection and spacing of wells ; Infiltration mechanism and curves ; Water balance budget and equations. **(3Hrs.)**
Water Storage and Rock Functions :
Porosity ; Void's ratio ; Water retention properties ; Specific yield ; Permeability and Permea meters ; Constant and variable head analysis and equations. **(3Hrs.)**

UNIT-II :
Geological Zones of Saturation:
Aeration zones; Soil water belt ; Saturation zone ; Aquifers ; Storage coefficient ; Water table fluctuations ; Springs. **(2Hrs.)**
Ground Water Flow :
Specific weight; Compressibility; Head distribution ; Laminar and turbulent flows; Reynold's number; Darcy's laws and applications ; Three dimensional flow ;Flow net Analysis; Storage Equations; Boundary conditions; Steady flow states; Radial flow of wells; Dupuit's equations and Applications; Draw down curves and cone of depression. **(3Hrs.)**

UNIT-III :
Aquifer Properties :
Aquifer tests; Test Measurements; Confined aquifers; Discharge analysis (Theis's and Jacob's methods); Unconfined aquifers and flow properties. **(2Hrs.)**
Well Hydraulics :
Types of wells and constructions; Infiltration galleries ; Tube well design and dimensions; Maintenance of wells; Performance tests; Specific capacity ; Revitalization of wells. **(3Hrs.)**

UNIT-IV :
Ground water Survey and Water Quality:
Geological and hydrological methods; Electrical resistivity method ; Seismic method; Magnetic Method; Gravity Method ; Radio Metric Method ; Tracer techniques. **(3Hrs.)**
Ground water quality- Factors affecting ground water quality, Water qualityrequirements Groundwater qualitydegradation, Reasons of groundwater quality degradation. **(2Hrs.)**

UNIT-V :

Saline Water Intrusion :

Sea water salinity ; Saline water Intrusion; Salinity influx in estuaries; Zone of diffusion and interface parameters; Prevention and control of saline water intrusion; Desalination of sea water. **(2Hrs.)**

Artificial Recharge :

Artificial Recharge & methods; Waste water recharge; Detention dams; Water shed management techniques ; Rain water harvesting ; Residential rain water harvesting.**(3Hrs.)**

UNIT-VI :

Pumps and Allied Machineries :

Discharge rates; Demands; Flow charts; Heads and losses; Power requirements and calculations; Pumps, types and their suitability; Installation and maintenance;, Flow measurements and metering;

Brief description of distribution network.**(5Hrs.)**

List of Practical :- (Minimum 12 Practicals)

1. Exercise on Ground water quality parameters , pollution sources and remedial measures.
2. Exercise on bore well drilling method (working, sketch, Parts, Drilling, stages, precautions, Flow measurements and billing)
3. Exercise on pumps, capacity, selections cost analysis, installation and maintenance.
4. Exercise on ground water pollution control norms, pollutions boards and legislations.
5. Exercise as a case study on water, shed management scheme.
6. Determine the TDS, Electrical Conductivity (ES) of groundwater sample.
7. Determine the pH and Hardness of groundwater sample.
8. Prepare a list of various types of wells in the states with sketches.
9. Develop an illustration of Artificial recharge methods of ground water.
10. Develop an illustration of Aquifers.
11. Visit to Water resources department/Irrigation department for collecting existing groundwater data of the district with respect to importance & necessity of ground water management.
12. Visit to various storage works and collect data pertaining to quality.
13. Visit to nearby water harvesting structure and prepare a report.
14. Prepare a model/prototype of groundwater recharging structure in the college/suggested Premises.
15. At least ten sketches of basic figures of the course

Course Outcome :

It is desired that students after undergoing academic study sessions as cited this above shall be competent and able to work as Engineers in the field of Ground Water Engineering with confidence and success.

REFERENCE BOOKS :

1. Ground Water Engineering (Assessment, Development & Management) : K.R. Karanth
2. Ground Water : H.M. Raghunath
3. Ground Water Hydrology :D.K.Todal
4. Ground Water and Seepage :M.E.Harr
5. Seepage ,Drainage and Flow Nets : H. R. Cedergren
6. Engineering Fluid Mechanics : C. Creaegar

Open Elective-II

OEEL606 A	**(Humanities)** **Soft skills and interpersonal**	**3L:0T:0P**	**3 CREDITS**

Module 1: Soft Skills **(4Hours)**

What are soft skills? – Importance of soft skills , Attributes regarded as soft skills – Soft skills – Social - Soft skills – Thinking - Soft skills – Negotiating – Exhibiting your soft skills – Identifying your soft skills – Improving your soft skills –Exercise : Measure your soft skills

Module 2: Self-Discovery Importanceof knowing yourself– **(4Hours)**

Process of knowing yourself - SWOT analysis - Benefits of SWOT analysis - Using SWOT analysis - SWOT analysis

Module 3: Developing Positive Attitude **(6Hours)**

Meaning of attitude - Features of attitudes - Attitude and behaviour - Formation of attitudes - Change of attitudes - What can you do to change attitude? - Ways of changing attitude in a person - Attitude in a workplace - The power of positive attitude - Developing positive attitude - Obstacles in developing positive attitude - Staying positive - Examples of positive attitudes - Positive attitude and its results - Staying negative - Examples of negative attitude - Overcoming negative attitude - Negative attitude and its results. Exercise: Measure your attitude

Module 4: Forming Values - **(6Hours)**

Meaning of value, a core of values - Values relating to education - Values relating to self and others - Values relating to civic

Team Building and Teamwork

Aspects of team building - Skills needed for teamwork - A model of team building - Team Vs Group - Characteristics of effective team - Role of a team leader - Role of team members - Nine persons a successful team should have - Inter-group collaboration - Advantages of inter-group collaboration

Module 5: Improving Perception **(6Hours)**

Factors influencing perception - Perceptual process - Improving perception - Perception and its application in organizations. Exercise: Test your perception

Stress Management:

Meaning of stress, type of stress, effect of stress, Sources of stress, identifying existence of stress, Sign of stress and stress management.

Module 6: Body Language (4Hours)

Body talk - Voluntary and involuntary body language - Forms of body language - Parts of body language - Origin of body language - Uses of body language - Body language in building interpersonal relations - Body language in building industrial relations - Reasons to study body language - Improving your body language - Types of body language - Gender differences - Female interest and body

Time Management:

Examination of Work, Sense of Time Management, Features of Time, Time Management Matrix, Difficulties in time management, Ideal way of spending a day

Reference Books

1. Soft Skills – Know yourself and Know your world by Dr.K.Alex – S.Chand and Publications, New Delhi
2. Presonality development and soft skills –by Barun K Mishra – Oxford University Press.-2011

OEEL606 B	ICT for Development skill	3L:0T:0P	3 CREDITS

Course objectives:

With rising use of Information and Communication technologies available, there is a high potential for these technologies to address sustainability issues.

1. The students of MA (SDP), as development practitioners must be equipped with the knowledge about their applications in the development field so as to enable them to provide ICT solutions to the target communities.
2. This is an elective course intended for students who would like to gain knowledge and skills on how ICTs can be best used to overcome sustainability challenges.
3. In order to succeed in the practice of sustainable development, professionals must be trained in a basic set of competencies that integrate cross-disciplinary knowledge for practical problem solving with the use of information and communication technologies.

Course Content

Module 1:

Introduction to ICTs for sustainable Development Introduction to Information and Communication Technology (ICT); Role of ICTs in Sustainable Development; Current Statusof ICTs in Sustainable Development-Global and India Scenario. Potential of ICTs in various fields, impact of information Technologies on GDP growth. **(6 Hours)**

Module 2:

Building Knowledge Societies-The concept of Knowledge Society; identifying stakeholders and target communities; Understanding information needs ,Traditional vs. contemporary knowledge systems, information processing and retrieval; Understanding means of communication in different areas, developing an effective communication strategy Case: Warna Unwired.**(6 Hours)**

Module 3:

Information and Communication Technologies The hardware and software, the physical infrastructure, satellite, wireless solutions, telecommunication technologies, mobiles, fixed line, internet and world wide web, community radio, technology-user interface, design of relevant ICT products and services. **(6 Hours)**

Module 4:

ICT Applications Applications of ICTin education, Health (telehealth, telemedicine and health informatics), Gender Equality, Agriculture (, e Governance, telecentres, Mobiles for

development, climate change and disaster management, ICT Networks for water management (This module will bedealt with the help of country case studies in all the sectors and inputs from ICT4D practitioners Case Studies: eCME, Apollo Telemedicine Network Foundation, Bhoomi, eSewa, Gyandoot, eAgriculture. M-ESA, CYCLETEL). **(6 Hours)**

Module 5:

ICT for Development In India Policy and Institutional Framework in India, e governance, ICTModels in health, education , agriculture, finance, gender equality, Mobiles for Development Experience sharing by ICT for Development practitioners Case Studies: Reuters Market Light, IffcoKisaan Sanchar Ltd. **(6 Hours)**

Module 6:

ICT4D Implementation Developing an ICT4D Project, Critical Success factors for technology diffusion and use, Constraints in adoption, The role of national policies, Institutional Policy framework, Multi-stakeholder partnerships, Role of Private Sector Case Studies: echaupal , Lifelines India. **(6 Hours)**

Outcomes:

- Discovering the milestones of ICT history;
- Acknowledging the role of technologies in modern society and the potential of social web;
- Identifying IT uses in digital citizenship contexts.
- Identifying the basic hardware and software components of a computer and/or similar electronic devices, and exploring their functioning;
- Acknowledging the need to keep a computer and/or similar electronic device components updated and checking for updates of classroom equipment;
- Identifying and validating basic protection measures (antivirus, firewall) for combating viruses and other forms of attack on computers and/or similar electronic devices;
- Learning and implementing the rules of ergonomics related with the use of computers and/or similar electronic devices.
- Identifying the main differences between operating system and application software;
- Acknowledging the concepts of intellectual property and copyright applied to software, distinguishing between free, proprietary and commercial software;
- Organising and customising the graphic environment of an operating system;
- Acknowledging the special care that must be exercised when downloading software from the Internet;

HSMC607	TechnicalandCompetitive Exam Skills	0L:0T:2P	1 CREDITS

Module1: Gate Exam Preparation: Orientation of GATE Curriculum for Civil Engineering, Providing information regarding literature of GATE Examination. Solving some sample question papers of GATE Examination. Giving information for Use of GATE for Job in PSU,Direct recruitment to Group A level posts in Central government and state Government**. (2 Hours)**

Module2:

Preparation ofEngineering Mathematics andGeneral Aptitude (GA) with Language and Analytical Skills for GATE examination. **(6 Hours)**

Module3:

Information regarding IES Examination and Recruitment procedure of Graduate Engineering students with detail curriculum, Literature and Guidance. **(2 Hours)**

Module4:

Information regarding Technical MPSC Examination and Recruitment procedure of Graduate Engineering students with detail curriculum, Literature and Guidance. **(2 Hours)**

Module 5:

Technical Post, Curriculum and authentic literature of RRB, BSRB examination **(2 Hours)**

Module6:

Information Regarding Higher Education in Foreign Universities, Preparation of Pre requirements like SAT,PTE, LSAT,ACT, CAE,CPE GMAT, GRE, IELTS and the TOEFL. **(2 Hours)**

PCC-CE608	Building Drawing/Estimation/water Analysis Software	0L:0T:4P	2 CREDITS

Practicals on Software of Building Drawing/Estimation/ Water Analysis Software.
(Any one software)

PCC-CE609	NPTEL Course – II	0L:0T:2P	1 credits

- Students have to complete minimum four weeks NPTEL web and video course from Civil Engineering Department which is available on portal nptel.ac.in. It is preferred that student should attend any one course related to subjects of Sixth semester.
- Certification courses are offered twice a year (Jan-Jun, Jul-Dec). Joining a course is free. Learning can be done by watching videos and this is tested by the weekly assignments, which are to be submitted online within the prescribed deadline.
- There is a certification examination that the student can take for a nominal fee at the end of the course to earn certificates from the IITs.

To earn credits of this course students have to produce the NPTEL course completion certificate and online submitted assignments to the department before end semester practical examination.