Kavayitri Bahinabai Chaudhari, North Maharashtra University, Jalgaon (M.S.)

Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Fourth Year Engineering

(Civil Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester - VII

W.E.F. 2020 – 2021

Syllabus for Fourth Year Civil Engineering w.e.f. 2021 – 22

Syllabus Structure for Fourth Year Engineering (CIVIL) (Semester – VII)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical/Oral		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
PCC CE305 Hydrology & Water Resources Engineering	D	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective Course III	E	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective Course IV	E	3	-	-	3	40	60	-	-	100	3
OEC Open Elective Course III	F	3	-	-	3	40	60	-	-	100	3
PCC CE305 Hydrology & Water Resources Engineering LAB	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE308: Construction Engineering & Management (LAB)	D	1	-	2	3	-	-	25	25 OR	50	2
PROJ Major Project Stage I	G	-	-	12	12	-	-	50	50 OR	100	6
MC IV Essence of India Traditional Knowledge		-	-	-	-	-	-	-	-	-	**0**
		13		**16**	**29**	**160**	**240**	**100**	**100**	**600**	**21**

Professional Elective Course III	Professional Elective Course IV	Open Elective Course III
Remote Sensing	**Prestressed Concrete**	**Solid and Hazardous Waste Management**
Port and Harbor Engineering	**Rural Sanitation**	**Geology for engineers**
Watershed Management	**Advanced Water Treatment Technology**	**Environmental Impact Assessment**
Advanced steel structural analysis and design	**Hydraulic Modeling**	**-**
	Geosynthetic engineering	

Syllabus Structure for Fourth Year Engineering (CIVIL) (Semester – VIII) (Civil)

Name of the Course	Group	Teaching Scheme				Evaluation Scheme					Credits
						Theory		Practical/Oral		Total	
		Theory Hrs / week	Tutorial Hrs / week	Practical Hrs / week	Total	ISE	ESE	ICA	ESE		
PCC CE309: Engineering Economy, Estimation & Costing	D	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective Course V	E	3	-	-	3	40	60	-	-	100	3
PEC Professional Elective Course VI	E	3	-	-	3	40	60	-	-	100	3
OEC Open Elective Course IV	F	3	-	-	3	40	60	-	-	100	3
PCC CE309: Engineering Economy, Estimation & Costing LAB	D	-	-	2	2	-	-	25	25 OR	50	1
PCC CE201 Advanced Surveying (LAB)	D	2	-	2	4	-	-	25	25 OR	50	3
PROJ Major Project Stage II	G	-	-	6	6	-	-	50	50 OR	100	3
		14	**0**	**10**	**24**	**160**	**240**	**100**	**100**	**600**	**19**

Professional Elective Course V	Professional Elective Course VI	Open Elective Course IV
Advanced Concrete Structural Analysis and Design	**Design of hydraulic structures**	**Operations Research methods and engineering applications**
Hydraulic Machines	**Bridges engineering**	**Biotechnology of waste treatment**
Advanced wastewater engineering	**Theory of elasticity and plasticity**	**Internet of things**
Foundation Engineering	**Industrial wastewater engineering**	**Interior Design**
	Ground improvement techniques	

Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Final Year Engineering

(Civil Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester - VII

W.E.F. 2020 – 2021

Hydrology & Water Resources Engineering

COURSE OUTLINE

Course Title:	Hydrology & Water Resources Engineering	**Short Title:**	**HWRE**	**Course Code:**	

Course description:

Water is the most precious civil engineering entity. Availability of water is an index of nation's prosperity. The responsibility of a civil engineer is to avail water for drinking, domestic, industrial and irrigation applications, which is the largest consumer of water. This requires identification of water resources, their harnessing techniques, water management and water conservation techniques. Sum total of this forms the syllabus of the present subject. It includes hydrology to assess the flow potentials and to plan the water retaining structures. It also includes the design of after retaining common structures. Topics like water logging, crop water requirements also supplement the subject.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The course enables students identifying water resources, plan and design their harnessing techniques.
2. It enables students to plan for water management and water conservation techniques.
3. The student will demonstrate ability use hydrology to assess the flow potentials and to plan the water retaining structures.
4. The students will have an ability to design water retaining common structures.
5. Student will have knowledge of water logging, crop water requirements and water quality criteria for irrigation.

Course outcomes:

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

1. Demonstrate phenomena of hydrological cycles and precipitation.
2. Demonstrate soil moisture content, water requirements of crops, quality criterion, water logging etc.
3. Design hydraulic structures like different types of dams and spillways and canals.
4. Select site for construction of water retaining structure and plan a complete mega water resource development project.
5. Understand the socio – economic aspect of water resources projects, their environmental impacts and mitigation measures.

COURSE CONTENT

Hydrology & Water Resources Engineering		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 08 Hours**	**Marks: 12**

Hydrology: terms and terminology, hydrological cycle, its applications.

Precipitation: forms, measurement, presentation of rain gauge data, mass inflow curves, hyeptograph, average precipitation, optimization of rain gauge numbers.

Concept of evaporation, transpiration, infiltration, factors affecting them, their measurements.

Stream gauging, discharge and stage measurements.

Run off: yield, factors affecting runoff, estimation of runoff using mathematical expressions.
hydrographs: definition, concept, factors affecting its shape, base flow separation.
flood hydro graph, unit hydrograph – definition, derivations, applications, *S* hydrograph.

Unit–II:	No. of Lectures: 08 Hours	Marks: 12

Ground water hydrology: occurrence and distribution of ground water, yield of acquifers, movement of ground water, Darcy's law, permeability, safe yield of basins, well loss, specific capacity of well, well irrigation and its applications.
Water logging and drainage: causes, preventive measures, curative measures.
Reservoir Planning, storage and diversion works, multi –purpose reservoir projects, investigations for locating a reservoir, mass curve and its use for estimation of required storage, economic aspects, B/C ratio.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Reservoir sedimentation: process of erosion, introduction to suspended and bed loads, critical tractive force, trap efficiency, life of reservoir, factors affecting silting, and control measures.
Irrigation: necessity, benefits, ill effects, methods.
Soil – water – plant relationship, classification of soil water, saturation capacity, field capacity, quality of irrigation water.
Crop water requirements, limiting soil moisture conditions, depth of irrigation water and frequency, principal Indian crops and their seasons, base period, duty of water and delta, factors affecting, duty and delta. Methods of improving duty. Intensity of irrigation, paleo irrigation, kor depth, kor period, outlet factor, capacity factor, time factor, crop ratio, overlap allowance, calculation of canal capacity, application of water.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Types of dams, reservoir storage zones, site selection for dams, choice of dam, economical height of dam.
Diversion head works: functions, types, site selection, types, and components.
Gravity dam: cross section, elementary and practical profile of dam, forces acting on gravity dam, modes of failure, introduction about infiltration gallery.
Introduction to arch dams, their types, suitability.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Earth dams: types, elements, basic design considerations, causes of failure, piping and its control, control of seepage, drainage in earth dam.
Spill ways: capacity, types, their suitability.
Gates: uses, types.
Canal irrigation: types of canal, canal alignment.
Losses in canals, schedule of area statistics.

Text Books:

1. Irrigation engineering and hydraulic structures by S K Garg, Khanna Publications.
2. Irrigation and water power engineering by B C Punmia, Laxmi Publications.
3. A Text book of hydrology and Water resources, by R K Sharma, Dhanpatrai Publications.

Reference Books:

1. Irrigation, water resources and water power engineering by P N Modi, Standard Book House Publication.
2. Theory and design of irrigation structures, Vol I and II, Varshney R S, Gupta S C and Gupta R L, New Chand and Brothers Publication, Roorki.

Remote Sensing (Professional Elective Course - III)

COURSE OUTLINE

Course Title:	***Remote sensing***	**Short Title:**	*RS*	**Course Code:**	

Course description:

This course introduce the students about concept in Remote Sensing such as scope and application of remote sensing in civil engineering, Importance of remote sensing in geology and geomorphology, Principles of remote sensing and its methods, Scope and application of photo graphrammetry in identification of soil mapping, Use of mirror stereoscopes parallax bar in interpretation of aerial photos, Interpretation techniques in satellite imageries.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. Indentify and calculate the theory of errors in measurement in Triangulation survey
2. To use an Mirror stereoscope to interpret aerial photos.
3. Calculate air base distance, overlap, and height of object in photographs.
4. Relate the knowledge gained after using parallax bar in photographs survey..
5. To relate the knowledge about remote sensing for soil mapping

Course outcomes:

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

1. To be able to interpret and analyze aerial photos and satellite imageries.
2. To be able to process aerial photos with respect to overlap and tone lithology.
3. To be able to apply knowledge of interpretations techniques of remote sensing for air photo interpretations and processing
4. To be able to apply knowledge of remote sensing in civil engineering projects.
5. To be able to apply knowledge of remote sensing in areas of geological aspects of foundation in civil engineering projects

COURSE CONTENT

Remote Sensing		**Semester:**	*VII*	
Teaching Scheme:		**Examination scheme**		
Lectures:	**3hours/week**	**End semester exam (ESE):**		**60**
		Duration of ESE:		**03**
		Internal Sessional Exams (ISE):		**40**

Unit–I:	**No. of Lectures: 09 Hours**	**12**

Introduction to Remote Sensing :

Basic principles ,definition , importance , scope brief history of remote sensing, sensors and its classifications ,platforms ,electromagnetic radiation and spectrum multispectral scanner MSS, black body radiation ,atmospheric windows, Types of satellite, their uses, imageries and their uses. Thermal infra red radiation techniques of Remote sensing. GIS and its components and applications, GPS and its applications with mapping.

Unit–II:	**No. of Lectures: 09 Hours**	**12**

Photogrammetry:

Objects, application to various fields , terrestrial photogrammetry and aerial photogrammetry, aerial camera, comparison of map and vertical photographs, classification of photographs , concept of principal point, nadir point, isocentre, horizon point, principal plane , Scale of vertical photograph ,computation of length and height from the photograph, relief displacement on vertical photograph , Mirror and lens stereoscopes, parallax bar, flight mission ,types of films, print and diapositives.

Unit–III:	No. of Lectures: 08Hours	12

Interpretation Techniques :

Fundamentals of Image interpretation ,Photo recognition elements , like tone , texture , lineaments and its types , factors affecting aerial photo interpretation , determination of scale height slope stereoscopic exaggeration aerial mosaics, annotation of mosaics, role of remote sensing in the detection of temporal changes,

Unit–IV:	No. of Lectures: 08Hours	12

Applications in Civil Engineering:

Aerial photo interpretation in major civil engineering projects like Dam sites, landslide investigation route location , Tunnels, Town planning, investigation in construction material , Terrain studies and soil mapping with the help of remote sensing techniques application in metrological interpretation , agriculture, forest areas, environmental studies .

Unit–V:	No. of Lectures: 08Hours	12

Application in Geology and Geomorphology :

Lithological interpretation ,recognizing igneous, sedimentary, metamorphic rocks on aerial photographs and satellite imageries , structural interpretation determination of strike, dip, joints , fractures , faults, folds, dykes and unconformity ,remote sensing application in ground water , surface water delineation, study of floods , drainage analysis ,drainage patterns ,density, frequency, landforms of types of rocks , landforms of structural features

Text Books:

1. Wolf R R , Elements of photogrammetry , McGraw Hill ,Tata McGraw Hill pub co. Ltd New Delhi
2. Campbell J B ,Introduction to remote sensing , The Guilford press London.
3. Mehrottra , Suri R K , Remote sensing for environmental and forest management , Indus publication , New Delhi.
4. Miller V C , Photogeology, McGraw Hill ,Tata McGraw Hill pub co. Ltd New Delhi

Reference Books:

1. Patel A N ,Surendra singh, Remote Sensing Principles and applications
2. Thornbary W B, Principles of Geomorphology , John wiley and sons.
3. Sabnis F F, Remote sensing principles and interpretation.
4. Kennine T J M, Methews M C, Remote Sensing in Civil Engineering.
5. Panday S N, Principles of Remote Sensing.

Port and Harbor Engineering (Professional Elective Course - III)

COURSE OUTLINE

Course Title:	**Port and Harbor Engineering**	**Short Title:**	*PHE*	**Course Code:**	

Course description:

Transportation facilities ensure the prosperity, security and integrity of a nation. Water transport is an ancient and conventional mode of transportation. A civil engineer is supposed to create dock, harbors and port facilities for the water ways particularly through sea. This course enables a student to plan design and execute a waterway project.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The basic objective of this course is enabling a student to plan, design and execute a waterway project.
2. The student must be able to carry out required marine surveys.
3. The students must be able to do design of the Docks, Harbour and port using available material and execution of the project.
4. The student must also be able to design water traffic signaling network using most advanced technology.

Course outcomes:

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

1. Understand the importance of transportation system in the development of a country, classification of Docks, Harbours and ports planning in India.
2. Demonstrate ability to carry out marine survey required for the Docks Harbours and ports.
3. Demonstrate ability to decide a Harbour geometry depending upon the anticipatory traffic and Structural design of Docks, Harbours and Ports.
4. Execution of a waterway project.
5. Installation, commissioning and maintenance of advanced signaling system and maintenance of Docks Harbors and Ports.

COURSE CONTENT

Docks Harbours and Ports		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Harbours and Ports:

Significance and history of water ways, Importance of Harbours and ports for inland water ways and sea routes. Classification of harbours and ports based on situation, location and their utility. Site selection criteria for harbours and ports, process for site selection for harbors and ports, Effects of winds, waves and tides on site selection.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Requirements of Good Harbours**,** Accessibility and size of Harbours, shape of Harbours, Harbour Depth, Features of harbours, Layout of harbours

Planning and design of Harbours: Area for free movement and depth requirements depending upon size of vessel, harbour entrance, entrance channel, light house, design of facilities for Parking, loading and unloading.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12
Ports: functions of port, Requirement of good ports, design of ports, Environmental impact of ports. **Break waters:** Introduction, Alignments Of Break water, Forces acting on break water, classification of break water, points to be observed in connection with the construction of vertical break water. Advantages of vertical wall break water, materials used in design of break waters, principles of design of break waters, safety and maintenance aspects.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Docks: Introduction, functions of docks, classification of Docks, Tidal basin, river ports, form and arrangement of basins and docks, excavation for docks and basins, shape of dock and basins, location of dock. Design and construction of dock**,** dock entrances, types of caissons for dock entrances, size of dock entrances, forces to be considered and materials to be used, design principles.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Dry or Repair Docks: Introduction, Repair arrangements, classification of dry docks, floating dry docks, marine railway dock, lift dry dock. **Dry or Graving Dock:** sequence of operation of dry dock, size of dock, forces acting on dry dock, design consideration, design of dry dock floor, construction of dry docks.		
Text Books:		
1. *B.L. Gupata, and Amit Gupta "Road, Railway, Bridges, Tunnels & Harbour Dock Engineering,* Standard Publishers Distributors 2. Hasmukh P. Oza and Gautam H. Oza " *Dock & Harbour Engineering"* Charotar Publishing House Pvt. Ltd.		
Reference Books:		
1. R. Srinivasan "*Harbour Dock and Tunnel Engineering"* Charotar Publishing House 2. S.P. Bindra "*Docks and Harbour Engineering*" Dhanpatrai Publications Pvt Ltd, New Delhi.		

Watershed Management (Professional Elective Course - III)					
COURSE OUTLINE					
Course Title:	*Watershed Management*	**Short Title:**	*WSM*	**Course Code:**	
Course description:					
This course is designed to enable student to asses, apply and analyze the relevant geological , ground water, irrigation principles . In this course , the topics on morphology, groundwater , irrigation pollution, agriculture , issues in irrigation , appraisals, rain water harvesting urban watershed management are mainly to highlight for the relevant basic knowledge . Students acquainted with related knowledge can be able to apply in design and economics of watershed projects.					
Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	03	*14*	*42*	*3*	
Prerequisite course(s):					
Irrigation , Engineering Geology , Environmental pollution , Ground water					
Course objectives:					
With successful completion of this course , the student should have the capability to : 1. Students aware about importance of conservation of water and its management 2. Design , issues , appraisals used for watershed management 3. To aware about geology and groundwater regarding strata to infiltrate water					
Course outcomes:					
After successful completion of this course the student will be able to:					
1. To identify and predict the watershed areas and its characteristics. 2. To evaluate the factors with respect to groundwater , rain water 3. To predict the water resource appraisal of watershed area 4. To be able to predict soil and water conservation 5. To be able to interpret planning and management of Urban watershed					
COURSE CONTENT					
Watershed Management		**Semester:**	*VIII*		
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End semester exam (ESE):**		**60 marks**	
		Duration of ESE:		**03 hours**	
		Internal Sessional Exams (ISE):		**40 marks**	
Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**			
Concept of watershed : Introduction ,importance of geology , significance of watershed based development, watershed characteristics, geomorphology and hydrology, Drainage basin network morphology					
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**			
Watershed Hydrology : Hydrological cycle water balance , climate and precipitation , soil and infiltration, interception and evaporation , evapotranspiration , groundwater stream flow and runoff , aquatic ecosystem					
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**			
Watershed Resource Appraisal : Physical ,hydrological and land use , land cover, ,land capability classification , watershed management planning and objectives.					
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**			

Issues in water resources : Point and agriculture and urban non point source pollution , soil conservation and water conservation measures ,Erosion , water scarcity , flooding, drinking water protection , Benefit cost analysis.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Urban watershed Management: Green roof, rain water harvesting from urban structures, Urban watershed management, goals and strategies, sustainability and Urban watershed management Urban storm water pollution.		
Text Books:		
1 Murthy, J V S (1994) , Watershed Management in India, Wiley Eastern Ltd New Delhi 2 Paranjape S and others (1998), Watershed based Development , Bharat Gyan Vigyan Samithi , New Delhi. 3 K. Subramanya, Engineering Hydrology, McGraw Hill Education		
Reference Books:		
1 Todd , Groundwater,Tata McGraw Hill pub co. Ltd New Delhi 2 Mutreja K N (1990), Applied Hydrology ,Tata McGraw Hill pub co. Ltd New Delhi 3Sinha R J (2000) ,Water planning and management , Yash publication House , Bikaner 3 Hoan C J , Hydrology and small watersheds .		

Advanced steel structural analysis and design (Professional Elective Course - III)

COURSE OUTLINE

Course Title:	**Advanced steel structural analysis and design**	**Short Title:**	*ASSAD*	**Course Code:**	

Course description:

Steel structures are getting popularity for special industrial applications, bridges and high rise structures. They are preferred owing to their higher strength, speedy construction and reliability. The present syllabus includes special steel structures like gentry girders, plate girder, water tanks, chimneys, towers, foundations with base plates etc. the syllabus confirms to IS 800 – 2007, IS 875 for wind force analysis and IS 1893 for earth quake analysis.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. This syllabus is aimed to appraise a learner with types of advanced steel structures
2. It describes their uses, their design principles, procedures, construction methodologies and maintenance requirements.
3. The learners must be able to analyze and design special steel structures like water tanks, chimneys, towers, foundations, plate girders, gentry girders etc.

Course outcomes:

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

1. Analyze and design bolted and welded connections.
2. Analyze and design beam, purlins, and castellated beams with different support conditions.
3. Analyze and design girder and trusses.
4. Analyze and design different types of steel chimneys.
5. Analyze and design different types of steel water tanks.

COURSE CONTENT

Advanced steel structural analysis and design		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Connections:

Bolted connections: Tpes of fasteners, types of joints, rigid connections, semi rigid connections bolt value, efficiency of joint, analysis and design of bolted connections.

Welded connections: introduction, types of weld, analysis and design truss members connections, framed connections, stiffened and unstiffened seat connection.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Design of Beams:

Introduction, Types of sections, lateral stability of beams, Builtup beams,Bending stress, bearing stress, web buckling, web crippling, diagonal buckling. Design of laterally supported and unsupported beams, design of purlins.

Castellated beams - Concept, fabrication of the castellated beam from rolled steel section, Effect of hole in beam. Design of castellated beam for bending and shear as per codal provisions by limit state method.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Girders:
Introduction, types of sections, elements of plate girder, proportioning of web and flanges, self weight, curtailment, types of stiffners, design of welded plate girder. Analysis and design of gantry girder.
Truss: Introduction, components, Load combinations, analysis and design of roof truss.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Chimney: Introduction, type, joints, lining, ladder, forces acting on chimneys, design of thickness of steel plates for self supporting chimney.
Chimney Foundation: Design of base plate, anchor bolt and foundation, stability of steel chimneys.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Water Tanks: Introduction, permissible stresses, Thickness specifications, Stiffening angle, stand pipe, Elevated tanks, Circular tanks, rectangular tanks, wind force, earthquake force, Design of elevated rectangular and circular tanks, design of staging.

Text Books:

6. *Shah and Veena Gore, Limit State Desin of Steel Structure, Structures Publication.*
7. S.S. Bhavikatti, Design of Steel Structure, *I. K. International Publishing House*

References Books

1. Ram Chandra, Design of steel Structures, Volume II, Standard Book House, Delhi.
2. Punmia and Jain, Comprehensive Design of steel structure, Laxmi Publication, Delhi.
3. M Raghupathi, Design of steel structures, Tata McGraw Hill, New Delhi.
4. S K Duggal, Limit state design of steel structures, Tata McGraw Hill Education.
5. N Subramanian, Design of steel structures, Oxford University Press.
6. Sarwar Alam Raz—Structural Design in Steel---New Age International Publishers
7. IS: 800 - 2007, Code of Practice for General Construction in Steel, BIS, New Delhi.
8. IS: 800 - 1984, Code of Practice for General Construction in Steel, BIS, New Delhi.
9. IS: 875-2015 Code of Practice for wind analysis
10. IS: 1893-2016 Code of Practice for earthquake analysis

Prestressed Concrete (Professional Elective Course - IV)

COURSE OUTLINE

Course Title:	***Prestress Concrete***	**Short Title:**	**PC**	**Course Code:**	

Course description:

This course is intended to provide the engineering student with the basic tools required to design and build prestressed concrete structures. Emphasis will be placed on the behavior of prestressed concrete under load along with potential failure mechanisms

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The main objective of this subject is to develop an understanding of the basic principles of prestressed concrete structures analysis and design.
2. To illustrate students with the analysis and design of prestressed concrete building members,

either in theoretical side of view or in analytical step-by-step procedures to enable students to make an easier transition from theory to problem solving.

Course outcomes:

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

1. Know basic concepts of pretressed concrete, system of prestressing, and losses in prestress.
2. Understand the design of prestess beam, concept of sher and deflection.
3. Design of Tension and Compression members and End Block.
4. Concept and design of continuous beam, circular tanks and pipes, concrete composite beam.
5. Concept and design of prestressed concrete piles, poles and pavement.

COURSE CONTENT

		Semester:	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

1.General principles of prestressed concrete members:

Introduction- definition-need of prestressing-use of high strength concrete-use of high tensile steel-assumptions-stress concept-beam with concentric tendon-effect of loading on the stress in the tendons- beam with eccentric tendons-effect of loading on the stress in the tendons- beam with bent tendon- beams of rectangular, T and I sections-the pressure line – C – line and P – line –strength concept – review of different techniques.

2.System of prestressing:

Classification of prestressed concrete members – externally and internally prestressed members- linear prestressing pretensioning post-tensioning- bonded and unbonded tendons- the hoyer system – the Freyssinet system- The magnel blaton system-The Gifford Udall system- C.C.L. standard system-The Lee – Mccall system.

3.Loss of prestress:

Losses of prestress at various stages – loss of stress due to length and curvature effects – loss of stress at the anchoring stage – loss of stress due to shrinkage of concrete- loss of stress due to creep of concrete – loss of stress due to elastic shortening of concrete – loss of stress due to creep in steel.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

1.Design of Prestressed concrete beams:

Simply supported beams – design principles- I.S. Recommendations - permissible stresses – various stages of analysis – lever arm conception – P and C lines – kern distance – Rectangular and I sections.

2. Shear:

Shear stresses – principle tensile stress – shear reinforcement – vertical prestressing – shear stresses and principle stresses due to torsion.

3.Deflection of prestessed concrete members:

Need to determine deflections – short term deflection – deflection caused by tendon – deflection caused by loads – long time deflection – permissible deflection.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

1. Tension and Compression members

Tension members – various approaches-design principles – strains in prestressed concrete tension members – tension members designed on cracking and ultimate strength consideration- compression members – direct loading – direct loading and bending – design principles.

2.End block

Introduction – stresses in the end block – spalling and bursting stresses – transmission zone – magnel's method – Horizontal, vertical and shear stresses – Guyon's method – anchor plate – Anchor plate placed symmetrically –

anchor plate placed eccentrically – end block with anchor plates I.S. recommendations.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

1.Continous beams

Important conceptions- The P – line and C – line – Primary moment – secondary moment – analysis of prestressed concrete continuous beams – concordant cable profile- linear transformation – non – concordant cable profile – design consideration – designs 101 to 109

2.Prestressed circular tanks and pipes

Introduction – composite construction – unpropped method – propped method – I.S. recommendations – shrinkage stresses – designs 110 to 112

3. Prestressed concrete composite beams

Introduction - composite construction – unpropped method – propped method – I.S. recommendations – shrinkage stresses – designs 112 A to 118

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

1. Prestressed concrete piles:

Introduction – handling stresses in a pile – need for prestressing – maximum length of pile.

2. Prestressed concrete pole:

Introduction – handling stresses in a pile – need for prestressing –Analysis for bending moment.

3. Prestressed concrete pavements:

Need for prestressing pavement slabs- stresses in pavement slab- longitudinal and transverse cables – oblique cables – designs.

Text Books:

1. Prestressed Concrete by S. Ramamrutham, Dhanpat Rai Publishing Company.
2. Prestressed Concrete by N. Rajagopalan, Narosa Publishing House.
3. Prestressed Concrete by N. Krishna Raju, The McGraw Hill Companies.

Reference Books:

1. Design of Prestresssd Concrete Structures by T. Y. Lin and Ned H. Burns, Willey Publisher.
2. Analysis and Design of Prestressed Concrete Structures by Dr. Hussam, https://www.researchgate.net/publication/328202827_Analysis_and_Design_of_Prestressed_Concrete_Structures.

Rural Sanitation (Professional Elective Course - IV)

COURSE OUTLINE

Course Title:	**Rural Sanitation**	**Short Title:**	**RS**	**Course Code:**	

Course description:

With the advent of the Prime Minister Narendra Modi's thought of making the country Open defecation free till 150th birth anniversary of Mahatma Gandhi, the concept of rural sanitation garnered loads of interest in local, national as well as global arena. On the sidelines of this statement this course is designed for the students so as to make them aware about the Rural Sanitation by virtue of which the can design various units of water supply and waste treatment in a judicious manner. The syllabus gives emphasis to the low cost technology which may be employed to rural areas with minimal maintenance requirement.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	42	3

Prerequisite course(s):

Nil

Course objectives:

The Objectives of course:

1. To make aware the students about schemes, practices and policies locally as well as globally in pertinent to the Rural sanitation.
2. To select an appropriate Treatment and disposal technique that is economically feasible and is viable in rural areas where maintenance facilities are limited. .

Course outcomes:

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

1. Be able to identify and understand rural issues of water supply and sanitation.
2. Acquiring skills and understanding about the development of these projects with cost effective implementation and operation & maintenance.
3. An ability in effective resource planning for rural environmental projects.
4. To optimize the treatment and disposal of processes in pertinent to rural sanitation.
5. To analyze the Distribution network of rural areas analytically and by use of software.

COURSE CONTENT

Rural Sanitation		**Semester:**	VII
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction:

Concept of Sanitation, its history and scope in rural areas, Problems of Rural water and Sanitation in local as well as global arena, Population to be covered, Awareness of national schemes and Policies in pertinent to the Rural Sanitation, Awareness of international schemes and Policies in pertinent to the Rural Sanitation, Interpretation of any one case study in pertinent to the development of Rural Sanitation augmenting the implementation of its schemes and policies.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Selection and development of Preferred Sources of water for Rural Sanitation:

Springs, Wells, infiltration wells, radial wells and infiltration galleries, collection of raw water from surface source,

Specific practices and problems encountered in rural water supply, Rainwater Harvesting, Groundwater Recharge, Numerical Problems on Design of Wells in confined and unconfined aquifer, Numerical Problems on Design of Rain water Harvesting system for Rural Sanitation, Quality of surface and sub surface water sources in pertinent to the rural sanitation.

Planning of water supply system:

Design population and demand loads. Various approaches of planning of water supply schemes in rural areas.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Specific Problem in rural water supply and Treatment:

Source Sustainability, Slippage, Water Quality, Operation and Maintenance. Low cost treatment, appropriate technology for water supply and sanitation augmented with flow charts, Numerical on Design of units of a rural water treatment plant.

Improved methods and compact systems of treatment:

Brief Details of multi-bottom settlers (MBS), diatomaceous earth filter, cloth filter, slow sand filter, chlorine diffusion cartridges, Water supply during fair, festival and emergencies, Numerical on design of Diatomaceous earth filter and slow sand filter.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Treatment and Disposal of Rural Waste:

Community latrines: Different types and location of latrines, various methods of collection and disposal of night soil, Simple waste water treatment units and systems in rural areas such as stabilization ponds, septic tanks, Imhoff tank, soak pit etc. Disposal of waste water soak pits and trenches, Numerical on design of community laterines, Numerical on design of units of wastewater treatment plant units for rural areas (Stabilization Ponds, Septic tanks, Imhoff tank, Soak pits and trenches), Disposal and characteristics of Solid Wastes, Composting, land filling, incineration, rural health, Other specific, issues and problems encountered in rural sanitation, Numerical on Evaluation landfill gases concentration, Numerical on design of domestic landfill for rural areas.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Analysis and Optimization of distribution networks:

Concept of distribution network for rural sanitation, Hardy Cross Method, Hazen William Equation, Use of computing techniques to analyze a rural distribution network (for water and wastewater) viz. BRANCH Software, LOOP Software and EPANET Software and Numerical based on it, optimization by Linear and Dynamic programming with Numerical treatment.

Economic Analysis of Rural Sanitation Project:

Terminologies in pertinent to the Economic Analysis augmented with basic concepts and equations, Methods of Economic Analysis: Net Present Value, Payback Period, Benefit Cost Ratio Analysis and Numerical based on it.

Biogas plants:

Definition, Objective, Methodology and Construction, operation and Maintenance, Economic analysis, Benefits, Shortcoming

Text Books:

1. Low cost waste water treatment technology, Trivedi R. K., Kaul S., ABD publications, Japan 2001.
2. Wastewater treatment for pollution control and reuse by S J Arceivala, S R Asolekar, TMH publication.
3. Wastewater Engineering-Treatment, disposal, reuse Metcalf & Eddy 4th Edition 2003. Tata McGraw Hill International Editions.

Reference Books:

1. Rural Water Supply in developing countries, International development research centre.
2. Water supply for rural areas and small communities, Publication W. H. O. Geneva, 1959.
3. Rural water supply and sanitation, Wright Forest b., second Edition, Wiley Eastern New Delhi 1956.
4. CPHEEO Manual of Water Supply and Treatment, 1999, Ministry of Urban Development.
6. CPHEEO Manual of sewerage and Sewage Treatment, 1993, Ministry of Urban Development.
7. Integrated solid waste management. Tchobanoglous, Theissen and Vigil-McGraw Hill Book Co.
8. CPHEEO Manual of Solid Waste 1993. Ministry of Urban Development.

Advanced Water Treatment Technology (Professional Elective Course - IV)

COURSE OUTLINE

Course Title:	Advanced Water Treatment Technology	**Short Title:**	AWTT	**Course Code:**	

Course description:

Purity of water is the first step of hygiene. In fact for all drinking, domestic, industrial and agricultural applications require wholesome water, not distilled water. Wholesomeness of water being supplied by the municipal corporation is an important index of living standard. It is the responsibility of a civil engineer to ensure adequate and safe water being supplied to the people. The under graduate course in civil engineering already includes a basic course related to water supply engineering. The present syllabus is next step to that. It takes the student for in depth knowledge of physic – chemical processes, and their mathematical modeling.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. This course enables a student to look into the physico – chemical process involved in the water treatment technology not as a black box phenomenon but with a rational perception.
2. This course helps student to develop a scientific insight into the process and operations going on in water treatment engineer.
3. This helps engineering graduate to not only plan, design, erect, commission, operate, maintain and trouble shoot a water treatment plant, but also to augment it for taking into account waters with special needs.

Course outcomes:

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

1. Plan and Design a water treatment plant with all accessories and Erect, maintain, commission, operate and trouble shoot a water treatment plant.
2. Demonstrate and ability to describe physic – chemical process of water treatment.
3. Augment a water treatment plant for growing needs.
4. Augment a water treatment plant for water with special needs.
5. Conduct pilot plant and bench scale research activities on water treatment process.

COURSE CONTENT

Advanced Water Treatment Technology		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Quality of water: Standards of raw and treated waters by WHO and relevant IS codes. Significance of acceptable and cause of rejection limits. Physical, chemical and biological parameters in water, standard methods for examination of water for relevant parameters. Sources of water and their natural quality. Protection of water resources. Effects of water quality on human life. Water ecology. Water demand analysis and its fluctuation. Changing characteristics of water with time.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
Water treatment: Requirements of water treatment facilities. Functional design and hydraulic design concept. Unit operations and process. Types of reactor according to hydraulic regime and their suitability. Reactors in series and parallel. Dye tracing of reactors to identify their hydraulic regime. Efficiency of reactors. Sedimentation and flotation: General equation for settling or rising of discrete particles. Hindered settling. Effect of temperature, viscosity. Efficiency of an ideal settling basin, Reduction in efficiency due to various causes. Sludge, Storage and removal. Design criteria of settling tanks. Numerical treatment for sedimentation tank design. Problems in maintenance of sedimentation tanks. Their remedy. Tube settles and plate settles.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Coagulation: theory of chemical coagulation, common coagulants, their chemistry, factors affecting their performance, coagulation aids. Mixing arrangement design of mechanical flocculator. Mean velocity gradient. Design of facilities for chemical coagulation. Filtration: Theory of filtration. Mechanism, of filtration, Size & shape characteristics of filter media. Preparation of filter sand. Hydraulics of filtration through homogenous and stratified media. Hydraulics of filter washing. Design of filter elements. Filter appurtenances. Filter stratification problem. Multimedia filters.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Water born diseases, sources of pathogen in water, disinfection methods, selection of chlorine, chemistry of chlorine, its limitations and bad effects. Break point chlorination and de-chlorination. Hardness: sources, cause, acceptable and rejection limits, bad effects, methods of determination. Methods of removal – lime soda process, zeolite process. Their theory, design and applications.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Aeration of water: necessity, theory, methods. Design of facility for aeration. Adsorption: necessity, common sorbents, theory of adsorption, kinetics – Langmuir isotherm, Frendlich isotherm, BET isotherm. Introduction to osmosis. Membranes used. Photo catalysis and its application in water purification, theory of photo induced oxidation and factors affecting it under slurry phase process. Future of photo catalytic treatment of water. Fluoride removal- Introduction, removal of taste and odor. Control of algae in water resources.		
Text Books:		
1. Water supply and sewerage by E W Steel, Terence J Mc Ghee International Student's edition. 2. Advanced Water Treatment by Mika Sillanpaa, Elsevier publication.		
Reference Books:		
1. Physico chemical treatment processes for water treatment, Walter J Weber		

Hydraulic Modeling (Professional Elective Course - IV)

COURSE OUTLINE

Course Title:	*Hydraulic Modeling*	**Short Title:**	*HM*	**Course Code:**	

Course description:

This syllabus introduces a learner with the basic principles of hydraulic modeling, its procedures, applications and limitations. It describes the common modeling techniques of ground and surface water flow using simulations and IT assistance and its uses in civil engineering. The syllabus is useful for watershed management engineer, water resources engineer and ground water engineer. The applications are there in environmental science and geology also.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*3*

Prerequisite course(s):

Nil

Course objectives:

The requisite objectives needs to be fulfilled are as follows:

1. To Understand the Concepts of Watershed and its Management.
2. To appreciate the meaning and significance of hydraulic modeling.
3. To Identify and define a hydraulic water resource Problem.
4. To Model and analyze the Hydraulic water Problem by using an appropriate method.

Course outcomes:

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

1. Develop a skill of choosing the correct management techniques for water resources.
2. Formulate problems, gather data, generate and prioritize a set of alternative solutions, and select and implement the best alternative.
3. Demonstrate the principles of remote sensing and GIS to the water resources for management.
4. Model and optimize the Hydraulic Problem.
5. Model a Water resource Problem by Soft Computing Methods.

COURSE CONTENT

Hydraulic Modeling		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Environmental and water resources problem: Watershed-element and types, Watershed hydrology, Hydrological cycle, Precipitation, water losses , Runoff , Rainfall-Runoff analysis, Watershed problem.

Water Resources Management:

Erosion control and watershed development: their benefit towards conservation of national water wealth. Rain water harnessing and recharge of ground water: role of society and people's participation for sustainable water resource development. Mitigation strategies for flood damage: structural and non-structural measures.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
Watershed Management techniques Spatial Decision Support Systems (SDSS) for land and water management at the watershed scale, Integrated Watershed Management, On-site and off-site management structures for soil and water conservation. Community Watershed Management. **Optimization** Optimization Multi - objective optimization, Review of probability theory, Uncertainty and reliability analysis, Stochastic optimization - Chance constrained LP, Stochastic DP with applications, Surface water quality control.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Simulation Simulation – Reliability, Resiliency and Vulnerability of water resource systems, Multipurpose reservoir operation for hydropower, flood control and irrigation, Groundwater Systems, Water quality modeling, River basin Planning and management, Advanced topics. **Soft computing techniques** Soft computing techniques ANN Genetic algorithms, Multi criteria decision making, Decision Support Systems, Expert Systems		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Surface flow modeling techniques: Hydrological and hydraulics flow model, Reservoir routing, channel routing, general operation of flood forecasting, forecasting methods adopted in India, forecasting by unit hydrograph method, Numerical modeling.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Subsurface flow modeling techniques: Concept, definition and expression for yield, transmissibility, Darcy's law for flow through porous media, its applications in practical problems of confined and unconfined aquifers, Dupuit's theory of unconfined flow, steady flow towards fully penetrating wells in case of confined and unconfined aquifers, scope and applications of the theory, limitations, Numerical modeling based upon the theory.		
Text Books:		
1. S. K. Som, G. Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill Education, Third Edition, 2013 2. Dr P. N. Modi & Dr. S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, Twentieth Edition, 2015 3. Bansal, R. K., A textbook of fluid mechanics and hydraulic machines, Laxmi Publications, Revised Ninth Edition, 2010		
Reference Books:		
1. Miroslav Nechleba, Hydraulic Turbines, ARTIA Prague 2. J. Stepanoff, Centrifugal and Axial flow Pumps, John Wiley & Sons, Inc., Second Edition, 1993 3. Igor J Karassik & Roy Carter, Centrifugal Pumps, McGraw – Hill 4. S. M. Yahya, Turbines Compressors and Fans, Tata McGraw – Hill, Fourth Edition		

Geosynthetic Engineering (Professional Elective Course - IV)

COURSE OUTLINE

Course Title:	*Geosynthetic Engineering*	**Short Title:**	*RS*	**Course Code:**	

Course description:

This course introduce the students about concept in Geosynthetic Engineering such as Design with geosynthetic materials used in geotechnical applications, design with geogrids, design with geomembranes, design with geonet, design with and geo-composites.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. To understand the emerging trends of Geosynthetic in Geotechnical Engineering
2. To evaluate the different properties by different tests
3. To analyze the functions of geosynthetic and its suitability
4. To design different structures using geosynthetics according to various applications

Course outcomes:

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

1. Select different geosynthetics for intended purpose
2. Evaluate properties of geosynthetics.
3. Design geosynthetics for intended purpose.
4. Apply geocomposite systems to solve contemporary geotechnical problems

COURSE CONTENT

Geosynthetic Engineering		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3hours/week**	**End semester exam (ESE):**	**60**
		Duration of ESE:	**03**
		Internal Sessional Exams (ISE):	**40**

Unit–I:	**No. of Lectures: 09Hours**	**12**

Introduction: An overview on the development and applications various geosynthetics - the geotextiles, geogrids, geonets, geomembranes, geocomposites and other products

Designing with geotextiles: Manufacture of geotextiles, Geotextile properties and test methods – functions - Designing geotextiles for separation, reinforcement, stabilization, filtration and drainage

Unit–II:	**No. of Lectures: 09Hours**	**12**

Designing with geogrids: Manufacture of geogrids, Types of geogrids, Geogrid properties and test methods – physical properties, mechanical properties, endurance properties and environmental properties – Designing geogrid for reinforcement in pavements, Retaining walls and bearing capacity

Unit–III:	**No. of Lectures: 08Hours**	**12**

Designing with geonets: Manufacture of geonets, Geonet properties and test methods – Physical properties, mechanical properties, hydraulic properties, endurance properties and environmental properties -Designing geonet for drainage

Unit–IV:	**No. of Lectures: 08Hours**	**12**

Designing with geomembranes: Geomembrane properties and test methods – physical properties, mechanical properties, chemical properties and biological hazard - Applications of geomembranes and design.		
Unit–V:	**No. of Lectures: 08Hours**	
Designing with geocomposites: Geocomposites in seperation, reinforcement – reinforced geotextile composites – reinforced geomembrane composites – reinforced soil composites using discontinuous fibres and meshes, continuous fibres and three –dimensional cells, Designing for bearing capacity, geocomposites in drainage and filtration		
Text Books:		
1. Mandal, J.N."Geosynthetics Engineering: in Theory and Practice", Research Publishing, Singapore, 2018 2. Koerner, R.M. "Designing with geosynthetics", Pearson Education Inc., 2012. 3. Rao, G.V. "Geosynthetics – an Introduction", Sai Master Geoenvironmental Services Pvt. Ltd. Hyderabad, 2011.		
Reference Books:		
1. SivakumarBabu G.L. "An Introduction to Soil Reinforcement and Geosynthetics" University Press, 2009. 2. Jonathan T.W. Wu "Geosynthetic Reinforced Soil Walls" First Edition, 2019 3. Sanjay Kumar Shukla and Jian-Hua Yin, "Fundamentals of Geosynthetics Engineering" CRC Press, 2017, Hyderabad.		

Solid and Hazardous Waste Management (Open Elective Course - III)

COURSE OUTLINE

Course Title:	*Solid and Hazardous Waste Management*	**Short Title:**	**SHWM**	**Course Code:**	

Course description:

Cleanliness is considered to be an step towards godliness. Hygiene and sanitation are indices of standards of living. India has a history of higher standards of cleanliness which is evident from so many references including the Arthashatra of Kautilya. However, modern India is poor in terms of organized cleanliness mechanism. The authorities have recognized the need of cleanliness programs and have embarked with so many initiatives including Sawchhbharat Abhiyan. The present syllabus includes importance and scope of solid waste management, its methods of solid waste collection, prevailing laws and legislations, methods of transportation of solid waste, methods of recycling and final disposal. Emphasis is given on Municipal solid waste as well as hazardous solid waste also.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*3*

Prerequisite course(s):

Nil

Course objectives:

The Objectives of course:

1. To make aware the students of characteristics, composition, sampling, identification and Management of MSW and Hazardous Wastes.
2. To enable students to select an appropriate Treatment and disposal technique that is economically feasible for the Solid and Hazardous Waste Management.
3. To enable students to plan a comprehensive SWM plan for the municipal corporations.

Course outcomes:

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

1. Have knowledge on the sources of Solid and Hazardous Waste along with its characteristics.
2. Design a sampling plan and characterize solid waste.
3. Design transportation network for the SWM, design disposal sites for the SWM.
4. Work out manpower requirements and economic aspects for SWM including recycling.
5. Aware about prevailing legislations in this regard.

COURSE CONTENT

Solid and Hazardous Waste Management		**Semester:**	*VII*	
Teaching Scheme:		**Examination scheme**		
Lectures:	**3 hours/week**	**End semester exam (ESE):**		**60 marks**
		Duration of ESE:		**03 hours**
		Internal Sessional Exams (ISE):		**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction:

Concept of Solid Waste, Categories of Solid Waste with sources and its generation, Environmental Impact of Solid waste disposal on land, Composition and characteristics of Solid Waste with Numerical Treatment on each of the Characteristics of Solid Waste.

Municipal Solid Waste Management:

Concept of Solid Waste Management, Objectives of Solid Waste Management, Principles of Solid waste Management, Functional Elements of Municipal Solid Waste Management, Hierarchy of Waste Management

options, Components of Municipal Solid Waste Management with an emphasis on linkages of other wastes generated from urban center, Steps involved in the development of a Solid Waste Management System.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Sampling of Solid Waste:

Need for Sampling, Field investigations to be carried out, Sampling Protocols for MSW, Factors affecting waste sampling, Number of samples to be collected as per CPHEEO Manual, Standard procedure for collection of Solid waste Sample, Numerical treatment on Sampling of Solid Waste.

Recycle and Recovery in Solid Waste Management:

Concept of Recovery and Recycle in MSW, Resource Recovery through Material Recycling, Resource Recovery through Waste Processing, Recycling Progress and statistics, Market issues and Purity of Materials.

Mini Research Project on Solid Waste Management:

Students here have to Select a pertinent city/district/taluka as per their choice and fetch the Population data of that city/district/taluka and per capita MSW generated with assistance of Internet (Preferably Census Data or by visiting Municipal Office), Forecast the Population by using appropriate Method augmented with forecasted quantity of solid waste to be generated and devise a Solid Management Plan for that requisite City/District/Taluka.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Sorting of Waste and Material Recovery:

Objectives of Sorting, Stages of Sorting, Concept of Material Recovery and Material Recovery Facility, Sorted Waste Streams, Sorting Operations, Hazards in Sorting and Measures to prevent it, Standard Guidelines for Sorting in pertinent to CPHEEO Manual.

Storage of Solid Waste:

Concept of Storage of Waste, Present scenario and measures to improve it, Steps to be taken by Urban Local Bodies for Storage of Waste and Recyclables.

Collection of Solid Waste:

Concept of Collection of Solid Waste, Present scenario and measures to improve it, Steps to be taken by Urban Local Bodies, Tools and equipment required for the collection of Solid Waste, Methods of Collection of Waste, Collection procedure for different categories of Solid Waste, Automated Waste Collection with aid of GIS Software.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Waste Storage Depots, Transportation of Wastes and Street Cleansing:

Concept of Storage of Solid Waste Storage Depots its Transportation and Street Cleansing, Present scenario and measures to improve it, Steps to be taken by Urban Local Bodies, Methods for different categories of Waste for the same.

Solid Waste Treatment and disposal Technologies:

Principles, Methods and Numerical Treatment for Solid Waste Treatment with an emphasis on Energy recovery if Possible: Composting, Vermi composting, Incineration, Sanitary Landfills, Other emerging Technologies.

Introduction to Hazardous Waste:

Elucidation of Concept of Hazardous Waste with a case study (Ex. Love Canal), Characteristics tests for Hazardous Waste, Generation of Hazardous waste, Transportation of Hazardous Waste, Legislation and Policy Guidelines for Hazardous Waste Management.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Treatment and Disposal of Hazardous Wastes with Numerical Treatment if Possible:

Incineration, Secured Landfill, Neutralization, Chemical Precipitation, Oxidation and Reduction, Sorption Process, Stabilization and Other Methods.

Special Wastes of Importance:

Storage, Collection, Transportation, Treatment and Disposal of: Biomedical Waste, E waste, Construction and Demolition Waste, Industrial Waste, Slaughter House waste.

Legislation on Solid and Hazardous Waste Management and Community Participation Augmented with EIA

Analysis:

Legal Aspects of Solid and Hazardous Waste Management in India and comparing it with other countries, Community Participation to raise the public awareness in a locality, Institutional aspects and Capacity Building, Prospects of Private Sector Participation, EIA process for Solid and Hazardous Waste Management aided with a Management Information System.

Text Books:

1. Integrated solid waste management. Tchobanoglous, Theissen and Vigil-McGraw Hill Book Co.
2. Solid waste management in developing courtiers, B B Sundersen and A D Bhide, Indian National Scientific Documentations Centre, New Delhi.

Reference Books:

1 Hazardous waste management LaGrega, Buckingham & Evans. McGraw Hill Book Co.

2. Solid wastes - Engineering principles and management issues. Tchobanoglous, Theissenand Eliassen. McGraw Hill Book Co.

3 CPHEEO Manual on Solid Waste Management, Urban Development Authority

Geology for Engineers (Open Elective Course - III)

COURSE OUTLINE

Course Title:	Geology for Engineers	**Short Title:**	*GE*	**Course Code:**	

Course description:

Geology is a basic subject for engineers especially for design of mega size structures, may be multistoried buildings, dams, tunnels bridges etc. Students of civil engineering have a basic course in geology as a lab work at second year level. Students interested for detailed study of the subject may opt for this subject. This course is designed to enable students to evaluate, to apply and to analyze the relevant geological principles. In this course, the related topics on rock types/classifications, geological structures and geological processes are covered. The principles of Structural geology are introduced mainly to highlight the relevancy of engineering properties of geological materials in designing rock engineering projects. At the end of the course, students acquainted with related knowledge and principles in geology and can be able to apply these knowledge and principles in designing safe and economic engineering structures in rock masses.

Lecture	**Hours/week**	**No. of weeks**		**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

NIL

Course objectives:

1. The prime objective of this course is to enable a student to identify the role of geologist in civil engineering projects.
2. It will enable students to understand the characteristics of ground water and its flow, to investigate the geological aspect of earthquakes and other engineering problems.
3. It assists student to demonstrate the concept and principles involved in geological exploration for engineering projects.
4. It will also enable students to examine the role of geological factors on mega engineering structures like tunnels, Dams, sky scrapers and bridges etc.

Course outcomes:

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

1. To identify rocks and minerals.
2. To interpret geological maps and deal with features like ground water structural features, prevailing under area of considerations.
3. To evaluate the geological factors with respect to good building material, morphological condition.
4. Plan the geological exploration or investigation, depending on extent of importance of civil engineering structures.
5. Predict the geological reason for performance of civil engineering structures like dam, tunnel etc.

COURSE CONTENT

Geology for Engineers		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3hours/week**	**End semester exam (ESE):**	**60**
		Duration of ESE:	**03**
		Internal Sessional Exams (ISE):	**40**

Unit–I:	**No. of Lectures: 09Hours**	**12**

Introduction: Objectives, scope, rock forming minerals, primary and secondary minerals.
Silicate and non silicate minerals, felsic and mafic minerals, essentials and accessories minerals.
Origin, texture, structure, classification of igneous rocks, secondary rocks, metamorphic rocks and their engineering applications
Foundation of cities.

Unit–II:	No. of Lectures: 09Hours	12

Structural Geology, Plate Tectonics & Ground water

Structural geology: Outcrop, dip and strike, conformable series, unconformity and overlap. Inliers and outliers.
Faults and their types, folds and their types,
Structural features resulted due to igneous intrusions, concordant and discordant igneous intrusions.
Joints and their types and Introduction to plate tectonics.
Water table and depth zones, relation between surface relief and water table, perched water table.
Natural springs and seepages, contact springs, hot springs and geysers, artesian wells.

Unit–III:	No. of Lectures: 08 Hours	12

Geomorphology, Historical Geology & Building stones

Geomorphology: geological action of river, rejuvenation, land forms resulted due to river erosion, deposition and rejuvenation.
Physiographic divisions of India and their characteristics, geological history of peninsula, study of formations in peninsula and the significance of their structural characters in major civil engineering activities. Field characters of Deccan Trap basalt
Requirements of good building stones, engineering properties of rocks. Availability of blocks of suitable size and appearance on mineral composition, textures, structures.
Earthquake & its causes, classification, seismic zones of India & geological consideration for constructions of building.
Geology of soil formation, suitability of Deccan trap basalt as construction material.

Unit–IV:	No. of Lectures: 08Hours	12

Preliminary Geological Studies, Remote Sensing, Geo physical exploration.

Verification of surface data by subsurface exploration, drill holes, test pits, trenches, exploratory tunnels, shafts, audits, drifts, etc.
Compilation and interpretation of information obtained from these. Correlation of surface data with results of subsurface exploration.
Limitations of drilling, comparative reliability of data obtained by drilling and excavation.
Engineering significance of geological structures such as stratification, dips, folds, faults, joints, crush zones, fault zones, dykes etc.
Landslides and its causes, preventive measures and case studies.
Principles of geo physical exploration, Gravitational, electric, magnetic seismic methods for sub surface survey.

Unit–V:	No. of Lectures: 08Hours	12

Role of Engineering Geology in Dams and tunneling

Preliminary geological investigation for tunnels. important geological consideration while choosing alignment
Role of groundwater, geological conditions likely to be troublesome, suitability of common rock type for tunneling, unlined tunnels, case studies.

a) Geological requirements for construction of dams and geological structures influence of geological condition on the choice of type and design of dam.
b) Preliminary geological work on dam sites, favorable and unsuitable geological conditions for locating a dam, precaution to be taken to counteract unsuitable condition
c) Treatment of leaky rocks, faults, dykes, crush zones, joints, fractures, unfavorable dips, etc. and case studies.
d) Tail channel erosion , importance , case study

Text Books:

1. K V G K Gokhale : Text Book of Engineering Geology, B S Publication
2. P. K. Mukerjee : A text Book of Geology, Calcutta Word Publishers.
3. Blyth F.G.M. A Geology for Engineers, Arnold London.
4. Prabin Singh. Engg. And general Geology. Katson Publishing House.
5. D. S. Arrora: Geology for Engineers, Mohindra Capital Publishing Candigarh.

Reference Books:

1. R.B. Gupte : A Text Book of Engineering Geology -P.V.G. Publications, Pune.
2. M. Anji Reddy : A Text Book of Remote Sensing and Geographical Information Systems by - 2nd Edition B S Publication.
3. R. Legget: Geology and Engineering - McGraw Hill Book Co., London.
4 Arthur Holmes : Physical Geology -ELBS Publication.
5 Tony Waltham : Fundamentals of Engineering Geology, SPON Press.
6 J.M. Treteth : Geology of Engineers, Princeton, Von. Nostrand.
7. F G Bell : Fundamentals of Engineering Geology, B S Publication

Environmental Impact Assessment (Open Elective Course - III)					
COURSE OUTLINE					
Course Title:	**Environmental Impact Assessment**	**Short Title:**	*EIA*	**Course Code:**	
Course description:					
This course introduces the importance, scope and methodology of environmental impact assessment (EIA). EIA is a vital tool for sound environmental management and decision making regarding implementation of an engineering project. The course provides an overview of the concepts methods issues and various forms and stages of the EIA process.					
Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	03	*14*	*42*	*03*	
Prerequisite course(s):					
Nil					
Course objectives:					
Environmental impact assessment (EIA) enables a student in anticipation and minimization of development's negative effects undertaken in the early stages of project planning and design, EIA helps shape development in a manner that best suits the local environmental and is most responsive to human needs.					
Course outcomes:					
After successful completion of this course the student will be able to:					
1. Explain the major principals of environmental impact assessment in India. 2. Understand the different steps within environmental impact assessment. 3. Communicate both orally and in written form the key aspects of environmental impact assessment. 4. Be able to access different case studies / examples of EIA in practice. 5. Discuss the implications of current jurisdictional and institutional arrangement in relation to EIA.					
COURSE CONTENT					
Environmental Impact Assessment			**Semester:**		
Teaching Scheme:			**Examination scheme**		
Lectures:	**3 hours/week**		**End semester exam (ESE):**		**60 marks**
			Duration of ESE:		**03 hours**
			Internal Sessional Exams (ISE):		**40 marks**
Unit–I:	**No. of Lectures: 09 Hours**		**Marks: 12**		
Development and environment: Need of environmental impact assessment, concept of EIA, elements of EIA, environmental attributes, nature of impacts- primary, secondary, tertiary, short term and long term, local and regional, reversible and irreversible impacts. **Overview of impacts**- Directly and indirectly measurable impacts with respect to air, noise, water, land, biological and socio economic environment.					
Unit–II:	**No. of Lectures: 09 Hours**		**Marks: 12**		
Screening and scooping in EIA: terms of reference for conducting EIA, methodologies of EIA- check list, matrices, overlays, cost benefit analysis adaptive environment and management network. **Frame work of EIA:** Scope of EIA, base line data collection, prediction of impacts, evaluation of impacts, Battelle environmental evaluation system, environmental management plan, green belt development, environmental quality monitoring, budgetary provisions for implementing control measures.					
Unit–III:	**No. of Lectures: 08 Hours**		**Marks: 12**		
Environmental appraisal of project, MOEF questionnaire for environmental clearance, elements of public					

participation and hearing, case study on EIA of industrial, mining, highway and water resources projects, critical environmental issues and formulation of strategies for EMP for this project.
Environmental legislation- Basic concepts, critical issues, civil liabilities, various enactments and their provisions- water act (1974, 1978), forest conservation act (1980), air pollution control act (1981, 1988), water (cess) act 1977, environmental protection act 1986, public liability and insurance act.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Environmental audit- definition, concept of EA, types of environmental audits, benefits of EA, scope and objectives, environmental statement, procedural aspects of conducting EA pre-audit phase, onsite audit phase and post audit phase, water audit, energy audit, raw material audit and health & safety audit. Conservation of energy and water, waste minimization, economic benefits of EA.
Sustainable development and environmental management: concept of carrying capacity, assimilative and supportive capacity, carrying capacity based developmental planning process, regional EIA and preparation of regional EMP, Development of action plan for critical environmental areas, training needs in EM and Environmental Educational Programs. Environmental management in India.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Resource management: types of resources, terrestrial (soil) resource, mineral plants and animal (biotic) resources, marine fresh water, air and bio energy resources, resource utilization, renewable and non-renewable resources. Optimal use of resources. Depletion of resources, causes and effects.
Human resources: importance of socio economic studies in development projects

Text Books:

1. Environmental Impact Assessment by R R Barthwal, New Age Publications Ltd.
2. Environmental Impact Assessment by L W Canter, McGraw-Hill Science publication.

Reference Books:

1. Environmental Impact Assessment, S.R. Khandeshwar N.S. Raman, A.R. Gajbhiye, Dreamtech Press.
2. Environmental Impact Assessment: Theory and Practice, Reddy, B S Publications.

Hydrology & Water Resources Engineering Lab

LAB COURSE OUTLINE

Course Title:	**Hydrology & Water Resources Engineering Lab**	**Short Title:**	*H&WREL*	**Course Code:**	

Course description:

Since the ancient times, water had been crucial parameter for development of civilization. Therefore Hydrology & Water Resources Engineering is included as a theory paper in the curriculum of the civil engineering. In addition to the theoretical knowledge, the students need practical exposure also. A student is supposed to practice a lot on analytical and design problems pertaining to hydrology and water resources development. The present course takes care of this aspect. It also includes visit to sites and study of videos for better understanding of curriculum.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	02	*14*	*28*	*01*

End Semester Exam (ESE) Pattern: ***Oral (OR)***

Prerequisite course(s):

Nil

Course objectives:

i. The basic objective of the present syllabus is to provide an opportunity to the student to practice on numerical problems of analysis and design related to hydrology and water resources engineering.
ii. It also provides a real world exposure to the students by including site visit in the curriculum.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Solve analytical problems pertaining to hydrology, unit hydrographs and mass flow curves.
2. Asses run of a catchment area, given the topographic characteristics and rainfall data.
3. Design a complete crop and water management plan of a region.
4. Design simple gravity dams.
5. Design diversion works.

LAB COURSE CONTENT

Hydrology & Water Resources Engineering Lab		**Semester:**	VII
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***
		Internal Continuous Assessment (ICA):	***25 marks***

LIST OF PRACTICAL (Assignments):

- Development of flood hydrograph from unit hydrograph and complex storm.
- Determination of reservoir capacity from mass inflow and mass demand curve.
- Stability analysis of a gravity dam considering all major forces.
- Stability analysis of slope of earth dam.
- Design of Ogee spillway with energy dissipator.
- Analysis of weir on permeable foundation by using Khosla's charts.
- Design of unlined canal in alluvium by using Garret's diagram /Lacey's equations (at
- least three sections along the alignment including calculation of design discharge from
- Command area and kor depth and kor period) and plotting L-section; also preparing
- Schedule of area statistics and channel dimensions.

- Detailed report along with drawings, based on visit to any dam; including proof of the
- Benefit - cost analysis of a water resources engineering project.

The students should visit to a dam site and reservoir.

Text Books:

1. Varshney R.S., Gupta S.C., Gupta R.L. Theory and Design of Irrigation Structures, Volume I and II", Fourth edition. New Chand & Bros., Roorki.
2. Bharat Singh - Irrigation Engineering.
3. Sharma R.K., "A Text Book of Hydrology & Water Resources", Dhanpat Rai and Sons.
4. K.B.Khushlani - Irrigation Engineering.

Reference Books:

1. Modi P.N. Irrigation, Water Resources and Water Power Engineering, Standard Book House, Delhi.
2. Garg S.K. Irigation Engineering And Hydraulic Structures. Khanna Publishers, Delhi.
3. Punmia B.C., Pande B.B., .Lal, 1999. Dams II: Irrigation and Water Power Engineering". Laxmi Publications Pvt. Ltd., New Delhi.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student's performance throughout the semester and term work prepared by the students in the form of journal.

Guidelines for ESE:

ESE shall be based on term work prepared by students & Evaluation will be based on performance during oral examination.

Construction Engineering & Management Lab

LAB COURSE OUTLINE

Course Title:	**Construction Engineering & Management Lab**	**Short Title:**	*CEML*	**Course Code:**	

Course description:
Construction industry is gradually giving up the conventional and is adopting new paradigms. Digitalization, automation and computerization have revolutionized the construction industry. IoT is another new player in this sector. The present course has been designed to provide student with a practical, in-depth introduction and orientation of various construction methodology and management techniques used in the professional construction approach.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	01	14	14	2
Laboratory	*02*	*14*	*28*	

Prerequisite course(s):

Nil

Course objectives:

1. To make student capable to handle variety of construction projects after completion of course.
2. The student must become aware of the new concepts coming up in the construction industry and must be updated with the use of latest technology.
3. The student must be able to give a quality output while strictly adhering to the time schedule.

Course outcomes:

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

1. An idea of how mega construction projects are dealt with.
2. An understanding of modern construction practices.
3. A good idea of basic construction dynamics – various stake holders, project objectives, resources required & project economics
4. A basic ability to plan, control & monitor construction projects with respect to time cost
5. An idea of how to optimize construction projects based on costs

LAB COURSE CONTENT

Construction Engineering & Management Lab		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Theory:	**1 hours/week**	**End semester exam (ESE):**	**25**
Practical:	**2 hours/week**	**Internal Sessional Exams (ICA:**	**25**

1. **Basic Construction**: Unique features of construction, construction projects: types & features, Phases of project, various agencies involved & their methods of execution.
   Construction project Planning :
   i. Stages of project planning : pre tender planning, pre-construction planning, detailed construction planning

ii. Process of development of plans & Schedules, work break down structure, activity list, assessment of work content, estimating durations, sequence of activities
iii. Technique of Planning : bar charts, Gantt charts
iv. Networks : basic terminology, preparation of CPM network, computation of float values, critical & semi critical path
v. PERT : Assumptions, PERT Analysis, determine their time estimate, calculating of probality completion

2. Construction methods :

i. Basic of form work and it staging for foundation, column beam and slab
ii. Common building construction methods (Conventional walls & slabs)
iii. Slip forms ; For tall structure
iv. Basic construction methods for steel structures
v. Basics construction methods for bridge

- Construction Equipment basics :
  i. Equipment for excavation, earthmoving, dewatering etc…
  ii. Concrete mixing, transporting & placing
  iii. Cranes, hoists etc..
  iv. Equipment for transportation of materials

3. Planning & organizing construction site & resources :

i. Site job layout – structures & other infrastructure
ii. Site organization, documentation, manpower, planning , organizing, staffing
iii. Materials ; concepts of planning, procurement and inventory control
iv. Equipment : basic planning & organizing
v. Funds ; sources of fund, cash flow

4. Project Monitoring & Control :

i. Supervision , record keeping, periodic progress reports, updating of plans, frequency & method of updating
ii. Common causes of time & cost over turns & corrective measures
iii. Quality control : concept of quality, quality of constructed structure, use of manuals & check list; ISO 9000 , ISO 14000 Only concept
iv. Safety on project site for various works, site accidents, their causes, preventive measures.
v. Audit of safety, accident report writing (as per CPWD/PWD format)

5. Contract management :

i. Importance of contracts, types of contracts, parties to a contract, common contract clauses
ii. Delays penalties and liquidated damages, force majeure
iii. Suspension & termination, changes and variation
iv. Dispute resolution methods , arbitration
v. Conciliation, essential of Conciliation.

Following activities are to be performed. Term works shall consist of journal giving details of the activities performed and assignment question answers.

b. Develop a bar chart for construction of G+2 or G +7 storied building with all activities (assuming reasonable activity durations)
c. Develop a bar chart for concerting 1500 sqm of a 15 cm thk slab using various equipment for production to placing of concrete at 3m height above GL
d. Develop a CPM chart for a 5 span bridge on open foundation
e. Write descriptive answer assignments questions from above contents**.**

Text Books:

- Varghese P C , Building construction, Prentice Hall India
- National Building Code, BIS, New Delhi
- Chudley R. Construction Technology , ELBS publishers
- Punmia B C, Project Planning with PERT & CPM, Laxmi publications

- Gopalan M.R. Project Management, WILLEY PUB.

Reference Books:

- Doald Barrie, Professional Construction Management,McGraw Hill Education.
- Saurabh Soni, Construction Management & Equipment, KATSON books Publishers
- Charles Patrick, Construction Project Planning &Scheduling,PEARSON
- JhakumarNeeraj, Construction Project management, Pearson Education India

Major Project (Stage – I)

LAB COURSE OUTLINE

Course Title:	**Major Project (Stage – I)**	**Short Title:**	**MPROJ-SI**	**Course Code:**	

Course description:

Laboratory work or experimentation is a line of distinction between science and other subjects. A project is an integration of experimental work performed to achieve an specific task. Projects not only teach experimentation, they teach resource planning and management, time and manpower management and ability work in team also. It also aims to enable to apply the theoretical concepts to solve problems with multidisciplinary approach. Ultimately it enables to demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Hence projects are given due space in the curriculum right from third year level.

The Major project stage I is the second link in the series. The objective of this project is primarily to formulate or identify a 'problem' that can be solved in the specified time and resources available and to actually solve it. The word problem is used in broad sense referring to any activity like analyzing, designing, fabricating, developing, surveying, etc.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	6	**14**	**84**	**3**

End Semester Exam (ESE) Pattern:	**----**

Prerequisite course(s):

Nil

Course objectives:

1. To understand the meaning, objectives and purpose of a practical size civil engineering project.
2. To understand the value of achieving perfection in project implementation & completion.
3. To apply the theoretical concepts to solve problems with teamwork and multidisciplinary approach.
4. To demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Undertake problem identification, formulation and solution
2. Demonstrate a sound technical knowledge of their selected project topic.
3. Design engineering solutions to complex problems utilizing a systems approach.
4. Demonstrate the knowledge, skills and attitudes of a professional engineer for problem solving.
5. Demonstrate ability to work in team

LAB COURSE CONTENT

Major Project (Stage – I)		**Semester:**	**V**
Teaching Scheme:		**Examination scheme:**	
Practical:	**6 hours/week**	**Internal Continuous Assessment (ICA):**	**50 marks**

At final year the students shall carry out a major project in a group of maximum five students. The project work spans both the semesters. By the end of Semester – VII the students shall complete the partial work, and by the end of Semester – VIII the students shall complete remaining part of the project. Assessment for the project shall also include presentation by the students. Each teacher can guide maximum 04 groups of major projects.

The project may be either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department. The work may also be Study/Survey/Design.

Majorr Project (Stage – I) Report will include literature survey, problem identification, work methodology, preparing material specification and material procurement, collection of data etc. Approximately 60% work should be completed by the end of Semester – VII. Each student group should submit partial project report in the form of thermal bound at the end of Semester –VIII.

Guide lines for ICA:

The Internal Continuous Assessment (ICA) for project shall be based on continuous evaluation of students' performance, active participation, knowledge / skill acquired throughout semester and presentation by the students. The final assessment shall be done jointly by the guide and departmental committee. A three-member departmental committee including guide, appointed by Head of the department, shall be constituted for the assessment. The assessment for Major Project (stage – I) in Semester – VII shall be as per the guidelines given in Table – A.

Table – A

		Assessment by Guide					Assessment by Departmental Committee		
Sr. No.	Name of the Student	Attendance / Participation	Problem Identification / Project Objectives	Literature Survey	Methodology / Design/work done	Report writing	Depth of Understanding	Presentation	Total
	Marks	5	5	5	15	5	10	5	50

Essence of Indian Traditional Knowledge

Course objective:

The course aims at imparting basic principles of thought process, reasoning and inferencing, sustainability is at the core of Indian traditional knowledge system connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. The course focuses on introduction to Indian knowledge systems, Indian perspective of modern scientific world-view, and basic principles of yoga and holistic health care system, Indian artistic tradition.

Outcomes:

Ability to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.

Course Contents:

Introduction to:

1. Ayurveda, Charaka Samhita, Sushruta Samhita
   Principles and Terminology: Vatha, Pitha, Kapha, Ether, Earth, Water, fire and Air Tatva, Influence of these on human health.
2. Architecture: Temple Architecture, Indo – Islamic Architecture, Mughal Architecture, Indian Rock Cut Architecture, Vastu Shastra.
3. Importance of Yoga for Physical and Mental health, Yoga Sutras of Patanjali, Meditation, International day of Yoga.
4. Indian Classical Music, Hindustani and Carnatic Music, Raga, Tala, Dhrupad, Khyal, Tarana and Thumri, Sangitaratnakara, Work of Tansen, Purandara Dasa, Bhimsen Joshi, Ustad Bismillah Khan, Bal Gandharva etc.
   Folk Music and Dances such as Rajasthani, Marathi, Gujrati, Punjabi etc.
5. Indian Classical Dances: Shastriya Nritya, Natya Shastra, Bharatanatyam, Kathak, Kuchipudi, Odissi, Kathakali, Sattriya, Manipuri, Mohiniyattam and Chhau dance forms.

References:

1. Amit Jha, “Traditional knowledge system in India”, Atlantic Publisher.
2. Basanta Kumar Malhotra, “Traditional Knowledge System and Technology in India”, Pratibha Prakashan.
3. Nitin Singhania, “Indian Art and Culture”, McGraw Will Publication.
4. Dr. Bramhand Tripathi, “Charak Sanhita”, Chaukhambha Surbharti Prakashan
5. Dr. Anantram Sharma, “Sushrut Samhita”
6. Valiatham M.S., “An Introduction to Ayurveda” Orient Bkackswan Publication.
7. Valiathan M.S., “The legacy of Charaka” University Press.
8. Valiathan M.S., “The legacy of Susruta” University Press.
9. Garg Maheshwari, “Ancient Indian Architecture”, CBS Publisher and Distributors
10. Sharmin Khan, “History of Indian Architecture”, CBS Publisher and Distributors.
11. Bindia Thapar, Surat ku. Manto, Suparana Bhalla, “Introduction to Indian Architecture”, Periplus Editions Ltd.
12. Vijay Prakash Singh, “An Introduction to Hindustani Classical Music”, Lotus Publisher
13. Leeta Venkataraman, Avinash Pasricha, “Indian Classical Dance” Lustre Publisher
14. Shovana Narayan, “Indian Classical Dances” New Dawn Press
15. Kapila Vatsyayan, “Indian Classical Dance”, Ministry of Information and Broadcasting, Govt of India.

Kavayitri Bahinabai Chaudhari

NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

Fourth Year Engineering

(Civil Engineering)

Faculty of Science and Technology

'A' Grade
NAAC Re-Accredited
3rd Cycle

COURSE OUTLINE

Semester - VIII

W.E.F. 2020 – 2021

Engineering Economy, Estimation & Costing

COURSE OUTLINE

Course Title:	*Engineering Economy, Estimating & Costing*	**Short Title:**	*EEEC*	**Course Code:**	

Course description:

Civil Engineering projects are mega projects involving huge cost, man power and time investment. A prediction of these requirements prior to the actual construction is necessary to take decision. The present work includes this aspect. It also includes the material and rate analysis and valuation aspect. The course also contains introduction to basic principles of economics applicable to civil engineering projects.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	14	44	*5*

Prerequisite course(s):

Nil

Course objectives:

The prime objective of this syllabus is to enable students to predict the cost of a civil engineering structure like building, dam, road, canal, bridge etc, prior to its construction thus to help in planning as well as in final payments of the bills. It also aims to enable student to evaluate the cost of an existing structure.

1. To enable student with working out quantities of various items involved in construction of structures
2. Student will also be able to work out the rate analysis
3. Student will also be able to work out the valuation of properties.

Course outcomes:

After successful completion of this course the student:

1. Will attain the level of proficiency to prepare approximate as well as detailed estimate of civil engineering projects.
2. Is competent enough to calculate the amount of material, labours & machinery required to execute any civil construction projects
3. Is expected to understand the terminologies associated with valuation, trained to make bills of venders of civil construction works
4. Have an idea of economics in general viz public sector and private business
5. Be able to perform and evaluate present worth, future worth & annual worth analyses on one of more economic alternatives, be able to understand how competitive bidding works & how to submit a competitive bid proposal.

COURSE CONTENT

Engineering Economy, Estimation& Costing		**Semester: VIII**	
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Economics: Basics Principles &Methodology of economics. Demand & supply, Theory of firm & Market structure, Basic Macro-economic concepts (including GDP/GNP/NI/Disposal income) and adenitis for both closed and open economics. Price indices (WPI/CPI), Interest rates, direct & indirect taxes.

Elements of Business Economics, Forms of organizations. Cost & its control techniques. Types of cost, lifecycle costs, budgets, Breakeven Analysis, capital Budgeting.

Investment analysis- NPV, ROI, IRR, Payback Period, Depreciation, time value of money (present & future worth of

cash flow. Business forecasting – elementary techniques
Commercial banks & their functions. Public sector Economics – welfare, externalities.
Indian Economy – brief overview, Employment – informal, organized, unorganized public, private sector.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Estimating: Approximate estimate for building, roads, bridges.
Detailed estimate: types, purpose, data required for preparing detailed estimate, Measurements for various items, use of relevant Indian Standard Specifications for various items, taking out quantities from the given requirement of the work.
Estimating Concrete stair case, RCC elements like slab, beam column footing & masonry, finishes, interiors.
Estimate of load bearing residential building, framed structure residential building.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Bar bending schedules: for RCC Elements like slab, beam, column, footing, staircase & retaining wall.Prepartion of Bar Bending Schedule (BBS) for use of Bar bender on actual site work.Mass haul diagram, Estimating earthwork for road work, irrigation works.
Material survey – thumb rules for computations of material requirement for different material for building, percentage breakup of the cost, market survey for basic material.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Rate Analysis : purpose, importance & necessity of the same, factor affecting, task work, daily output from different equipment, labour (skilled / unskilled), analysis of rates of items like excavation, RCC works, Masonry (brick/stone), Plastering work, building finishes work.
Specifications : types – requirements and importance, detailed specification for building roads , bridge & industrial structure.
For building works: RCC works , Brick masonry & Plastering .

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Tender : preparation of tender documents, importance of inviting tenders, types of contracts, relative merits, prequalification.
General & special Conditions : termination of contracts, extra works & changes, penalty and liquidated charges, settlements of disputes.
RA Bill & Final Bill, payment of advance, insurance claims, price variation, etc.
Preparing Bids: Bid price build up: material, labour, equipment cost, risks, direct indirect over heads, profit; bid conditions. Bid process management.
Introduction to acts pertaining to minimum wages, Workman's compensation, contracts, Arbitrations.

Text Books:

1. *Dutta B N, Estimating & Costing in civil engineering UBS Publishers*
2. *Birde G. S., Text book of estimating & costing, Dhanpatrai publishing*
3. *Misra S. K. &Puri, Indian economy, Himalaya publishers*
4. *Pareeksaroj Text book of business Economics, Sunrise Publishers*
5. *V. mote, S. Paul, G Gupta, Managerial economics, Tata Mcgraw Hill*

Reference Books:

i. Mankiw Gregory N. Principles of Economics, Thompson Asia
ii. Quantity Surveyor's Pocket Book, Duncan Cartilidge, BH Publications.
iii. Joy P K, Handbook of Construction Management, Macmillan
iv. District Schedule Rate (DSR).

Advanced Concrete Structural Analysis and Design (Professional Elective Course - V)

COURSE OUTLINE

Course Title:	**Advanced Concrete Structural Analysis and Design**	**Short Title:**	**ACSA&D**	**Course Code:**	

Course description:

Design of structures is considered traditionally to be the primary job of civil engineers. Concrete is the most common material is used for construction presently. Hence design of concrete structures is an integral part of civil engineering syllabus. One basic course in this is already there at third year level. However students interested for the design of special structures like domes, combined footings, retaining walls, water tanks, flat slabs prestressed concrete structures, etc may opt this subject. The syllabus confirms to the relevant IS codes.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*40*	*04*

Prerequisite course(s):

Nil

Course objectives:

1. The main objective is to enable a student with the analysis and design of RCC special structures, including chimneys, water tanks, domes, flat slabs etc.
2. The students should be appraised with prestressed concrete material, which is a relatively newer concept.
3. The students should be illustrated with the techniques of selection of type of structure for a particular requirement, assessment of loads coming on it, load combinations, design of structure considering architectural as well as safety and economic aspects, confirming to relevant codes of practices.

Course outcomes:

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

1. Demonstrate ability to assess critical loads and its combinations for special RCC structures like flat slabs and combined footing and analyze and design them.
2. Demonstrate ability to assess critical loads and its combinations for special RCC structures like Cantilever Retaining wall and dome and to analyze and design them.
3. Demonstrate ability to analyze and design water tanks.
4. Understand basic concepts and principles of pre-stressing and methods used for it.
5. Demonstrate ability to analyze and design pre-stressed concrete beam.

COURSE CONTENT

		Semester:	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Flat Slab

Introduction, Terminology Related With Flat Slab, IS Code Provisions for Flat Slab Construction, Analysis of Flat Slab, **The Direct Design Method,** Distribution of Bending Moment Across the Panel Width, Shear in Flat Slab, Equivalent Frame Method, Reinforcement Detailing in a Flat Slab. Analysis, design and reinforcement detailing of interior panel of flat slab.

Combined Footing:

Introduction –necessity, types, analysis and design of rectangular combined footing as per IS code, reinforcement detailing,

Unit–II:	No. of Lectures: 09 Hours	Marks: 12

Retaining Walls

Introduction, Types of Retaining Walls, Earth Pressure on Retaining Walls, Forces on a Cantilever Retaining Wall, Stability of a Cantilever Retaining Wall, Proportioning of the Cantilever Retaining Wall, Structural Behaviour and Design of a Cantilever Retaining Wall. Analysis and design of cantilever level backfill retaining wall.

Analysis, design and reinforcement detailing of thin dome without crown load with small angle at crown.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Design of Water Tank

Introduction, Design Philosophy and Requirements, IS Code Recommendations Regarding Detailing in Water Tanks, Joints in Water Tanks, Jointing Materials.

Analysis of Circular tanks Resting on the Ground, Tank With Flexible Joint Between the Floor and the Walls (Approximate Method), Circular Tank width Rigid Joint Between Floor and the Wall (Approximate Method), IS Code Method for Design of Circular Tanks.

Analysis, design and reinforcement detailing of Rectangular Water Tanks resting on the ground using approximate method of designing.

Analysis, design and reinforcement detailing of Rectangular underground Water Tanks with condition i) Tank is Empty and Active Earth Pressure is Present, ii) Tank is Full and there is no Earth Fill.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

1.General principles of prestressed concrete members:

Introduction- definition-need of prestressing-use of high strength concrete-use of high tensile steel-assumptions-stress concept-beam with concentric tendon-effect of loading on the stress in the tendons- beam with eccentric tendons-effect of loading on the stress in the tendons- beam with bent tendon- beams of rectangular, T and I sections-the pressure line – C – line and P – line –strength concept – review of different techniques.

2.System of prestressing:

Classification of prestressed concrete members – externally and internally prestressed members- linear prestressing pretensioning post-tensioning- bonded and unbonded tendons- the Hoyer system – the Freyssinet system- The magnel blaton system-The Gifford Udall system- C.C.L. standard system-The Lee – Mccall system.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

1.Loss in prestress:

Losses of prestress at various stages – loss of stress due to length and curvature effects – loss of stress at the anchoring stage – loss of stress due to shrinkage of concrete- loss of stress due to creep of concrete – loss of stress due to elastic shortening of concrete – loss of stress due to creep in steel.

2.Design of Prestressed concrete beams:

Simply supported beams – design principles- I.S. Recommendations - permissible stresses – various stages of analysis – lever arm conception – P and C lines – kern distance – Rectangular and I sections.

Text Books:

1. Reinforced Cement Concrete Design by Neelam Sharma, S. K. Kataria & Sons.
2. Reinforced Concrete Design by S Unnikrishna Pillai and Devdas Menon Tata McGraw-Hill
3. Prestressed Concrete by S. Ramamrutham, Dhanpat Rai Publishing Company
4. Prestressed Concrete by N. Rajagopalan, Narosa Publishing House.
5. Design of Reinforced Concrete Structures by S. Ramamrutham, Dhanpat Rai Publishing Company.
6. Design Of Reinforced Concrete Structures, by Subramanian N, Oxford University Press.

Reference Books:

1. Prestressed Concrete by N. Krishna Raju, The McGraw Hill Companies.
2. Limit state design of reinforced concrete by B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publication.
3. Design of Prestresssd Concrete Structures by T. Y. Lin and Ned H. Burns, Willey Publisher.

Hydraulic Machines (Professional Elective Course - V)					
COURSE OUTLINE					
Course Title:	Hydraulic Machines	**Short Title:**	*HM*	**Course Code:**	
Course description:					
Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**	
	3	*14*	*42*	*3*	
Prerequisite course(s):					
Nil					
Course objectives:					
The present course will fulfill following objectives: 1. To enable student to Classify Hydraulic Machines. 2. To enable student to understand the Principle and Working of various Hydraulic Machines. 3. To enable students to analyze the performance of Various Hydraulic Machines. 4. To enable students to design the Various elements of Hydel Power Plant.					
Course outcomes:					
After successful completion of this course the student will be able to:					
1. Analyze and evaluate the performance of hydraulic turbines 2. Analyze and evaluate the performance of pumps 3. Design Hydraulic Machines employed in Hydel Power Plants 4. Design the overall Layout Hydel Power Plants. 5. To draw the Phasor diagram for various Hydraulic Machines					
COURSE CONTENT					
Hydraulic Machinery		**Semester:**	VIII		
Teaching Scheme:		**Examination scheme**			
Lectures:	**3 hours/week**	**End semester exam (ESE):**		**60 marks**	
		Duration of ESE:		**03 hours**	
		Internal Sessional Exams (ISE):		**40 marks**	
Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**			
Principles of Fluid Machines Introduction, Classification of common Fluid Machines, their uses in civil engineering practices. The Linear-Momentum Equation – theory, derivation, application in fluid machinery, Impact of jet on fixed and moving Vanes - theory, derivations of formulae, applications to hydraulic machines, The Angular- Momentum Principle, Euler Equation for Turbo machines.					
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**			
Hydraulic Turbines-I Hydro Electric Power Plants: Components of Hydro Electric Power Plants, Classification of Hydel plants. Classification of hydraulic Turbines, Principle, theory and formulae for Design of Hydel Power Plants. Design problems. Pelton Turbine: Components and their functions, Force, Power and Efficiency, Design of components, Specific speed, Limitations, principle, theory and formulae for Design of Pelton Turbine					

Unit–III:	No. of Lectures: 08 Hours	Marks: 12
Hydraulic Turbines-II Francis Turbine: Components, Draft tube. Design of components, Degree of reaction, specific speed and runner shapes, Types of draft tubes, Cavitations, Thoma's Cavitations parameter. Kaplan/Propeller Turbine: Components, Design Parameters Main and operating Characteristics of Turbines, Model Testing, Governing of turbines, surge tanks, Selection of turbines, Bulb turbines, pumped storage power plants.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Pumps-I Classification of Pumps: Positive displacement & Non positive displacement pumps, Positive Displacement Pumps: Types and applications. Reciprocating Pumps: Components, Working, Types, Work done by reciprocating pump, Indicator Diagram, Effects of acceleration of piston, Air vessels. Rotary Pumps: Gear pumps, vane pumps & Piston pumps, Classification, Construction and Working aspects, Characteristics.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Pumps-II Centrifugal Pumps: Introduction, classification of pumps, Pumping System and the Net Head Developed, Centrifugal pump components and their functions. Mechanical seals, Materials of construction, Slip Factor, Terminology frequently used theory of centrifugal pump impeller: Euler‟ Head, Theoretical characteristics, Losses and Efficiencies. pump characteristics, Duty point, Pumping systems and system head curves, Operating point, Specific speed and its relation with pump characteristics, model testing, Pumps in Series and Parallel NPSH & Cavitation in Pumps: Calculation of NPSH (A) and significance. Axial Flow or Propeller Pump. Selection of pumps, Axial Thrust & Radial Thrust, Operation and Maintenance of pumps, Field Troubles Pump testing: procedure for testing, tolerances allowed (reference to IS codes), Affinity laws.		
Text Books:		
1. S. K. Som, G. Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw-Hill Education. 2. Dr P. N. Modi & Dr. S. M. Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House. 3. Bansal, R. K., A textbook of fluid mechanics and hydraulic machines, Laxmi Publications.		
Reference Books:		
1. Miroslav Nechleba, Hydraulic Turbines, ARTIA Prague 2. J. Stepanoff, Centrifugal and Axial flow Pumps, John Wiley & Sons, Inc. 3. S. M. Yahya, Turbines Compressors and Fans, Tata McGraw – Hill, Fourth Edition.		

Advanced wastewater treatment technology (Professional Elective Course - V)

COURSE OUTLINE

Course Title:	*Advanced Wastewater Treatment Technology*	**Short Title:**	*AWTT*	**Course Code:**	

Course description:

Wastewater is the principal cause of surface and ground water pollution. This wastewater can be collected from various sources and treated to reduce its pollution strength to permissible level. Then it can be discharged into natural bodies or it can be recycled also. The present syllabus describes the importance, necessity, and technology for wastewater collection, characterization, treatment, disposal and feasible reuse. The course includes the conventional as well as latest technology available in the field of wastewater engineering.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*3*

Prerequisite course(s):

Nil

Course objectives:

The requisite objectives needs to be fulfilled are as follows:

1. To allow human and industrial effluents to be disposed of without danger to human health or unacceptable damage to the natural environment
2. To Design the Various elements of waste water treatment Plant.
3. To aware about the various treatment methodologies for industrial waste.
4. To understand the Principle and Working of CETP.
5. To improve the awareness amongst the students related to the environmental scenario.

Course outcomes:

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

1. Effectively plan wastewater projects.
2. Appreciate unit operations and unit processes in wastewater treatment.
3. Demonstrate ability to work out appropriate flow sheet for specific wastewater treatment.
4. Design all unit of a wastewater treatment plant.
5. Develop treatment technology for special wastewater through lab studies and field trials.

COURSE CONTENT

Advanced wastewater treatment technology		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Fluctuations in quality and quantity. Sampling, preservation of samples. C.O.D. B.O.D. Aerobic decomposition of organic material. Five day and ultimate values of oxygen demand. Population equivalent. Generalized B.O.D. formulations. Different methods of B.O.D. curve fitting. Various equations mathematical, Nitrogen and phosphorous. Objectives of sewage treatment, unit operations, Process design and hydraulic design. Period of design, Pre-treatment, primary treatment and secondary treatment methods Percentage removal and overall efficiency. Physics, chemical and biological methods of treatment. Measurement of sewage flow. Economics.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Screening, Design of fixed and rotary screens. Operation, disposal of screening, comminutors. Separation of

grit. Principles of sedimentation applied to design of grit chambers. Primary, intermediate and final clarification. Intermittent or continuous removal of sludge. Scum removal. Factors affecting performance. Sedimentation aided by chemicals.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Principles of biological treatment of sewage, Mechanism of stabilization, zoological films. Design and operation of trickling filters, Rotating Biological Contactors, Biological treatment in activated sludge process: Loading parameters, Sludge Volume Index, Process control, Aeration requirements and methods of Aerations, Activated sludge process modification. Mathematical models and optimization, Aerated lagoons, Oxidation ditches Sequential Batch Reactor, Membrane Bio reactor, Moving Media Bio Reactor.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

General considerations in disposal of sludge, Sludge pumping. Quantities, Characteristics and behavior of sludge. Moisture–weight–volume relationships. Digestibility, Fuel value, Fertilizer value, Flow characteristics. Unit operations in sludge disposal, Design of sludge digestion tanks. Disposal of digested sludge, and supernatants. Gas utilization. Kinetics of sludge digestion. Design of thickeners. Disinfection of sewage effluents. Natural Treatment Systems: Stabilization Pond, Design considerations in oxidation of stabilization pond, Natural and Constructed Wetlands, Vermiculture, Wastewater Irrigation.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Design consideration in septic tanks, Up-flow Anaerobic filters, Effluent disposal.
Wastewater Reuse: Industry, Agriculture.
advanced and non conventional wastewater treatment technology. Adsorption – kinetics, low cost sorbents, factors affecting sorption.
Basics of photo catalysis.
Hazardous waste treatment.

Text Books

1. Wastewater Engineering-Treatment, disposal, reuse Metcalf & Eddy 4th Edition 2003. Tata McGraw Hill International Editions.
2. Water and Wastewater Engineering-Vol. II Fair, Geyer & Okun Wiley Toppan Co. Ltd. 1981, Tokyo.
3. CPHEEO Manual of sewerage and Sewage Treatment 1993. Ministry of Urban Development.
4. Wastewater Treatment for Pollution Control S. J. Arceivala Tata McGraw hill Publishing Co. Ltd. 3rd Edition, 2007, New Delhi.

Reference books

1. Wastewater treatment Plants Planning, Design and Operation. S.R. Qasium CBS International Edition.
2. Waste Water Engineering, R. Parker, N. Morris, F. N. Fair, S. C. Bhatia, CBS publishers & distributors, 2008, New Delhi.

Foundation Engineering (Professional Elective Course - V)

COURSE OUTLINE

Course Title:	Foundation Engineering	**Short Title:**	FE	**Course Code:**	

Course description:

Foundation is the first and most important component of a building structure which transmits load to the soil beneath. The students of civil engineering already have a basic course in geotechnical engineering in which soil properties, behavior of soil under load are included. Students interested for in depth study of foundations will find the present course worthy. The course includes classification of foundations, their analysis, design etc. Topics of relevance like bearing capacity, Theories of lateral earth pressure, retaining wall etc are also included in the syllabus.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1) To enable a student to estimate of bearing capacity of shallow foundations by various theories.
2) To enable to design mat foundation and understand design consideration for foundations on difficult soils
3) To demonstrate the need for pile foundations and determine their load carrying capacity.
4) To demonstrate in brief theories of lateral earth pressure.
5) To enable to analyze and design Gravity, Cantilever Mechanically Stabilized Retaining walls

Course outcomes:

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

1) To determine bearing capacity of shallow foundation and concept of consolidation settlement.
2) Design of mat foundation and foundations on foundations on difficult soils.
3) Design of pile foundation and to analyze pile foundation settlement
4) Understand theories and design considerations of Lateral earth pressure
5) Analyze and design Gravity, Cantilever Mechanically Stabilized Retaining wall

COURSE CONTENT

Foundation Engineering		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Shallow Foundations

Introduction, Tertzaghi's bearing capacity theory, Effect of water table, numerical problem, factor of safety, Effect of soil compressibility, Eccentrically loaded foundations, Ultimate Bearing capacity for one way and two way eccentricity. Bearing capacity of a continuous foundation subjected to eccentrically inclined loading. Numerical problems.

Consolidation settlement

Primary consolidation settlement relationships, Three dimensional effects on consolidation settlement, Field Load Test, Presumptive bearing capacity, Tolerable settlement of buildings. Problems.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Mat Foundations:
Introduction, Combine footings, types of mat foundations, bearing capacity, differential settlement of mats, Field Settlement Observations for mat foundations. Compensated foundations. Structural design of mat foundations.
Foundations on Difficult soils:
Design of foundation Susceptible to wetting, collapsible soil, foundation considerations for expansive soil. Numerical problems

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Pile Foundations:
Types and their structural characteristics, Estimating pile length, Piles installation, Load transfer mechanism, Meyerhof's and Vesic's method for estimating pile capacity, ultimate capacity of group piles in saturated clay, elastic and consolidation settlement of group piles. Piles in rock. Numerical Problems.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Lateral Earth Pressure
Rankine's active and passive earth pressure, Generalized case for granular backfill, active and passive earth pressure with vertical wall back-face and inclined c'- ϕ' soil backfill, coulomb's active and passive earth pressure, earth pressure due to surcharge, active and passive earth pressure for earthquake conditions-granular backfill.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Gravity and Cantilever Retaining Walls
Proportioning, application of lateral earth pressure theories, stability check, check for overturning, check for sliding along the base, check for bearing capacity failure, construction joints and drainage from backfill. Problems
Mechanically Stabilized Retaining wall
Soil reinforcement, Design considerations, retaining wall design with metallic strip reinforcement, retaining wall with geotextile reinforcement, Retaining wall with geogrid reinforcement and design. Numerical Problems.

Text Books:

1) Kasmalkar B. J. "Geotechnical Engineering", Pune Vidyarthi Griha Prakashana, Sadashiv Peth Pune-30, Latest edition.
2) V. N. S. Murthy "Soil mechanics and foundation engineering",Vol.1, Saikrupa Technical Consultants, Bangalore, Latest edition.
3) Shashi K. Gulhati and Manoj Datta, "Geotechnical Engineering" Tata McGraw Hill Publication, Latest edition.

Reference Books:

1) Punmia B. C. "Soil mechanics and foundation engineering " , Laxmi Publications Pvt. Ltd., New Delhi, Latest edition.
2) J.E.Bowles, "Foundation analysis and design", McGraw Hill International. New York.
3) Wayne C. Teng, "Foundation Design" Prentice Hall of India, New Delhi.
4) K.R. Arora, "Soil Mechanics and Foundation Engineering" Standard Publishers Distributors.
5) T.W. Lambe, "Soil Testing for Engineers", John Wiley Publication.
6) Gopal Ranjan, Rao, "Basic and Applied Soil Mechanics", New age publication.
7) Braja M. Das, "Principles of foundation Engineering", Cennage Publications, Delhi.

Design of Hydraulic Structures (Professional Elective Course - VI)

COURSE OUTLINE

Course Title:	**Design of Hydraulic Structures**	**Short Title:**	*DHS*	**Course Code:**	

Course description:

Hydraulic structures like different types of dams, canals, intake structures, water power generation structures etc are quite typical in their design due to continuous exposure to water and critical load combinations. They play important role in the socio economic development of a nation. They are generally mega projects and take large time for execution. They involve huge investment too. The present course includes basic descriptions of such structures, their design theories, analysis and complete design procedures. The design must be in accordance to the relevant IS specifications.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*3*

Prerequisite course(s):

Nil

Course objectives:

The requisite objectives needs to be fulfilled are as follows:

1. To introduce the students with different types of dams, their modes of failures and stability analysis.
2. To introduce the students with the diversion head works and explain stability analysis of weirs on permeable foundation.
3. To explain the different type of spillway and their design principles.
4. To demonstrate the students with details of energy dissipation below spillway.
5. To demonstrate the unlined irrigation canals and their design principles.

Course outcomes:

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

1. Understand different type of dams, their suitability and their functions.
2. Demonstrate the design theory of different types of dams.
3. Demonstrate the diversion head works and its components.
4. Demonstrate and ability to analyze stability of weir on permeable foundation using Khosla's theory and analyze the energy dissipation below spillway
5. Design different sections of canals and their linings.

COURSE CONTENT

Design of Hydraulic Structures		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Dams:-Introduction and scope of the subject ,types of dams, reserviour storage zones, selection of site for dam ,choice of a dam ,economical height of dam.

Gravity dams:-Introduction ,cross section ,forces acting on dam, load combination as specified by IS 6512-1984, stresses in dam,modes of failures, stability analysis and design of gravity dam, elementary and practical profile, low and high dam ,materials of construction, control of cracking ,galleries ,joint and keys.

Unit–II:	No. of Lectures: 09 Hours	Marks: 12
Spillway: Introduction, spillway capacity, different types of spillway, their construction and suitability,design principles of ogee spillway and sipon spillway. Energy dissipation below spillway ,types of hydrallic jump height curves and tail water rating curves, various types of Energy Dissipaters. Gates:-Various types of spillway crest gates and their uses.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Earth dams:- Introduction, types, element of earth dams basic design consideration ,causes og failures, piping its prevention, control of seepage ,drainage in earth dams, design of filter and racktoe, phreatic line, stability of U/S and D/S slopes under various situations, introduction to rockfill dam. Diversion headworks: Introduction, selection of site types of weirs and barrage, layout of diversion headworks and its components and function, causes failures of weirs on parable foundation and remedies, design of subsurface flow ,safety against piping and uplift. Khosal'sa theory.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Canal irrigation: types of canals, canal alignment. Design of unlined stable channels in alluvial. Kennedy's and Lacey's theory and their merits and demerits Preliminary sediment transport theory, critical tractive in alluvial soil according to IS 7112-1973. Lining of irrigation canals, advantage of lining, and economics of lining types of lining. Design of lined channel, land drainage, discharge and spacing of closed drain, various types of canal outlet.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Canal masonary work:- cross drainage works, necessity, types, selection, comparative merits and demits ,various types of falls, their necessity and location, distributary head regulator and cross regulator, escape canal . River Training works:- Necessity and types of river training works and bank protection and their construction details. Hydropower:- General features of hydropower development .advantage of hydropower, types of hydropower plants and their layout ,assessments of power Potential .		
Text Books:		
1. S. K. Garg-Irrigation Engineering and Hydraulic Structures, Dhanpat Rai Publications. 2. Dr P. N. Modi & Dr. S. M. Seth, Hydraulics Water resources and water power engineering, Standard Book House. 3. Dr. BC Punmia, Irrigation and water Power engineering, Laxmi Publications.		
Reference Books:		
1. Engineering of Dams by William P. Creager, Read Book Publications. 2. Design of Hydraulic Structures, by DR R.P.RETHALIYA, Atul Prkashan		

Bridge Engineering (Professional Elective Course - VI)

COURSE OUTLINE

Course Title:	Bridge Engineering	**Short Title:**	*BE*	**Course Code:**	

Course description:

Bridges are the most important and typical structures in civil engineering from architecture point of view as well as for structural engineering point of view. Bridges have history as old as the human civilization. The present syllabus includes classification of bridges, planning and design of different types of bridges, construction of bridges and maintenance of bridges. The design is in accordance to the most relevant IS codes for practice in bridge engineering.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

The objectives of the present course are as follows:

1. To appraise a student from different types of bridges.
2. To enable a student to opt for an appropriate type of bridge for a specific case.
3. To enable a student to design an appropriate bridge architecturally.
4. To enable a student to design a bridge structurally
5. To carryout monitoring task of bridges, execute maintenance tasks.

Course outcomes:

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

1. Demonstrate an ability to opt an appropriate bridge type for a given case.
2. Demonstrate an ability to opt an appropriate bridge material for a given case.
3. Design a bridge considering traffic conditions, climatic conditions and economy.
4. Design bridge considering various load combinations.
5. Carryout maintenance and repair work of bridges.

COURSE CONTENT

Bridge Engineering		**Semester:**	***VIII***
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction

Introduction to bridge engineering, classification and components of bridges, layout, planning. Structural forms of bridge decks, beam and slab decks, cellular decks.

Loading Standards

Standard specification for bridges, IRC loadings for road bridges, loading standards for railway bridges.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Investigation for Bridges and culverts

Investigation for culverts and minor bridges, Topographic details, Catchment area map, Hydrologic particulars, Geotechnical details, Seismology of the area, navigational requirements, Construction resources, traffic forecast.

Design of culverts

Design of slab culvert, box culvert and skew bridge.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Superstructure design aspects Material selection ,design principles, composite construction, Box girders, continuous girders, Permissible stresses in structural steel. **Superstructure design aspects** Structural classification of Rigid Frame bridge, site erection methods, analysis and design of steel girder bridges, cable stayed bridges, Introduction to Courbon's method, Henry-Jaegar method and Guyon - Massonet method. Design of T-beam PC bridges using Courbon's method.		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Bearings Definitions, Purpose of bearings, Fixed and Free Bearings, Materials for bearings, Maintenance of bearings, Classification and design of bearings. Expansion joints. **Substructure** Abutment, Piers, Wing wall, Setting out for piers and abutments, Materials used for Substructures, Forces acting on abutments and piers. Bridge inspection.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Foundation Types of cassion, uses of cassions, material used for construction of well, cassions and pile foundation. classification of pile foundation. Advantages of pile, well and cassion foundation. Uses of Coffer dam. Bridge foundations, design of open well, pile and caisson foundation. Analysis and design, types and design of wing walls.		
Text Books:		
1. Rangawala, "Bridge Engineering", Charotar Publication, Gujarat India 2. S.P. Bindra, " Principles and practice of bridge engineering" Dhanpatrai Publications 3. Aaheesh Kumar, " Bridge Engineering" Vayu Education of India		
Reference Books:		
1. D. Johnson Victor - Essentials of Bridge Engineering Fifth Edition, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi 2. IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83 3. Nainan P. Kurian – Design of Foundation Systems, Narosa Publishing House		

Theory of Elasticity and Plasticity (Professional Elective Course - VI)

COURSE OUTLINE

Course Title:	Theory of Elasticity and Plasticity	**Short Title:**	*TEP*	**Course Code:**	

Course description:

The materials used for civil engineering construction are traditionally considered as elastic. The behavior of a material under elastic conditions is a matter of interest for research engineers. However modern concept is to use the strength of material under plastic state also. Moreover, there are some extreme conditions under which material behaves plastic like e. g. Under extreme temperature to which a spaceship cell is subjected. Hence to explore the properties of an engineering material under elastic as well as plastic state is the requirement of modern design. This aspect is explored in the present course.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. To appraise students about the changing paradigm of concrete technology. (Traditionally the civil engineering materials are explored for their performance under elastic conditions. However with the development of science and technology, the paradigm is changing. Modern materials are subjected to extreme condition under which they behave like plastic.
2. To demonstrate students about modern designs, the engineering properties of a material under elastic and plastic state are necessary to be explored.
3. The present syllabus introduces a student with the elastic and plastic properties of common engineering materials and prepares a student for research in these fields.

Course outcomes:

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

4. Demonstrate an ability to describe Hooke's law, stress strain relationship, stress varients and stress transformation.
5. Describe and use Airy's function, equations of equilibrium and compatibility.
6. Demonstrate ability to describe relationship between Cartesian and Polar coordinate system, Equilibrium equations, Strain displacement relations.
7. Aware of basic concepts of plasticity, yield criteria, Von Mises initial yield condition, the Tresca initial yield condition, strain hardening and rules of plastic flow.
8. Demonstrate ability to describe Plane stress and plane strain problems, torsion, bending of bars and tube under pressure.

COURSE CONTENT

Theory of Elasticity and Plasticity		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Elasticity:

Stress at a point, stress tensor, stress components on a rectangular parallelepiped in Cartesian coordinate system, derivation of stress equilibrium equations, transformation of stresses, stress invariants. The state of strain at a point, strain displacement relations, strain compatibility condition and stress compatibility conditions. Generalized

Hook's law		
Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**
Plane stress, Plane strain and axisymmetric problems, Problems in 2D Cartesian coordinate system, Airy's stress function, bending of beams. Principal stresses and strains, Plane stress and Plane strain problems. Differential equations of equilibrium and compatibility equations.		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Relationship between Cartesian and Polar coordinate system, Equilibrium equations, Strain displacement relations, Stress-strain relationship, Strain-displacement relationship for plane stress and plane strain conditions		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Plasticity: Basic concepts, yield criteria, Criterion of yielding, von Mises initial yield condition, the Tresca initial yield condition, strain hardening rules of plastic flow different stress-strain relation, flowand deformation theories		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Plane stress and plane strain problems, torsion, bending of bars, theoretical problems. Examples of tube under pressure		
Text Books:		
1. Theory of Elasticity", Timoshenko and Goodier, McGraw hill book Co. 2. S. S. Bhavikatti – Structural Analysis-II Vikas Publishing House, Pvt Ltd 3. Sadhu Singh – Theory of Elasticity, Khanna Publishers		
Reference Books:		
1. "Applied Elasticity", Wang, McGraw hill book Co. 2. "Theory of Plasticity", J. Chakrabarti, McGraw hill book Co. 3. "Strength of Materials Vol – I & II", Timoshenko S., CBS Publishers 4. "Advanced Mechanics of Solids", Srinath L. S., Tata McGraw		

Industrial Wastewater Engineering (Professional Elective Course - VI)

COURSE OUTLINE

Course Title:	**Industrial Wastewater Engineering**	**Short Title:**	*IWE*	**Course Code:**	

Course description:

This course describes the importance, scope and technology used for industrial wastewater engineering. The syllabus includes design wastewater treatment facilities, commissioning, operation, maintenance, trouble shooting and augmentation, specially for industrial applications.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The basic objective of the course is to make aware a student about sources and characteristics of wastewaters from major industries.
2. Pollutional effects of major industries and their common treatment technologies.
3. The student should be able to curb the industrial wastewater pollution and thus to save the receiving water bodies.

Course outcomes:

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

1. A student will be able to understand the sources and amount of wastewater generated by major industries. .
2. A student will be able to assess the quality of wastewater generated by major industries.
3. A student will be able to design facilities for treatment of industrial wastewater.
4. A student will be able to commission and operated facilities for treatment of industrial wastewater.
5. A student will be aware about the prevailing environmental legislations and practices.

COURSE CONTENT

Industrial Wastewater Engineering		**Semester:**	
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Major industries in India and across globe, their process description, water uses, wastewater generation rates.
Sampling of wastewater, characteristics major industrial wastewaters, pollution effects, permissible standards, pollution control norms.
Special problems of Industrial wastewaters, segregation and mixing, balancing and equalization of industrial wastewaters.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Industrial waste treatment: treatment of dairy waste, eggs poultry and meat product industries, tanneries, distilleries, refineries, paper industry, textiles industry, sugar industry, paint industry, food processing industries, metal plating industries, steel plants, metallurgical industries, perto-chemcial industries, motor industries, acid plants, pesticide industries, fertilizer industries, chemical industries, pharmaceutical industries, leather industry, jute industry etc. Relevant IS codes. Typical problems of common industries in India with reference to wastewater treatment.

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

Legal aspects of industrial wastewater management, Regulatory agencies, Standards for treatment. Formation of pollution control boards and central and state levels, their functions, duties and responsibilities.

Concept of end of pipe and cleaner technology, Concept of water quality index and its application for industrial wastewater recirculation, concept of Reduce, Recover, Reuse, and Recycling. Concept of industrial ecology, integrated approach for industrial water and wastewater management. Housekeeping and its implications.

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Combine effluent treatment plants, technological aspect of CETP, Effluent treatment plant manufacture in India, combined domestic and industrial wastewater treatment plants. Disposal of wastewaters in rivers and purification of industrial waste water.

Special wastewater treatment methods like adsorption, high pressure oxidation, Treatment with UV rays. Low cost sorbents. Kinetics of adsorption. Limitations of adsorption.

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

Acclimatization of bio mass for industrial wastewater treatment, principle, process, applications, case studies, limitations and future scope. Addition of nutrients in deficient wastewaters. Seeding of industrial wastewaters. Combined treatment of industrial wastewater with domestic wastewater.

photocatalysis: principle, materials used, factors affecting photo-catalysis, reactor configurations, design methodology for real world application. Sources of UV radiation.

Text Books:

1. Nemerow N.L., Liquid Wastes of Industry: Theory, Practices and Treatment, Addison Wesley Co. N.Y.
2. Industrial wastewater management by R Mahajan TMC publication

Reference Books:

1. Industrial water pollution control by W W Eekenfelder, McGraw-Hill Science/Engineering
2. Industrial waste treatment Manual by NEERI & CPHEEO.

Ground Improvement Technique (Professional Elective Course - VI)

COURSE OUTLINE

Course Title:	Ground Improvement Technique	**Short Title:**	**GIT**	**Course Code:**	

Course description:

The soil which provides support to any structure should have sufficient strength to transmit load safely without any failure. The availability of good soil is scared which make civil engineer to utilize available site for a given structure. The responsibility of a civil engineer is to make weak soil or problematic soil into a good soil. This requires understanding various ground improvement technique which can chosen based upon the characteristic of soil. It includes different compaction method, dewatering technique, various consolidation technique, grouting and use of geosynthetic.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The course enables students to introduce with the various types of improvement methods of engineering properties of soil.
2. The student will demonstrate the application of engineering methods to ground improvement projects.
3. S/he will have an ability to design suitable method depending upon type of soil, time requirement and economy.

Course outcomes:

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

1. To develop an awareness of problematic soils and selection of ground improvement techniques based on soil conditions.
2. Understand basics of soil compaction.
3. To understand drainage, dewatering, grouting technique in ground improvement method.
4. To demonstrate an ability to describe the types and applications
5. To study the applications of geosynthetics to improve structural strength of soil.

COURSE CONTENT

Ground Improvement Technique		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Ground improvement - Role of ground improvement in foundation engineering – methods of ground improvement –geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Dewatering Techniques - Well points – Vacuum and electro-osmotic methods – Seepage analysis for two dimensional flow - fully and partially penetrated slots in homogeneous deposits (Simple cases only).

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

In-situ densification of cohesion-less soils and consolidation of cohesive soils: Dynamic compaction Vibroflotation, Sand compaction piles. Consolidation: Preloading with sand drains, and fabric drains, Stone columns - Lime pilesinstallation techniques only – relative merits and limitations – deep soil mixing		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Grouting - Types of grouts – Suspension grouts - solutions grouts - Grouting equipment and method - Grouting with soil, Bentonite - cement mixes and asphalt - Grout monitoring schemes.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Geosynthetics - Types – functions of Geotextiles – Separation – Filtration – Drainage - reinforcement - Geomembranes - Containments and barriers Application to Ground Anchors.		
Text Books:		
1. Ground Improvement Techniques by Purushothama Raj .P, Laxmi Publications (P) Ltd., New Delhi, 2000. 2. Soil Mechanics and Foundation Engineering by B C Punmia, Laxmi Publications. 3. Reinforced soil and its Engineering Applications – Swami Saran., I.K. International Pvt. Ltd.		
Reference Books:		
1. IS: 13094:1992- “Selection of ground improvement techniques for foundations in weak soils”. 2. Ground Improvement byMoseley .M.P, Blockie Academic and Professional, Chapman and Hall, Glassgow, 1998.		

Operations Research Methods and Engineering Applications (Open Elective Course - IV)

COURSE OUTLINE

Course Title:	*Operations Research Methods & Engineering Application*	**Short Title:**	*ORMEA*	**Course Code:**	

Course description:

Decision making should neither be random nor be influenced by personal factors. This must be done rationally in a systematic manner so that under similar circumstances similar decisions are obtained. Such decisions will be beyond disputes and allegations. It is a very important task of engineering especially for project management. This course approach enables to student to develop the required skills and apply operations research techniques to all kinds of decision-making problems with special reference to civil engineering projects.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The student must be made aware about the need and importance of systematic decision making.
2. Student must be made aware about importance of research data interpretation and drawing conclusions out of it.
3. The students must know the techniques of operations research and must be able to apply them to solve real world problem.
4. Students must be prepared for handling managerial tasks using OR techniques and suggest solutions to managerial issues that arises time to time in organization.

Course outcomes:

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

1. Demonstrate ability phase out any project into activities and to construct network diagrams of project. He/she must have knowledge about various forms & functional role of inventory
2. Define the problem, develop the model, solve the model using OR techniques.
3. Presents basic, assumption, limitations, components of any linear programming model & broad application areas of linear programming.
4. Able to understand steps of decision making process and to determine expected value of perfect information.
5. Demonstrate ability to formulate optimal strategies in conflict and competitive environment.

COURSE CONTENT

Operations Research Methods and Engineering Applications	**Semester:**	*VIII*

Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Operation Research :

- Quantities approach to decision making, history, definition, feature of OR,
- Advantages of model building, methodology & advantages of OR,
- Features of operations Research, Applications of operations Research
- Operations Research Models Practice

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Linear Programming :

- Introduction and structure of Linear Programming (LP)
- Assumption of an LP Model
- Advantages and limitations of Linear Programming
- Application areas of linear programming
- Guidelines on linear programming model formulation
- Linear Programming (LP) :
  - i. By the Graphical Method
  - ii. By the Simplex Method

Unit–III:	No. of Lectures: 08 Hours	Marks: 12

- Decisions Theory & Decision Trees :
  - i. Introduction and steps of decision making process
  - ii. Types of decision making environments
  - iii. Decision making under uncertainty
  - iv. Decision making under risk
  - v. Decision making with utilities & Tree Analysis
- Theory of Games :
  - i. Two person zero sum games
  - ii. Pure strategies (Minimax & Maximum Principles)
  - iii. Mixed strategies games with saddle point
  - iv. The Rules Of Dominance

Unit–IV:	No. of Lectures: 08 Hours	Marks: 12

Project Management :

- Introduction of PERT and CPM
- Basic difference between PERT and CPM
- Phase of project management
- PERT /CPM network components & Precedence Relationship
  - i. Rules for AOA Network construction
  - ii. Errors & Dummies in Network
- Critical Path Analysis
  - i. Forward pass Method
  - ii. Backward Pass Method
  - iii. Float (slack) of an activity and event
  - iv. To find the critical path

Unit–V:	No. of Lectures: 08 Hours	Marks: 12

- Deterministic Inventory Control Models:
  - i. Introduction & the meaning of inventory control
  - ii. Functional role inventory control
  - iii. Reasons for carrying inventory
  - iv. Factors involved in inventory problem Analysis: inventory cost components, demand for inventory items, replenishment lead time
  - v. Inventory building model: steps of inventory model building, replenishment. order size decisions & concept of EOQ, classification of EOQ.
  - vi. Single item inventory control models without shortages.
- Probabilistic Inventory Control Model:
  - i. Instantaneous Demand Inventory Control model without set up cost.
  - ii. Continuous Demand Inventory Control model without set up cost Demand.

Text Books:

- J K SHARMA, Operations Research Theory & Applications, TRINITY Press
- Hamdy A Taha, Operations Research, Pearson
- Mittal Prakash M., Operations Research , Surendra Publications

Reference Books:

- Doald Barrie, Professional Construction Management, McGraw Hill Education.
- R. Panneeselram, Operations Research Theory & Applications, PHI
- Chary S.N. , Production & Operation Mangemnt, McGraw Hill.

Biotechnology of Waste Treatment (Open Elective Course - IV)

COURSE OUTLINE

Course Title:	Biotechnology of Waste Treatment	**Short Title:**	**BWT**	**Course Code:**	

Course description:

Industrial and domestic wastewaters are the prime causes of water pollution. They can be treated prior to the discharge. The wastewaters containing organic impurities are treated by biological methods. This course is aimed to develop the basic knowledge of operations of wastewater treatment processes to undergraduate students. The goals of the course are to demonstrate the basic principles of biochemistry and microbiology involved in the treatment processes and their applications in engineering trade.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	3	*14*	*42*	*3*

Prerequisite course(s):

Nil

Course objectives:

1. The Objectives of course is to develop in students the basic knowledge of microbiology and chemistry involved in the wastewater treatment process for organically rich wastewaters.

2. The advanced wastewater treatment processes Including Nitrification, De-nitrification, activated sludge process, anaerobic digestion, photo-catalysis etc.

Course outcomes:

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

1. Select the best treatment alternative for a given wastewater.
2. Demonstrate the microbiology and biochemistry of the waste treatment process.
3. Apply basic knowledge in research and development related to biological process.
4. Demonstrate current applications of biotechnology and advances in the different areas i.e. environmental, bioremediation, bioleaching and xenobiotics etc.
5. Apply the theoretical concepts for designing the experiments for studying the metabolism of various compounds present in waste water.

COURSE CONTENT

Biotechnology of Waste Treatment		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Introduction:

Concept and categories of Waste in pertinent to biological treatment, brief overview of domestic waste and Waste water Treatment, Site Selection surveys of a waste and wastewater treatment plant, Physical, Chemical and Biological Treatment Processes.

Microorganismsand their role in Waste Treatment:

Cell Structure, Eukaryotes, Prokaryotes, Viruses, their detection and quantification, Chemical composition of cell and nature of organic matter used by microorganisms, Metabolic classification of microorganisms: Phototrophs, Chemotrophs, application in environmental field, Nuisance causing organisms in Waste Treatment, Indicator Organisms in Waste Treatment Process.

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Background of Biological Treatment of Waste:

Concept of Biological Treatment of Waste and Wastewater with an emphasis to Nitrification, De-nitrification, Aerobic, Anaerobic, Facultative, Suspended Growth, Attached Growth, C/N Ratio for Composting, Leachate from Landfills.

Metabolism and growth of Microorganisms in Waste Treatment:

Central pathways, aerobic, anaerobic and fermentative metabolism of carbohydrates, proteins, lipids, nucleic acids and hydrocarbons, control of metabolic reactions, Nutrition and growth conditions: Temperature, pH, oxygen, nutritional requirements as selective agents for microbial population.Kinetics of biological growth, bacterial growth in terms of numbers and mass, growth curve, interpretation of curve, substrate limited growth, Monod's expression, substrate utilization and cell growth, effect of endogenous metabolism, effect of temperature, application of growth and substrate removal kinetics to biological treatment, Enzymes function, classification, kinetics, inhibitors and inhibition.

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**

Waste Characteristics:

Characteristics of Waste with an emphasis to Biological Characteristics, Numerical Treatment on Characteristics of Waste, sampling protocol for waste collection, types of samples, number of samples to be collected for biological treatment.

Microbiology and ecology of the following Waste Treatment process:

Microbiology and ecology of activated sludge process, trickling filters, oxidation ponds, aerobic and anaerobic digesters, anaerobic filters, UASB reactors, composting, vermin composting and other methods.

Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**

Design of Biological waste Treatment process with Numerical Treatment:

Activated Sludge Process, Trickling Filter, Oxidation Ponds, Aerated Lagoons, Anaerobic Digesters, UASB Reactors, Rotating Biological Contactors, Composting Unit, Landfills, Incinerator and other methods.

Nitrification and De-nitrification Process in Waste water Treatment:

Introduction, Forms of nitrogen, Nitrifying and denitrifying bacteria, Stoichiometry of nitrification and de-nitrification, Process variables in nitrification and de-nitrification process, Nitrification processes: Plug flow v\s complete mix, Single stage v\s two stage systems, Bio-film nitrification, De-nitrification using methanol, Organic matter and thiosulfate and sulfide, Anaerobic reactor system, Numerical Treatment on the design of Nitrification and De-nitrification systems in the above Biological Treatment Process.

Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**

Hazardous Waste Management& Biological Control:

Introduction - Xenobiotic compounds, recalcitrance, hazardous wastes - biodegradation of Xenobiotics , Biological detoxification, Biological control of foliar pathogens and pests with bacterial bio-control agents: bio-control agents, ecology of the plant pathogen or pest, source of antagonist, Empirical approaches to select bio-control agents.

Biological Degradation of Waste:

Introduction, Determination of biological degradability, Pilot studies: PCB (polychlorinated biphenols) biodegradation, Methylethyl ketone, Aerobic biodegradation: TCE (trichloro ethane) Degradation, Polycyclic aromatic hydrocarbon degradation, Oil degradation, phenanthrene degradation.

Bioremediation:

Introduction, constraints and priorities of Bioremediation, Biostimulation of Naturally occurring microbial activities, Bioaugmentation, in situ, ex situ, intrinsic & engineered bioremediation, Solid phase bioremediation - land farming, prepared beds, soil piles, Phytoremediation, Composting, Bioventing &Biosparging; Liquid phase bioremediation - suspended bioreactors, fixed biofilm reactors.

Text Books:

1. Metcalf Eddy – Waste water Engineering – 3rd Ed., TMH publications.
2. Wastewater Treatment By SJ Arceiwala, ShyamAsolekar, TMH Publications.
3. Nicholas P. Cheremisinoff, Biotechnology for waste water treatment, Eastern Economy edition.

Reference Books:
1. P. F. Stanbury, A. Whitaker and S. J. Hall, Principles of fermentation technology Aditya book private limited.
2.. CPHEEO Manual on Water Supply, Urban Development Authority
3.. CPHEEO Manual on Wastewater, 1993, Urban Development Authority

Internet of Things (Open Elective Course - IV)

COURSE OUTLINE

Course Title:	Internet of Things	**Short Title:**	*IoT*	**Course Code:**	

Course description:

This course develops a foundation of concepts and solutions that supports the project planning & management concepts. Describe how to managing development of project by applying project management concepts. Project risk management provides students with an organized approach for managing the uncertainties that can lead to undesirable project outcomes. Course topics include: Project procurement management and post project analysis.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The objective of this course is to impart necessary and practical knowledge of components of Internet of Things.
2. To develop skills required to build real-life IoT based projects.

Course outcomes:

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

1. Understand the design principles for connected devices
2. Understand the design principles of Internet connectivity
3. Analyze the concepts of knowledge acquiring, managing and storing
4. Understand the wide variety of sensors
5. Design the software for IoT applications

COURSE CONTENT

Internet of Things		**Semester:**	VIII
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Internet of Things: An Overview: Internet of Things, IoT Conceptual Framework , IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication, Examples of IoT **Design Principles for Connected Devices**: IoT/M2M Systems Layers and Designs Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway, Ease of Designing and Affordability

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Design Principles for Web Connectivity: Web Communication Protocols for Connected Devices, Message Communication Protocols for Connected Devices, Web Connectivity for Connected-Device a Network using Gateway, SOAP, REST, HTTP RESTful and WebSockets **Internet Connectivity Principles**: Internet Connectivity, Internet-Based Communication, IP Addressing in the IoT, Media Access Control, Application Layer Protocols: HTTP, HTTPS,
FTP, Telnet and Others

Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Data Acquiring, Organizing, Processing and Analytics: Data Acquiring and Storage, Organizing the Data, Transactions, Business Processes, Integration and Enterprise System, Analytics, Knowledge Acquiring, Managing and Storing Processes, **Data Collection, Storage and Computing Using Cloud Platform:** Cloud Computing Paradigm for Data Collection, Storage and Computing, Everything as a Service and Cloud service Models, IoT Cloud-Based Services using the Xively, Nimbits and Other Platforms		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Sensors, Participatory Sensing, RCIDs, and Wireless Sensor networks: Sensor Technology, Participatory Sensing, Industrial IoT and Automotive IoT, Actuator, Sensor Data Communication Protocols, Radio Frequency Identification Technology, Wireless Sensor Networks Technology **Prototyping the Embedded Devices for IoT and M2M:** Embedded Computing Basics, Embedded Platforms for Prototyping, Things Always Connected to the Internet/Cloud.		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Prototyping and Designing the software for IoT Applications: Prototyping Embedded Device Software, Devices, Gateways, Internet and Web/Cloud Services Software-Development, Prototyping Online Component APIs and Web APIs **IoT Privacy, Security and Vulnerabilities Solutions:** Vulnerabilities, Security Requirements and Threat Analysis, Use Cases and Misuse Cases, IoT Security Tomography and Layered Attacker Model, Identity Management and Establishment, Access Control and Secure Message Communication, Security Models, Profiles and Protocols for IoT		
Text Books:		
Raj Kamal, “Internet of Things: Architecture and Design”, McGraw Hill		
Reference Books:		
Jeeva Jose, “Internet of Things”, Khanna Publishing House, Delhi		

Interior Design (Open Elective Course IV)

COURSE OUTLINE

Course Title:	**Interior Design**	**Short Title:**	*ID*	**Course Code:**	

Course description:

Any building whether it is residential or commercial requires interior. Interior design is the art and science of enhancing the interior of a building to achieve a healthier and more aesthetically pleasing environment for the people using the space. This course enables a student to plan design and execute ainterior design project.

Lecture	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	03	*14*	*42*	*03*

Prerequisite course(s):

Nil

Course objectives:

1. The basic objective of this course is enabling a student to plan, design and execute interior design project.
2. The student must be able to understand various materials used and different planning concept of interior design.
3. The student must also be able to design and construct necessary structures for enhancing esthetics of the structure.

Course outcomes:

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

1. Understand the functional planning of interior spaces.
2. Understand various elements and principle of interior design.
3. Demonstrate ability to design interior of building.
4. Understand the physical dimension of various furniture.
5. Understand construction of partition walls and false ceiling.

COURSE CONTENT

Interior Design		**Semester:**	*VIII*
Teaching Scheme:		**Examination scheme**	
Lectures:	**3 hours/week**	**End semester exam (ESE):**	**60 marks**
		Duration of ESE:	**03 hours**
		Internal Sessional Exams (ISE):	**40 marks**

Unit–I:	**No. of Lectures: 09 Hours**	**Marks: 12**

Interior Designs: Character of good design - Values of design, Influence of environment on design in tune with community & site location, Eco friendly designing, Creative problem solving, styles & taste

Functional Planning of Interior Spaces - Planning for specific functions, Planning for coordination & circulation, Psychological space planning

Unit–II:	**No. of Lectures: 09 Hours**	**Marks: 12**

Elements of Interior Design:

Form, texture, hard, medium, soft & importance of texture in design

Light- Importance of light as an art element & effect of light color & texture.

Space - Organization of space in design.

Color- Importance of color as an art element

Color theory- Lightness & Darkness, intensity, Brightness &, dullness warm & cool color, paint & their properties- how

to apply, textures & patterns		
Unit–III:	**No. of Lectures: 08 Hours**	**Marks: 12**
Principles of Design: Balance its definition, types, formal & informal balance. Harmony definition, aspect of harmony, line, shape size, texture, color, idea Rhythm - definition, methods of obtaining rhythm repetition of shapes, progression of size, continuous line movements **Emphasis –** definition, how to emphasis grouping of objects, using contrasting color, using decoration, having sufficient plain background, using unusual lines, shapes & size Anthropometric data- Standard dimensions of human body in different postures Standard dimension of furniture		
Unit–IV:	**No. of Lectures: 08 Hours**	**Marks: 12**
Interior Materials: Floor covering carpets, types & fixing of carpets Finishes- Walls & Furniture finishing likes paint, wallpaper paneling & cladding Furnishing materials - cloth, Rexene, leather, etc. curtains, Plastics - Study of types of plastics, casting, molding process, use in interiors		
Unit–V:	**No. of Lectures: 08 Hours**	**Marks: 12**
Furniture - Movable furniture like chairs, tables, fixed furniture like wall units, wardrobe, kitchen platform, partitions, Upholstered furniture like sofa sets, chairs etc. Lighting, study of types of lighting, Direct & Indirect lighting, study of different wiring systems & their suitability **Construction:** Partition – wooden partition, aluminum partitions, sound proofing partitions False ceiling, different types of false ceiling systems in different materials		
Text Books:		
1. Interior Design Principles and Practice by M. Pratap Rao, 4th edition, 2017. *2.* Interior Design by S. N. Chaudhari, Aviskar Publisher, ISBN: 9788179101667 *3.* Building Material, P. C. Vargeesh, PHI Learning Pvt. Ltd.		
Reference Books:		
1. Time Saver Standards for Interior Design and Space Planning, by Joseph De Chiara, 2017 *2.* The Interior Design Reference & Specification Book updated & revised: Everything Interior Designers Need to Know Every Day by Chris Grimley and Mirni Love, Rockport publishers, 2018		

Engineering Economy, Estimation & Costing LAB

LAB COURSE OUTLINE

Course Title:	***Engineering Economy, Estimation & Costing Lab***	**Short Title:**	*EEEC LAB*	**Course Code:**	

Course description:

Estimating and costing is a core syllabus of civil engineering which needs practical treatment. This subject already has a theory paper. However it is essential for the students to practice a lot with real world examples. The present syllabus includes this aspect. Here, a student has to find estimated cost of variety of contemplated structures using standard procedures and DSR. Some part of the syllabus is dedicated to economics also which again is a very important aspect of civil engineering where projects cost millions and billions of Rs. The treatment is preliminary and gives emphasis on practical approach.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	2	*14*	*28*	*5*

End Semester Exam (ESE) Pattern:	***Oral (OR)***

Prerequisite course(s):

Nil

Course objectives:

The objectives of the course are :

1. To enable student with working out quantities of various items involved in construction of structures based upon detailed drawings.
2. To enable student to carry out the rate analysis
3. To enable student to carry out valuation of existing property considering depreciation.
4. To enable students to draft the specifications for new civil work.

Course outcomes:

Upon successful completion of lab Course, student:

1. Attain the level of proficiency to prepare approximate as well as detailed estimate of civil engineering projects.
2. Will be competent enough to calculate the amount of material, labor & machinery required to execute any civil construction projects
3. Will be well trained to make bills of venders of civil construction works
4. Will be able to perform and evaluate present worth of a property.
5. Will be able to assess the future worth & annual worth analyses on one of more economic alternatives.

LAB COURSE CONTENT

Engineering Economy, Estimation & Costing Lab		**Semester:**	**VIII**
Teaching Scheme:		**Examination scheme**	
Practical:	**2 hours/week**	**End semester exam (ESE):**	***25 marks***
		Internal Continuous Assessment (ICA):	***25 marks***

Term work Assignments:

1. An approximate estimate for a multistoried building by approximate method
2. Detailed Estimate for :- (*any 3*)
   i. Ground plus three storied RCC framed building with block work walls
   ii. R. C C Bridge with minimum two span
   iii. Factory Building
   iv. Road Works

v. Cross Drainage Works
vi. Ground plus three storied building with Load bearing walls

3. Rate analysis and Specifications for (*any 3)*
   i. Excavation work
   ii. RCC work
   iii. Brick masonry work
   iv. Plastering both internal & external

4.Prepartion of Bar Bending Schedule (BBS) (*any2)*
   i. RCC footing, Column, Beam & slab
   ii. R C C Retaining wall
   iii. RCC Doglegged Stair case

5. Detailed estimate on Minor Structure like (*any1*)
   i. Box Culvert
   ii. , Earthen Bund
   iii. Single Toilet Block with Septic tank

Text Books:

1. Dutta B N, Estimating & Costing in civil engineering UBS Publishers
2. Estimating, Costing, Specifications & Valuation in Civil Engineering, by M. Chakraborti, M Chakraborty Publications.
3. Birde G. S., Text book of estimating & costing, Dhanpatrai publishing

Reference Books:

Quantity Surveyor's Pocket Book, Duncan Cartilidge, BH Publications.

Guide lines for ICA:

ICA will be based upon the assignments done by the student.

Guidelines for ESE:

The ESE will be based upon the viva voce given by the student on his/her term work.

Advanced Surveying Lab					
COURSE OUTLINE					
Course Title:	*Advanced Surveying Lab*	**Short Title:**	*ASL*	**Course Code:**	

Course description:

This course introduce the students about concept in surveying such as Scope of geodetic surveying and triangulation in civil engineering society, Adjustment of triangulation figure by using different methods, Terrestrial and aerial photography for large scale survey, Principles of remote sensing and its methods, Locating of sounding in hydrographic surveying, Importance and principles of Total station, Setting of curves on roads and railways.

	Hours/week	**No. of weeks**	**Total hours**	**Semester credits**
Theory	02	14	28	02
Laboratory	*02*	*14*	*28*	

Prerequisite course(s):

Nil

Course objectives:

1. Indentify and calculate the theory of errors in measurement in Triangulation survey
2. To operate an Total station to perform all measurement.
3. Calculate air base distance, overlap, and height of object in photographs.
4. Relate the knowledge gained after using nautical sextant in hydrographic survey.
5. To setting out the curves on roads and railways.
6. To relate the knowledge about Geodetic survey.

Course outcomes:

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

1. To be able to conduct Geodetic survey in remote areas.
2. To be able to determine probable error and its determination , distribution of error to the field measurements , adjustment of a geodetic triangle.
3. To be able to identify aerial photos with respect to overlap , air base distance , tone lithology.
4. To be able to carry hydrographic survey, soundings.
5. To be able to setting out curves on roads and railways.

COURSE CONTENT

Advanced Surveying Lab		**Semester:**	*VII*
Teaching Scheme:		**Examination scheme**	
Theory:	**2 hours/week**	**End semester exam (ESE):**	**25**
Practical:	**2 hours/week**	**Internal Sessional Exams (ICA:**	**25**

Unit–I:	**No. of Lectures: 04 Hours**	

Geodetic surveying :

Objects and methods in geodetic surveying. Triangulation figure, strength of figure, classification of triangulation system, Selection of stations , inter visibility of height of station towers, signals and their classification, phase signals, satellite station and reduction to centre eccentricity of signals , Base line measurement , apparatus used, base net; equipment used for base line measurement, extension of base .

Unit–II:	**No. of Lectures: 05 Hours**	

Triangulation Adjustments :

Kinds of errors, laws of weights, determination of the most probable values f quantities , the method of least squares, indirect observations on independent quantities , normal equation , conditioned quantities, The probable error and its determination , distribution of error to the field measurements , methods of correlates , station adjustment , adjustment of a geodetic triangle, figure adjustment of a triangle calculation of spherical angles, adjustment of geodetic quadrilateral , adjustment of a quadrilateral with a central station by method of least squares

Unit–III:	No. of Lectures: 05 Hours	

Photogrammetry:

Objects, application to various fields , terrestrial photogrammetry and aerial photogrammetry, aerial camera, comparison of map and vertical photographs, classification of photographs , concept of principal point, nadir point, isocentre, horizon point, principal plane , Scale of vertical photograph ,computation of length and height from the photograph, relief displacement on vertical photograph , Mirror and lens stereoscopes.

Unit–IV:	No. of Lectures: 05 Hours	

Hydrographic surveying and Remote sensing :

Objects, establishing controls, shore line survey , river survey, soundings tide gauges, equipments for taking soundings signals, Nautical sextant measurement of horizontal and vertical angles with the nautical sextant, methods of locating soundings .

Basic principles ,definition , importance scope of remote sensing, sensors and its classifications, platforms, applications of remote sensing, electromagnetic radiation and spectrum multispectral scanner MSS, black body radiation , atmospheric windows. Study and use of Total station.

Unit–V:	No. of Lectures: 08 Hours	

Curves :

Horizontal and vertical curves and their purposes, simple circular curves its elements and setting out by linear and angular methods, Compound curves and its elements and setting out of compound curves, Transition curves its types and uses length ,elements of cubic parabola, Introduction to reverse curves and its elements and uses.

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

1. **Measurement of horizontal and vertical angles by One Second Theodolite**
   a. Study the component parts of One Second Theodolite.
   b. Measurement of horizontal angles by face left and right position.
   c. Measurement of vertical angles by face left and right position.
2. **Measurement of horizontal angles by reiteration method.**
   a. Measurement of horizontal angles by face left and right position.
   b. Verification of check by reiteration method.
3. **Study and use of mirror stereoscope and finding out the air base distance**
   a. Find out the location of principal point on photograph
   b. Fix the photograph along the line of principal point and conjugate principal point
   c. Measurement of air base distance by mirror sterescope
4. **Hydrographic survey**
   i) Study and use of nautical sextant for measurement of angles.
   a. Study of components parts of nautical sextant
   b. Measurement of horizontal, vertical and oblique angle
4. **Measurement of angles and elevation by Total Station**
   a. Study of components parts of total station
   b. Measurement of horizontal and vertical angles by total station
   c. Measurement of vertical elevation by total station
   d. Measurement of horizontal distance by total station.

Note: The practical examination will be based on the above exercises.

Text Books:

1. Surveying and leveling (vol-I&II) by T.P. Kanitkar, & S.V. Kulkarni, Pune Vidarthi Griha Prakashan, Pune,
2. Surveying Vol. I ,Vol .II and III ,by Dr B.C.Punmia,Ashok K Jain, Arun K Jain , Laxmi Publication (P) New Delhi.
3. Principles of surveying by Cliver and clendening
4. Advance surveying , Vol.I & II, Handbook by P.B. Shahani
5. A handbook of accurate surveying methods by S.P.Collins
6 Surveying by, S K Duggal , Vol.I & II, McGraw Hill Education (India) private Limited New Delhi.
7 Introduction to Geographic information systems, by Kang- tsung Chang, McGraw Hill Education (India) private Limited New Delhi.
8 Surveying by, C L Kochher , Dhanpat Rai publicating co. New Delhi

Reference Books:

1. Advance surveying by P.Som , B.N.Ghosh, TMH Publication.
2. Surveying and leveling , by N N Basak, Vol.I & II,McGraw Hill Education (India) private Limited New Delhi.
3. Elements of Photogrammetry by Paul Richard Wolf, McGraw-Hill Education (India) Pvt Limited.
4. Plane and geodetic surveying by David Clark, J. E. Jackson
5. Principal of remote sensing by A. N. Patel
6. Concept and techniques of Geographic Information System , by C P LO Albbert K W Yeung ,Prentice Hall of India Private Limited , New Delhi.

Major Project Stage II

LAB COURSE OUTLINE

Course Title:	**Major Project**	**Short Title:**	**MPROJ**	**Course Code:**	

Course description:

Major project is a step towards learning by doing. A group of students are provided a guide. The group identifies a real world problem. They seek the solution by literature survey, case study, simulations, experimentation, analysis etc. It offers the opportunity to apply and extend material learned throughout the program. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres.

Laboratory	**Hours/week**	**No. of weeks**	**Total hours**	**Semester credits**
	6	**14**	**84**	**3**

End Semester Exam (ESE) Pattern: **Oral (OR)**

Prerequisite course(s):

Nil

Course objectives:

1. To understand the basic concepts & broad principles of projects.
2. To understand the value of achieving perfection in project implementation & completion.
3. To apply the theoretical concepts to solve problems with teamwork and multidisciplinary approach.
4. To demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

Course outcomes:

Upon successful completion of lab Course, student will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilizing a systems approach.
4. Conduct an engineering project
5. Demonstrate the knowledge, skills and attitudes of a professional engineer.

LAB COURSE CONTENT

Minor Project		**Semester:**	**VI**
Teaching Scheme:		**Examination scheme:**	
Practical:	**6 hours/week**	**End semester exam (ESE): (OR)**	**25 marks**
		Internal Continuous Assessment (ICA):	**50 marks**

In continuation with Major Project (Stage – I) at Semester – VII, by the end of Semester – VIII, the student should complete implementation of ideas as formulated in Major Project (Stage – I). It may involve fabrication / coding, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. It may also include testing, results and report writing. Each student group should submit complete project report at the end of Semester-VIII in the form of Hard bound. Assessment for the project shall also include presentation by the students.
Each student group is required to maintain separate log book for documenting various activities of the project.

Guide lines for ICA:

The Internal Continuous Assessment (ICA) for project shall be based on continuous evaluation of students' performance, active participation, knowledge / skill acquired throughout semester and presentation by the students. The assessment shall be done jointly by the guide and departmental committee. A three-member departmental committee including guide, appointed by Head of the department, shall be constituted for the assessment. The assessment for Major Project in Semester – VIII shall be as per the guidelines given in Table – B.

Table – B

		Assessment by Guide				Assessment by Departmental Committee			
Sr. No.	Name of the Student	Attendance / Participation	Implementation	Results	Report	Depth of Understanding	Presentation	Demonstration	Total
	Marks	5	5	5	5	10	10	10	50

Guidelines for ESE:

In End Semester Examination (ESE), the student may be asked for presentation / demonstration and questions on Project. Evaluation will be based on answers given by students in oral examination.