SYLLABUS

(With effect from 2017-18)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2017–18)

V& VI Semester

Bachelor Degree
in
Civil Engineering

Out Come Based Education with Choice Based Credit System

P.E.S. College of Engineering

Mandya - 571 401, Karnataka
(An Autonomous Institution Affiliated to VTU, Belagavi)
Grant -in- Aid Institution
(Government of Karnataka)
Accredited by NBA, New Delhi
Approved by AICTE, New Delhi.

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

Ph : 08232- 220043, Fax : 08232 – 222075,Web : www.pescemandya.org

Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight undergraduate and Eight Postgraduate programs. It consists of Six M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has recently become a Permanent Member by signing the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill courses). The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills and Personality Development modules have been added to the existing curriculum of the academic year 2015-16. Industry Interactions have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are included in all undergraduate programs.

Dr. Umesh D R	Dr. Nagarathna
Deputy Dean (Academic)	Dean (Academic)
Associate Professor,	Professor
Dept. of CS &Engg	Dept. of CS &Engg

PES College of Engineering

VISION

PESCE shall be a leading institution imparting quality engineering and management education, developing creative and socially responsible professionals

MISSION

- Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching -learning practices
- Impart engineering and managerial skills through competent and committed faculty using Outcome Based Educational curriculum
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs
- Promote research, product development and industry-institution interaction.

DEPARTMENT OF CIVIL ENGINEERING

The Civil Engineering Department was started in the year 1962 as one of the first branches in P.E.S. College of Engineering, Mandya with an intake of 40. The department has carved a niche for itself by offering the most competent instructional programs to the students. The department is running an undergraduate programme with an intake of 120 and it has started PG in CAD Structures with an intake of 18 in the year 2006. The department has been recognized as research centre under VTU, Belgaum. The department is accredited by NBA, New Delhi for five years (2004-2009). The department is well equipped with laboratories, computing facilities, independent library and other infrastructure. The department has well qualified and experienced teaching faculties. The department also takes up consultancy work pertaining to planning, structural designs of buildings, testing of materials, soil investigation.

VISION

To attain Excellence in imparting quality civil engineering education to meet the societal needs.

MISSION

- Impart civil engineering and managerial skills with state of art infrastructure, competent and Committed faculty using outcome based educational curriculum.
- Promote research, project management and consultancy
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.

Programme Education Objectives (PEOs)

Graduates will be able to

- Apply technical competence in the field of Civil Engineering with a strong background in basic science and mathematics.
- Analyse and interpret data to design or evaluate civil engineering systems to satisfy societal needs with the use of modern tools including higher education.
- Function effectively as an individual and or to work in a team on multispecialized civil engineering projects with professional ethics and effective communication skills inculcating the habit of life-long learning.

Programme Specific Outcomes (PSOs)

The Program specific outcomes have been derived from the PSC's defined by ASCE. By the time of graduation, Civil Engineering students will be able to

PSO1: Apply knowledge of basic science to analyze and solve problems in the core area of Civil Engineering such as Structural, Geotechnical, Transportation, Environmental, Hydraulics and Water resources engineering.

PSO2: Analyze, Plan, design, quality assessment and cost estimate of Civil Engineering structures with professional ethics.

PSO3: Work in a consulting organization or can be an entrepreneur to investigate and supervise Civil Engineering structures using modern tools and technology to provide sustainable solutions to meet the societal needs.

Programme Outcomes(Pos)

Engineering program must demonstrate that their students attain the following outcomes:

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Department of Civil Engineering

P.E.S College of Engineering, Mandya, (An Autonomous Institution under VTU)

SCHEME OF TEACHING AND EXAMINATION
V Semester B.E. (Civil)

Sl. No.	Course Code	Course Title	Teaching Dept.	Hrs/Week L:T:P:H	Total Credits	Examination Marks		
					CIE	SEE	Total	
1.	P17C V51	Water Supply and Treatment	Civil	4:0:0:4	4	50	50	100
2.	P17C V52	Hydrology and Water Resources Engineering	Civil	4:0:0:4	4	50	50	100
3.	P17C V53	Analysis of Indeterminate Structures	Civil	4:0:0:4	4	50	50	100
4.	P17C V54	Design of RC Structural Elements (Foundation course 1)	Civil	4:0:0:4	4	50	50	100
5.	P17CV55x	(Foundation Elective)	Civil	3:0:0:3	3	50	50	100
6.	P17CV56X	Elective-1	Civil	3:0:0:3	3	50	50	100
7.	P17CVL57	Concrete and Highway Materials Testing laboratory	Civil	0:0:3:3	1.5	50	50	100
8.	P17CVL58	CAD Laboratory-1(Auto Cad, Building Drawing)	Civil	0:0:3:3	1.5	50	50	100
9.	P17CV59	Industry Visit & Interaction	Civil	0:0:2:2	1	50	--	50
10.	P17CV510	Aptitude and Reasoning Development – Advanced. (ARDA)	HS&M	2:0:0:2	1	50	50	100
		Total 27				500	450	950

List of Electives

Foundation Elective			**Elective – 1**		
Sl. No	Course Code	Course Title	Sl.No.	Course Code	Course Title
1.	P17CV551	Basic Geotechnical Engineering	1.	P17CV561	Alternative Building Materials
2.	P17CV552	Mechanics of Composite Materials	2.	P17CV562	Municipal and Rural Sanitation
3	P17CV553	Construction Quality and Safety Management	3	P17CV563	Pavement Design & Analysis
4	P17CV554	Open Channel Hydraulics	4	P17CV564	Building Services

SCHEME OF TEACHING AND EXAMINATION
VI Semester B.E. (Civil)

Course Code	Course Title	Teaching Dept.	Hrs/Week L:T:P:H	Total Credit	Examination Marks		
					CIE	SEE	Total
P17 CV61	Waste Water Collection and Treatment	Civil	4:0:0:4	4	50	50	100
P17 CV62	Applied Geotechnical Engineering	Civil	4:0:0:4	4	50	50	100
P17 CV63	Irrigation Engineering	Civil	4:0:0:4	4	50	50	100
P17CV64	Transportation Engineering (Foundation course 2)	Civil	4:0:0:4	4	50	50	100
P17 CV65X	Elective – 2	Civil	3:0:0:3	3	50	50	100
P17 CV66X	Elective – 3	Civil	3:0:0:3	3	50	50	100
P17 CVL67	Geotechnical Engineering Laboratory	Civil	0:0:3:3	1.5	50	50	100
P17 CVL68	Extensive Surveying	Civil	0:0:3:3	1.5	50	50	100
P1 7CV69	Mini Project	Civil	0:0:2:2	1	50	--	50
P175xx610	Aptitude and Reasoning Development – EXPERT(ARDE)	HS&M	2:0:0:2	1	50	50	100
	TOTAL			27	500	450	950

List of Electives

Elective-II			**Elective – III**		
Sl. No.	**Course Code**	**Course title**	**Sl.No.**	**Course Code**	**Course title**
1.	P17CV651	Highway Construction, Maintenance and Evaluation	1.	P17CV661	Matrix Methods of Structural Analysis
2.	P17CV652	Municipal Solid Waste Management	2.	P17CV662	Design of Masonry Structures
3.	P17CV653	Ground Water Hydrology	3.	P17CV663	Photogrammetric and Remote Sensing
4	P17CV654	Ground Improvement Techniques	4.	P17CV664	Repair and Rehabilitation of Structures

Course Title : WATER SUPPLY AND TREATMENT			
Course Code: P17CV51	**Semester: V**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Understand the importance of safe drinking water, different water demands, population forecasting methods to arrive at per capita consumption for city/town, different water sources along with intake structures and pumps and to apply the knowledge to solve engineering problems
2. Summarize drinking water quality parameters and analysis (Examination) procedure for compliance with standards.
3. Explain types of aeration and to understand sedimentation, coagulation and flocculation and to apply design concepts to sedimentation units.
4. Understand different types of filtration units and disinfection types, to apply design concepts to filtration units.
5. Explain different water softening methods and to illustrate different water distribution systems.

Course Content

UNIT – I

INTRODUCTION: Role of water, need for protected water supply. Types of water demands, Fire demand–estimation by different empirical formulae, Per capita consumption, population forecasting-different methods with merits & demerits, variations in demand of water, peak factors, design periods.
INTAKE STRUCTURES – Different types, factor of selection and location of intakes.
PUMPS- Necessity, power of pumps, Design of the economical diameter for the rising main.
Self Study Component: SOURCES: Surface and subsurface sources – suitability with regard to quality and quantity. **12 Hrs**

UNIT – II

QUALITY OF WATER: Concept of safe water, wholesomeness & palatability, water borne diseases. Examination of Water - Objectives – Physical, chemical and Microbiological Examinations. Drinking water standards-BIS&WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc.
WATER TREATMENT: Introduction, objectives, treatment flow-chart showing units & impurities removed. AERATION- Principles, Objectives, types of aerators.
Self Study Component: Examination tests for physical, chemical and Biological water quality, sampling methods**.** **10 Hrs**

UNIT – III

SEDIMENTATION: Introduction, objectives, types of settling, factors affecting settling, Theory of settling, settling tanks-types, design of circular, rectangular tanks only.
COAGULATION AND FLOCCULATION: Coagulant aided sedimentation: objectives, common coagulants, factors affecting, jar test, chemical feeding, flash mixing, Flocculation and clari-flocculation.
Self Study Component: Different methods of coagulant feeding, inlet and out arrangement for sedimentation tanks **10 Hrs**

UNIT – IV

FILTRATION: Theory of filtration, types of filters- slow sand, rapid sand and pressure filters including construction, operation, cleaning and their design –under drainage system, back washing of filters.

DISINFECTION: Theory of disinfection, types of disinfection, Chlorination, chlorine demand, residual chlorine, use of bleaching powder. Numerical

Self Study Component: Operational problems in filters, Chemistry of Chlorination**. 10 Hrs**

UNIT – V

DISTRIBUTION SYSTEMS: System of supply, service reservoirs and their capacity determination, methods and layout of distribution systems.

MISCELLANEOUS: Pipe appurtenances, various valves, type of fire hydrants, pipe fitting, MISCELLANEOUS TREATMENT: Water softening **–** Definition, methods of removal of hardness by lime soda process and zeolite process.

Removal of colour, odour, taste, adsorption technique, fluoridation and de fluoridation.

Self Study Component: Nalgonda technique for defluoridation, layout of water supply in buildings

10 Hrs

TEXT BOOKS:

1. Environmental Engineering-I – B.C. Punmia & Ashok Jain, Lakshmi Publications (P) Ltd.
2. Water supply Engineering – S.K.Garg, Khanna Publishers, New Delhi.

REFERENCES:

1. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi.
2. Environmental Engineering- Howard S. Peavey, Donald R. Rowe, George
3. Water & Wastewater Engineering Vol-I-- Fair, Geyer and Okun : John Willey Publishers, New York

Note: Self-study is for 5 marks only in CIE and not in SEE

Course outcomes

Students will be able to;

1. Apply knowledge of mathematics to forecast population of community to determine total quantity of water to meet demands of community.[PO1,PSO1]
2. Apply knowledge of basic science for testing and analyze the drinking water quality parameters from public health consideration as per standards.[PO1 & PO2,PSO1,PSO2]
3. Design various water treatment units to remove selected impurities in raw water [PO3,PSO2]
4. Analyze the community pipe network of water distribution. [PO2,PO7,PSO2]

Course Articulation Matrix (CAM)

Sl.No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply knowledge of mathematic to forecast population of community to determine total quantity of water to meet demands of community.	**3**												**3**		
02	Apply knowledge of basic science for testing and analyze the drinking water quality parameters from public health consideration as per standards.	**2**	**3**											**2**	**3**	
03	Design various water treatment units to remove selected impurities in raw water			**3**											**3**	
04	Analyze the community pipe network of water distribution.		**3**			**2**									**3**	

1-Low, 2-Medium, 3-High

Course Title : HYDROLOGY AND WATER RESOURCES ENGINEERING			
Course Code: P17CV52	**Semester: V**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Define and comprehend key concepts related to surface water hydrology.
2. Understand the process of Evaporation and Evapotranspiration
3. Understand the process of infiltration and runoff and obtain the knowledge about hydrograph.
4. Define ground water hydrology and to know its occurrence, its movement, its vertical distribution and Understand well Hydraulics.
5. Understand methods of flood routing and the importance of flood frequency studies and the type of data used for it.

Course Content

UNIT – I

PRECIPITATION AND CATCHMENT: Introduction, Hydrologic cycle, world water budget Indian's water budget, Precipitation- types and forms, Measurement of precipitation (standard gauge and siphon type of rain gauge only), Mean precipitation over an area, estimation of missing rainfall data, rain gauge network, rain fall mass curve, Hyetograph, Double mass curve technique. Problems. Catchment – definition, stream pattern, description of the basin.
Self-Study Component:-Meteorological Parameters**10Hrs**

UNIT – II

ABSTRACTIONS AND RUNOFF: Introduction. to Abstractions–Evaporation, Factors affecting evaporation, Measurement of evaporation using evaporation pans, estimation of evaporation using empirical methods – Mayer's and Rowher's formula, Methods of reduction of reservoir evaporation, Transpiration, Evapo-transpiration, Estimation of evapo-transpiration using Blaney-Criddle equation. Infiltration – Infiltration capacity, Measurement of infiltration by infiltrometers, Infiltration indices. Runoff – Introduction, Types of runoff, Factors affecting runoff, Basin yield, Rainfall-runoff correlation, Estimation of runoff with empirical equations – Inglis formula. Problems& Khosla's formula- Problems
Self Study Component:-Flow duration curves **10 Hrs**

UNIT – III

STREAM FLOW AND HYDROGRAPH: Stream–classification of stream, stream gauging, stage-discharge relationship, measurement of velocity in streams- current meter and floats, measurement of discharge-area velocity method and slope area method. Hydrograph – Definition, Factors affecting flood hydrograph, Components of a hydrograph, Base flow separation, Effective rainfall, Unit Hydrograph, Unit hydrograph of complex storms, Unit hydrograph of different duration. Problems **11 Hrs**
Self Study Component:-S curve hydrograph

UNIT – IV

GROUND WATER HYDROLOGY: Introduction. Occurrence and movement of ground water, Vertical distribution of groundwater, Aquifers, Aquifer parameters-Specific retention, Specific yield, Storativity, Hydraulic conductivity, Transmissivity. Darcy's Law, Well Hydraulics – Steady-radial flow into a confined aquifer, Steady-radial flow into an unconfined aquifer. Yield of an open well- recuperation test and

pumping test. Problems. **9 Hrs**

Self Study Component:-Well development & well disinfection

UNIT – V

FLOODROUTING AND FLOOD ESTIMATION: Introduction. Flood routing–reservoir routing and Channel routing, establishment of storage discharge relationship, Flood routing -ISD method and Buckingham method. Design flood, estimation of design flood using empirical formulae (Dicken's, Ryve's formula and English formula) and rational method, Flood frequency analysis using Gumbel's extreme value distribution. Problems. **12 Hrs**

Self Study Component:-Envelope curve

TEXT BOOKS:

1. Engineering Hydrology – Subramanya K, Tata McGraw Hill, New-Delhi.
2. A Text Book of Hydrology – Jayarami Reddy, Lakshmi Publications, New-Delhi.

REFERENCES:

1. Hand Book of Hydrology – Ven Te Chow Publishers
2. Hydrology and Water Resources Engineering – R.K. Sharma and Sharma, Oxford and IBH, New Delhi.
3. Hydrology and water resources Engineering – Garg S.K., Khanna Publishers, New Delhi.
4. Ground Water Hydrology – Todd, Wiley Eastern Publication, New Delhi.
5. Hydrology – H.M. Raghunath, Wiley Eastern Publication, New Delhi.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes (CO's)

1. Apply the knowledge of Science and mathematics to evaluate hydrologic parameters of watershed [PO1,PS01]
2. Estimate, evaporation, Evapotranspiration, runoff, hydrograph of different duration and discharge using various methods.[PO3,PSO2]
3. Analyse aquifer parameters and to interpret the observation well data for estimation of yield from a well.[PO2,PSO3]
4. Interpretation of flood data for various hydrological studies. [PO4,PSO3]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome – (CO)	Program outcome												PSO'S		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	11	12	1	2	3
01	Apply the knowledge of Science and mathematics to evaluate hydrologic parameters of watershed	3												**3**		
02	Estimate, evaporation, Evapor transpiration, runoff, and discharge using various methods			2											**2**	
03	Analyse aquifer parameters and to interpret the observation well data for estimation of yield from a well		2													**2**
04	Interpretation of flood data for various hydrological studies				2											**2**

1-Low, 2-Moderate, 3-High

Course Title : ANALYSIS OF INDETERMINATE STRUCTURES			
Course Code: P17CV53	**Semester: V**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.;	**Exam: 3Hrs.**	**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This course aims to

1. Categorise the structures on the basis of Static and Kinematic Indeterminacies. Understanding the importance of Force and Deformation methods in analysing the Indeterminate Structures.
2. Analysing Beams and Rigid jointed Plane frames, orthogonal, manually, unknowns<=3, using Slope-Deflection ,Moment Distribution and Kani's Methods.
3. Introducing the analysis of Indeterminate Structures using Matrix methods,system approach only.
4. Analysing plane truss,continuous beams and plane frames, manually, unknowns<=3, using flexibility and stiffness matrix methods.
5. Learn the Energy concept in dealing the indeterminate Pin jointed plane truss,Castigliono's Theorems.

Course Content

UNIT – I

SLOPE DEFLECTION METHOD : Introduction, sign convention, Development of Slope-deflection equations and Analysis of Beams and Orthogonal Rigid jointed plane frames (non-sway and sway) with kinematic redundancy less than or equal to three. (Members to be axially rigid)

Self Study Component:- Additional numerical problems involving kinematic indeterminacy greater than 3 by Slope Deflection method (Solutions to simultaneous equations by numerical methods) **10 Hrs**

UNIT – II

MOMENT DISTRIBUTION METHOD: Introduction, Definition of terms – Distribution factor, Development of method and Analysis of beams and orthogonal rigid jointed plane frames (non-sway and sway) with kinematic redundancy less than/equal to three (Members to be axially rigid).

Self Study Component:- Problems on gable frames and frames with inclined columns from moment distribution method. **10 Hrs**

UNIT – III

KANI'S METHOD: Introduction, Basic Concept, Analysis of Continuous beams and Analysis of orthogonal rigid jointed non-sway plane frames. Analysis of rigid jointed plane frame with symmetry considerations, non-sway frames. Analysis of rigid jointed plane frames sway due to vertical and horizontal loadings.

Self Study Component: - Introduction to analysis of multistoried buildings by approximate methods (portal method, cantilever method and method of substitute frames) **10 Hrs**

UNIT – IV

FLEXIBILITY MATRIX METHOD OF ANALYSIS: System Approach-Introduction, Development of flexibility matrix for plane truss element and continuous beams. Analysis of continuous beams and rigid jointed plane frames by flexibility method with static indeterminacy $\leq$.3.

STIFFNESS MATRIX METHOD OF ANALYSIS: System Approach-Introduction, Development of stiffness matrix for plane truss and continuous beams elements. Analysis of continuous beams and rigid jointed plane frame by stiffness method with kinematic indeterminacy less than or equal to three.
Self Study Component:- Analysis of pin jointed plane truss by flexibility and stiffness method (System approach)
14 Hrs

UNIT – V

INDETERMINATE TRUSS ANALYSIS: Analysis of indeterminate trusses by Strain Energy Method, using Castiglione's theorem with static indeterminacy ≤ 3. **08 Hrs**
Self Study Component:- Problems involving lack of fit and temperature stresses in trusses.

TEXT BOOK:

1. Basic Structural Analysis – Reddy C.S. – Second Edition, Tata McGraw Hill Publication Company Ltd.
2. Theory of Structures Vol. 2 – S.P. Gupta, G.S. Pandit and R. Gupta, Tata McGraw Hill Publication Company Ltd.
3. Structural Analysis-II – S.S. Bhavikatti – Vikas Publishers, New Delhi.

REFERENCE BOOKS:

1. Indeterminate Structural Analysis – J. Sterling Kinney, Oxford and IBH Publishing Co.
2. Elementary Structural Analysis- Noris C.H., Wilbur J. B., McGraw Hill International Book Edition.
3. Advanced Structural Analysis- Ashok K. Jain., Nem Chand & Bros., Roorkee. India.
4. Structural Analysis- D.S. PrakashRao., A Unified Approach, University Press.
5. Intermediate Structural Analysis- C.K. Wang., McGraw Hill Publications.

Note: Self study is for 5 marks only in CIE and not in SEE

COURSE OUTCOMES (COs)

After completing this course, students are able to,

1. Idealize the structural elements and loads and analyze statically indeterminate or redundant structures by Slope Deflection method as a classical approach.[PO1,PO2,PO3,PSO1,PSO2]
2. Analyze continuous beams and frames by Cross method and Kani's method and understanding its iterative nature of obtaining solutions.[PO1,PO2,PO3,PSO1,PSO2]
3. Apply Matrix concept through flexibility and stiffness system approaches.[PO1,PO2,PO3,PSO1,PSO2]
4. Develop an understanding of strain energy approach to analyze redundant truss structures. [PO1, PO2, PO3, PSO1, PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome(PO's)												PSO's		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply Matrix concept through flexibility and stiffness system approaches.	2	3	3										2	3	
02	Idealize the structural elements and loads and analyze statically indeterminate or redundant structures by Slope Deflection method as a classical approach.	2	3	3										2	3	
03	Analyze continuous beams and frames by Cross method and Kani's method and understanding its iterative nature of obtaining solutions.	2	3	3										2	3	
04	Develop an understanding of strain energy approach to analyze redundant truss structures.	2	3	3										2	3	

1-Low, 2-Moderate, 3-High

Course Title : DESIGN OF RC STRUCTURAL ELEMENTS			
Course Code: P17CV54	**Semester: V**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This Course aims to

1. To provide basic knowledge of mathematics, science and engineering in the areas of limit state of collapse and serviceability of R.C. elements.
2. Enable the students to identify, formulate and solve engineering problems of R C elements subjected to flexure, shear and torsion.
3. To give procedural knowledge to design a R C elements such as beams, slabs, columns and footings subjected to various load combinations with different boundary conditions.
4. To imbibe the culture of professional and ethical responsibilities by following codal provisions in the analysis, design and detailing of R C elements for strength and durability.
5. To show the impact of engineering solutions on the society and also will be aware of contemporary issues regarding failure of structures due to wrong design, use of poor quality of materials and faulty construction methods.

Course Content

UNIT – I

INTRODUCTION TO LIMIT STATE DESIGN: Philosophy and principle of limit state design along with the assumptions, Partial safety factors Characteristic Load and Strength. Introduction to stress block parameters, Concept of balanced, under and over reinforced sections. Limit state of collapse in flexure of rectangular sections with examples.

Self Study Component: Philosophy of ultimate load method and working stress method. **10 Hrs**

UNIT – II

LIMIT STATE OF COLLAPSE IN FLEXURE, SHEAR AND TORSION: Limit state of collapse in flexure of flanged sections with examples. Limit state of collapse in shear and torsion with examples. Importance of bond, anchorage, lap length.

Self Study Component: Deflection and cracking using IS codal provisions. **10 Hrs**

UNIT – III

LIMIT STATE DESIGN OF BEAMS: Design of singly Reinforced, Doubly Reinforced, Flanged Beams [T and L beams].

Self Study Component:-Design of Beams subjected to Torsion **12 Hrs**

UNIT – IV

LIMIT STATE DESIGN OF SLABS AND STAIRS: Design of one way and two way slabs with different end conditions. Design of dog legged and open well stairs.

Self Study Component:-Design of Tread riser types of stair**.** **10 Hrs**

UNIT – V

LIMIT STATE DESIGN OF COLUMNS AND FOOTINGS: Design of short axially loaded RC columns, with uniaxial and bi-axial moments. Footings with axial load and moment – Square and Rectangular types.

Self Study Component:-Design of columns with helical reinforcement**.** **10 Hrs**

TEXT BOOKS:

1. SINHA S N, Reinforced Concrete Design, II edition, Tata McGraw Hill Publications.
2. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, TMH, 3rd Edition 2009

REFERENCES:

1. Park and Paulay, Reinforced Concrete, John Wiley and Sons
2. Punmia B C, Jain A K and Jain A K, Reinforced Concrete Design, Lakshmi Publications, New Delhi.
3. Jain A K, Limit State Method of Design, Nem Chand and Brothers, Roorkee.
4. Karve S R and Shah V L, Limit State Theory And Design Of Reinforced Concrete –Vidyarthi Prakashan, Pune.
5. N Subramannaya, Design of RC Structures, Oxford IBH

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

Student will be able to

1. Apply the knowledge of engineering fundamentals in the areas of limit state method and the concept of design of R.C. structural elements.[PO1,PSO1]
2. Identify, formulate and solve engineering problems in reinforced concrete elements like beam , slabs, columns , footing subjected to tension, compression and flexure.[PO2,PSO2,PSO3]
3. Practice the culture of professional and ethical responsibilities by following codal provisions of IS;456-2000 and SP:16 in the analysis, design and detailing of R.C. structural elements,[PO4, PO8,PSO2,PSO3]
4. Gain the factual knowledge on analysis and design of reinforced concrete and indulge in lifelong learning [PO3, PO8, PSO3]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome											Program Specific outcome			
		1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO2	PSO 3
01	Apply the knowledge of engineering fundamentals in the areas of limit state method and the concept of design of R.C. structural elements	**3**												**3**		
02	Identify, formulate and solve engineering problems in reinforced concrete elements like beam , slabs, columns , footing subjected to tension, compression and flexure		**3**												**2**	**3**
03	Practice the culture of professional and ethical responsibilities by following codal provisions of IS;456-2000 and SP:16 in the analysis, design and detailing of R.C. structural elements				**3**				**3**						**3**	**3**
04	Gain the factual knowledge on analysis and design of reinforced concrete and indulge in lifelong learning			**3**					**3**							**3**

1-Low, 2-Moderate, 3-High

Course Title : BASIC GEOTECHNICAL ENGINEERING			
Course Code: P17CV551	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This course aims to know

1) History of soil mechanics, origin and formation of soil.
2) Clay mineralogy and soil structure, soil as three phase system and interrelationship
3) Index properties and their determination, classification of soil.
4) Flow of water through soils, compaction of soils.
5) Effective stress concept and consolidation of soil.

Course Content

UNIT– I

INTRODUCTION: History of soil mechanics, origin and formation of soil.

CLAY MINERALOGY AND SOIL STRUCTURE- Primary and Secondary valence forces, clay mineral structure, common clay minerals in soils – Kaolinite, Illite and Montmorillonite, soil water interaction – diffuse double layer and double layer repulsion; structure of coarse grained soils – single grained structure, structure of fine grained soil – flocculent and dispersed structure and honeycomb structure.

SOIL AS A THRSEE–PHASE SYSTEM- Phase Diagram, Basic definitions and interrelationship.

Self Study Component: Isomorphism substitution, Specific surface, cation exchange capacity of soil **12 Hrs**

UNIT– II

INDEX PROPERTIES OF SOILS AND THEIR DETERMINATION: Water content and specific gravity of soils and their determination, Particle size distribution, (Sieve analysis) Consistency limits- liquid limit by Casagrande's' method, plastic limit, Shrinkage limit and indices, Insitu density-Core cutter and Sand replacement method, Activity of clay.

CLASSIFICATION OF SOILS: Purpose of soil classification, Particle size classification–IS classification, unified soil classification, Plasticity chart and its importance, Field identification of soils.

Self Study Component: Particle size distribution by Hydrometer analysis Determination of liquid limit by fall cone methods.

10 Hrs

UNIT– III

FLOW OF WATER THROUGH SOILS: Darcy's law- assumption and validity, coefficient of permeability and its determination (laboratory tests), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation.

COMPACTION OF SOILS: Definition, Principle of compaction, Standard and Modified proctor's compaction, factors affecting compaction, Effect of compaction on soil properties Field compaction control, and Proctor needle.

Self Study Component:-Determination of coefficient of permeability by field method, Compacting equipments

10 Hrs

UNIT– IV

EFFECTIVE STRESS CONCEPT – Total and effective stresses, Pore water pressure, Terzaghi's effective stress equation and its limitations, Capillary phenomena, Quick sand phenomena.

CONSOLIDATION OF SOILS : Definition, spring analogy for normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by- Casagrande's method, Consolidation characteristics of soil (Cc, av, mv and Cv),Terzaghi's one-Dimensional consolidation theory (Assumptions and limitations only) Laboratory 1-D consolidation test to determine the consolidation characteristics of soil, determination of coefficient of consolidation by square root of time fitting method, logarithmic time fitting method.

Self Study Component: Determination of pre consolidation pressure by Log- log method, Determination of Coefficient of consolidation by Rectangular hyperbola method. **10 Hrs**

UNIT– V

SHEAR STRENGTH OF SOILS: Concept of shear strength, Mohr's-coulomb theory, conventional and modified failure envelopes, Total and effective shear strength parameters, Laboratory determination of shear strength of soils – Direct shear test, Triaxial compression test, Unconfined compression test and vane shear test, Test under different drainage conditions, sensitivity and Thixotropy of clay.

Self Study Component: Concept of pore pressure, factors affecting shear strength of soils**.** **10 Hrs**

TEXT BOOKS:

1. Soil Mechanics and Foundation Engg.- Punmia B.C. (2005), 16th Edition Laxmi Publications Co. , New Delhi.
2. Soil Mechanics and Foundation Engineering- Murthy V.N.S. (1996), 4th Edition, UBS Publishers and Distributors, New Delhi.

REFERENCES:

1. Foundation Analysis and Design- Bowles J.E. (1996), 5th Edition, McGraw Hill Pub. Co. New York.
2. Basic and Applied Soil Mechanics- Gopal Ranjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi.
3. Geotechnical Engineering- Venkataramaiah C. (2006), 3rd Edition New Age International (P) Ltd., New Delhi.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

Student will be able to

1. Apply the knowledge of chemistry & Geology to distinguish structural arrangements of soils.[PO1,PSO1]
2. Examine and evaluate index properties of soils [PO2,PSO2]
3. Implement compaction and consolidation characteristics of ground modification for sustainable developments [PO7, PSO3]
4. Examine and evaluate the shear strength of soil. [PO2,PSO2]

Course Articulation Matrix CAM)

Sl. No	Course Outcomes	Programme Outcome												PSO's		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of chemistry & Geology to distinguish structural Arrangements of soils.	2												2		
02	Examine and evaluate index properties of soils		3												3	
03	Implement compaction and consolidation characteristics of ground modification for sustainable developments							3								2
04	Examine and evaluate the shear strength of soil		3												2	

1- Low, 2-Moderate, 3-High

Course Title : MECHANICS OF COMPOSITE MATERIALS			
Course Code: P17CV552	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This course aims to

1. Gain the knowledge of mathematics, science and engineering to understand the basic properties of composite materials.
2. Learn the analysis and evaluate the stress strain characteristics and orientation for stability of composite materials.
3. Identify, investigate and evaluate failure and fracture characteristics of composites.
4. Study the analysis, design and explore various composite materials.
5. Understand the applications leading to environmental sustainability.

Course Contents

UNIT I

Introduction: Introduction to composites, classification of composite materials, commonly used fiber and matrix constituents, manufacture of composites, properties of unidirectional composites along lateral and longitudinal directions, rule of mixture.

Self Study Component:-Poisson's ratio **10 Hrs**

UNIT II

Stress strain relations: Concepts in solid mechanics, Hooke's law for orthotropic and anisotropic materials, linear elasticity for anisotropic materials, rotations of stresses, strains, residual stresses.

Self Study Component:-Compliance and stiffness matrix **10 Hrs**

UNIT III

Analysis of laminated composites: Governing equations for anisotropic and orthotropic plates. Angle-ply and cross ply laminates – static, dynamic and stability analysis for simpler cases of composite plates, inter laminar stresses.

Self Study Component:- Coupling in anisotropic composite materials **12 Hrs**

UNIT IV

Failure and fracture of composites: Netting analysis, failure criterion, maximum stress, maximum strain, fracture mechanics of composites, sandwich construction.

Self Study Component: Failure of hybrid laminates **10 Hrs**

UNIT V

Applications and design: Metal and ceramic matrix composites, applications of composites, composite joints, design of composites (volume calculations only), review, environmental issues

Study Component: - Applications of composites in civil engineering **10 Hrs**

TEXT BOOKS:

1. Agarwal.B.D., Broutman.L.J., and Chandrashekara.K. "Analysis and Performance of Fiber Composites", John-Wiley and Sons, 2006.
2. Daniel.I.M., and Ishai.O, "Engineering Mechanics of Composite Materials", Oxford University Press, 2005.

REFERENCES:

1. Hyer M.W., and White S.R., "Stress Analysis of Fiber-Reinforced Composite Materials", D.Estech PublicationsInc., 2009
2. Jones R.M., "Mechanics of Composite Materials", Taylor and Francis Group 1999.
3. Mukhopadhyay.M, "Mechanics of Composite Materials and Structures", Universities Press, India, 2005.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes:

The Student will be able to:

1. Apply the knowledge of mathematics, science and engineering to understand the basic properties of composite materials.[PO1,PO2,PSO1]
2. Analyze and evaluate the stress strain characteristics and orientation for stability of composite materials.[PO1,PO2,PSO2]
3. Identify, investigate and evaluate failure and fracture characteristics of composites.[PO4,PSO2]
4. Analyze, design and explore various composite materials and its applications leading to environmental sustainability.[PO3,PO6,PO7,PSO3]

Course Articulation Matrix (CAM)

Sl. No	Course Outcomes	Programme Outcome												PSO's		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of mathematics, science and engineering to understand the basic properties of composite materials	3	1											2		
02	Analyze and evaluate the stress strain characteristics and orientation for stability of composite materials	2	3												2	
03	Identify, investigate and evaluate failure and fracture characteristics of composites				3										2	
04	Analyze,design and explore various composite materials and its applications leading to environmental sustainability			3			2	2								2

1- Low, 2-Moderate, 3-High

Course Title : CONSTRUCTION QUALITY AND SAFETY MANAGEMENT			
Course Code: P17CV553	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This course aims to

1. Facilitate the understanding of Quality Management principles and process.
2. Remember quality control processes for different works in construction industry.
3. Apply the knowledge of Total Quality Management for quality certification of construction projects.
4. Understand the concepts of safety management relevant to construction industry.
5. Describe the safety practices to be followed to prevent common hazards in construction sites.

Course Content

UNIT I

QUALITY: Principles, Concepts in Quality Management, Managing for quality, Impact of Quality Management in Business and Commerce.

Quality Control, Quality costs and its components, Features of Quality, Determinants of service Quality, Need for Quality management in industry.

Self Study Component: Objectives, structure, steps in formation of Quality Circle. **11 Hrs**

UNIT II

TOTAL QUALITY MANAGEMENT: Meaning and Scope, TQM models – Oakland Model, integrated model of TQM, Building blocks of TQM, 3-D Model of TQM, Benefits of TQM program, causes for TQM failures, Remedial measures, Quality Manuals, System Procedures. ISO: 9001:2000 - Process Approach, Compatibility with other management systems, certification Procedure, ISO: 9000 for construction, ISO 14000: Environmental Management – general requirements, , Planning, Implementation and operation.

Self Study Component: Environmental Policy, Checking and Corrective action. **11 Hrs**

UNIT III

QUALITY CONTROL IN CONSTRUCTION PROJECTS: QC in concreting, Brick work, stone masonry, Formwork, Foundations, Piling work, Structural work, Woodwork & Timber, Painting, Electrical system, Waste recovery and maintenance.

Self Study Component: Roles and Responsibilities of Leader/ Deputy leader, Prerequisites for a successful leader **10 Hrs**

UNIT IV

Safety Management: Introduction**,** salient features of safety programs, general safety programs for construction. Safe working environment, Safety clauses in contract documents, Safety programme, Safety policy, Safety department, safety officers, safety records, safety training.

SAFETY STANDARDS Indian standards for safety in construction, BIS standards, American National Standards.

Self Study Component: Safety lacunae in Indian Construction Industry **10 Hrs**

UNIT V

CONSTRUCTION ACCIDENTS AND SAFETY: Accident- Causes, Effects and Safety measures, Legal requirements, Responsibility of the employers. Reporting occurrence of accidents, Reporting occurrence of hazards, Action to be taken by the Site-in-charge in case of accidents.

Self Study Component: Common Hazards- Materials, Movement, Drowning, Openings, Weight.

10 Hrs

TEXT BOOKS:

1. Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Lakshmi Publications Pvt. Ltd., New Delhi.
2. Total Quality Management by B. Janakiraman and R.K. Goapal, Prentice-Hall of India Private Limited, New Delhi
3. Construction Safety Management, NICMAR Publications, Hyderabad, October 2003.

REFERENCE BOOKS:

1. Total Quality in Construction Projects by Hellard R.B.: Achieving profitability with customer satisfaction, Thomas Telford, London, 1993.
2. Jimmy W. Hinze, construction safety, Prentice hall Inc 1997

Note: Self study is for 5 marks only in CIE and not in SEE

.Course outcomes:

After studying this course, students will be able to;

1. Describe the quality management principles,& control processes related to construction projects.[PO2,PO11,PO12,PSO2]
2. Demonstrate the knowledge of Total Quality Management for quality certification of construction projects.[PO1,PO11,PO12,PSO2]
3. Define the safety concepts pertaining to safety management in construction industry.[PO1,PO11,PSO3]
4. Illustrate the safety practices to mitigate common hazards in construction site.[PO1,PO11,PSO1]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	6	6	7	8	9	10	11	12	PS O1	PS O2	PS O3
01	Describe the quality management principles,& control processes related to construction projects		**2**									**2**	**1**		**2**	
02	Demonstrate the knowledge of Total Quality Management for quality certification of construction projects	**1**										**3**	**1**		**2**	
03	Define the safety concepts pertaining to safety management in construction industry.	**1**										**2**				**2**
04	Illustrate the safety practices to mitigate common hazards in construction site.	**1**										**3**		**2**		

1-Low, 2-Moderate, 3-High

Course Title : OPEN CHANNEL HYDRAULICS			
Course Code: P17CV554	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This course aims to

1. Differentiate open channel flow and to determine whether a flow with specified volumetric flow rate and depth of flow through an open channel of given shape & size, is critical, subcritical or supercritical flow.
2. Use the Manning Equation to calculate volumetric flow rate, average velocity, Manning roughness coefficient, or channel bottom slope, if given adequate information about a reach of open channel flow
3. Determine the critical slope for a specified volumetric flow rate through an open channel of specified shape, size, & Manning roughness coefficient.
4. Identify surface profile (e.g. M1, M2, M3, S1, S2, S3, etc.) in a specified gradually varied flow situation.
5. Calculate the depth of flow after a hydraulic jump given the depth before the hydraulic jump, the volumetric flow rate and the shape and dimensions of the open channel.

Course Content

UNIT – I

INTRODUCTION: Open channels, types, channels of first kind and channels of second kind. Difference between pipe flow and open channel flow, classification of flow, pressure distribution open channel flow, energy equation, momentum equation, kinetic energy and momentum factors, problems.

UNIFORM FLOW: Concepts, uniform flow equations, conveyance of channel section, section factor for uniform flow, Normal slope and critical slope, hydraulic exponent for uniform flow, design of channels for uniform flow, standard channel sections- problems.

Self study component: Surges in open channels. **12 Hrs**

UNIT – II

CRITICAL FLOW: Concept of specific Energy .Calculation of critical depth for rectangular, triangular, circular and trapezoidal sections, Design of channel, Section Factor for critical flow, Hydraulic exponent for critical flow, critical depth as a flow measurement, problems.

GRADUALLY VARIED FLOW: Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation for wide rectangular channels, classification of channel bottom slopes, classification of water surface profiles in different sloped channels-problems. **10Hrs**

Self study component: Control sections.

UNIT – III

Gradually Varied Flow Computations - Different methods, direct integration method- Chow's solution, Bresse's Solution, direct step method, standard step method and graphical integration method. Problems.

Self study component: Backwater curves in natural channels. **10Hrs**

UNIT – IV

Rapidly Varied Flow: Concepts, hydraulic jump in rectangular channels, classification of hydraulic jump based on Froude's number, characteristics of hydraulic jump, Tail water curve and jump water curve, classification of hydraulic jump based on tail water depth, problems.

Self study component: Location of hydraulic jump. **10Hrs**

UNIT –V

Hydraulic Jump in non rectangular channels, jump in exponential channels, jump in Sloping channels, application of hydraulic jump as energy dissipater, stilling basins – type-II and type – IV, overflow spillways(ogee spillway), problems.

Self study component: Siphon spillways **10Hrs**

TEXTBOOKS:

1. Open Channel Hydraulics: Ven Tee Chow: Mc Graw Hill Book Company, New Delhi.
2. Flow through Open Channel: R G Rangaraju: Tata McGraw Hill Publishing Co Ltd, New Delhi.
3. Open Channel Hydraulics: K Subramanya: Tata Mc Graw Hill Publishing Co Ltd, New Delhi

REFERENCE BOOKS:

1. Open Channel Hydraulics: French: Mc Graw Hill Book Company, New Delhi.
2. Fluid Mechanics: Modi and Seth: Standard Book Home, New Delhi.
3. Open Channel Hydraulics: Henderson: Mr. Millan Publishing Co. Ltd., New York.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

Student will be able to

1. To apply the knowledge of fluid mechanics, conservation equations for mass, momentum, and energy to develop a strong knowledge of open channel flow. (PO1) (PSO 1)
2. To Analyze and compute flow profiles. (PO2 and PO3) (PSO 2)
3. To develop and apply relationships for hydraulic jumps. (PO2) (PSO 2)
4. Apply the knowledge of open channel flow in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs.(PO5, PO9, PO11) (PSO 3)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO2	PS O3
01	To apply the knowledge of fluid mechanics, conservation equations for mass, momentum, and energy to develop a strong knowledge of open channel flow.	**3**												**3**		
02	To Analyze and compute flow profiles.		**3**	**2**											**3**	
03	To develop and apply relationships for hydraulic jumps.		**3**												**3**	
04	Apply the knowledge of open channel flow in future to work effectively either as an individual or as a team member to satisfy the changing professional and societal needs.					**2**				**1**		**3**				**3**

1-Low, 2-Moderate, 3-High

Course Title : ALTERNATIVE BUILDING MATERIALS			
Course Code: P17CV561	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Know the significance of Energy and environmental issues concerned to building materials and understanding the characteristics of building blocks for walls.
2. Know about Lime-pozzolana cements, Fibre reinforced concretes and building materials from agro and industrial wastes.
3. Know about new Alternative Building Technologies and different construction methods.
4. Design the masonry compression elements, Concepts in lateral load resistance.
5. Gain the knowledge about cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.

Course Content

UNIT I

Introduction: Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building technologies, Requirements for building of different climatic regions, Traditional building methods.

Alternative Building Materials: Characteristics of building blocks for walls, Stones and Laterite blocks and hollow clay blocks, Concrete blocks, Stabilized mud blocks, Steam cured blocks, Fal-G Blocks stone masonry block.

Self study component: Vernacular architecture, Bricks **12 Hrs**

UNIT II

Lime-pozzolana cements: Raw materials, Manufacturing process, Properties and uses, Fibre reinforced concrete, Matrix materials, Fibers: metal and synthetic, Properties and applications,

Fibre reinforced plastics, Matrix materials, Fibers: organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of

Industrial wastes and Properties and applications.

Self study component: Field quality control test methods, mine wastes **10 Hrs**

UNIT III

Alternative Building Technologies: Alternative for wall construction, Types, Construction method. Masonry mortars, Types , Preparation, Properties, Ferro cement and ferro concrete building components, Materials and specifications, Properties, Construction methods, Applications. Alternative roofing systems, Concepts, Filler slabs, Composite beam panel roofs.

Self study component: Masonry vaults and domes. **10 Hrs**

UNIT IV

Structural Masonry: Compressive strength of masonry elements, Factors affecting compressive

strength, Strength of units, prisms / wallettes and walls, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry.

IS Code provisions: Design of masonry compression elements, Concepts in lateral load resistance.

Self study component:-Effect of brick work bond on strength **10 Hrs**

UNIT V

Cost effective building design: Cost concepts in buildings, Cost saving techniques in planning, design and construction.

Equipment for production of alternative materials: Machines for manufacture of concrete, Equipment's for production of stabilized blocks, Moulds and methods of production of precast elements.

Self study component:-Cost analysis: Case studies using alternatives. **10 Hrs**

TEXT BOOKS:

1. Jagadish.K.S, Venkatarama Reddy.B.V and Nanjunda Rao.K.S. "Alternative Building Materials and Technologies" , New Age Int. Pub. New Delhi – 2008.(Ch.1 to 8)
2. Hendry A.W., "Structural Masonry", 2nd Ed., Palgrave Macmillan Publishers, 1988.(Ch.7 & 8)

REFERENCES:

1. "Proceedings of workshop on Alternative Building Material and Technology" 19th – 20th Dec 2003 @ BVB College of Engineering & Tech, Hubli.(Ch.3,4 & 5)
2. Manuals published by HUDCO.9ch. 7 & 8)
3. Relevant IS 2250 : 1985, IS 3466 : 1999, IS 4098 : 1999, IS 2116 :1998, IS 1095 : 1998

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

Student will be able to

1. Apply the knowledge of science and technology for selection of alternate building materials.[PO1,PSO1]
2. Analyze and evaluate the embed energy of various alternate building materials.[PO2,PSO2]
3. Analyze alternate building technologies for walls & roofs and evaluate strength of structural Masonry for Sustainable development as per codal provisions[PO2, PSO2].
4. Design and demonstrate cost effective building using alternative materials &technology. [PO2, PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
01	Apply the knowledge of science and technology for selection of alternate building materials.	**2**													**2**	
02	Analyze and evaluate the embed energy of various alternate building materials		**2**												**2**	
03	Analyze alternate building technologies for walls & roofs and evaluate strength of structural.		**2**												**2**	
04	Design and demonstrate cost effective building using alternative materials &technology.			**2**											**2**	

1-Low, 2-Moderate, 3-High

Course Title : MUNICIPAL AND RURAL SANITATION			
Course Code: P17CV562	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Understand the concept of sanitation and its importance and understand the drinking water quality standards.
2. Understand the General methods of control, Water borne, Airborne, Communicable diseases and modes of communication,
3. Explain the Concept of Eco sanitation
4. Explain the concept of refuse collection disposal.
5. Explain the concept of milk sanitation, Food sanitation and Swimming pool sanitation.

Course Content

UNIT– I

INTRODUCTION: Definition of Sanitation, , Need for protected water supply, Investigation for water supply scheme, Protection of well waters, Rain water harvesting its needs and uses, methods of recharging ground water using water from roof tops of buildings.

Self study component: Sanitation status in India, Drinking water quality standards. **11 Hrs**

UNIT– II

COMMUNICABLE DISEASES: Terminology, modes of communication, general methods of control. Waterborne, Air borne, vector borne and Rodent borne diseases, Zoonosis Occurrence and their control.

Self study component: Water borne diseases and their control**.** **11 Hrs**

UNIT– III

ECOLOGICAL SANITATION: Concept of Eco-san components of sanitation:- Criteria for sanitation, Trenching composting toilets, Two pit latrines, Aqua privy,Eco- toilets

Self study component: Method of recharging ground water using by different methods. **10 Hrs**

UNIT– IV

REFUSE COLLECTION DISPOSAL: Definition, Elements of management, collection, Transport and disposal-open dumping, composting, land filling-Advantages and Disadvantages.

Self study component: Elements of transfer and transport of refuse**.** **10 Hrs**

UNIT– V

MILK SANITATION: Essential, Diseases transmitted, test for milk quality pasteurization-H.T.S.T, L.T.L.T, Ultraviolet.

FOOD SANITATION: food Contamination, food borne infection and Intoxication food adulteration Effects and Control.

SWIMMING POOL SANITATION: Diseases, Athletes food, swimming Itch, Sore Elbow-Causes and Control, Control of algae.

FAIRS AND FESTIVAL SANITATION:- Problems involved –case studies like khumbhamela steps of sanitation**.**

Self study component: Case studies like Khumbhamela and similar festivals **10Hrs**

TEXT BOOKS:

1. "Environmental sanitation – Joseph A Solvato – John Willey.
2. Municipal rural sanitation – Ehler, VMl Steel EW, T.M.M.

REFERENCES:

1. Ecological sanitation – Unowinblad &Stockholm Environmental Institute.
2. Preventive and social medicine – Park & Park.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

Students will be able to

1. Identify different communicable diseases, effects and its control. [PO2,PSO1]
2. Apply the knowledge of basic science and engineering for surface and sub- surface water pollution prevention in rural areas from health consideration. [PO6,PSO1]
3. Apply the knowledge of Eco-sanitation in rural areas for environment sustainability. [PO7,PSO3]
4. Suggest remedial measures to maintain sanitation in swimming pool, milk and food infections for public health protection. [PO6,PSO2,PSO3]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
01	Identify different communicable diseases, effects and its control.		**3**											**2**		
02	Apply the knowledge of basic science and engineering for surface and sub- surface water pollution prevention in rural areas from health consideration.						**2**							**2**		
03	Apply the knowledge of Eco-sanitation in rural areas for environment sustainability.							**2**								**3**
04	Suggest remedial measures to maintain sanitation in swimming pool, milk and food infections for public health protection.							**2**							**2**	**3**

1-Low, 2-Moderate, 3-High

Course Title : PAVEMENT DESIGN AND ANALYSIS			
Course Code: P17CV563	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %;**	**SEE: 50%**

Course Learning Objectives (CLOs)

This course aims to

1. Gain knowledge of science and engineering to acquire the fundamentals of various factors affecting design and performance of pavements.
2. Calculate the stresses and deflection in flexible pavements.
3. Calculate the stresses and deflection in rigid pavements.
4. Design of flexible pavements by IRC method.
5. Design of rigid pavements by IRC method.

Course Content

UNIT – I

Introduction: Factors Affecting Pavement Design, Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types, Tire Pressure, Contact Pressure, EAL and ESWL Concept, Lane Distributions & Vehicle Damage Factors.
Self study component:-Effect of Transient & Moving Loads. **11 Hrs**

UNIT – II

Stresses And Deflections In Flexible Pavements: Stresses and deflections in homogenous masses. Burmister's two-layer theory, three layer and multilayer theories, Problems on above.
Self study component:-Application of two layer theory in flexible pavement design. **11 Hrs**

UNIT – III

Flexible Pavement design: Design Methods Principle, design steps, advantages and applications of different pavement design methods – Group Index, CBR, McLeod, Kansas Triaxial test, IRC, and AASHTO methods

Self study component:-Asphalt Institute method of pavement design **10 Hrs**

UNIT – IV

Stresses In Rigid Pavements: Factors affecting design and performance of pavements. Types of stresses and causes, factors influencing the stresses, general considerations in rigid pavement analysis, EWL, wheel load stresses, warping stresses, frictional stresses, combined stresses. Problems on above.
Self study component:-Westergaard's analysis of rigid pavements **10 Hrs**

UNIT – V

Rigid Pavement Design: Types of joints in cement concrete pavements and their functions, joint spacing, design of CC pavement for roads and runways, design of joint details for longitudinal joints, contraction joints and expansion joints. IRC method of design by stress ratio method. Problems on above
Self study component:- Design of continuously reinforced concrete pavements. **10 Hrs**

TEXT BOOK:

1. Yoder, E.J., and Witczak, `Principles of Pavement Design', 2nd ed. John Wiley and Sons, 1975.
2. Yang, `Design of Functional Pavements', McGraw Hill Book Co.
3. Khanna and Justo, 'Test Book of Highway Engineering 'Nemchand brothers, Roorke-2004.

REFERENCE BOOKS:

1. Relevant IRC codes
2. Principles of Transportation Engineering- Partha Chakra Borthy, Prentice- Hall.
3. Specifications for Roads and Bridges- MoRT& H, IRC, New Delhi
4. HRB/TRB/IRC/International Conference on Structural Design of Asphalt Pavements.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of science and engineering to acquire the fundamentals of various factors affecting design and performance of pavements. [PO1,PO3,PSO1]
2. Calculate the stresses and deflection in flexible pavements. [PO3,PO6,PSO1,PSO2]
3. Calculate the stresses and deflection in rigid pavements. [PO3,PO6,PSO1,PSO2]
4. Design flexible and rigid pavements. [PO2,PO3,PO6,PSO2,PSO3]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome – CO	Program outcome												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of science and engineering to acquire the fundamentals of various factors affecting design and performance of pavements.	1		1										3		
02	Calculate the stresses and deflection in flexible pavements.			3			1							1	2	
03	Calculate the stresses and deflection in rigid pavements.			3			1							1	2	
04	Design flexible and rigid pavements.		1	3			2								3	1

1-Low, 2-Moderate, 3-High

Course Title : BUILDING SERVICES			
Course Code: P17CV564	**Semester: V**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Gain the knowledge of different building services and their types used in buildings.
2. Understand requirements and constraints in providing building services suitable for buildings.
3. Determine design factors of building services suitable for buildings.
4. Understand concepts of Elevators & Escalators, their types, working principle & design principles and type of energy conservation technologies suitable for buildings.
5. Determine factors of building services like ventilation, thermal comfort & illumination in buildings.

Course content

UNIT I

Ventilation: Definition, Necessity, Functional Requirements of Ventilation, Types of Ventilation- Natural Ventilation and Artificial Ventilation Sound Amplification Equipments- Necessity, Factors affecting, Mechanism of sound amplification,

Thermal comfort in buildings: Factors affecting, heat transfer through buildings, thermal properties of building materials, insulation materials for buildings. Communication systems- terminologies, necessity, systems of communication.

Self study component: Types of sound amplification equipments. **11Hrs**

UNIT II

Electrical wiring: Planning of Electrical Supply System, - Systems of wiring- domestic and commercial buildings, - Materials and Devices used in Wiring. Earthing- Procedure and Types, Inspection and Testing of Installation, Electrical Supply layout and conventional symbols of electrical items.

Fire protection: Necessity, fire hazards, characteristics and types of fire resistant materials, fire load and its calculation, fire resistant construction – walls and columns, floors and roofs, wall openings, escape elements and strong room construction, fire protection equipment.

Self study component: General fire safety requirements. **11 Hrs**

UNIT III

Illumination of buildings: Definition, laws of illumination, principles of illumination, artificial lighting, day lighting, flood lighting, Introduction to various types of lamps.

Acoustics:-Definition of terminologies, Behaviour of Sound in enclosures, Acoustic materials- properties, Acoustical Defects & Remedies, design of assembly halls, theatre.

Self study component: Auditorium and musical Studio. **10 Hrs**

UNIT IV

Noise control in buildings: Sound insulation-Materials, Types- Horizontal Barriers & Vertical Barriers.

Elevators – Components of an typical elevator, types, working principle, principles of design of an elevator.

Escalator: Necessity, Components of a typical escalator, working principle.

Self study component: Design considerations of escalator. **10Hrs**

UNIT V

Energy conservation in buildings: Necessity, Advantages and Limitations , Introduction to Zero Energy Buildings& Green Buildings , Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation.

Self study component: LEED Certification for buildings **10Hrs**

TEXT BOOKS:

1. Mechanical and Electrical Systems in Buildings, by Tao, Prentice Hall publications
2. Building construction by B.C. Punmia, Laxmi Publications.
3. A Text Book on Building Construction by P.C.Varghese, Prentice Hall of India publications
4. Architectural Lighting by Bran David.
5. Acoustics and noise control-theory, design by S.K.Kandaswamy(Ed), practice-allied publishers

REFERENCE BOOKS:

1. Mechanical Services for Buildings by Eastop, Longman Publications.
2. IS SP41and SP32-hand book on functional requirements of buildings

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes:

After studying this course, students will be able to;

1. Prepare the design factors for providing ventilation, thermal comfort & in construction of buildings.[PO3,PO12,PSO2]
2. Interpret the knowledge of design factors of electric and fire protection in building construction. [PO1,PO3,PO12,PSO1]
3. Prepare the design factors for providing illumination, acoustics and noise control construction of buildings.[PO3,PO12,PSO2]
4. Choose & suggest type of elevators & escalators based on working principle & design principles and type of energy conservation technologies suitable for buildings. [PO3,PO12,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Prepare the design factors for providing ventilation, thermal comfort & in construction of buildings.			**3**									**2**		**2**	
02	Interpret the knowledge of design factors of electric and fire protection in building construction	**1**		**2**									**2**	**2**		
03	Prepare the design factors for providing illumination, acoustics and noise control construction of buildings.			**3**									**2**		**2**	
04	Choose & suggest type of elevators & escalators based on working principle & design principles and type of energy conservation technologies suitable for buildings.			**3**									**2**		**2**	

1-Low, 2-Moderate, 3-High

Course Title : CONCRETE AND HIGHWAY MATERIALS TESTING LABORATORY			
Course Code: P17CVL57	**Semester: V**	**L – T – P – H : 0– 0 – 3 – 3**	**Credits:1.5**
Contact Period - Lecture: 39Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Characterize the physical properties of cement and correlate with the specifications of relevant IS codes.
2. Determine the basic physical properties of fine aggregates and coarse aggregates.
3. Determine the properties of fresh concrete and hardened concrete.
4. Gain the knowledge and determine the strength of specimens by NDT.
5. Determine the properties of bituminous materials.

Course Content

CEMENT: Normal Consistency, Setting time, Soundness test, Compression strength test, fineness test by Sieve analysis and Air permeability method, Specific gravity of cement. **9 Hrs**

FRESH CONCRETE: Workability–Slump, Compaction factor and VeeBee tests.
HARDENED CONCRETE: Compression strength and Split tensile tests. Test on flexural strength of RCC beams.Test on hardened concrete using NDT –Rebound hammer and Ultrasonic test. **12 Hrs**

AGGREGATES: Crushing, abrasion, impact and Shape tests (Flaky, Elongation, Angularity number) Specific gravity and water absorption. **9 Hrs**

BITUMINOUS MATERIALS: Specific Gravity, Penetration, Ductility, Softening point, Flash and fire point, Viscosity. **9 Hrs**

TEXT BOOKS:

1. Concrete technology-M.S Shetty, Chand S and Co.
2. Highway Material and pavement Testing- S.K.Khanna, CEG Justo, A.veeraragavan- Nemi Chand & Bros-Roorkee

REFERENCES:

1. Relevant IRC Codes.
2. Highway Material Testing Laboratory Manual– Nemi Chand & Bros.

Course Outcomes (COs)

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

1. Determine the physical properties of cement like consistency, setting time, compressive strength etc., and correlate with the specifications of relevant IS codes. (PO1, PO2, PO4,PSO1)
2. Determine the basic physical properties of fine aggregates and coarse aggregates. (PO1, PO2, PO3, PO4, PSO2).
3. Determine the properties of fresh concrete and hardened concrete. (PO2, PO3, PO4, PO5,PSO2)
4. Determine the properties of bituminous materials. (PO3, PO4, PO5,PSO2)

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
01	Determine the physical properties of cement like consistency, setting time, compressive strength etc., and correlate with the specifications of relevant IS codes.	**1**	**1**		**2**									**2**		
02	Determine the basic physical properties of fine aggregates and coarse aggregates.	**1**	**1**	**2**	**3**										**2**	
03	Determine the properties of fresh concrete and hardened concrete.		**1**	**1**	**2**	**2**									**2**	
04	Determine the properties of bituminous materials.			**1**	**2**	**2**									**2**	

1-Low, 2-Moderate, 3-High

Course Title : CAD LABORATORY-1(AUTO CAD, BUILDING DRAWING)			
Course Code: P17CVL58	**Semester: V**	**L – T – P – H : 0– 0 – 3 – 3**	**Credits:1.5**
Contact Period - Lecture: 39Hrs.; Exam: 3Hrs.		**Weightage: CIE: 50 %; SEE: 50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Gain the knowledge of AUTO CAD software and its applications.
2. Apply engineering knowledge to draw components of building like doors, windows etc. using AUTO CAD.
3. Prepare plan and develop the elevation and cross sectional details for the given building plan using AUTO CAD.
4. Draw the functional requirements like water supply and sanitary layouts using AUTO CAD.
5. Develop bubble diagram and single line diagram for the given details by AUTO CAD

Course Content

UNIT-I

Introduction to AUTO CAD software and its applications. Use of drawings, editing and annotation tools. Introduction to the use of layers, blocks and dimension text leader. Presentation and plotting with AUTO CAD **06 Hrs**

UNIT-II

To prepare working drawing of components of buildings i) Stepped wall footing ii) Fully paneled and flush doors iii) half paneled and half-glazed window **09 Hrs**

UNIT-III

Functional design of building (Residential, Public and Industrial), positioning of various Components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio. **06Hrs**

UNIT-IV

Development of plan, elevation, section and schedule of openings from the given line diagram of residential buildings i) Two bed room building ii) Two storied building. **12 Hrs**

UNIT-V

Functional design of building using inters connectivity diagrams (bubble diagram), development of line diagram only for i) Primary health centre, ii) Primary school building, iii) College canteen iv) Office building v). For a given single line diagram, preparation of water supply, sanitary layouts **03 Hrs**

TEXT BOOK:

1 Building Drawing: Shah M.H and Kale C.M, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2 Building Construction by Guru Charan Singh, Standard Publishers & distributors, New Delhi.
3 AutoCAD reference guide by Dorothy Kent

REFERENCE BOOKS:

1. National Building Code, BIS, New Delhi.

Course Outcomes (Cos)

1. Develop bubble diagram and single line diagram for the given details using AUTO CAD. [PO3, PO5, PO6, PO12, PSO1, PSO2, PSO3]
2. Apply engineering knowledge to draw components of building like doors, windows etc. using AUTO CAD. [PO1,PO3,PO5,PO12,PSO1,PSO2,PSO3]
3. Prepare plan and develop the elevation and cross sectional details for the given building plan using AUTO CAD. [PO2, PO3, PO5, PO12,PSO1, PSO2, PSO3]
4. Draw the functional requirements like water supply and sanitary layouts using AUTO CAD. [PO2, PO3, PO5, PO6, PO12,PSO1, PSO2, PSO3]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome – CO	Program outcome												Program Specific Outcomes		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Develop bobble diagram and single line diagram for the given details using AUTO CAD			3		3	2						2	2	2	3
2	Apply engineering knowledge to draw components of building like doors, windows etc. using AUTO CAD	2		3		2							2	1	2	2
3	Prepare plan and develop the elevation and cross sectional details for the given building plan using AUTO CAD		1	3		3							2	1	2	3
4	Draw the functional requirements like water supply and sanitary layouts using AUTO CAD		1	3		3	2						2	2	2	3

1-Low, 2-Moderate, 3-High

Course Title : Aptitude and Reasoning Development - Advanced (ARDA)			
Course Code : P17HU510	Semester : 5	L:T:P:H :0:0:2:2	Credits: 1
Contact Period: Lecture: 32 Hr, Exam: 3 Hr		Weightage: CIE:50;% SEE:50%	
Prerequisites: Vocabulary builder, Concept of Percentage.			

Course Learning Objectives (CLOS)

This course aims to,

1. Describe the importance of reading with comprehension.
2. Explain seven dimensions approach to better reading skills.
3. Explain the purpose, plan and the ways to identify specific details in a paragraph for better comprehension.
4. Formulate easier ways to solve problems of averages.
5. Explain the Application of the technique of alligation while solving weighted average and mixture problems.
6. Describe the concepts of profit, loss, discount, marked price.
7. Explain the application of percentage in our daily life.
8. Discover different ways to identify the progressions and to compare between AP< GP and HP.
9. Explain the basic concepts in calculating simple interest and compound interest.
10. Differentiate between simple interest and compound interest and describes the importance of compound interest and its behavior.

Course Content

UNIT – I

Reading Comprehension:

Introduction: Read more and more, the process of writing and its relevance to the process of writing, how reading skills are important for aspects other than the reading comprehension questions, the daily reading scheme.

Seven dimension approach to better reading skills:

Developing the ability of understanding vocabulary in context, Ability to identify and understand main ideas, Ability to predict and identify supporting details, Understanding the use of transition and idea organization patterns, Inferences, Identifying purpose and tone, Recognizing and evaluating arguments and their common structures.

Theory of reading comprehension:

Solving RC passages is an exact science, tackling RC on the basis of evaluation of support, All passages have a topic, purpose and a plan, Other things to pick up while reading the passage– The tonality and other software related the author's viewpoint in the passage, specific details and their use in the passage, Types of questions asked in reading comprehension passage. **10 Hrs**

UNIT – II

Averages and Alligations mixtures:

Average: relevance of average, meaning of average, properties of average, deviation method, concept of weighted average. **Alligation method:** situation where allegation technique, general representation of alligations, the straight line approach, application of weighted average and alligation method in problems involving mixtures. Application of alligation on situation other than mixtures problems.

6 Hrs

UNIT – III

Profit and Loss: percentage change, original 100 concept effect of percentage increase or decrease in number, effect of successive percentage change, amount of change, comparison of two numbers through percentage and ratio, return to original concept, net percentage change to keep product fixed. Definition of basic terms— cost price, selling price, profit percentage, discount and marked price, solving problems using n/d method, techniques to tackle from standard set of problems, the concept of mark up. Concept of partnership and problems involving partnership **6 Hrs**

UNIT IV

Progression:

Arithmetic Progression: sum of given number of terms in an A.P., arithmetic mean, to insert a given number of arithmetic means between two given quantities, nth term of an A.P., finding common difference of an A.P. given 2 terms of an A.P., types of A.P.s– increasing A.P.s and decreasing A.P. s

Geometric: to find, the geometric mean between two given quantities, to insert a given number of geometric means between two given quantities, sum of a number of terms in a G.P. Types of G.P.s— increasing G. P. s type one and two , decreasing G. P. s type one and two.

Harmonic Progression: to find the harmonic mean between two given quantities, theorems related with progressions, solved examples Sample Company questions **6 Hrs**

UNIT- V

Simple Interest and Compound Interest

Concept of time value of money, Terminology pertaining to interest, Relation among Principal, Time, Rate percent per annum and total interest. Compound interest, Depreciation of value, Population, Application of interest in D.I.– The difference between simple annual growth rate and compound annual growth rate.

4 Hrs

Reference books:

1. **Trachtenberg speed system ofbasic mathematics**, published by Rupa publications.
2. AbhijithGuha **"CAT Mathematics"**published by PHI learning private limited.
3. Dr. R. S Agarwal "**Quantitative aptitude**" published by S.Chand private limited.
4. Dr. R. S Agarwal , " **Verbal reasoning**"published by S. Chand private limited.
5. Arun Sharma " **Quantitative aptitude**" for CAT by, published by McGraw Hill publication.

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Apply the approach of seven dimensions to better reading skills. L2
2. Solve the questions under reading comprehension confidently with higher accuracy than random reading. L4
3. Apply the technique of alligation for effective problem solving. L2
4. Interpret the requirement of different methods of calculating average and apply the right method at right scenario. L4
5. Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest. L5

6. Formulate the equations for summation and other functions for all the kinds of progressions– AP, GP and HP. L1

Course Articulation Matrix (CAM)															
Course Outcome (CO)	Program Outcome (ABET/NBA-(3a-k))														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Apply the approach of seven dimensions to better reading skills.	L2	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Solve the questions under reading comprehension confidently with higher accuracy than random reading.	L4	-	-	-	-	-	-	2	-	2	-	-	-	-	-
Apply the technique of alligation for effective problem solving.	L2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Interpret the requirement of different methods of calculating average and apply the right method at right scenario.	L4	2	-	-	-	-	-	-	-	2	-	-	-	-	-
Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest.	L5	3	-	-	-	-	-	-	-	2	-	-	-	-	-
1 – Low, 2 – Moderate and 3 – High															

Course Title : WASTE WATER COLLECTION AND TREAMENT			
Course Code: P17CV61	**Semester: VI**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. To understand wastewater generation characteristics and need for waste water treatment
2. To study design different unit operations and unit process in involved in wastewater treatment process
3. To impart knowledge on the various biological treatment processes used in waste water treatment plant.
4. To describe different methods for wastewater disposal and environmental effects of wastewater
5. To grasp the microbiological processes in the activated sludge process

Course Content

UNIT – I

INTRODUCTION: Necessity of sanitation, Systems of sanitation and disposal, types of sewerage systems and their suitability. Dry weather flow (DWF) - factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow. Wet weather flow (WWF) - estimation of storm flow by rational method and empirical formulae, Time of concentration. Problems on DWF & WWF. HYDRAULIC DESIGN OF SEWERS: Hydraulic formulae for velocity, effects of flow variations on velocity, self-cleansing and non-scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full (No derivations). Problems on design of sewers.

Self Study Component: Problems on time of concentration, Design formula to calculate WWF, Nomograms. **12 Hrs**

UNIT – II

MATERIALS OF SEWERS: Sewer materials, Selection criteria, shape of sewers, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers. SEWER APPURTENANCES: Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps. PUMPING OF SEWAGE: Need, types of pump, problems on power of pumps and rising mains. HOUSE DRAINAGE-Typical layout plan showing house drainage connections, maintenance of house drainage.

Self Study Component: Loads on sewer, precaution to be taken before entry into Manhole, Drop Manhole. **10Hrs**

UNIT – III

WASTE WATER CHARACTERIZATION: Physical, Chemical and Biological characteristics, typical wastewater characteristics, and Biological treatment process-Aerobic and Anaerobic, CNS cycles. BOD and COD - their significance & problems on BOD. DISPOSAL OF SEWAGE: Disposal by dilution-self-purification phenomenon. Oxygen sag curve, Zones of purification, Sewage farming, sewage sickness, Effluent standards for Disposal on to land & in to surface waters.

Self Study Component: Typical composition of Domestic waste water, population equivalent, Problem on Oxygen sag curve. **10 Hrs**

UNIT – IV

TREATMENT OF SEWAGE: Importance of treatment, methods of treatment, Flow diagram of conventional municipal sewage treatment plant. PRIMARY TREATMENT: Screening, grit chambers, skimming tanks and primary sedimentation tanks, Design criteria & Design examples of PST. SECONDARY TREATMENT: Advantages of biological treatment system, Suspended growth and attached growth system. Trickling filter – theory, operation, types, operational problems & design problems.

Self Study Component: Preliminary primary & unit operation,unit process. **10 Hrs**

UNIT – V

ACTIVATEDSLUDGEPROCESS- Principle, flow diagram, Modifications of ASP, F/M ratio,

Design problems. ANAEROBIC SLUDGE DIGESTION- Sludge digestion tanks, Design of Sludge drying beds, low cost. WASTE TREATMENT METHOD- Septic tank, Oxidation Pond and Oxidation ditches.

Self Study Component: UASB **10 Hrs**

TEXT BOOKS:

1. Environmental Engineering II – B.C. Punmia & Ashok Jain, Lakshmi Publications (P)Ltd.
2.Wastewater treatments – S.K. Garg, Khanna publications

REFERENCES:

1. Manual on Waste Water Treatment: CPHEEO, Ministry of Urban Development, NewDelhi.
2. Water & Wastewater Engineering Vol-II-- Fair, Geyer and Okun: John Willey Publishers,New York.
3. Waste Water Treatment, Disposal and Reuse: Metcalf and Eddy Inc: Tata McGrawHill

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

Students will be able to;

1. Apply knowledge of mathematics and science to estimate sewage and storm water flow in community.[PO1,PSO1]
2. Apply knowledge of basic science for testing and analyze the sewage characteristics and to compare with legal standards. [PO1,PO2,PSO1,PSO2]
3. Hydraulic design of sewers and various sewage treatment units to remove selected impurities to meet disposal standards.[PO3,PSO2]
4. To understand the impact of different waste water disposal methods of sewage for sustainable environment.[PO7,PSO3]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply knowledge of mathematics and science to estimate sewage and stormwater flow in community.	**2**												**2**		
02	Apply knowledge of basic science for testing and analyze the sewage characteristics and to compare with legal standards.	**2**	**3**											**2**	**3**	
03	Hydraulic design of sewers and various sewage treatment units to remove selected impurities to meet disposal standards.			**3**											**2**	
04	To understand the impact of different waste water disposal methods of sewage for sustainable environment.							**3**								**3**

1-Low, 2-Moderate, 3-High

Course Title : APPLIED GEOTECHNICAL ENGINEERING			
Course Code: P17CV62	**Semester: VI**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Gain the knowledge of Science and Geology to compute engineering properties of soil.
2. Sketch the flow nets for soil structures as per Laplace Equation.
3. Learn and analyze earth pressure and stability of slopes for design of earth retaining structures.
4. Evaluate and interpret bearing capacity and settlement data for design of footings.

Course Content

UNIT – I

SUBSURFACE EXPLORATION: Importance of exploration program, Methods of exploration: Boring, sounding tests, geophysical methods- Electrical resistivity and Seismic refraction methods. Types of samples, undisturbed, disturbed and representative samples Samplers, sample disturbance, area ratio, Recovery ratio, clearance ratios, Stabilization of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures. DRAINAGE AND DEWATERING: Location of ground water table in fine and coarse grained soils. Determination of ground water level by Hvorselev's method. Dewatering- Ditches and sumps, well point system, Shallow well system, Deep well system, Vacuum Method, Electro- Osmosis method.

Self Study Component: Soil exploration report. Control of ground water during excavation. **12 Hrs**

UNIT – II

STRESSES IN SOILS: Boussinesq's and Westergaard's theories for concentrated, circular, rectangular, line and strip loads. Comparison of Boussinesq's and Westergaard's analysis. Nemark's chart. FLOWNETS: Laplace equation (no derivation) assumptions and limitations only, characteristics and uses of flow nets, Methods of drawing flow nets for Dams and sheet piles. Estimating quantity of seepage and exit gradient. Determination of phreatic line in earth dams with and without filter. Piping and protective filter graded filter. **10 Hrs**

Self Study Component: contact pressure.

UNIT – III

LATERAL EARTH PRESSURE: Active and passive earth pressures, Earth pressure at rest, Earth pressure coefficient. Earth pressure theories- Rankine's and Coulomb's –assumptions and limitations, Graphical solutions for active earth pressure (cohesion less soil only) –Culmann's and Rebhann's methods, lateral earth pressure in cohesive and cohesion less soils.

Self Study Component: Earth pressure distribution. **10 Hrs**

UNIT – IV

STABILITY OF EARTH SLOPES: Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of finite and infinite slopes- Method of slices, Friction Circle method, Fellineous method, Taylor's stability number.

Self Study Component: Infinite slopes **10 Hrs**

UNIT – V

BEARING CAPACITY: Definitions of ultimate, net and safe bearing capacities, Allowable bearing pressure. Terzaghi's and Brinch Hansen's bearing capacity equations-assumptions and limitations Bearing capacity of footing subjected to eccentric loading. Effect of ground water table on bearing capacity. Plate load test, Standard penetration test, cone penetration test. FOUNDATION SETTLEMENT: Settlement Analysis, Data for settlement analysis, computation of settlement, Concept, immediate, consolidation and secondary settlements (no derivations), Tolerance.

Self Study Component: BIS specifications for total and differential settlement soffootingsandrafts.

10 Hrs

TEXT BOOKS:

1. Soil Mechanics and Foundation Engg.- Punmia B.C. (2005), 16thEdition Laxmi Publications Co. , NewDelhi.
2. Soil Mechanics and Foundation Engineering- Murthy V.N.S.(1996), 4th Edition, UBS Publishers and Distributors, NewDelhi.
3. Soil Engineering in Theory and Practice- Alam Singh and Chowdhary G.R. (1994), CBS Publishers and Distributors Ltd., New Delhi.

REFERENCES:

1 Foundation Analysis and Design- Bowles J.E. (1996), 5th edition, McGraw Hill Pub. Co. New York.
2 Basic and Applied Soil Mechanics- Gopal Ranjan and Rao A.S.R.(2000), New Age International (P) Ltd., New Delhi.
3 Geotechnical Engineering- Venkatrahmaiah C. (2006), 3rd Edition New Age International (P) Ltd., New Delhi

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

Student will be able to

1. Apply the knowledge of Science and Geology to compute engineering properties of soil. [PO1,PSO1]
2. Sketch the flow nets for soil structures as per Laplace Equation[PO3,PSO2]
3. Analyze earth pressure and stability of slopes for design of earth Retaining structures.[PO2, PO3,PSO2]

4. Evaluate and interpret bearing capacity and settlement data for design of footings. [PO4,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of Science and Geology to compute engineering properties of soil.	**2**												**2**		
02	Sketch the flow nets for soil structures as per Laplace Equation.			**3**											**3**	
03	Analyze earth pressure and stability of slopes for design of earth Retaining structures.		**3**	**3**											**3**	
04	Evaluate and interpret bearing capacity and settlement data for design of footings.				**3**										**3**	

1-Low, 2-Moderate, 3-High

Course Title : IRRIGATION ENGINEERING			
Course Code: P17CV63	**Semester: VI**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Acquire knowledge of science & Mathematics to adopt Irrigation practices and to classify canals and CD works.
2. Learn the classification and analysis problems related to crop water requirements, reservoir sedimentation.
3. Analyze & Design of irrigation Canals.
4. Gain knowledge of hydrology and irrigation in future to design hydraulic structures either as an individual or team to satisfy the changing professionals, environmental and social needs.

Course Content

UNIT – I

IRRIGATION ANDWATER REQUIREMENT OF CROPS: Introduction, Definition, necessity of Irrigation, Advantages and Disadvantages of irrigation, Types of Irrigation – surface and sub-surface, Methods of Irrigation, Quality of Irrigation water, Potential and Development of Irrigation in India. Water Requirement of crops- crop period, Duty and Delta of a crop, Relationship between Duty and Delta, Factors affecting Duty, Optimum utilization of Irrigation water, Irrigation efficiency, soil moisture irrigation relationship, Frequency of Irrigation, Problems.

Self study component: Water resource projects in India and Karnataka. **12 Hrs**

UNIT – II

CANALS AND CROSS DRAINAGE WORKS: Canals – Definition, Types, Alignment of Canals, Canal system, Design of stable channels- Kenndy's theory and Lacey's theory, Problems. Cross section of an Irrigation channel, canal regulation, canal regulator. Drops – Notch type and Sarda type, Cross Drainage works- types, selection of CD work, Aquiducts and super passages-types, selection of suitable type, design considerations (No problems).

Self study component: Maintenance of irrigation canals. **10 Hrs**

UNIT – III

RESERVOIR PLANNING AND SEDIMENTATION: Reservoir Planning- Types of reservoir, Investigations for reservoir planning, Selection of site for a reservoir, Zones of storage in a reservoir, Reservoir yield, Reservoir losses, Mass curve and Demand curve, determination of reservoir capacity using mass curve, problems. Reservoir sedimentation – density currents, capacity Inflow ratio, Trap efficiency, silting control in reservoirs, factors affecting the erodiblity of a soil.

Self study component: Silting control in reservoirs and methods of removal of sedimentation in reservoirs. **10 Hrs**

UNIT – IV

GRAVITY DAM AND SPILLWAYS: Introduction , Definition, factors governing the selection of a dam, Typical cross section, Forces acting on Gravity dam, modes of failures, Principal shear and stresses, Problems, Two dimensional stability analysis by Analytical method, Elementary profile of a gravity dam, High and low gravity dam, galleries. Spillway – Definition, Types, Ogee spillway- Design of crest, Energy dissipaters, Indian Standard stilling basins-Type-I &Type-II.

Self study component: Joints in gravity dam. **10 Hrs**

UNIT – V

EARTHEN DAM AND TANK IRRIGATION: Introduction, Types of Earthen dams, Causes of failure of earthen dams, Design criteria for earthen dams, preliminary design of an earth dam, seepage control and its types. Tank irrigation- Definition, Isolated tanks and tanks in series, surplus escape weirs-types, typical cross section of type A, Tank sluices - typical cross sections.

Self study component: Study of Rock fill dam, arch dam and buttress dam. **10 Hrs**

TEXT BOOKS:

1. Irrigation engineering and Hydraulic structure – S.K. GARG,Khanna Publishers
2. Irrigation engineering and Hydraulic structure– B.C. Punmia, Lakshmi Publications

REFERENCES:

1. Irrigation engineering and hydraulic structure – P.M Modi and S.M. Seth, Standard Book House Publishers.
2. Irrigation and water power engineering –B.C.Punmia, Lakshmi Publications.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

Student will be able to:

1. Apply the knowledge of science & Mathematics to adopt Irrigation practices and to classify canals and CD works. [PO1,PSO1].
2. Classify and analyze problems related to crop water requirements, reservoir sedimentation. [PO3,PSO2]
3. Analyze & Design of irrigation Canals.[PO2,PO3,PSO2]
4. Apply the knowledge of hydrology and irrigation in future to design hydraulic structures either as an individual or team to satisfy the changing professionals, environmental and social needs. [PO3,PO7,PO11,PO12,PSO1,PSO2]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of science & Mathematics to adopt Irrigation practices and to classify canals and CD works.	**3**												**2**		
02	Classify and analyze problems related to crop water requirements, reservoir sedimentation			**2**											**2**	
03	Analyze & Design of irrigation Canals.		**3**	**3**											**2**	
04	Apply the knowledge of hydrology and irrigation in future to design hydraulic structures either as an individual or team to satisfy the changing professionals, environmental and social needs.			**2**				**2**				**1**	**1**	**2**	**2**	

1-Low, 2-Moderate, 3-High

Course Title : TRANSPORTATION ENGINEERING			
Course Code: P17CV64	**Semester: VI**	**L – T – P – H : 4– 0 – 0 – 4**	**Credits:4**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Learn and identify different components of railway track and selection of appropriate materials for construction.
2. Compute various geometric features of railway track for a given set of requirements.
3. Gain knowledge about Planning and design airport runway and taxiway.
4. Understand the components of harbour and tunnels and their classification.

Course Content

UNIT – I

RAILWAY TRANSPORTATION: Role of railways in transportation, Advantages of Railways, Permanent Way, Requirements of an ideal permanent way, Capacity of Railway Track, Gauges in Railway Track, Selection of Gauges, Uniformity of Gauges, Railway Track Cross-sections, Coning of Wheels, Stress in Railway Tracks**,** Traction and Tractive Resistances, Hauling Capacity of Locomotive, Problems on above.

Self study Component: Stresses in Rails, Sleepers and Ballast. **10Hrs**

UNIT – II

RAILS, SLEEPERS AND BALLAST: Functions of Rails, Requirements, Types of Rail Sections, Comparison of Rail Types, Length of Rails, Rail Failures, Wear on Rails, Methods to reduce wear, Rail Joints, Requirements, types of joints, Welding of Rails and advantages, Creep of Rails, Effects of Creep, Measurement of Creep and remedies, Sleepers-function and requirements, Classification of Sleepers, Comparison of Different types of sleepers, Spacing of Sleepers and Sleeper Density. Ballast-Functions and requirements, Types of Ballast, Size and Section of Ballast, Materials required for one km length of track, Problems on above.

Self study Component: Quantity of Ballast and Renewal of Ballast. **12 Hrs**

UNIT – III

GEOMETRIC DESIGN OF THE TRACK: Necessity, Gradient and Grade Compensation, Speed of Train, Radius of Curve, Cant, Cant-Deficiency, Negative Cant, Curves-Effect of curvature, Types of Curves, Necessity of providing Transition Curve, Length of TC, Widening of Gauge on Curves, Problems on above, Points and Crossings- Necessity, Turnouts, Switches, Fixed Heel type, Crossings, Problems on above. Stations, Yards-Site selection for RS, Requirements of RS.

Self study Component: Types of Yards,Level Crossings. **10Hrs**

UNIT – IV

AIRPORT PLANNING AND RUNWAY DESIGN: Introduction to airport engineering, Regional planning and Airport site selection Runway Design - Orientation of runway by using wind rose diagram - Basic runway length, Corrections for Elevation, Temperature and Gradient to runway length by ICAO and FAA specification - runway cross sections problems on above. Taxiway Design: Factors affecting the layout of the taxiway geometrics of taxiway- design of Exit taxiways- ICAO Specifications, Fillets, Separation Clearance, Problems on above.

Self study Component: Visual aids: Airport marking, lightings. **10 Hrs**

UNIT – V

TUNNELSAND HARBOURS: Introduction – types of tunnels, advantages and disadvantages, economics of tunneling, tunnel surveying, transferring of centerline and gradient from the earth surface to inside the tunnel working face. Design of shape and size of tunnel. Methods of tunneling in soft soil Liner Plate Method of tunneling. Tunnel lining and tunnel ventilation, Harbours- Introductions, classifications, natural phenomenon affecting the design of harbor viz. wind, wave, tide and currents. Harbour layout with component parts, breakwaters, wharfs and Quays, Jetties and Piers, Dry Dock and Wet Dock, Navigational aids.

Self study Component: Tunneling in rock - vertical shafts, pilot tunneling, methods of tunneling in hard rock. **10 Hrs**

TEXT BOOKS:

1. Railway Engineering- Saxena and Arora, Dhanpat Rai and Sons, New Delhi.
2. Railway Engineering- Satish Chandra and Agarwal, M.M., Oxford University Press, New Delhi
3. Dock & Tunnel Engineering- Srinivasan R Harbour, Charotar Publishing House.
4. Airport Planning and Design – Khanna, Arora and Jain – Nemch and Roorkee.

REFERENCES:

1. Indian railway Track, Agarwal M.M, Jaico Publications, Bombay.
2. Docks and Harbour Engineering- Oza H.P. and Oza G.H., Charotar Publishing House.

Note: Self study is for 5 marks only in CIE and not inSEE

CourseOutcomes

Students will be able to

1. Identify different components of railway track and selection of appropriate materials for construction.[PO1,PSO1]
2. Compute various geometric features of railway track for a given set of requirements.[PO2, PO4,PSO1]

3. Plan and design airport runway and taxiway.[PO3,PO4,PSO2]
4. Understand the components of harbour and tunnels and their classification[PO1,PSO1]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Identify different components of railway track and selection of appropriate materials for construction.	**2**												**1**		
02	Compute various geometric features of railway track for a given set of requirements.		**1**		**2**									**2**		
03	Plan and design airport runway and taxiway.			**2**	**3**										**3**	
04	Understand the components of harbour and tunnels and their classification.	**2**												**2**		

1-Low, 2-Moderate, 3-High

Course Title : HIGHWAY CONSTRUCTION, MAINTENANCE AND EVALUATION			
Course Code: P17CV651	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Understand the appropriate technique to select suitable construction method for preparation of sub grade in cutting or filling and also the preparation steps for base and sub base layers by studying the general features of highway construction.
2. Learn highway engineering to characterize the different types of bituminous layers and design of bituminous surfacing along with safety aspects needed for roads.
3. Learn the design of base course thickness and selection of materials as base layer for CC pavements using IRC norms.
4. Understand and analyze the defects in road construction and general pavement failures with remedies and also conduct structural and functional evaluation.

Course content

UNIT-I

General features of highway construction: Typical components of highway pavement, Steps for construction of new highway on embankment and in cutting. Embankment and subgrade: function and design elements of highway embankment, high embankment on week foundations, Construction of highway embankment: materials, construction method and quality control checks during construction.
Self study Component: Construction of sub grade: Materials, construction method, and quality control check**.** **10 Hrs**

UNIT-II

Construction of flexible pavement: Different types of granular base course WMM, WBM, specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses, their specifications (as per IRC and MORTH), Construction method and quality control tests. Special structural courses like stone matrix asphalt and mastic asphalt.

Self study Component: Construction of porous asphalt and Low volume roads. **10Hrs**

UNIT-III

Construction of rigid pavements: General features of cc pavements and construction, components of cement concrete pavements and their function, different types of joints, quality control during construction. Construction of special Cement concrete pavements like interlocking concrete block pavements (ICBP), Continuously reinforced cement concrete pavements (CRCP).

Self study Component: Fibre reinforced cement concrete pavements (FRCP) **12Hrs**

UNIT-IV

Highway maintenance: Importance and objectives of highway maintenance work, classification of highway maintenance works, deterioration and damage in road infrastructure, cause of distress in newly constructed roads, Maintenance requirements in different road components. Maintenance of surface drainage system, road embankment and other component of road works.

Self study Component: Maintenance of UN surfaced roads gravel and WBM roads. **10 Hrs**

UNIT-V

Structural and functional evaluation of pavements: Deterioration in flexible and rigid pavements. Functional evaluation of pavements by unevenness index, MERLIN method, Structural evaluation: Benkelman beam deflection method. Cement concrete overlay on flexible pavements, white topping methods.

Self study Component: Distress in rigid pavements and maintenance measures. **10 Hrs**

TEXT BOOKS:

1 Highway Engineering – S.K. Khanna, C.E.G Justo, and A.Veeraragavan, Nem Chand and Bros, Roorkee, Revised 10thEdition.
2 Highway Engineering- Kadiyali, L.R., Khanna Publishers, NewDelhi.
3 Transportation Engineering – Subramanyam, K.P., Scitech Publications,Chennai

REFERENCES:

1. Relevant IRCcodes
2. Principles of Transportation Engineering- Partha Chakra Borthy, Prentice-Hall.
3. Specifications for Roads and Bridges- MoRT&H, IRC, NewDelhi

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

This course will enable students to

1. Apply appropriate technique to select suitable construction method for preparation of sub grade in cutting or filling and also the preparation steps for base and sub base layers.[PO5,PSO1]
2. Apply the knowledge of highway engineering to characterize the different types of bituminous layers and design of bituminous surfacing along with safety aspects needed for roads. [PO3, PO6,PSO1,PSO2]
3. Design the base course thickness and selection of materials as base layer for CC pavements using IRC norms. [PO3,PO8,PSO2]

4. Analyze the defects in road construction and general pavement failures with remedies and also conduct structural and functional evaluation.[PO2,PSO2]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply appropriate technique to select suitable construction method for preparation of sub grade in cutting or filling and also the preparation steps for base and sub base layers.					**2**								**2**		
02	Apply the knowledge of highway engineering to characterize the different types of bituminous layers and design of bituminous surfacing along with safety aspects needed for roads.			**2**			**1**							**2**	**2**	
03	Design the base course thickness and selection of materials as base layer for CC pavements using IRC norms.			**3**					**2**						**3**	
04	Analyze the defects in road construction and general pavement failures with remedies and also conduct structural and functional evaluation.		**3**												**3**	

1-Low, 2-Moderate, 3-High

Course Title : MUNICIPAL SOLID WASTE MANAGEMENT			
Course Code: P17CV652	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. To understand material flow and different elements of solid waste management from generation of solid waste to disposal.
2. To Study the different methods of solid waste management system in par with statutory rules.
3. To Analyze different processing technologies of conversion of municipal solid waste to compost or biogas.
4. To Evaluate landfill site and to study the sanitary landfill reactions.

Course Content

UNIT – I

INTRODUCTION: Definition, Land Pollution – scope and importance of solid waste management, Material flow and waste generation functional elements of solid waste management. Sources: Classification and characteristics – Municipal, commercial & industrial, Methods of quantification. **Self study Component:** Types of Solid waste and factor affecting generation rates. **11Hrs**

UNIT – II

COLLECTION AND TRANSPORTATION: Systems of collection, collection equipment, transfer stations – bailing and compacting, route optimization techniques and problems on moisture content and Energy content. TREATMENT / PROCESSING TECHNIQUES: Components separation, volume reduction, size reduction.

Self study Component: Chemical reduction and biological processing. **11 Hrs**

UNIT – III

INCINERATION: Process – 3 T's, factors affecting incineration process, incinerators –pyrolysis, design criteria for incineration. COMPOSTING: Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes, Vermi-composting.

Self study Component: Prevention of air pollution and Types of incinerators. **10 Hrs**

UNIT – IV

SANITARY LAND FILLING: Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, leachate & gas collection and control methods.

Self study Component: Prevention of land pollution, geosynthetic fabric and lining in sanitary landfill.

10 Hrs

UNIT – V

DISPOSAL METHODS: Open dumping – selection of site, ocean disposal, incineration, pyrolysis, composting, sanitary land filling, merits and demerits, biomedical wastes. RECYCLE AND REUSE: Material and energy recovery operations, plastic wastes, environmental significance and reuse.

Self study Component: Ploughing into fields, feeding to hogs and reuse of material in other industry.

10 Hrs

TEXT BOOKS:

1. Integrated Solid Waste Management: Tchobanoglous: M/c GrawHill.
2. Solid Waste Management in developing countries. Bhide and Sunderashan, Indian National Scientific, DocumentationCentre.

REFERENCES:

1. Hand book on Solid Waste Disposal.: Pavoni J.L., Published by Van Nost. Reinhold, 1975.
2. Environmental Engineering, Howard S. Peavy, GeorgeTchobanoglous and Donald R. Rowe's Environmental Engineering, published by Tata McGraw-HillEducation.
3. Environmental Engineering – Vol II: S.K. Garg, Khanna publishers.

Note: Self study is for 5 marks only in CIE and not in SEE

CourseOutcomes

Student will be able to

1. Understand the importance, source, classification of solid waste [PO2,PSO1]
2. Learn different methods of collection, transportation and management of solid waste [PO2, PO3, PO4, PSO1]
3. Learn different methods of treatment of solid waste like incineration composing, sanitary land filling and design of sanitary land fill. [PO1, PO3,PSO1]
4. Learn different disposal methods of solid waste, recycling and reusing of solid waste. [PO2,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Understand the importance, source, classification of solid waste.		**2**											**2**		
02	Learn different methods of collection, transportation and management of solid waste.		**1**	**2**	**2**									**2**		
03	Learn different methods of treatment of solid waste like incineration composing, sanitary land filling and design of sanitary landfill.	**1**		**3**										**2**		
04	Learn different disposal methods of solid waste, recycling and reusing of solid waste.		**2**												**2**	

1-Low, 2-Moderate, 3-High

Course Title : GROUND WATER HYDROLOGY			
Course Code: P17CV653	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Differentiate surface water hydrology and ground water hydrology, characterize the subsurface water, and assess the availability of ground water in different hydrologic formations.
2. Use different methods to investigate type of soil formation and hence to assess the availability of ground water. Classify the geologic formations and assess the effect excessive ground water with drawals.
3. Use different methods of estimating the hydraulic conductivity in sub soil. Estimate the yield of sub surface water resources using different methods. Evaluate the safe amount of ground water that can be withdrawn from different hydrological formations.
4. Classify different types of wells, their design, construction and maintenance. To develop, complete and maintain a well. Select the type and capacity of pump for particular well.
5. Understand and adopt the ground water recharge. Manage the basins with conjunctive use.

Course Content

UNIT– I

INTRODUCTION: Importance. Vertical distribution of sub-surface water. Occurrence of ground water. Ground water exploration – Seismic method, Electrical resistivity method, Definition of aquifer, Aquifuge, Aquitard and Aquiclude. Confined and unconfined aquifers. Problems. Aquifer parameters – Specific yield, Specific retention, Porosity, Storage coefficient. Land subsidence due to ground water withdrawals, Problems.

Self study Component: Bore hole geophysical technique. **10 Hrs**

UNIT– II

DARCY'S LAW AND GROUND WATER FLOW: Introduction. Darcy's law. Coefficient of permeability and Intrinsic permeability, Transmissibility, Hydraulic conductivity. Determination of hydraulic conductivity- formulae, laboratory methods, Hydraulic conductivity in Anisotropic aquifers. Problems. Ground water flow problems- Steady one dimensional flow in a homogeneous aquifer, flow in a confined aquifer of constant thickness and flow in a confined aquifer of variable thickness. Barometric efficiency, tidal efficiency and relation between them. Problems.

Self study Component: Tracer tests, auger hole tests for hydraulic conductivity. **10 Hrs**

UNIT– III

WELL HYDRAULICS – STEADY FLOW: Introduction. Steady radial flow in confined and unconfined aquifers. Pumping tests. Well efficiency, Problems. UNSTEADY FLOW: Unsteady confined flow – Theis equation. Theis solution (recovery test), and Jacob's solution for Theis non equilibrium equation. Image wells, law of times- barrier and recharge boundaries, Problems**.**

Self study Component: Hydraulics of open well. **12 Hrs**

UNIT– IV

DESIGN AND CONSTRUCTION OF WATER WELLS: Well diameter, well depth and design of well screen. Open wells versus tube well – advantages and disadvantages. Water well drilling – Boring, driving, cavity wells, jetting, core drilling, rotary drilling. Well revitalization. Water well construction – pull back method, open hole method, bail down method, wash down method. Problems

Self study Component: Well rehabilitation. **10 Hrs**

UNIT– V

GROUND WATER MANAGEMENT & GROUND WATER RECHARGE: Well completion.

Well development. Well maintenance selection of pumps of an open well. Tube wells – types and design. Pumps for lifting water - Working principles, Power requirements. Problems. Ground water management –concepts, equation of hydrologic equilibrium and management by conjunctive use.

Self study Component: Yield test of pumps. **10 Hrs**

TEXT BOOKS:

1. Ground Water- H.M. Raghunath, - New Age International (P) Limited, publishers,Bangalore.
2. Ground Water Hydrology - D K. Todd, - Wiley and Sons,Singapore.

REFERENCES:

1. Ground Water Hydrology- Bower H.- McGraw Hill, NewDelhi.
2. Ground Water and Tube Wells- Garg Satya Prakash, - Oxford and IBH, NewDelhi.
3. Ground Water Resource Evaluation- W.C. Walton, - McGraw Hill - Kogakusha Ltd., NewDelhi.
4. Hydrology – Dr.P.Jara Rami Reddy, Lakshmi Publication Pvt., NewDelhi

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

1. Apply the knowledge of fluid mechanics, hydrology, physics and mathematics to understand Fundamentals of groundwater flow [PO1,PSO1]
2. Analyze aquifer parameters and to interpret the observation well data for estimation of yield from a well. [PO2, PO4,PSO2]
3. Evaluate the merits and demerits of open wells and tube wells and to select an efficient pump

for lifting water. [PO2, PO5,PSO3]

4. Analyze Conjunctive use of ground water along with other fresh water sources.[PO2,PO6,PSO3]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of fluid mechanics, hydrology, physics and mathematics to understand Fundamentals of ground water flow.	**3**												**3**		
02	Analyze aquifer parameters and to interpret the observation well data for estimation of yield from a well.		**2**		**2**										**2**	
03	Evaluate the merits and demerits of open wells and tube wells and to select an efficient pump for lifting water.		**2**			**1**										**2**
04	Analyze Conjunctive use of groundwater along with other fresh water sources.		**2**				**1**									**2**

1-Low, 2-Moderate, 3-High

Course Title : GROUND IMPROVEMENT TECHNIQUES			
Course Code: P17CV654	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Acquire the knowledge of Geology &Geotechnical Engineering in Ground improvement techniques.
2. Learn and analyze the Mechanical Modification Techniques for soils.
3. Investigate chemical modification techniques for soils.
4. Gain knowledge to select appropriate geo-synthetics and grouting methods for ground improvements for sustainability.

Course Content

UNIT – I

GROUND IMPROVEMENT: Definition, Objectives of soil improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. MECHANICAL MODIFICATION: Type of mechanical modification, Aim of modification, compaction, Principle of modification for various types of soils. COMPACTION: Effect of compaction on engineering behavior like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. Field compaction – static, dynamic, impact and vibratory type. Specification of compaction. Shallow and deep compaction.

Self Study Component: Effect of grain size distribution on compaction for various soil types like BC soil, lateritic soil, coarse-grained soil, micaceous soil, Tolerance of compaction. **11 Hrs**

UNIT – II

HYDRAULIC MODIFICATION: Definition, aim, principle, techniques. Lowering of water table, multistage well point, vacuum dewatering. Discharge equations. DRAINAGE & PRELOADING: Drainage of slopes, preloading, vertical drains, sand drains. Assessment of ground condition for preloading, Electro kinetic dewatering.

Self Study Component: Gravity drain, Design of dewatering system including pipe line effects of dewatering. **11Hrs**

UNIT – III

CHEMICAL MODIFICATION-I: Definition, aim, special effects, and methods. Techniques – sandwich technique, admixtures, cement stabilization. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage. Stabilization using Fly ash. CHEMICAL MODIFICATION-II: Lime stabilization – suitability process, special effects, criteria for lime stabilization. Other chemicals and

lignin. Properties of chemical components, reactions and effects. Bitumen, tarorasphaltin stabilization.

Self Study Component: Criteria for cement stabilization, chlorides, hydroxides and hydrofluoric acid.

10Hrs

UNIT – IV

GROUTING: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting, Grouting procedure and Applications of grouting. MISCELLANEOUS METHODS (ONLY CONCEPTS): Introduction, Soil reinforcement. Ground improvement by confinement – Crib walls, Gabions and Mattresses. Anchors, Rock bolts and soil nailing.

Self Study Component: Thermal methods of stabilization. **10 Hrs**

UNIT – V

GEOSYNTHESIS: Introduction, geosynthetic types-raw materials, composites, membranes, properties of geosynthetic- material and fiber properties, geometrical aspects, mechanical properties, hydraulic properties, durability, applications of geo-synthetics- separation, filtration and fluid transmission, reinforcement, containment and barriers.

Self Study Component: Woven, non-woven, knitted, bio-degradable, nets and girds, three-dimensional mats. **10 Hrs**

TEXT BOOKS:

1. Construction and Geotechnical Method in Foundation Engineering, Koerner R.M. (1985) - Mc Graw Hill Pub. Co., NewYork.
2. Ground Improvement Techniques- Purushothama Raj P. (1999), Laxmi Publications, NewDelhi.

REFERENCE BOOKS :

1. Engineering principles of ground modification- Manfred Hausmann (1990)- Mc Graw Hill Pub. Co., NewYork.
2. Methods of treatment of unstable ground- Bell, F. G. (1975) Butterworths,London.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes

After learning all the units of the course, the student is able to

1. Apply the knowledge of Geology &Geotechnical Engineering in Ground improvement techniques.[PO1,PSO1]
2. Analyze Mechanical Modification Techniques for soils.[PO2,PSO2]
3. Investigate chemical modification techniques for soils.[PO3,PSO3]

4. Select appropriate geo-synthetics and grouting methods for ground Improvements for sustainability.[PO7,PSO1]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of Geology & Geotechnical Engineering in Ground improvement techniques.	**2**												**2**		
02	Analyze Mechanical Modification Techniques for soils		**3**												**2**	
03	Investigate chemical modification techniques for soils.			**3**												**2**
04	Select appropriate geo-synthetics and grouting methods for ground Improvements for sustainability.							**3**						**1**		

1-Low, 2-Moderate, 3-High

Course Title : MATRIX METHODS OF STRUCTURAL ANALYSIS			
Course Code: P17CV661	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.	**Weightage: CIE:50 %;**	**SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Categories the structures on the basis of force and deformations.
2. Energy concept in dealing the indeterminate structures.
3. Understanding matrix influence, transformation procedures from system to element and hence flexibility and stiffness matrix methods.
4. Analyzing plane truss, continuous beams and plane frames, manually, unknowns<=3, using flexibility and stiffness methods.
5. Direct stiffness approach and analysing plane truss and continuous beam problems.

Course Content

UNIT – I

ENERGY CONCEPTS : Brief history of structural mechanics, structural systems, degrees of static and kinematic indeterminacies, geometrical and material non-linearity, concepts of stiffness and flexibility, energy concepts in structural analysis, strain energies – axial, flexural and shear, real work and complementary work. Principle of virtual displacement for a rigid body and deformable body, principle of potential energy, stationary complementary energy, minimum complementary energy, Development of flexibility and stiffness matrices with reference to the given coordinates.

Self Study Component: Maxwell Betti's theorem of reciprocal displacement. **12 Hrs**

UNIT – II

TRANSFORMATION MATRIX: Relationship between element and system, transformation of information from system forces to element forces using equilibrium equations, transformation of information from system displacement to element displacement, contra gradient laws, element stiffness and flexibility matrices (bar, beam). Generation of system stiffness/ flexibility matrix using uncoupled element stiffness/ flexibility matrices. Analysis of statically indeterminate structures - trusses and continuous beams by flexibility matrix method (element approach).

Self Study Component: Analysis of plane truss subjected to temperature change, lack in fit by flexibility methods **10 Hrs**

UNIT – III

FLEXIBILITY MATRIX METHOD: Analysis of statically indeterminate rigid jointed plane frames by flexibility matrix method (element approach). STIFFENESS MATRIX METHOD: Analysis of statically indeterminate structures-trusses by stiffness matrix method (element approach)

Self Study Component: Analysis of continuous beam subjected to support settlement. **10 Hrs**

UNIT – IV

STIFFENESS MATRIX METHOD: Analysis of statically indeterminate structures- continuous beams and simple frames by stiffness matrix method (element approach).

Self Study Component: Considerations of temperature change & support settlement. **10 Hrs**

UNIT – V

DIRECT STIFFENESS METHOD: Local and global coordinate systems, rotation transformation matrix, direct assembly of element stiffness matrices. Analysis of indeterminate structures (i) Plane truss and (ii) continuous beam.

Self Study Component: Analysis considerations of plane frame. **10 Hrs**

TEXT BOOKS:

1 C.S.Reddy, Basic Structural Analysis,3rd edition TATA McGraw-Hill
2 G.S.Pandit & S.P.Gupta, Structural Analysis-A Matrix Approach, 2nd Edition, TATA McGraw Hill.

REFERENCES:

1 W.Weaver and J.H.Gere., Matrix Analysis of Framed Structures, 2nd edition, CBS Publishers.
2 A.K.Jain, Advanced Structural Analysis with computer Application Nemchand and Brothers, Roorkee,India
3 M.L. Gambhir, Fundamentals of Structural Mechanics,PHI, NewDelhi.
4 S. Rajashekaran, Computational Structural Mechanics, PHI, NewDelhi.

Note: Self study is for 5 marks only in CIE and not inSEE

Courseoutcomes

Student will be able to

1 Apply matrix algebra to solve the problems of structural analysis. [PO1, PO2,PSO1].
2 Apply stiffness and flexibility approaches of matrix methods for structural analysis. [PO2,PO3,PSO2]
3 Apply flexibility and stiffness methods (element approach) to truss, beam and plane frame problems to evaluate the internal forces and displacement of members. [PO2,PO3,PSO2].
4 Apply matrix methods for advanced structural analysis and computer applications.[PO2, PO3,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply matrix algebra to solve the problems of structural analysis.	**3**	**3**											**3**		
02	Apply stiffness and flexibility approaches of matrix methods for structural analysis.		**3**	**3**											**3**	
03	Apply flexibility and stiffness methods (element approach) to truss, beam and plane frame problems to evaluate the internal forces and displacement of members.		**3**	**3**											**3**	
04	Apply matrix methods for advanced structural analysis and computer applications.		**3**	**3**											**2**	

1-Low, 2-Moderate, 3-High

Course Title : DESIGN OF MASONRY STRUCTURES			
Course Code: P17CV662	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Learn different types of masonry units, properties, suitability and types of mortars as per IS1905
2. Understand the possible causes of defects in masonry, factors affecting strength of masonry, and permissible stresses in masonry
3. Understand design parameters like effective height, slenderness ratio, load dispersion , arch action in masonry and design of lintels
4. Learn the design of walls subject to both axial and eccentric load as per IS1905
5. Design masonry buildings up to three floors as per IS 1905 andSP-20
6. Understand the concept of reinforced masonry and design reinforced masonry lintels and slabs

Course Content

UNIT – I

MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION: Brick, stone and block masonry units – strength, modulus of elasticity and water absorption of masonry materials – classification and properties of mortars, selection of mortars. Cracks in masonry, types, reasons for cracking, methods of avoiding cracks.

Self Study Component: Defects and Errors in masonry construction. **10 Hrs**

UNIT – II

STRENGTH AND STABILITY: Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, and effect of curing, workmanship and mechanism of failure for masonry subjected to direct compression.

Self Study Component: Effect of aging and IRA-strength formulae. **10 Hrs**

UNIT – III

PERMISSIBLE STRESSES: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads.

Self Study Component: Permissible tensile and shear stresses. **10 Hrs**

UNIT – IV

DESIGN CONSIDERATIONS: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, design of load bearing masonry for building

up to 3 storey's using IS : 1905 and SP : 20 procedure.

Self Study Component: Arching action, lintels and load dispersion. **12 Hrs**

UNIT – V

LOAD CONSIDERATIONS FOR MASONRY: Wall carrying axial load, eccentric loaded elements with different eccentricity ratios, walls with openings, free standing wall, Application.

Self Study Component: Composite wall-beam elements and infilled frames. **10 Hrs**

TEXT BOOKS:

1. Dayaratnam P, "Brick and Reinforced Brick Structures"- Oxford &IBH
2. Sinha B.P & Davis S.R., "Design of Masonry structures"- E & FNSpon

REFERENCES:

1. Hendry A.W., "Structural masonry"- Macmillan Educaon Ltd., 2ndedition
2. Curtin, "Design of Reinforced and Prestressed Masonry"- ThomasTelford
3. Sven Sahlin, "Structural Masonry"-PrenticeHall
4. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, "Alternative Building Materials and Technologies"-New Age International, New Delhi & Bangalore
5. IS 1905, Code of practice for structural use of unreinforced masonary, BIS, New Delhi.
6. 6. SP20(S&T),NewDelhi
7. IS: 2250-1981: Code of practice for preparation and use of masonary mortors.

Note: Self study is for 5 marks only in CIE and not in SEE

Course outcomes

This course aims to

1. Learn different types of masonry units, properties, suitability and types of mortar as per IS 1905 and understand the possible causes of defects in masonry, factor affecting strength of masonry and permissible stresses in masonry.[PO1,PO5,PSO1]
2. Understand design parameters like effective height, slenderness ratio, load dispersion, arch action in masonry, design of lintels and learn the design of walls subject to both axial and eccentric load as per IS1905:1987.[PO2,PO4,PSO2]
3. Design masonry buildings up to three floors as per IS 1905:1987 and SP-20. [PO3,PO4,PO8,PSO1,PSO3]
4. Understand the concept of reinforced masonry and design of reinforced masonry lintels and slabs.[PO3,PO4,PSO1,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Learn different types of masonry units, properties, suitability and types of mortar as per IS 1905 and understand the possible causes of defects in masonry, factor affecting strength of masonry and permissible stresses in masonry.	**2**				**2**								**1**		
02	Understand design parameters like effective height, slenderness ratio, load dispersion, arch action in masonry, design of lintels and learn the design of walls subject to both axial and eccentric load as per IS 1905:1987		**2**		**2**										**3**	
03	Design masonry buildings up to three floors as per IS 1905:1987 andSP-20.			**3**	**3**				**2**					**2**		**2**
04	Understand the concept of reinforced masonry and design of reinforced masonry lintels andslabs.			**2**	**2**									**3**	**3**	

1-Low, 2-Moderate, 3-High

Course Title : PHOTOGRAMMETRY AND REMOTE SENSING			
Course Code: P17CV663	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %; SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Gain knowledge about horizontal position from photographic measurements and explain Ground coordinates, computation of length of align, computation of flying height.
2. Acquire knowledge about active and passive sensors, MSS, AVHRSR, LISS, TM, PAN, WIFS.
3. Learn and analyze image enhancements, image transforms based on arithmetic operation, image filtering.
4. Understand change detection, water resource, urban planning, environmental and geological applications.

Course Content

UNIT– I

PHOTOGRAMMETRY: Introduction, basic definitions, terrestrial Photogrammetry, photo theodolite, Horizontal and vertical angles from terrestrial photographs, horizontal position from photographic measurements.

Self Study Component: Elevation of points by photographic measurements, determination of focal length. **12 Hrs**

UNIT– II

AREIAL PHOTOGRAMMETRY: Advantages of vertical tilted and oblique photographs, geometry of vertical photographs, scale of vertical photograph over flat and variable terrain, ground coordinates, computation of length of align, computation of flying height, relief displacement, overlaps, flight planning, computation of required number of photographs for a given area, ground control in photogrammetry.

Self Study Component: Basic elements in photographic interpretation, introduction to digital photogrammetric. **12 Hrs**

UNIT– III

REMOTE SENSING PLATFORMS AND SENSORS: Introduction, ideal remote sensing system, basic of electromagnetic remote sensing, electromagnetic energy, electromagnetic spectrum, interaction with earth's atmosphere, interaction with earth surface materials, spectral reflectance of earth surface materials, Introduction platforms-IRS, Landsat, SPOT, cartsat, ikonos, envisat etc., sensors-active and passive, MSS, AVHRSR, LISS, TM, PAN, WIFS.

Self Study Component: Microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal). **10 Hrs**

UNIT– IV

PROPERTIES OF DIGITAL IMAGE DATE FORMATS: Basics of digital image processing-radiometric and geometric corrections, image enhancements.

Self Study Component: Image transforms based on arithmetic operation and image filtering.

10 Hrs

UNIT– V

REMOTE SENSING IMAGE INTERPRETATION: Thematic classification (supervised and unsupervised), maximum lively hood classification, introduction to accuracy assessment of classification, applications remote sensing, applications in land use cover analysis, change detection.

Self Study Component: Water resource, urban planning, environmental and geological applications.

10Hrs

TEXT BOOKS:

1. Mikhail E J Bethe and J.C. McGlone, Introduction to modern photogrammetric Wiley,2001.
2. Wolf P.R and B.A. Dewitt, Elements of photogrammetric with application in GIS, 3rd ed, McGraw-hill2000.
3. Lille sand T.M and R.W. Kiefer, Remote sensing and image interpretation. 4th ed, john Wiley &sons,2000

REFERENCES:

1. Jensen J.R., Introduction digital image processing: a remote sensing perspective. 2nd ed prentice Hal, 1996.
2. Richards J.A. and X. Jia, Remote sensing digital image analysis: an introduction. 3rd ed, Springer,1999
3. Mather P.M., Computer processing of remotely-sensed image: an introduction. Wiley,1988.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes (CO)

After learning all the units of the course, the student is able to

1. Understand horizontal position from photographic measurements and explain Ground coordinates, computation of length of align, computation of flying height.[PO1,PO5,PSO1]
2. Describe active and passive sensors, MSS, AVHRSR, LISS, TM, PAN, WIFS. [PO2,PO4,PSO2]
3. Analyze image enhancements, image transforms based on arithmetic operation, image filtering.[PO9.PO11,PSO2,PSO3]
4. Understand change detection, water resource, urban planning, environmental and geological applications.[PO9,PO10,PO12,PSO2,PSO3]

Course Articulation Matrix(CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Understand horizontal position from photographic measurements and explain Ground coordinates, computation of length of align,computation of flying height.	**2**				**2**								**2**		
02	Describe active and passive sensors, MSS, AVHRSR, LISS, TM, PAN, WIFS.		**3**	**3**											**3**	
03	Analyze image enhancements, image transforms based on arithmetic operation, image filtering.									**2**		**2**			**2**	**1**
04	Understand change detection, water resource, urban planning, environmental and geological applications.									**2**	**2**		**2**		**2**	**2**

1-Low, 2-Moderate, 3-High

Course Title : REPAIR AND REHABILITATION OF STRUCTURES			
Course Code: P17CV664	**Semester: VI**	**L – T – P – H : 3– 0 – 0 – 3**	**Credits:3**
Contact Period - Lecture: 52Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %;**	**SEE:50%**

Course Learning Objectives (CLOs)

This course aims to

1. Study the different types of maintenance and inspection in a building.
2. Understand the concepts with regard to durability and chemical causes and remedial measures in buildings for different exposure condition.
3. Gain engineering knowledge to analyze and detect the damages in a building by NDT.
4. Understand and analyze the different functions for repair and strengthening techniques.

Course content

UNIT –I

Maintenance: Definition, necessity of maintenance, classification of maintenance, atmospheric agencies, normal wear and tear, and failure of structures, inspection periods, preventive maintenance, predictive maintenance, and reliability centered maintenance, reactive maintenance, and organization for maintenance, computerized maintenance management system. Building maintenance (steel and wood work maintenance), inspection of building, integral maintenance of building, safety in maintenance, concentration audit safety in building maintenance.

Self Study Component: Demolition management, concrete demolition review in advanced demolition technique. **12 Hrs**

UNIT -II

Durability and Deterioration: Physical causes: Introduction, Durability of concrete, causes of distress in concrete structure, shrinkage in concrete, freeze and thaw in concrete, creep in Concrete, abrasion, erosion & cavitations on concrete, Temperature changes thermal movement in concrete, form work movement, sub grade movement, Design errors. Chemical Causes: Basic Principle of corrosion, corrosion process, codal provisions for different exposure condition. Corrosion protection techniques.

Self Study Component: Fire on concrete, foundation settlement, biological attack on concrete.

10Hrs

UNIT -III

Structural Damage Assessment: Destructive Testing systems: Introduction, investigation of damage, testing system of hardened concrete. Non- Destructive testing systems: Nondestructive testing methods, surface hardness method, ultrasonic pulse velocity method, pulse attenuation methods, electromagnetic methods. Semi destructive testing method**:** Penetration techniques pull out tests, core sampling and permeability test.

Self Study Component: Recent development in NDT equipments destructive testing systems.

10 Hrs

UNIT -IV

Functional Materials for Repair and Rehabilitation: Introduction on Repair materials, selection, classification of repair materials, Evaluation test for repair materials: test for computing tensile strength, coefficient of thermal expansion, shrinkage, and adhesive/bond strength. Functions of repair materials- Patching materials, cementitious materials, polymer concrete and mortar .Quick setting compounds - sealing materials, sealant types, sealant selection, water stops.

Special repair materials: Chemical admixtures -super plasticizers, accelerators, mineral admixtures - fly ash, ground granulated blast furnace slag (GGBS) Condensed Silica fume (CSF), Admixture for Rehabilitation- Lattice latex modified system, epoxy resin, epoxy for crack repairs, poly coatings for reinforcement, types and applications of polymers.

Self Study Component: Polymer mediated cement composites (PMCC) polymer concrete (PC) polymeric impregnated concrete (PIC),polymeric coatings. **10 Hrs**

UNIT -V

Rehabilitation and Strengthening Techniques:

Repair of cracks- Introduction, factors affecting cracking, nature of cracking, stages of Concrete repair, methods of repair- resin injection, grouting and sealing, stitching, sand blasting, Acid etching. Rehabilitation- Shorcrete, Gunite, grouting, resin injection, slab jacketing techniques- advantage, disadvantage and limitations. Strengthening Techniques- Need for strengthened Structure, concrete strengthening, Column strengthening- jacketing techniques, external bonding.

Self Study Component: Types and classification of repair strengthening with external reinforcement, dam safety –concrete repair techniques. **10 Hrs**

Text Books:

1. "Rehabilitation of Concrete Structures", Dr. B. Vadivelli, Standard Publishers and Distributors, Delhi.
2. Concrete Structures Repair, Rehabilitation and Retrofitting by J.Bhattacharjee. CBS Publishers and distributors, Pvt.Ltd.

Reference Books:

1. Repair and Rehabilitation of Concrete Structures by Poonam I. Modi & Chirag N.Patel
2. RT. Allen and S.C. Edwards, "Repair of concrete Structures", Blakie and sons, UK, 1987.
3 "Training course notes on damage assessment and Repair in low cost housing Santhakumar", S.R. RHDC-NBO Anna University, Madras, July, 1992.
4 "CPWD hand book for Rehabilitation of structures"
5 "Concrete Technology – Theory and practice", MS. Shetty, S.Chand and company, New Delhi.

Note: Self study is for 5 marks only in CIE and not in SEE

Course Outcomes (CO's)

On completion of this course, students are able to

1. Identify, formulate the different types of maintenance and inspection in a building. [PO1,PO2,PO7,PO10,PSO3]
2. Understand the concepts with regard to durability and chemical causes and remedial measures in buildings for different exposure condition. [PO2,PSO1]
3. Apply engineering knowledge to analyze and detect the damages in a building by NDT. [PO4,PO5,PO8,PO10,PSO2]
4. Understand and analyze the different functions for repair and strengthening techniques. [PO2,PO4,PO8,PO12,PSO1]

Course Articulation Matrix (CAM)

Sl. No	Course outcomes	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	Identify, formulate the different types of maintenance and inspection in a building.	2	2					1			1					1
2	Understand the concepts with regard to durability and chemical causes and remedial measures in buildings for different exposure condition.		2											1		
3	Apply engineering knowledge to analyze and detect the damages in a building by NDT.				3	3			2		2				2	
4	Understand and analyze the different functions for repair and strengthening techniques.		2		2				2				2	2		

1-Low, 2-Moderate, 3-High

Course Title : GEOTECHNICAL ENGINEERING LABORATORY			
Course Code: P17CVL67	**Semester: VI**	**L – T – P – H : 0– 0 – 3 – 3**	**Credits:1.5**
Contact Period - Lecture: 39Hrs.; Exam: 3Hrs.		**Weightage: CIE:50 %;**	**SEE:50%**

Course learning objectives

This course aims to

1) Determine the specific gravity of different types of soil using density bottle and pycnometer method. Determine moisture content present in the soil by different methods.
2) Classify the soil as per IS classification by sieve analysis. Determine the density of soil in the field by core cutter and sand replacement method.
3) Determine maximum dry density and optimum moisture content of soil by light and heavy compaction test.
4) Calculate the co-efficient of permeability of soil by constant and variable head method. Calculate the shear parameters, major and minor principal stress of soil by direct shear test.
5) Calculate the unconfined compressive strength and cohesion of the soil by unconfined compression test. Calculate the California bearing ratio of soil by CBR test.

LIST OF EXPERIMENTS TO BE CONDUCTED:

1. Tests for determination of specific gravity and moisture content **3 Hrs**
2. Grain size analysis of soil sample (sieve analysis) **3 Hrs**
3. In situ density by core cutter and sand replacement methods. **3 Hrs**
4. Consistency Limits – Liquid Limit (Casagrande method), plastic limit and shrinkage limit **3 Hrs**
5. IS Light Compaction Test and IS Heavy Compaction Test **3 Hrs**
6. Coefficient of permeability by constant head and variable head methods **3 Hrs**
7. Strength Test
    a. Unconfined Compression Test **3Hrs**
    b. Direct Shear Test **3 Hrs**
    c. Triaxial Compression Test (Unconsolidated & Untrained) **3Hrs**
8. Consolidation Test – Determination of compression index and coefficient of consolidation **3 Hrs**
9. Laboratory vane shear test **2 Hrs**
10. Determination of CBR value **3 Hrs**
11. Determination of free Swell index of soils **2 Hrs**

12. a) Demonstration of miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter, Proctor's needle

b) Demonstration of Hydrometer Test

c)Demonstration of Swelling Pressure Test

d) Demonstration of determination of relative densityof sands **2 Hrs**

REFERENCES:

1. Soil Testing for Engineers – Lambe T.W., - Wiley Eastern Ltd., NewDelhi.
2. Manual of Soil Laboratory Testing – Head K.H., (1986) – Vol I, II, III, Princeton Press, London.
3. Engineering Properties of Soil and Their Measurements – Bowles J.E (1988), - Mc Graw Hill Book Co. NewYork.
4. BIS CODES of Practice: IS 2720 (Part-3/sec.1) – 1987; IS 2720 (Part-2)-1973; IS 2720 (Part – 4)-1985; IS 2720 (Part – 5)-1985; IS 2720 (Part-6) – 1972; IS 2720 (Part – 7) -1980; IS 2720 (Part -8)-1983; IS 2720(Part -17) – 1986; IS 2720 (Part -10)- 1973; IS 2720 (Part-13)-1986; IS 2720 (Part-11)-1971; IS 2720 (Part -15)-1986; IS 2720 (Part30)- 1987; IS 2720 (Part 14)-1977; JS 2720 (Part -14) -1983; IS 2720 (Part–
28)-1974; IS 2720 (Part -29) – 1966, IS 2720 (Part – 60)1965.

Course outcomes

Student will be able to

1. Apply the knowledge of Geotechnical engineering to evaluate index properties of soils.[PO1,PSO1]
2. Conduct shear test, permeability test and consolidation test to evaluate various soil parameters. [PO2,PSO2]
3. Carryout investigations on different soils to provide sustainable solutions for design of foundations.[PO3,PSO2]
4. Interpret permeability data for seepage analysis, shear strength data for evaluate bearing capacity and consolidation data for settlement analysis.[PO4,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply the knowledge of Geotechnical engineering to evaluate index properties ofsoils.	**2**												**2**		
02	Conduct shear test, permeability test and consolidation test to evaluate various soil parameters.		**3**												**3**	
03	Carryout investigations on different soils to provide sustainable solutions for design of foundations.			**2**											**2**	
04	Interpret permeability data for seepage analysis, shear strength data for evaluate bearing capacity and consolidation data for settlement analysis.				**3**										**3**	

1-Low, 2-Moderate, 3-High

Course Title : EXTENSIVE SURVEY			
Course Code: P17CVL68	**Semester: VI**	**L – T – P – H : 0– 0 – 3 – 3**	**Credits:1.5**
Contact Period - Lecture: 39Hrs.; Exam: 3Hrs.	**Weightage: CIE:50 %;**	**SEE:50%**	

Course learning objectives

This course aims to

1. Gain skills to handle conventional & modern surveying equipments for location of objects and setting outworks.
2. Learn how to Capture data, interpret and analyze data to prepare drawings and reports of engineering projects like water supply, highway and irrigation.
3. Understand the technical difficulties at site and managerial skills to tackling them in completing the assigned survey work.
4. Function as a team member imparting networking, communicating effectively in gaining lifelong learning process.

To be conducted between 5th& 6th Semester for a period of 2 weeks, Viva voce conducted along with 6th Semester exams.

LIST OF EXPERIMENTS TO BE CONDUCTED:

An extensive survey training involving investigation and design of the following project report consisting of design and drawings.

1. **GENERAL INSTRUCTIONS, RECONNAISSANCE OF SITES AND FLY LEVELING TO ESTABLISHBENCHMARKS. 02Hrs**

2. **NEW TANK PROJECTS**: The work shall consist of
   i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the centerline.
   ii) Capacity surveys.
   iii) Details at Waste weir and sluice points.
   iv) Canal alignment.

   (At least one of the above new tank projects should be done by using TOTAL STATION)

   12 Hrs

3. **RESTORATION OF OLD TANK PROJECTS**: The work shall consist of
   i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the centerline.
   ii) Capacity surveys.
   iii) Details at Waste weir and sluice points.

iii)Canal alignment. **10 Hrs**

4. **WATER SUPPLY AND SANITARY PROJECT**: Examination of sources of water supply, Calculation of quantity of water based on existing and projected population. Preparation of village map by any suitable methods of surveying (like plane tabling). Location of sites for ground level and overhead tanks, underground drainage system surveys for laying the sewers.

08 Hrs

5. **HIGHWAY PROJECT**: Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road. (Drawing should be preferably done using AutoCAD). **07Hrs**

Course outcomes

Student will be able to

1. Apply skills to handle conventional & modern surveying equipments for location of objects and setting out works [PO1,PO5,PSO2,PSO3]
2. Capture data, interpret and analyze data to prepare drawings and reports of engineering projects like water supply, highway and irrigation.[PO2,PO4,PSO2,PSO3]
3. Understand the technical difficulties at site and managerial skills to tackling them in completing the assigned survey work[PO9,PO11,PSO1]
4. Function as a team member imparting networking, communicating effectively in gaining lifelong learning process.[PO9,PO10,PO12,PSO2]

Course Articulation Matrix (CAM)

Sl. No	Course Outcome-CO's	Program outcome												Program Specific outcome		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
01	Apply skills to handle conventional & modern surveying equipments for location of objects and setting out works	**2**				**3**									**2**	**1**
02	Capture data, interpret and analyze data to prepare drawings and reports of engineering projects like water supply, highway and irrigation.		**2**		**2**										**2**	**2**
03	Understand the technical difficulties at site and managerial skills to tackling them in completing the assigned survey work									**2**		**2**		**2**		
04	Function as a team member imparting networking, communicating effectively in gaining lifelong learning process									**2**	**2**		**1**		**2**	

1-Low, 2

Course Title : Aptitude and Reasoning Development - EXPERT (ARDE)			
Course Code : P17HU610	Semester : 6	L:T:P:H -0:0:2:2	Credits: 1
Contact Period: Lecture: 32 Hr, Exam: 3 Hr	Weightage: CIE:50%; SEE:50%		
Prerequisites : Number system, Concept of percentage, Analytical reasoning-2.			

Course Learning Objectives (CLOS)

This course aims to

1. Explain different types of functions, representation of different functions on the graphs.
2. Describe the properties of quadratic equations and application of quadratic equations.
3. Demonstrates the principle of counting.
4. Differentiates between permutation and combination and solve problems conceptually.
5. Predict the probabilities in different scenarios and its application in our day-to-day life.
6. Evaluate the cause and effect of the statements logically.
7. Recognize different ways in which a statement can be strengthened or weakened.
8. Explain the criticality of data sufficiency chapter., universal methodology to solve any problem.
9. Analyse the data in a bar graph , pie chart and tabular column and line graph and the combination of these graphs.
10. Compare the data in different format and understand the difference between them

Course Content

UNIT – I

Functions and Quadratic equations:

Functions: Basic methods of representing functions– Analytical representation, tabular representation, graphical representation of functions. Even and odd functions, Inverse of a function, Shifting of graph. Representation of standard set of equations. Methodology to tackle inverse functions. Graphical process for solving inequalities, graphical view of logarithmic function.

Quadratic equations: Theory, properties of quadratic equations and their roots, the sign of quadratic equation, Equations in more than one variable. Simultaneous equations, number of solutions of the simultaneous equations. **6 Hrs**

UNIT – II

Permutation and Combination: Understanding the difference between the permutation and combination, Rules of Counting-rule of addition, rule of multiplication, factorial function, Concept of step arrangement, Permutation of things when some of them are identical, Concept of 2^n, Arrangement in a circle.

Probability: Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes. **8 Hrs**

UNIT – III

Analytical reasoning 3: Punchline: Introduction, format of the problem, An analysis, Does a suggested statement qualify as a punchline?. If a given statement fits as a punchline, what is its idea or wavelength?, The complete method of solving a punchline problem, Solved examples, conclusion, Sample company questions.

Strengthening and Weakening arguments: Format of the problem, An analysis, Suggested methods, solved examples, conclusion, sample company questions.

Cause and Effect : Cause and Effect—A theoretical discussion, Immediate cause, Principal cause, A quick check– Cause always antecedent. The strategy for solution. **6 Hrs**

UNIT IV

Data Sufficiency: Introduction, answer choices in data sufficiency, tips to solve data sufficiency problems, directions of questions, classification of sections in data sufficiency– Number system, Algebra, series and sequence, logical, geometry and mensuration, arithmetic. **6 Hrs**

UNIT V

Data Interpretation: Approach to interpretation - simple arithmetic, rules for comparing fractions, Calculating (approximation) fractions, short cut ways to find the percentages, Classification of data– Tables, Bar graph, line graph, Cumulative bar graph, Pie graph, Combination of graphs. Combination of table and graphs **6 Hrs**

Reference Books:

1. **"The Trachtenberg speed system of basic mathematics**, published by Rupa publications.
2. **CAT Mathematics** by AbhijithGuha. published by PHI learning private limited.
3. **Quantitative aptitude** by Dr. R. S Agarwal, published by S.Chand private limited.
4. **Verbal reasoning** by Dr. R. S Agarwal , published by S. Chand private limited.
5. **Quantitative aptitude** for CAT by Arun Sharma, published by McGraw Hill publication.
6. **Analytical reasoning** by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Graphically represent the functions and analyze it. L5
2. Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them. L6
3. Effective solve the problems of permutation and combination. L4
4. Predict different possibilities by the principle of probability. L3
5. Interpret the data given in the graphical format and infer the results. L5
6. Analyze the statement critically and solve the questions from verbal logic section. L5

A. Course Articulation Matrix (CAM)															
Course Outcome (CO)	**Program Outcome (ABET/NBA-(3a-k))**														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Graphically represent the functions and analyze it.	L5	2	-	-	-	2	-	-	-	-	-	-	-	-	-
Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them.	L6	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Effective solve the problems of permutation and combination.	L4	3	-	-	-	2	-	-	-	2	-	-	-	-	-
Predict different possibilities by the principle of probability.	L3	3	-	-	-	-	-	-	-	2	-	-	-	-	-
Interpret the data given in the graphical format and infer the results.	L5	2	-	-	-	-	-	-	-	-	-	-	-	-	-
L- Low, M- Moderate, H-High															