**DEPARTMENT OF**
**CIVIL ENGINEERING**

PERIYAR MANIAMMAI UNIVERSITY
(Under Sec. 3 of UGC Act, 1956)
NAAC ACCREDITED

# CURRICULUM & SYLLABUS

*(Based on Outcome Based Education)*

*For*

# B.Tech – CIVIL ENGINEERING

## (PART TIME – 3 1/2 Years)

## (I -VII Semesters)

# Regulations 2017

# PERIYAR MANIAMMAI UNIVERSITY

| | | |
|---|---|---|
| **Vision** | | To be a University of global dynamism with excellence in knowledge and innovation ensuring social responsibility for creating an egalitarian society. |
| **Mission** | **UM1** | Offering well balanced programmes with scholarly faculty and state-of-art facilities to impart high level of knowledge. |
| | **UM2** | Providing student - centred education and foster their growth in critical thinking, creativity, entrepreneurship, problem solving and collaborative work. |
| | **UM3** | Involving progressive and meaningful research with concern for sustainable development. |
| | **UM4** | Enabling the students to acquire the skills for global competencies. |
| | **UM5** | Inculcating Universal values, Self respect, Gender equality, Dignity and Ethics. |

**Core Values**

- Student – centric vocation
- Academic excellence
- Social Justice, equity, equality, diversity, empowerment, sustainability
- Skills and use of technology for global competency.
- Continual improvement
- Leadership qualities.
- Societal needs
- Learning, a life – long process
- Team work
- Entrepreneurship for men and women
- Rural development
- Basic, Societal, and applied research on Energy, Environment, and Empowerment.

## DEPARTMENT OF CIVIL ENGINEERING

| | | |
|---|---|---|
| **Vision** | | To create technocrats in the discipline of Civil Engineering through research integrated academic programme of UG, PG and Ph.D. of global standards and in turn contribute to the socio-economic development of the nation through research and consultancy. |
| **Mission** | **DM1** | To create, disseminate and integrate knowledge of science , engineering and technology through innovative teaching learning process that expands Civil Engineering Knowledge base and enhance the betterment of industry and human society |
| | **DM2** | To develop , perform forward looking research by integrating proper blend of applied and theoretical knowledge with a positive impact for the society |
| | **DM3** | To educate , inspire and create competent civil engineering professionals who possess the knowledge and skills required by industries for careers or to become an entrepreneur |
| | **DM4** | To serve as a reliable,highly capable resource for society,the profession and the university through activities in the professional organization,committees, consultancy and continuing education |

**Table: 1 Mapping of University Mission (UM) and Department Mission (DM)**

| | **UM 1** | **UM 2** | **UM 3** | **UM 4** | **UM 5** |
|---|---|---|---|---|---|
| **DM 1** | 2 | 3 | 2 | 1 | 3 |
| **DM 2** | 1 | 2 | 2 | 1 | 2 |
| **DM 3** | 2 | 3 | 3 | 2 | 2 |
| **DM 4** | 3 | 2 | 2 | 2 | 3 |
| | **8** | **10** | **9** | **6** | **10** |

**1-Low 2- Medium 3 – High**

## PROGRAMME EDUCATIONAL OBJECTIVES

Based on the mission of the department, the programme educational objectives is formulated as

| | |
|---|---|
| **PEO1** | Graduates will successfully apply the engineering concepts to the formulation and provide solution to the emerging technical problems in industry, government or other organizations towards implementing efficient civil engineering practices. |
| **PEO2** | Graduates will have the ability to use their education to be lifelong learners and in turn utilize intellectual curiosity in enhancing technical, personal and professional growth. |
| **PEO3** | Graduates will become entrepreneurs (professional engineers) in starting-up and growing their own new firms in the domain of civil engineering and also exhibit leadership role of highest standards of professional endeavors in their chosen profession and in other activities. |
| **PEO4** | Graduates will be aware of ethical, social and cultural issues within a global context and their importance in the exercise of professional skills and responsibilities. |

**Table: 2 Mapping of Program Educational Objectives (PEOs) with Department Mission (DM)**

| | **DM 1** | **DM 2** | **DM3** | **DM 4** |
|---|---|---|---|---|
| **PEO 1** | 3 | 2 | 1 | 1 |
| **PEO 2** | 2 | 3 | 2 | 1 |
| **PEO 3** | 1 | 1 | 3 | 2 |
| **PEO 4** | 2 | 1 | 1 | 3 |
| | **8** | **7** | **7** | **7** |

*1- Low 2 – Medium 3-High*

## GRADUATE ATTRIBUTES

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse 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 t h e specified needs with appropriate consideration for public health and safety, and 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 modelling 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, and 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 t h e 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:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAM OUTCOMES

| | |
|---|---|
| **PO 1** | Apply the knowledge of mathematics, science, Engineering fundamentals and Civil Engineering principles to the solution of complex problems in Civil Engineering. |
| **PO 2** | Identify, formulate, research literature and analysis complex civil engineering problems reaching substantiated conclusions using first principles of mathematics and Engineering Sciences. |
| **PO 3** | Design solutions for complex civil engineering problems and design system components or processes that meet the specified needs with appropriate considerations for the public health and safety and the cultural, societal and environmental conservations |
| **PO 4** | An ability to plan, draw and design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability |
| **PO 5** | An ability to work effectively as an individual and a team. |
| **PO 6** | An ability to identify, formulate, and solve engineering problems. |
| **PO 7** | An understanding of professional and ethical responsibility in a global context |
| **PO 8** | An ability to articulate and communicate ideas persuasively and effectively both in written and oral. |
| **PO 9** | A recognition of the need for, and an ability to engage in lifelong learning |
| **PO 10** | A knowledge of contemporary issues relevant to engineering practice |
| **PO 11** | An ability to understand the critical issues of professional practice such as the procurement of work, financial management and the interaction with contractors during the construction phase of a project. |
| **PO 12** | An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice |
| | **PROGRAM SPECIFIC OUTCOME** |
| **PSO 1** | Capably plan, analyse and design the civil engineering structures. |
| **PSO 2** | Apply knowledge of three technical areas appropriate to Civil Engineering such as Geotechnical, Environmental and water resources engineering etc. |

**Table 3 Mapping of Program Educational Objectives (PEOs) with Program Outcomes (POs)**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PEO 1** | 3 | 2 | 2 | 1 | 1 | 2 | - | - | - | 1 | 2 | - | 3 | - |
| **PEO 2** | 1 | 3 | 2 | 3 | 2 | 1 | 1 | - | - | 2 | 1 | 1 | - | 2 |
| **PEO 3** | - | 1 | 3 | 2 | 3 | - | 2 | 1 | 1 | 2 | 1 | 2 | 1 | 1 |
| **PEO 4** | - | 1 | 2 | 2 | - | 1 | 3 | 1 | 1 | 1 | 1 | 1 | - | 1 |
| | **4** | **7** | **9** | **8** | **6** | **4** | **6** | **2** | **2** | **6** | **5** | **4** | **4** | **4** |

**1 - Low 2 – Medium 3 - High**

**CURRICULUM**

**REGULATIONS – 2016**

(Applicable to the students admitted from the Academic year 2016– 2017)

**SEMESTER – I**

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| PCE 101 | Numerical Methods | 2 | 1 | 0 | 3 | 4 |
| PCE 102 | Solid Mechanics | 3 | 1 | 1 | 5 | 7 |
| PCE 103 | Fluid Mechanics | 3 | 1 | 0 | 4 | 5 |
| PCE 104 | Surveying | 3 | 1 | 0 | 4 | 5 |
| | **TOTAL** | **11** | **4** | **1** | **16** | **21** |

**SEMESTER – II**

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| PCE 201 | Structural Mechanics | 3 | 1 | 0 | 4 | 5 |
| PCE 202 | Open Channel Flow and Hydraulic Machines | 3 | 1 | 1 | 5 | 7 |
| PCE 203 | Concrete Technology | 2 | 0 | 1 | 3 | 4 |
| PCE 204 | Environmental Studies | 0 | 0 | 0 | 0 | 3 |
| | **TOTAL** | **9** | **2** | **1** | **12** | **19** |

**SEMESTER III**

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| **THEORY** | | | | | | |
| PCE 301 | Structural Analysis | 2 | 1 | 0 | 3 | 4 |
| PCE 302 | Environmental Engineering | 3 | 1 | 1 | 5 | 7 |
| PCE 303 | Geotechnical Engineering | 3 | 0 | 1 | 4 | 5 |
| PCE 304 | Total Quality Management | 3 | 0 | 0 | 3 | 3 |
| | **TOTAL** | **11** | **2** | **2** | **15** | **19** |

## SEMESTER – IV

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| | **THEORY** | | | | | |
| PCE 401 | Irrigation Engineering | 3 | 0 | 0 | 3 | 3 |
| PCE 402 | Transportation Engineering | 3 | 0 | 1 | 4 | 5 |
| PCE 403 | Design of Concrete Structures | 3 | 1 | 0 | 4 | 5 |
| PCE 404 | Economics for Engineers | 3 | 0 | 0 | 3 | 3 |
| | **TOTAL** | **12** | **1** | **1** | **14** | **16** |

## SEMESTER V

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| | **THEORY** | | | | | |
| PCE501 | Professional Elective -I | 3 | 0 | 0 | 3 | 3 |
| PCE 502 | Professional Elective -II | 2 | 1 | 0 | 3 | 4 |
| PCE 503 | Structural Steel Design | 3 | 1 | 0 | 4 | 5 |
| PCE 504 | Business Communication | 1 | 0 | 0 | 1 | 3 |
| | **TOTAL** | **9** | **2** | **0** | **11** | **15** |

## SEMESTER VI

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| | **THEORY** | | | | | |
| PCE 601 | Construction Project Management | 3 | 0 | 1 | 4 | 5 |
| PCE 602 | Professional Elective -III | 3 | 0 | 0 | 3 | 3 |
| PCE 603 | Professional Elective -IV | 3 | 0 | 0 | 3 | 3 |
| PCE 604 | Academic Writing | 0 | 0 | 0 | 0 | 2 |
| | **TOTAL** | **9** | **0** | **1** | **10** | **13** |

## SEMESTER VII

| Sub. Code | Name of the subject | L | T | P | C | H |
|---|---|---|---|---|---|---|
| | **THEORY** | | | | | |
| PCE 701 | Cost Estimation and Valuation | 3 | 1 | 1 | 5 | 7 |
| PCE 702 | Professional Elective -V | 3 | 0 | 0 | 3 | 3 |
| PCE 703 | Project | 0 | 0 | 12 | 12 | 24 |
| | **TOTAL** | **6** | **1** | **13** | **20** | **34** |

**TOTAL CREDITS = 98**

## LIST OF ELECTIVES

### PROFESSIONALELECTIVES GROUP – I

| Sub. Code | Name of the Course | L | T | P | C | H |
|---|---|---|---|---|---|---|
| PCE 501A | Repair and Rehabilitation of Structures | 3 | 0 | 0 | 3 | 3 |
| PCE 501B | Smart Materials and Structures | 3 | 0 | 0 | 3 | 3 |
| PCE 501 C | Industrial Waste Water Management | 3 | 0 | 0 | 3 | 3 |
| PCE 501 D | Solid and Hazardous Waste Management | 3 | 0 | 0 | 3 | 3 |

### PROFESSIONAL ELECTIVES GROUP – II

| Sub. Code | Name of the Course | L | T | P | C | H |
|---|---|---|---|---|---|---|
| PCE 502A | Basics of Earthquake Engineering and Seismic Design | 2 | 1 | 0 | 3 | 4 |
| PCE 502 B | Tall Buildings | 2 | 1 | 0 | 3 | 4 |
| PCE 502 C | Advanced Pavement Design | 2 | 1 | 0 | 3 | 4 |
| PCE 502 D | Design of Plate and Shell Structures | 2 | 1 | 0 | 3 | 4 |

### PROFESSIONAL ELECTIVES GROUP – III

| Sub. Code | Name of the Course | L | T | P | C | H |
|---|---|---|---|---|---|---|
| PCE 602A | Prefabricated Structures | 3 | 0 | 0 | 3 | 3 |
| PCE 602 B | Disaster Management | 3 | 0 | 0 | 3 | 3 |
| PCE 602 C | Water Resource planning and management | 3 | 0 | 0 | 3 | 3 |
| PCE 602D | Environmental Impact Assessment | 3 | 0 | 0 | 3 | 3 |

### PROFESSIONAL ELECTIVES GROUP – IV

| Sub. Code | Name of the Course | L | T | P | C | H |
|---|---|---|---|---|---|---|
| PCE 603A | Prestressed Concrete Structures | 3 | 0 | 0 | 3 | 3 |
| PCE 603B | Earth Retaining Structures | 3 | 0 | 0 | 3 | 3 |
| PCE 603C | Finite Element Method | 3 | 0 | 0 | 3 | 3 |
| PCE 603D | Experimental Stress Analysis | 3 | 0 | 0 | 3 | 3 |

### PROFESSIONALELECTIVES GROUP – V

| Sub. Code | Name of the Course | L | T | P | C | H |
|---|---|---|---|---|---|---|
| PCE702A | Air Quality Management | 3 | 0 | 0 | 3 | 3 |
| PCE 702B | Urban and Regional Planning-Future Trends | 3 | 0 | 0 | 3 | 3 |
| PCE 702C | Construction and Law | 3 | 0 | 0 | 3 | 3 |
| PCE 702D | Docks, Harbour and Airport Engineering | 3 | 0 | 0 | 3 | 3 |

**Semester** **I**

**Subject Name** **NUMERICAL METHODS**

**Subject Code** **PCE101**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 2- 1– 0 – 3 | 3:0:0 | 2- 2– 0 -4 |

| *Course Outcome* | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | Solve algebraic and transcendental equations and to find eigen values of a matrix by power method | C(Response) C(Application) |
| **CO2** | Interpret and approximate the data using interpolation methods | C (Understand) |
| **CO3** | Solve the numerical differentiation and integration and to apply the Trapezoidal and Simpson's rules. | C(Application) |
| **CO4** | Solve the first order and second order differential equations using single step and multistep methods. | C(Application) |
| **CO5** | Apply finite difference methods to solve two-point linear boundary value problems and to solve one dimensional heat-flow equation and wave equation. | C(Application) |

**COURSE CONTENT**

**UNIT I** **SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS** **12 hrs**

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton- Raphson method- Solution of linear system of equations - Gauss Elimination method –Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method – Eigen values of a matrix by Power method.

**UNIT II** **INTERPOLATION AND APPROXIMATION** **12 hrs**

Interpolation with equal intervals - Newton's forward and backward difference formulae- Interpolation with unequal intervals - Lagrange interpolation – Newton's divided difference interpolation

**UNIT III** **NUMERICAL DIFFERENTIATION AND INTEGRATION** **12 hrs**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rules – Romberg's method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's rules.

**UNIT IV** **INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** **12 hrs**

Single step-methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations - Multi-step methods - Milne's and Adams-Bashforth predictor-Corrector methods for solving first order equations.

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12 hrs**

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat-flow equation by explicit and implicit methods - One dimensional wave equation by explicit method.

**L = 30 hrs T = 30 hrs Total = 60hrs**

**Text books**


1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, (2004).
2. SankaraRao, K. "Numerical methods for Scientists and Engineers', 3rd Edition, Prentice Hall of India Private Ltd., New Delhi, (2007).


**References**


1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, (2007).
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, (2006).
3. Brian Bradie, "A friendly introduction to Numerical analysis", Pearson Education Asia, New Delhi, (2007)
4. Jain M.K.IyengarS.R.K,JainR.K,"NumericalMethods problems and solutions",Revised Second Edition (2007).


**E-References**

1. www.nptel.ac.in
   Elementary Numerical Analysis Prof. Rekha P. Kulkarni. Department of Mathematics, Indian Institute Of Technology, Bombay.

**Mapping of COs with GAs**

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 3 | | | | | | | | | 1 | | 1 |
| **CO 2** | 3 | | | | | | | | | 1 | | 1 |
| **CO 3** | 3 | | | | | | | | | 1 | | 1 |
| **CO 4** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 |
| **CO 5** | 3 | 2 | | | 1 | | | | | 1 | 1 | 1 |
| | 15 | 4 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 5 | 2 | 5 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **I**
**Subject Name** **SOLID MECHANICS**
**Subject Code** **PCE 102**

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3- 1 – 1- 5** | **1.5:1:0.5** | **3 -2 - 2- 7** |

| **Course Outcomes** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Analyse stresses and strains in members subjected to axial, bending and torsional loads. | C (Analyse) P (Measure) |
| **CO2** | Examine the stability of structural members by studying the reactions and internal forces. | C (Analyse) |
| **CO3** | Find out the critical point in structural members where maximum shear force and bending moment occur at various loading conditions. | C (Analyse) A (Response) |
| **CO4** | Evaluate the deflection and shear stress distribution for beams of varioussections. | C (Analysis) & P(Measure) |
| **CO5** | Assess the output of springs and shafts for its maximum energy. | C (Knowledge) & P(Response) |

**COURSE CONTENT**

**UNIT I** **STRESS, STRAIN AND DEFORMATION OF SOLIDS** **15 hrs**

Stress, Strain, Hooke's Law, Elastic Constants, Thermal stress, deformation of simple and compound bars – shear modulus, bulk modulus, relationship between elastic constants, biaxial state of stress – stress at a point – stress on inclined plane – Principal stresses and Principal planes .

**UNIT II** **ANALYSIS OF PLANE TRUSS, THIN CYLINDERS/SHELLS15 hrs**

Stability and equilibrium of plane frames – types of truss – analysis of forces in truss members method of joints, method of sections– Graphical Method - Thin cylinders and shells – under internal pressure – deformation of thin cylinders and shells.

**UNIT III** **TRANSVERSE LOADING AND STRESSES OF BEAMS15 hrs**

Beams–Types of Supports, Types of Load –Relationship between Bending Moment and Shear Force–Shear Force and Bending Moment Diagrams for Statically Determinate Beam with Concentrated Load, Uniformly Distributed Load, Uniformly Varying Load. Theory of Simple Bending – Analysis of Stresses.

**UNIT IV** **DEFLECTION AND SHEAR STRESSES OF BEAMS15hrs**

Double Integration Method - Macaulay's Methods - Area Moment Method - Conjugate Beam Method for computation of Slopes and Deflections of determinant beams-Variation of Shear Stress– Shear Stress distribution in Rectangular and I Sections, Solid and Hollow Circular Sections, Angle and Channel Sections.

**UNIT V** **TORSION AND SPRINGS15 hrs**

Stresses and deformation in circular (solid and hollow shafts) – stepped shafts – shafts fixed at both ends – leaf springs – stresses in helical springs – deflection of springs

**Practical** **30 hrs**

1.Tension test on HYSD bar / MS rod

2. Impact Test(Izod and Charpy)

3. Hardness Test(Brinells and Rockwell)

4. Test on timber

i) Compressive strength test

ii)Tensile strength test

iii)Shear Strength test

iv) Static bending test

5. Deflection Test

**L=45 hrs T =30 hrs P=30 hrs Total = 105 hrs**

**Text books**


1. Bansal.R.K. "A Text Book of Strength of materials", Laxmi Publications, Sixth Edition,2015
2. Bhavikatti.S. "Strength of Materials", Vikas Publishing House Pvt Limited, Fourth Edition, 2013
3. Khurmi. R.S "Strength of Materials ", S.Chand Limited, Revised edition, 2013
4. Rajput. R.K. "Strength of Materials ", 2012, S.Chand Limited, Revised Edition,2012


**References**


1. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2012, Second Edition.
2. Srinath L.S, "Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2009, Third Edition.
3. William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition, 2011.


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | | 1 | 3 | | | | | | 2 | | 2 | |
| **CO2** | 1 | 2 | | | | | | | | | 1 | | 1 | |
| **CO3** | 1 | 3 | | | | 2 | | | | | 2 | | 2 | |
| **CO4** | 1 | 2 | 2 | 1 | | | 1 | 1 | | | 2 | | 1 | |
| **CO5** | 1 | 1 | 1 | | 3 | | 1 | 1 | | | | | 1 | |
| | 6 | 11 | 3 | 2 | | 2 | 2 | 2 | | | 7 | | 7 | |

***1 - Low , 2 – Medium , 3 – High***

**Semester** I
**Subject Name** FLUID MECHANICS
**Subject Code** PCE 103

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 1 – 0- 4 | 3:1:0 | 3- 2 – 0 – 5 |

| Course Outcomes | | Domain C or P or A |
|---|---|---|
| **CO1** | Acquiring knowledge of fluid mechanics fundamentals, including concepts of mass and momentum conservation | C (Knowledge) |
| **CO2** | Application of Bernoulli equation to solve problems in fluid mechanics | C (Application) |
| **CO3** | Identify the losses in pipes and field applications | C(Knowledge) & P (Measure) |
| **CO4** | Perform dimensional analysis for problems in fluid mechanics. | C (Analyse) |

**COURSE CONTENT**

**UNIT-I** **FLUID PROPERTIES AND FLUID STATICS12 hrs**

Fundamental definitions dimensions and units – fluid properties – classification of fluids. Concepts of fluid pressure and its measurement (manometer) – forces on solid surfaces buoyancy and floatation – fluid mass under relative equilibrium.

**UNIT –II** **FLUID KINEMATICS12 hrs**

Lagrangian and Eulerian methods – Classification of flow – Streamlines, path lines and streak lines – Continuity equation – Velocity potential and Stream function – Flow nets.

**UNIT-III** **FLUID DYNAMICS** **12 hrs**

Euler's and Bernoulli's equations – Application of Bernoulli's equation – orifice meter, Venturimeter, Pitot tube, flow through orifice, mouthpiece, weir and notch, momentum principle. Flow through pipes: Loss of energy in pipes – pipes in series and parallel – moody diagram.

**UNIT-IV** **DIMENSIONAL ANALYSIS AND SIMILITUDE** **12 hrs**

Dimensional homogeneity - Non Dimensional parameter - Π theorem - dimensional analysis - choice of variables - Rayleigh methods. Model analysis - similitude, types of similarities, force ratio, similarity laws - model classification, scale effects.

**UNIT-V** **BOUNDARY LAYER** **12 hrs**

Definition of boundary layer – Displacement, momentum and energy thickness – laminar and turbulent boundary layers – Total drag on flat plate due laminar and turbulent boundary layer - Separation of boundary layers and its control.

**L=45 hrs T =15 hrs Total = 60 hrs**

**Text books**


1. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, 2011.
2. Kumar K.L., Engineering Fluid Mechanics, S.Chand (p) Ltd., New Delhi, 2008.
3. Natarajan, M.K., Principles of Fluid Mechanics, Oxford and IBH publishing Co. New Delhi, 2008.
4. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi, 2010

**Reference books**


1. Prof. S. Nagarathinam , Fluid Mechanics , Khanna Publishers, New Delhi
2. K. R. Arora,Fluid Mechanics, Hydraulics and Hydraulics Machines, Standard Publishers, New Delhi,2011
3. P. N. Modi & S. M. Sethi "Hydraulics, Fluid Mechanics and Hydraulics Mechanics" Standard Publishers, New Delhi, 2009


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | | | | | | | | | | | | |
| **CO2** | 3 | 3 | 1 | | | | | | | | | | 2 | 1 |
| **CO3** | 3 | 3 | | | | | | | | | | | | |
| **CO4** | 3 | 3 | | | | | | | | | | | 2 | |
| | 12 | 12 | 1 | | | | | | | | | | 4 | 1 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **I**

**Subject Name** **SURVEYING**

**Subject Code** **PCE 104**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 1- 4 | 1.5:1:0.5 | 3- 0 – 2- 5 |

| **Course Outcomes** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Inculcate the knowledge on collection of data required to prepare the map/plan | C (Knowledge)<br>A (Response) |
| **CO2** | Determine the location and reduced level of different points to determine the contours applicable to different projects. | C (Analysis)<br>P (Measure) |
| **CO3** | Understand the significance of surveying in practical field. | C (Evaluation)<br>A (Receive) |
| **CO4** | Handle modern surveying instruments | C (Knowledge)<br>P (Diagnose) |

**COURSE CONTENT**

**UNIT I** **BASIC SURVEYING** **9 hrs**

Introduction to Plane and Geodetic Surveying –Scales- Chain surveying- Distance Measurement –offsets- Field Book- Compass Instrument - Measurement of angles and directions - Magnetic declination and its variation- Local attraction - traverse- Plane Table Surveying – Principle-Equipment -Two point and three point problem

**UNIT II** **LEVELLING** **9 hrs**

Leveling - terms and definitions - Instruments and its parts -Temporary and permanent adjustments - Reduction of level - Height of collimation and Rise and fall methods - Reciprocal leveling -Longitudinal and cross sectioning - Contouring -Capacity of reservoirs

**UNIT III** **THEODOLITE AND TACHEOMETRY** **9 hrs**

Description of theodolite - Measurement of horizontal angles and vertical angles - Methods of repetition and reiteration –Tachometry - Tachometric systems - Determination of Instrument constants-Problems in tachometry survey.

**UNIT IV** **TRIANGULATION** **9 hrs**

Triangulation system, Requirements for selection of triangulation stations - Satellite station, signals, Phase of signal -Trignometrical leveling Both base of object accessible and inaccessible, problems.

**UNIT V** **MODERN SURVEYING** **9 hrs**

Introduction to advance surveying - Total Station and Global positioning system - Geographic information system (GIS)- Photogrammetry - Stereoscopy – Principle of Electromagnetic distance measurement

**Practical** **15 hrs**

1. Chain surveying- Distance Measurements.
2. - Magnetic declination and its variation.
3. Two point and three point problem.
4. Height of collimation and Rise and fall methods.
5. Longitudinal and cross sectioning – Contouring.
6. Single plane method and double plane method.
7. Determination of Instrument constants.
8. Determination of reduce level using theodalite by Angle of elevation and depression method.
9. Area calculation and contouring using Total Station.
10. Co ordinate measurement using Global positioning.

**L=45 hrs P = 15 hrs Total = 60 hrs**

**Text books**


1. Punmia B.C. Surveying, Vols. I, II and III, Laxmi Publications, 2014
2. Bannister A. and Raymond S., Surveying, ELBS, Sixth Edition, 2014
3. Kanitkar T.P., Surveying and Levelling, Vols. I and II, United Book Corporation, Pune, 2014.
4. S.C.Rangwala and P. S. Rangwala, Charotar Surveying and leveling, Publishing House Pvt. Ltd, 2014


**References**


1. Agor ,"A Text Book of Surveying and Levelling" Khanna Publishers, 11th Edition, 2014
2. Basak.N. "Surveying and Leveling" McGraw Hill Education (India) Private Limited, 2nd Edition,2014
3. Subramanian.R Surveying and Leveling by Oxford University Press, 2007


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 1 | 2 | 3 | | | | | 1 | | | 3 | 2 |
| CO2 | 3 | | 1 | 2 | 3 | | | | | 1 | | | 2 | 1 |
| CO3 | | | 2 | 3 | 3 | | 1 | 3 | | | 1 | | | |
| CO4 | | | 1 | | 3 | | | | | 2 | | | | |
| | 6 | | 5 | 7 | 12 | | 1 | 3 | | 4 | 1 | | 5 | 3 |

**Semester** **II**

**Subject Name** **STRUCTURAL MECHANICS**

**Subject Code** **PCE 201**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3 - 1 – 0 - 4 | 2:0.5:0.5 | 3- 2 –0- 5 |

| **Course Outcome:** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | Identify the behavior of structural element under combined stresses. | C (Knowledge) & A (Receive) |
| **CO2** | Analyse indeterminate structures under various loading condition. | C (Analysis) |
| **CO3** | Understand the failure criteria of the column and cylinder. | C (Comprehension) & P (Diagnose) |
| **CO4** | Generate the solutions for simple structural element by energy principles. | C (Knowledge) |
| **CO5** | Recognize the fundamental principles to check the stability of structural elements | C (Knowledge) |

**COURSE CONTENT**

**UNIT I** **STATE OF STRESS IN THREE DIMENSIONS** **12 hrs**

Stress and strain tensor - Principal stresses and principal planes –Theories of failure - Application of strain gauges for stress analysis.

**UNIT II** **INDETERMINATE BEAMS** **12 hrs**

Propped cantilever beams and fixed beams - Fixed end moments and support reactions – Analysis of continuous beam - Theorem of Three Moments

**UNIT III** **COLUMNS AND THICK CYLINDERS** **12 hrs**

Short and Long Columns, Euler's Theory , Eccentrically loaded column - Rankine-Gordon formula - Thick cylinders – Compound cylinders

**UNIT IV** **ENERGY PRINCIPLES** **12 hrs**

Unit load method for deflection – Castigliano's theorem – Principle of virtual work – Application of energy theorems for computing deflections in beams.

**UNIT V** **ADVANCED TOPICS** **12 hrs**

Unsymmetrical bending - Curved Beams –Stability of dams and Retaining walls.

**L=45 hrs T=15 hrs Total = 60 hrs**

**Text books**


1. Bansal R.K. "A Text Book of Strength of materials", 2010, Laxmi Publications, Fourth Edition.
2. Bhavikatti.S. S. "Strength of Materials", 2010, Vikas Publishing House Pvt Limited.
3. Rajput. R.K. "Strength of materials", 2011, S.Chand Limited.

**References**


1. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi, 2012, Second Edition.
2. Srinath L.S, "Advanced Mechanics of Solids", Tata McGraw-Hill Publishing Co., New Delhi, 2009, Third Edition.
3. William Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series, McGraw-Hill International Edition, 2011.
4. Timoshenko.S.B.andGere.J.M,"MechanicsofMaterials",VanNosReinbhold,NewDelhi, 2010.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | | | | | 1 | | | 1 | | | | | |
| **CO2** | 2 | 1 | | | | 1 | | 1 | | | 1 | | 3 | 1 |
| **CO3** | 1 | | | | 1 | | 1 | | | | 1 | | | |
| **CO4** | 3 | 1 | | 3 | | | 1 | | | | | | 1 | |
| **CO5** | 3 | 3 | | | | | | | | | | | 1 | |
| | 10 | 5 | | 3 | 1 | 2 | 2 | 1 | 1 | | 2 | | 5 | 1 |

***1-Low , 2- Medium ,3-High***

**Semester** **II**
**Subject Name** **OPEN CHANNEL FLOW AND HYDRAULIC MACHINES**
**Subject Code** **PCE 202**

| **L –T –P –C** | **L –T –P –H** |
|---|---|
| **3- 1 – 1- 5** | **3- 2 –2- 7** |

| **Course Outcome:** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | Measure discharge in open channel. | C (Evaluation) P (Measure) |
| **CO2** | Understand impact jet on vanes. | C (Comprehension) |
| **CO3** | Understand the working principles and selection of Impulse and reaction turbines | C (Knowledge) |
| **CO4** | Understand the working principles of roto dynamic and position displacement pumps | C (Knowledge) |
| **CO5** | Select the type of pump for a practical situation | C (Evaluation) P (Palpate) |

**COURSE CONTENT**

**` UNIT-I** **OPEN CHANNEL FLOW** **15 hrs**

Open channel flow - Classification – Terminology - velocity distribution in open channels - Chezy, Manning and other formulae – Best hydraulic section - specific energy - specific force - hydraulic jump and its characteristics – Gradually varied flow surface profiles – notches, weirs and venturiflumes – discharge through notches.

**UNIT –II** **IMPACT OF JET** **15 hrs**

Principles of impingement of jets – Impact of jet on a stationary vertical plate, stationary inclined plate, stationary curved plate, hinged plate, moving vertical and inclined plates, moving curved plate, series of moving flat and curved vanes.

**UNIT-III** **TURBINES** **15 hrs**

Turbines – classification – impulse turbines – Pelton wheel – Reaction turbines – Francis and Kaplan turbines –draft tubes – performance of turbines – specific speed and their significance.

**UNIT -IV** **CENRIFUGAL PUMP** **15 hrs**

Centrifugal pump – description and working – head, discharge and efficiency of a Centrifugal pump - pressure rise in the pump – minimum starting speed of a pump – cavitation – characteristics curves – priming – multistage pumps

**UNIT - V** **OTHER PUMPS** **15 hrs**

Reciprocating pump - description and working – types – discharge and slip – power required to drive the pump – indicator diagram- air vessel – work done against friction with and without air vessels – working principle and use of- deep well pumps – submersible and jet pumps, special pumps – gear pump – screw pump, sewage pump.- Characteristics test on jet pump, gear pump, vane pump, reciprocating pump.

**Practical** **30 hrs**

1. Notches
2. Venturimeter
3. Friction factor of the pipe
4. Centrifugal Pump
5. Reciprocating Pump
6. Jet Pump
7. Submersible Pump
8. Pelton Turbine
9. Francis Turbine

**L=45 hrs T=15 hrs P= 15 hrs Total = 75 hrs**

**Text books**


1. Subramanya, "Flow in Open channels", McGraw Hill Education (I), New Delhi, 2015.
2. Bansal, R.K., Fluid Mechanics and Hydraulic Machines, Laxmi Publications (P) Ltd., New Delhi, 2011.
3. R.K.Rajput, Fluid Mechanics and Hydraulic Machines, S.Chand & Company Ltd., New Delhi, 2002.


**References**


1. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by K. R. Arora, Standard Publishers, New Delhi.
2. Hydraulics, Fluid Mechanics and Hydraulics Mechanics by P. N. Modi & S. M. Sethi Standard Publishers, New Delhi.
3. Bakhmeteff, "Hydraulics of open channel", Tata Mc Graw Hill Education (P) Ltd., New Delhi, 2011


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | | | | 1 | | 1 | | 1 | | | 1 |
| CO2 | 3 | 3 | 2 | | 1 | | 1 | | | | | | | 1 |
| CO3 | 3 | 3 | 2 | | | 1 | | | | | 1 | | | 2 |
| CO4 | 2 | 3 | 2 | | 1 | | | | | | | | | 1 |
| CO5 | 2 | 3 | 2 | | | 1 | | 1 | | | | | | |
| | 13 | 15 | 10 | | 2 | 2 | 2 | 1 | 1 | | 2 | | | 5 |

***1-Low , 2- Medium ,3-High***

| | | |
|---|---|---|
| **Semester** | **IV** | |
| **Subject Name** | **CONCRETE TECHNOLOGY** | |
| **Subject Code** | **PCE 203** | |

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **2 – 0 – 1 –3** | **2:0.75:0.25** | **2– 0 – 2– 4** |

| **Course Outcome:** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | ***Identify*** and ***test*** the properties of ingredients of Concrete | C (Knowledge) |
| **CO2** | ***Identify*** and ***test*** the properties of Concrete | C (Application) & P(Palpate) |
| **CO3** | ***Carry out*** the mix design of M20 and M35 as per IS456 | C (Application) |
| **CO4** | ***Ensure*** quality during Transporting, Laying, Compacting and finishing of concrete | C (Knowledge) |
| **CO5** | ***Adopt*** special concreting technologies to meet out the modern construction requirements. | C (Knowledge) |

**COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT I** | **CONSTITUENT MATERIALS** | **6+0+12 hrs** |
| | Cement: - Properties-Testing- Modern methods of analysis- Blended Cements; Aggregates: Classification- Properties-Testing-Artificial aggregates; Water: Various sources-Standards- Admixtures and Chemicals: Properties, Uses. | |
| **UNIT II** | **FRESH CONCRETE** | **6+0+9hrs** |
| | Rheology-Workability: Factors affecting- Measurement- Testing; Manufacture of concrete: Process- Compaction; Properties: Segregation-Bleeding- Setting times- Curing-Finishing. | |
| **UNIT III** | **CONCRETE MIX DESIGN** | **6+0+9hrs** |
| | Concepts of Mix Design- Factors influencing mix design- ACI and IS code recommended mix design methods; Non Pumpable concrete; Pumpable Concrete. Compressive Strength of Concrete Cube- Quality control –Sampling and testing | |
| **UNIT IV** | **HARDENED CONCRETE** | **6+0+0hrs** |
| | Concepts of mix design - Factors influencing mix design – ACI and IS code recommended mix design methods; Non-pumpable concrete; Pumpable concrete:. | |
| **UNIT V** | **SPECIALCONCRETES** | **6+0+0hrs** |
| | Manufacture, Properties and Uses: High strength and high performance concrete - Use of eco-friendly recyclable and sustainable materials - Waterproofing concrete - Fiber Reinforced concrete - Light weight and High Density Concrete - Aerated - No fines - Organic concrete; Special concreting methods: Self compacting concrete - Hot and Cold weather concreting - Prepacked - Vacuum - Gunite and Shotcrete – Ferrocement - Quality control - Sampling and testing-Acceptance criteria | |
| | | **L=45 hrs Total = 45 hrs** |

**Text Books**


- Shetty,M.S. "Concrete Technology: Theory and Practice",7th edition, S.Chand& Company, New Delhi,2014.


**References**


- Gambhir, M.L. "Concrete Technology", 5th edition, Tata McGraw Hill New Delhi, 2013.
- Santhakumar, A.R., "Concrete Technology", Oxford University Press, New Delhi, 2006
- Neville, A.M. and Brookes, J.J. "Concrete Technology", Pearson Publishers, New Delhi,

2010.

- Sandor Popovic, " Concrete Materials, 2nd Edition, Properties, Specifications and Testing",William Andrew,2012.
- John Newman,"Advanced Concrete Technology Processes" 1st edition, Elsevier Science, 2003

**E-References**

http://nptel.ac.in/courses/105102012
http://nptel.ac.in/courses/105104030
http://freevideolectures.com/Course/3357/Concrete-Technology
http://engineeringvideolectures.com/course/289

| S.No. | List of Experiments | Cos |
|---|---|---|
| 1. | Determination of Specific gravity of Cement | 1 |
| 2. | Work out the fineness of Cement | 1 |
| 3. | Find out the Consistency of Cement | 1 |
| 4 | Compute the Setting time of Cement | 1 |
| 5 | Determine the Fineness modulus of fine aggregate | 1 |
| 6 | Calculate the Specific gravity of fine aggregate | 1 |
| 7 | Find out the Bulking of fine aggregate | 1 |
| 8 | Estimate the Fineness modulus of coarse aggregate | 1 |
| 9 | Compute the Specific Gravity of Coarse aggregate | 1 |
| 10 | Find out the Bulking of coarse aggregate | 1 |
| 11 | Carry out the Aggregate Impact test | 1 |
| 12 | Determine the workability of Concrete through Slump Cone Test | 2 |
| 13 | Compute the Compaction Factor for the given mix ratio of concrete | 2 |
| 14 | Carry out the mix design of M20 and M35 as per IS 456 | 3 |
| 15 | Determine the Compressive Strength of Concrete Cube | 3 |

## Mapping of COs with POs

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | 1 | 1 | | | | 1 | 1 | 3 | 1 | 3 | 1 | |
| **CO2** | | | | | 1 | | | | 2 | 2 | | | | |
| **CO3** | 1 | 3 | 3 | 3 | | | | | 1 | | | | 3 | |
| **CO4** | 1 | | | | | 1 | 1 | | 1 | | | 1 | | 1 |
| **CO5** | | | | | 1 | | | 1 | | 3 | | | | |
| | 3 | 6 | 4 | 4 | 2 | 1 | 1 | 2 | 5 | 8 | 1 | 4 | 4 | 1 |

***1 - Low, 2 – Medium, 3 – High***

| | | | |
|---|---|---|---|
| **Semester** | **II** | | |
| **Subject Name** | **ENVIRONMENTAL STUDIES** | | |
| **Subject Code** | **PCE 204** | | |
| **L –T –P –C**<br>**0- 0 – 0- 0** | **C:P:A**<br>**2.5 :0: 0.5** | **L –T –P –H**<br>**3 - 0 – 0 - 3** | |

| **Course Outcome:** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Describe the significance of natural resources and explain anthropogenic impacts | C(Remember) & Understand) |
| **CO2** | Illustrate the significance of ecosystem and biodiversity for maintaining ecological balance | C(Understand) |
| **CO3** | Identify the facts , consequences , preventive measures of major pollution and Recognize the disaster phenomenon | C(Remember)<br>A (Receive) |
| **CO4** | Explain the socio- economics, policy dynamics and practice the control measures of global issues for sustainable development. | C(Understand& Analyse) |
| **CO5** | Recognize the impact of population and apply the concept to develop various welfare programs. | C(Understand &Apply) |

**COURSE CONTENT**

| | |
|---|---|
| **`UNIT-I** | **INTRODUCTION TO ENVIRONMENTAL STUDIES AND ENERGY 9 hrs** |
| | Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. |
| **UNIT II** | **ECOSYSTEMS AND BIODIVERSITY 9hrs** |
| | Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. |
| **UNIT III** | **ENVIRONMENTAL POLLUTION 12hrs** |
| | Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – Soil waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: flood, earthquake, cyclone and landslide. |

| | | |
|---|---|---|
| **UNIT-IV** | **SOCIAL ISSUES AND THE ENVIRONMENT** | **9hrs** |
| | Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation – Consumerism and waste products – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness. | |
| **UNIT V** | **HUMAN POPULATION AND THE ENVIRONMENT** | **6hrs** |
| | Population growth, variation among nations – Population explosion – Family Welfare Programme – Environment and human health – Human Rights – Value Education - HIV / AIDS – Women and Child Welfare – Role of Information Technology in Environment and human health – Case studies. | |
| | | **L-45 hrs Total – 45hrs** |

**Text Books**


1. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co, USA, 2000.
2. Townsend C., Harper J and Michael Begon, Essentials of Ecology, Blackwell Science, UK, 2003
3. Trivedi R.K and P.K.Goel, Introduction to Air pollution, Techno Science Publications, India, 2003.
4. Disaster mitigation, Preparedness, Recovery and Response, SBS Publishers & Distributors Pvt. Ltd, New Delhi, 2006.
5. Introduction to International disaster management, Butterworth Heinemann, 2006.
6. Gilbert M.Masters, Introduction to Environmental Engineering and Science, Pearson Education Pvt., Ltd., Second Edition, New Delhi, 2004.


**Reference Books**


1. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media, India, 2009.
2. Cunningham, W.P.Cooper, T.H.Gorhani, Environmental Encyclopedia, Jaico Publications House, Mumbai, 2001.
3. S.K.Dhameja, Environmental Engineering and Management, S.K.Kataria and Sons, New Delhi, 2012.
4. Sahni, Disaster Risk Reduction in South Asia, PHI Learning, New Delhi, 2003.
5. Sundar, Disaster Management, Sarup& Sons, New Delhi, 2007.
   G.K.Ghosh, Disaster Management, A.P.H.Publishers, New Delhi, 2006
6. Benny Joseph, Environmental Studies,Tata McGraw Hill Publications, 2005.


**e- Resources**


1. Bharat Raj Singh , 2015,Global Warming: Causes, Impacts and Remedies , InTech.
2. Richard C. J. Somerville , The Forgiving Air: Understanding Environmental Change , 1998, University of California Press

**Mapping of COs with GAs**

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | | | | | | | | | | |
| **CO2** | 2 | | | | | 2 | 1 | | | 1 | | |
| **CO3** | 2 | 1 | 3 | | | 1 | | | 1 | | 1 | |
| **CO4** | 1 | 1 | 2 | | | | | 2 | | | | |
| **CO5** | 2 | 1 | 1 | | | | | 1 | | | | 1 |
| | 10 | 3 | 6 | | | 3 | 1 | 1 | 1 | 1 | 1 | 1 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **III**
**Subject Name** **STRUCTURAL ANALYSIS**
**Subject Code** **PCE 301**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 2 - 1 – 0 - 3 | 2.5:0:0.5 | 2 – 2 - 0- 4 |

| **Course Outcome:** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Identify the behavior of structural element under various loading condition. | C & A |
| **CO2** | Understand the advantage of statically indeterminate structure and the statically determinate structure. | C |
| **CO3** | Superimpose the effects of settlement and rotation of the supports over the regular analysis. | C |
| **CO4** | Apply knowledge on advanced methods of analysis of structures including arches and cables. | C |
| **CO5** | Recognize the failure mechanism of structural elements. | C |

**COURSE CONTENT**

**UNIT I** **SLOPE DEFLECTION METHOD** **12hrs**

Continuous beams and Rigid frames (with And without sway) – Symmetry and Asymmetry– Simplification for hinged end – Support Displacements-Introduction to matrix methods

**UNIT II** **MOMENT DISTRIBUTION METHOD** **12hrs**

Stiffness and carry over factors-Distribution and carryover of Moments– Analysis of continuous Beams with and without displacement – Plane Rigid Frames with and without Sway

**UNIT III** **MOVING LOADS AND INFLUENCE LINES** **12 hrs**

Influence Lines for Reactions, Shear Forces and Bending Moments in Determinate Structures – Muller Breslau's principle for indeterminate structures(Reactions, Shear Forces and Bending Moments)

**UNIT IV** **ARCHES AND SUSPENSION CABLES** **12hrs**

Types of Arches – Transfer of loads - Arch action- Horizontal forces- Analysis of Parabolic and Circular Arches(Hinged, fixed) - Cables- Components and their functions – Analysis of Suspension Cables, Reaction-Tension and Length of suspension cables.

**UNIT V** **PLASTIC ANALYSIS OF STRUCTURES** **12hrs**

Plastic hinge and mechanism – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor –Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.

**L- 30 hrs T-30hrs Total – 60hrs**

**Text books**


1. Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", Laxmi Publications, New Delhi, 2013.
2. L.S. Negi& R.S. Jangid, Structural Analysis", Tata McGraw-Hill Publications, New Delhi, 2013
3. S SBhavikatti, Structural Analysis", Vikas Publishing House, 2011.

**References**


1. C.K. Wang, "Analysis of Indeterminate Structures", Tata McGraw-Hill, 2010.
2. B.C Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Theory of Structures", Laxmi Publication, 2012.
3. DevdasMenon, "Structural Analysis", Narosa Publishers, 2010.


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | | | | 1 | | | | | | | 1 | |
| **CO2** | 3 | 1 | 1 | | | 1 | | | | | | | | |
| **CO3** | 1 | 3 | 2 | | | | | 1 | 1 | | 1 | | | |
| **CO4** | 3 | 2 | 2 | | 1 | 1 | | | | | 1 | | 1 | |
| **CO5** | 1 | 1 | 1 | | 1 | | | | | | | | 1 | 1 |
| | 10 | 10 | 6 | | 2 | 3 | 2 | 1 | 1 | | 2 | | 3 | 1 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **III**
**Subject Name** **ENVIRONMENTAL ENGINEERING**
**Subject Code** **PCE 302**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0– 1- 4 | 2:0.5:0:5 | 3- 0 –2- 5 |

| **Course Outcome** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | An insight into the structure of drinking water supply systems, including water transport, treatment and distribution | C (Knowledge) |
| **CO2** | Able to design the various water and waste water treatment units. | C (Comprehension) |
| **CO3** | An understanding of water quality criteria and standards and their relation to public health | C (Analysis) |
| **CO4** | The student will be able to identify the characteristics of sewage, distinguish and classify the different sewerage systems. | C (Analysis)<br>P (Measure) |
| **CO5** | The student will have the knowledge on operation and maintenance of treatment units | C (Analysis)<br>A(Response) |

**COURSE CONTENT**

**UNIT I** **WATER AND ENVIRONMENT** **12hrs**

Public water supply schemes, Forms and properties of water –per capita demand - population forecasts - variation in demand pattern – Water Quality standards – water borne diseases – planning of public water supplies.

**UNIT II** **SOURCES AND TRANSMISSION OF WATER** **12hrs**

Types of water sources- Intake structures -wells, infiltration galleries – Transmission of water through pipes and channel - Hydraulics of pipe flow - use of charts and nomograms for computations – pipe materials - laying, jointing and testing of pipes- Distribution networks.

**UNIT III** **WATER TREATMENT** **12hrs**

Layout of Treatment plants for conventional water treatment plant. Principles and Functions of Screen, Flash Mixer, Flocculator, Sedimentation Tank, Slow and Rapid Sand Filters, and Disinfection Process- advanced water treatment techniques.

**UNIT IV** **WASTE WATERTREATMENT** **12hrs**

Characteristics and composition of sewage - cycles of decomposition of organic wastes - D.O, BOD and COD and their significance. Treatment methods - Layout of waste water treatment plant- Activated sludge process and its modifications; Tricking filters and Rotating biological contactors - oxidation pond- Operational problems –planning organizing and controlling of plant operations and Trouble shooting.

**UNIT V** **DISPOSAL OPTIONS** **12Hrs**

Land disposal - sewage farming practice - dilution - discharge into rivers, estuaries and ocean - river pollution - oxygen sag - self-purification - eutrophication. - sludge treatment - properties and characteristics of sludge - sludge digestion and drying beds – Recycle and reuse.

**Practicals** **30hrs**

1. Determination of pH, turbidity and conductivity.
2. Determination of the available chlorine in bleaching powder and estimation of the residual chlorine.
3. Determination of optimum dosage of coagulant
4. Determination of Iron and Fluoride.
5. Determination of Phosphorous
6. Determination of Potassium
7. Determination of Total Solids and Suspended solids.
8. Determination of Biochemical Oxygen Demand.
9. Determination of Chemical Oxygen Demand.
10. Determination of Ammonia Nitrogen.
11. Demonstration of Bacteriological analysis of water.

**L - 60hrs P - 30hrs Total -90 hrs**

**Text books**


1. Gurucharan Singh," Water supply and Sanitary Engineering", Standard Publishers Distributors, 2009
2. Garg, S.K., "Environmental Engineering I & II", Khanna Publishers, New Delhi 2007
3. S.K. Garg, Wastewater Engineering, Khanna Publishers, New Delhi, 2007
4. CPHEEO Manual on Water Supply And Treatment,1999
5. CPHEEO Manual on Sewerage And Sewage Treatment,1993


**References**


1. Karia G L & Christian R A, "Wastewater Treatment", Prentice Hall of India, New Delhi, 2013.
2. Rangwala, " Water Supply and Sanitary Engineering PB,24/e, Charotar Publishing house Pvt. Ltd.-Anand, 2011
3. B.C. Punmia, Wastewater Engineering, Volume – II, Laxmi Publication 2008
4. LinvilG.Rich, Unit operations of Sanitary Engineering, Tata Mcgraw Hill, New Delhi, 2007
5. Standard methods for the Examination of Water and Wastewater,17$^{th}$Edition,WPCF,APHA and AWWA,USA,1989.


**Mapping of CO s with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | 1 | 4 | 1 | 1 | 1 | | | 1 | | | | 1 | |
| **CO2** | | 1 | 2 | 1 | 1 | 1 | | | 2 | | | | 2 | 1 |
| **CO3** | 1 | | 3 | 2 | | | 1 | | 1 | 1 | 1 | | 2 | |
| **CO4** | 1 | 1 | 1 | 1 | | | 1 | 1 | 2 | | | 1 | 1 | |
| **CO5** | | | 2 | 2 | | | | 1 | 4 | 1 | | 2 | 5 | |
| | 2 | 3 | 12 | 7 | 2 | 2 | 2 | 2 | 10 | 2 | 1 | 3 | 11 | 1 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **III**
**Subject Name** **GEOTECHNICAL ENGINEERING**
**Subject Code** **PCE 303**

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3- 0 – 1- 4** | **1.25:0.5:0.5** | **3- 0 –2- 5** |

| **Course Outcome** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | Know about the engineering properties of soils. | C (Knowledge) |
| **CO2** | Understand about the compaction and consolidation of soil. | C (Comprehension) |
| **CO3** | Compute the stress distribution and evaluate shear strength of soil. | C (Analysis) |
| **CO4** | Calculate the safe bearing capacity of soils | C (Analysis)<br>P (Measure)<br>A(Response) |
| **CO5** | Acquire knowledge about shallow and deep foundation. | C(Knowledge)<br>P (Palpate)<br>A(Receive) |

**COURSE CONTENT**

**UNIT I** **SOIL PROPERTIES** **9 hrs**

Index properties including consistency limits and grain size distribution – Identification and classification of soil – Textural HRB and BIS specification – Soil water – Concept effective and neutral stresses – Darcy's law, Permeability –Seepage flow, seepage pressure, exit gradient – significance of Laplace equation – quick sand condition, Soil sensors applied in field, Modern advancements , Trenchless Technology.

**UNIT II** **COMPACTION AND CONSOLIDATION** **9 hrs**

Compaction – Factors affecting compaction – Field compaction – Field compaction controls, CBR value. Consolidation of soils – Terzaghi's one dimensional consolidation theory – pressure void ratio relationship – prediction of pre consolidation pressure – Total settlement and time rate settlement – secondary compression – coefficient of consolidation – Curve fitting methods, consolidation models.

**UNIT III** **STRESS DISTRIBUTION AND SHEAR STRENGTH** **9 hrs**

Vertical stress distribution in soil - Boussinesq's and Westerguard's equations – New mark's influence chart – Principle, Construction and use - Equivalent point load and other approximate procedures, stress isobars & pressure bulbs Shear Strength; Mohr – Coulomb failure criterion and models – shear properties of cohesion less and cohesive soils - Shear Strength. Parameters for under consolidated, normally consolidated and over consolidated clays

**UNIT IV** **BEARING CAPACITY AND SUB SOIL INVESTIGATION** **9 hrs**

Bearing capacity - Ultimate and allowable theories of bearing capacity - Terzaghi, Balla, Skempton, Mayerhof & Hansan. I.S.Code on B.C., Determination of BC, factors affecting BC, limits of total and differential settlement, Methods of exploration, geophysical and conventional methods; Sounding drilling and boring technique; Field tests – penetration tests

**UNIT V FOUNDATIONS 9 hrs**

Foundations - types & selection, footing, rafts and floating foundation, -Philosophy of deep foundation, piles, estimation of individual and group capacity of piles in cohesive and non-cohesive soils, static and dynamic approaches, pile load test, settlement of pile groups, negative skin friction.

**Practical 30hrs**

1.Moisture content of Soil
2.Atterberg Limits Test
3.Grain Size Distribution-Sieve Analysis and Hydrometer Analysis
4.Field Density of soil by Sand Replacement method and Core Cutter method
5.Relative Density of Soil and Free Swell index of soil
6.Specific Gravity by Pycnometer and density bottle
7. Moisture- Density relationship using standard Proctor test.
8.Permeability determination(constant head and falling head methods)
9. Direct shear test on cohesionless soil.
10.Unconfined compression test on cohesive soil
11.Triaxial compression test
12.One dimensional consolidation test(co-efficient)

**L - 45 hrs P - 30hrs Total - 75 hrs**

**Text books**


1. Punmia. B.C., Asok Kumar Jain and Arun Kumar Jain, "Soil Mechanics and Foundations" Laxmi Publications Pvt. Ltd., New Delhi, Sixteenth edition, 2006.
2. Murthy, V.N.S. Soil Mechanics and Foundation Engineering, CBS Publishers and Distributors, Reprint, 2009.
3. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 4th edition, 2012.


**References**


1. Braja.M.Das, "Principles of Geotechnical Engineering", Cengage Engineering published by Global Engineering, 8th Edition ,2014
2. IS 1080:1985, Code of practice for design and construction of foundations in soils (other than raft, ring and shell) (second revision) Re affirm date Dec 2011
3. IS 1498:1970, Classification and identification of soils for general Engineering purposes (first revision) Reaffirm Dec 2011


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 1 | | | 1 | | | | 1 | | | 1 | |
| **CO2** | 2 | 1 | | | | | 1 | 1 | | 2 | | | 1 | |
| **CO3** | | 1 | 1 | | | | 1 | 1 | | 2 | | 2 | | |
| **CO4** | | 2 | 1 | 1 | | 2 | | | | 3 | | 3 | 3 | 3 |
| **CO5** | 1 | 1 | 3 | 3 | 3 | | | | 1 | 2 | 3 | | 3 | 3 |
| | 5 | 6 | 6 | 4 | 3 | 3 | 2 | 2 | 1 | 10 | 3 | 5 | 8 | 6 |

***1-Low , 2- Medium ,3-High***

**Semester** **III**
**Subject Name** **TOTAL QUALITY MANAGEMENT**
**Subject Code** **PCE304**

| **L –T –P –C** | **L –T –P –H** |
|---|---|
| **3- 0– 0- 3** | **3- 0 –0- 3** |

| **Course Outcome** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | List and explain the basic concepts of total quality concepts and its limitations. | C (Remembering, Understanding) |
| **CO2** | Analyzeand explain the customer satisfaction, employee involvement, supplier selection and appraise the performance by TQM principle. | C (Comprehension) |
| **CO3** | Explain and apply the statistical process control tools. | C (Understanding, Appling) |
| **CO4** | Select and explain the different TQM tools and their significance. | C (Remembering, Understanding) |
| **CO5** | Explain the importance aspects of different quality systems. | C (Understanding) |

**COURSE CONTENT**

**UNIT I** **INTRODUCTION** **9hrs**

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of Total Quality Management – Historical review –Principles of TQM – Leadership – Concepts – Role of senior management – Quality Council –Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation

**UNIT II** **TQM PRINCIPLES** **9hrs**

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality –Customer retention – Employee involvement – Motivation, empowerment, teams, recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

**UNIT III** **STATISTICAL PROCESS CONTROL (SPC)** **9hrs**

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

**UNIT IV** **TQM TOOLS** **9hrs**

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

**UNIT V** **QUALITY SYSTEMS** **9hrs**

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements –Implementation of quality system – Documentation – Quality auditing – TS 16949 – ISO 14000 –Concept, requirements and benefits.

**L-45 hrs Total -45 hrs**

**Text Books**


1. Dale H. Besterfiled, et. Al. "Total Quality Management", New Delhi, Pearson Education, Inc,2007.
2. James R. Evans and William M. Lidsay, "The Management and Control of Quality", 5th Edition, South-Western, 2002.


**References**


1. Feigenbaum, A.V., "Total Quality Management", McGraw Hill, 1991.
2. Oakland, J.S., "Total Quality Management", Butterworth Heineman, 1989.
3. Narayana V. and Sreenivasan, N.S., "Quality Management – Concepts and Tasks", New Age International, 1996.
4. Zeiri, "Total Quality Management for Engineers", Wood Head Publishers, 1991.


**E-References**

http://nptel.ac.in/faq/110101010/Prof.IndrajitMukherjee,IIT,Bombay and Prof.TapanP.Bagchi, IIT, Kharagpur.

**Semester** **IV**
**Subject Name** **IRRIGATION ENGINEERING**
**Subject Code** **PCE 401**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0– 0- 3 | 2.5:0.5:0 | 3- 0 –0- 3 |

| **Course Outcome** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | Understand the knowledge on methods of irrigation including canal irrigation. | C(Understand) |
| **CO2** | Find the crop water requirement for various crops in the commanded area. | P( Measure) |
| **CO3** | Understand the design aspects of dams and channel systems. | C ( Comprehension) |
| **CO4** | Understand the concept of various hydraulic structures such as dam, energy dissipaters, head and cross regulators and structures involved in cross drainage works. | C(Knowledge) |
| **CO5** | Know the water resources available and management system. | C(Knowledge) |

**COURSE CONTENT**

**UNIT I** **IRRIGATION ENGINEERING** **9hrs**

Catchment area – Ayacut- Duty, delta and base period- relationship - Irrigation efficiencies – Crop water requirement –Estimation of consumptive use of water.

**UNIT II** **METHODS OF IRRIGATION** **9hrs**

Surface and subsurface irrigation-Sprinkler and Drip irrigation- Lift irrigation- Tank irrigation- Well irrigation - Flooding methods.

**UNIT III** **HYDRAULIC STRUCTURES** **9hrs**

Weir and Barrage – Site selection for dam construction- Gravity dam –Earthen dam- Arch dam – Buttress dam- Diversion head works with drawings- Canal drop-Canal regulators-Canal outlets- Forces acting on dam – Spillway

**UNIT IV** **CANAL IRRIGATION** **9hrs**

Classifications of canals- Canal alignment- Canal lining -Cross drainage works including drawing -River training works

**UNIT V** **WATER RESOURCES AND MANAGEMENT** **9hrs**

Water resources survey – water resources of India and Tamilnadu –Estimation of water requirements for irrigation and drinking-Single and multipurpose reservoir-Storage of reservoir –National water policy- Water prizing-Water losses – Participatory irrigation management-Irrigation scheduling-water distribution.

**L = 45hrs** **Total = 45hrs**

**Text Books**


1. Linsley R.K and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000.
2. Punmia B.C., et.al; Irrigation and water power Engineering, Laxmi Publications, 16th Edition, New Delhi, 2009.
3. GargS.K.,”Irrigation Engineering and Hydraulic structures”, Khanna Publishers, 23rd Revised Edition, New Delgi. 2009.
4. Sharma, S.K., Principles and Practice of Irrigation Engg, S.Chand Co, 1984.

**References**


1. Duggal, K.N. and Soni, J.P., "Elements of water Resources Engineering", New Age International Publishers. 2005.
2. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata Mcgraw-Hill Inc., New Delhi, 1997.
3. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd., Noida, Up, 2008.


**Mapping of COs with POs**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSo1** | **PSo2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | | | 2 | | | | | | | | 1 | 1 |
| **CO2** | | 3 | | | | | | | 1 | | | | 1 | 2 |
| **CO3** | 2 | | 2 | 1 | | | | 1 | 1 | | | | 1 | |
| **CO4** | 2 | 2 | | | | 1 | 1 | 1 | | | | | 1 | 1 |
| **CO5** | 2 | 2 | 1 | | 2 | 1 | | | | | | | 2 | 2 |
| | 9 | 9 | 3 | 1 | 4 | 2 | 1 | 2 | 2 | | | | 6 | 6 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **IV**
**Subject Name** **TRANSPORTATION ENGINEERING**
**Subject Code** **PCE 402**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3 – 0 –1–4 | 2:0.5:0.5 | 3 – 0 – 2 –5 |

**Course Outcome:**

| | | Domain C or P or A |
|---|---|---|
| **CO1** | Understand the importance of transportation infrastructure planning and design. | C |
| **CO2** | Apply basic science principles in estimating stopping and passing sight distance requirements. | C&P |
| **CO3** | Design and analyse the highway system and railway track system. | C & A |
| **CO4** | Make use of computer technology in the development of transportation infrastructure. | C & A |
| **CO5** | Insight on the basics of Airport and Harbour Engineering | C |

**COURSE CONTENT**

**UNIT I** **INTRODUCTION TO TRANSPORTATION ENGINEERING** **9hrs**

Types, characteristics and components of transportation systems - Transportation capacity – Concept – Level of service- transportation planning and evaluation – Environmental issues- Transportation safety – Introduction to intelligent transportation and application of information technology in transportation development.

**UNIT II** **HIGHWAY ENGINEERING** **9 hrs**

Functional Classification of Highway System - History of road development - pioneer works of Romans, Tresaguat, Telford, Metcalf and Macadam –Highway Alignment and Geometric Design; Alignment factors – Engineering surveys; Cross–section elements – Superelevation – pavement widening - sight distances – Horizontal Alignment – Vertical Alignment – Grade compensation – Geometric design of Hill roads.

**UNIT III** **HIGHWAY PAVEMENT DESIGN** **9 hrs**

Pavement Design - Flexible pavement - CBR Method, IRC: 37-2001 - Rigid pavement: Westergaard's analysis of wheel load stress, temperature stresses IRC: 58-2002 method of design. Types of joints and their functions,; Highway materials, construction procedure of WMM roads, bituminous roads, concrete roads and soil stabilized road - MOST specifications. Highway Drainage: Maintenance and repairs. Intersections - Miscellaneous Elements (Pedestrian facilities on Urban Roads,CycleTracks,,Bus bays, Parking facilities, Traffic Signs and Markings).

**UNIT IV** **RAILWAY ENGINEERING** **9 hrs**

Railway Engineering - Location surveys and alignment - Permanent way - Gauges - Components - Functions and requirements - Geometric design Track Junctions-Points and crossings - types and functions - design and layout - simple problems - Railway stations and yards. Signalling and interlocking - Control systems of train movements

**UNIT V DOCK, HARBOUR AND AIRPORT 9 hrs**

Airport Engineering-Aircraft characteristics - Airport obstructions and zoning - Runway - taxiways and aprons- Terminal area planning

Docks and Harbours - Types - Layout and planning principles- Breakwaters - Docks- Wharves and Quays - Transit sheds- Warehouses- Navigation aids. Urban transportation systems - Bus transit - Mass Rapid Transit System - Light Rail Transit. Transport economics and Financing - Intelligent Transportation Systems (ITS)

**Practical 30 hrs**

**I )** Tests on Aggregates

a) Specific Gravity

b) Water absorption

c) Impact Strength

d) Crushing strength

e) Abrasion

f) Grading

g) Flakiness and Elongation Index

h) Stripping Value

**II)**Tests on Bitumen

**a)** Penetration

**b)** Softening point

**c)** Flash and fire point

**d)** Ductility

**e)** Viscosity

**L-45 hrs P-30hrs Total – 75 hrs**

**Text books**


1. Khanna S.K.,HighwayEngineering, Nem Chand & Bros.,2011.
2. L.R.Kadiyali and N.B.Lal: Principles and Practice of Highway Engineering, Khanna publishers, 2007.
3. Ministry of Road Transport and Highways. Specifications for Road and Bridge Works, 5th Revision , Indian Roads Congress, 2014.
4. Rangwala, S.C., Railway Engineering, Charotar Publishing House, Pvt. Limited,2008.
5. Saxena, S.C. Railway Engineering, DhanpatRai, 2015.

**References**


1. Papacostas C.S. and PD Prevedouros. Transportation Engineering and Planning, Third Edition. Prentice Hall of India Pvt. Ltd, New Delhi, India, 2002.
2. JotinKhisty C. and B. Kent Lall.Transportation Engineering, Third Edition,Phi Learningpublishers, 2009
3. IRC: 37-2001 – Guidelines for the Design of flexible Pavements for Highways, IRC, New Delhi, 2012.
4. IRC: 58-2002(Second Revision) – Guidelines for the Design of Rigid Pavements for Highways, IRC, New Delhi, 2002.
5. Horonjeff Robert: The Planning and Design of Airports, McGraw Hill Co., New York, 2010.
6. Chandra S. and M.M. Agarwal, Railway Engineering,Second Edition, Oxford University Press, New Delhi, 2013.


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | 1 | 1 | | | | | | | | | 1 | 1 |
| **CO2** | | 1 | 1 | 1 | 1 | | | 1 | 1 | | 1 | | 1 | |
| **CO3** | 2 | | 3 | 2 | 1 | 1 | | 1 | 1 | | | | 3 | |
| **CO4** | | | 1 | 1 | 2 | 1 | 1 | | | 3 | | 3 | 1 | |
| **CO5** | 1 | 2 | | 1 | | | 1 | | | | | | 1 | |
| | 3 | 3 | 6 | 6 | 4 | 2 | 2 | 2 | 2 | 3 | 1 | 3 | 7 | 1 |

***1 – Low, 2 – Medium, 3 – High***

**Semester** **IV**
**Subject Name** **DESIGN OF CONCRETE STRUCTURES**
**Subject Code** **PCE 403**

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3- 1 – 0- 4** | **1.5:0.5:1** | **3- 2 –0- 5** |

**Course Outcome:**

| | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Acquaint knowledge on design processes for idealising RC structures and construct their load paths. | C |
| **CO2** | Interpret ultimate and serviceability limit state approaches in current structural design philosophy | C&A |
| **CO3** | Estimate primary design loads on structural elements to find the critical load combination that governs design. | C&A |
| **CO4** | Model building structure and analyse structural elements for design actions | C&P |

**COURSE CONTENT**

**UNIT-I** **METHODS OF DESIGN OF CONCRETE STRUCTURES** **15 hrs**

Methods and principles of Design-Properties of Concrete and Steel –Code specifications for structural members –Working stress method- Yield line theory-Design of beams and slabs.

**UNIT –II** **LIMIT STATE DESIGN FOR FLEXURE** **15 hrs**

Design of one way and two way slab - singly anddoubly reinforced beams- continuous beams –Flanged beams – Staircase.

**UNIT-III** **LIMIT STATE DESIGN FOR SHEAR, BOND AND TORSION** **15 hrs**

Behaviour of RC members in bond and anchorage – Design requirements –Behaviour of RC beams in shear and torsion – Design of RC members for combined bending shear and torsion.

**UNIT –IV** **DESIGN OF COLUMNS AND FOOTINGS** **15 hrs**

Types of columns-Design of shortcolumns and long columns-Footings- Square, rectangular and circular footing –Raft and pile foundations.

**UNIT – V** **DESIGN OF MISCELLANEOUS STRUCTURES** **15 hrs**

Liquid retaining structures-Bridge deck slabs-Retaining walls-Culverts

**Practical 30 hrs**

Design and drafting of slabs, beams and columns using software.

**L-45 hrs T-15 hrs P-15hrs Total- 75 hrs**

**Text books**


1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi,Second Edition, 2010.
2. Krishna Raju, N., “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors, New Delhi,2007.

**References**


1. DevadasMenon&UnnikrishnanPillai, Reinforced Concrete Design,Tata McGraw-Hill Publishing Company Ltd., New Delhi 2011
2. Dr.P.Purushothaman, Reinforced Concrete Structures, Oxford Publication (P) Ltd, Delhi, 2007.
3. M.L.Gambhir, Design of reinforced concrete structures, PHI Learning Private Limited, 2013.
4. IS 456 -2000, Plain and Reinforced Concrete – Code of Practice, $4^{th}$ revision
5. SP16-1980,


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | | 1 | | | | | | | | | | 2 | |
| **CO2** | 2 | 3 | | 1 | | 1 | 1 | | | | | | 3 | 1 |
| **CO3** | 1 | 1 | 3 | 1 | | 1 | 1 | 1 | | | 1 | | 1 | |
| **CO4** | 1 | | 2 | 1 | | | | 1 | 1 | | 1 | | 3 | |
| | 7 | 4 | 6 | 3 | 1 | 2 | 2 | 2 | 1 | | 2 | | 9 | 1 |

***1 – Low, 2 – Medium, 3 – High***

**Semester** **IV**

**Subject Name** **ECONOMICS FOR ENGINEERS**

**Subject Code** **PCE 404**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0– 3 | 3:0:0 | 3 - 0– 0 - 3 |

| *Course Outcome* | | Domain/Level C or P or A |
|---|---|---|
| **CO1** | Understand the concepts of economics in engineering | C (Remember) |
| **CO2** | Interpret break-even analysis | C (Understand) |
| **CO3** | Illustrate value engineering procedure | C (Understand) |
| **CO4** | Understand and analyze replacement problem | C (Understand) |
| **CO5** | Explain depreciation | C (Understand) |

**COURSE CONTENT**

**UNIT I** **INTRODUCTION TO ECONOMICS** **8 hrs**

Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- types of costing, element of costs, preparation of cost sheet and estimation, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost

**UNIT II** **BREAK-EVEN ANALYSIS & SOCIAL COST BENEFIT ANALYSIS** **12 hrs**

Margin of Safety, Profit, Cost & Quantity analysis-Product Mix decisions and CVP analysis, Profit/Volume Ratio (P/V Ratio), Application of Marginal costing, Limitations

Social Cost Benefit Analysis: compare different project alternatives, Calculate direct, indirect and external effects; Monetizing effects; Result of a social cost benefit analysis.

**UNIT III** **VALUE ENGINEERING &COST ACCOUNTING** **10 hrs**

Value engineering – Function, aims, Value engineering procedure - Make or buy decision.Business operating costs, Business overhead costs, Equipment operating costs

**UNIT IV** **REPLACEMENT ANALYSIS** **7 hrs**

Replacement analysis –Types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset.

**UNIT V** **DEPRECIATION** **8 hrs**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation, Annuity method of depreciation, service output method of depreciation.

**L = 45 hrs Total = 45 hrs**

**Text books**

1. S.P Gupta, Ajay Sharma & Satish Ahuja, "Cost Accounting", V K GlobalPublications, Faridabad, Haryana, 2012

2. S.P.Jain & Narang, "Cost accounting – Principles and Practice", Kalyani Publishers, Calcutta, 2012

3. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.

4. William G.Sullivan, James A.Bontadelli & Elin M.Wicks, "Engineering Economy", Prentice Hall International, New York, 2001.

**References**

1. Luke M Froeb / Brian T Mccann, " Managerial Economics – A problem solving approach" Thomson learning 2007
2. Truett & Truett, "Managerial economics- Analysis, problems & cases " Wiley India 8th edition 2004.
3. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2002.
4. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002

**Mapping of COs with GAs**

| | GA1 | GA2 | GA3 | GA4 | GA5 | GA6 | GA7 | GA8 | GA9 | GA10 | GA11 | GA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | 2 | | | | | 1 | 1 | | | | | |
| **CO 2** | 2 | 3 | | | | | | | | | | |
| **CO 3** | 2 | | | | | 1 | 1 | | | | | |
| **CO 4** | 3 | 1 | | | | 1 | | | 1 | | | |
| **CO 5** | | 1 | | | | | 1 | | 2 | | | |
| | 9 | 5 | | | | 3 | 3 | | 3 | | | |

***1-Low , 2- Medium ,3-High***

**Semester** **V**

**Subject Name** **STRUCTURAL STEEL DESIGN**

**Subject Code** **PCE 503**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 1 – 0- 4 | 2 : 1: 0 | 3- 2 –0- 5 |

**Course Outcome:**

| | | Domain C or P or A |
|---|---|---|
| **CO1** | Design of structural connections | C & P |
| **CO2** | Design of tension and compression members | C |
| **CO3** | Understand fabrication of plate girders and gantry girders | C & P |
| **CO4** | Design of structural elements of Industrial Structures. | C |

**COURSE CONTENT**

**` UNIT-I INTRODUCTION 12 hrs**

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Metal joining methods using welding, bolting – Design of bolted and welded joints – Eccentric connections - Efficiency of joints – High Tension bolts

**UNIT –II TENSION MEMBERS 12 hrs**

Types of sections – Net area – Net effective sections for Angles and Tee – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

**UNIT-III COMPRESSION MEMBERS 12 hrs**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base

**UNIT -IV BEAMS 12 hrs**

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders– Intermediate and bearing stiffeners – Web splices – Design of beam columns

**UNIT V TRUSSES AND INDUSTRIAL STRUCTURES 12 hrs**

Roof trusses – Roof and side coverings – Design loads - Design of purlin and elements of truss- Design of gantry girder

**L-45 hrs T -15 hrs Total – 60 hrs**

**Text Books**


1. N.Subramaniayan , “Design of Steel Structures: Theory and Practice” , Oxford University Press, 2010
2. S.S Bhavikatti, “Design of Steel Structures”, I.K International Publishing Houses Pvt. Ltd, 2012.
3. Ramachandra S., “Design of Steel Structures – Vol. I & II”, Standard Publication, New Delhi,2010

**Reference Books**


1. Duggal S.K., "Limit state Design of Steel Structures", 2nd edition, Tata McGraw - Hill Education, 2014
2. Dayaratnam, P., "Design of Steel Structures", A.H.Wheeler& Co. Ltd., Allahabad, 2008
3. Jack C. McCormac , Stephen F.Csernak , "Structural Steel Design"Prentice Hall, Jul 2011


**IS codes**

1. IS 800 -2007, General Construction in Steel, Code of Practice.
2. SP6 – 1 : ISI Hand Book of Structural Engineers, Part -I

**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 3 | 2 | | | 1 | 1 | 1 | | | | 2 | |
| **CO2** | 2 | 1 | 3 | 2 | | | 1 | | 1 | | | | 2 | |
| **CO3** | 1 | 1 | 3 | 1 | | 1 | | | | | | | 1 | |
| **CO4** | 3 | 1 | 3 | 3 | 1 | 1 | | | | | | | 2 | |
| | 8 | 4 | 12 | 8 | 1 | 2 | 2 | 1 | 2 | | | | 7 | |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **V**
**Subject Name** **BUSINESS COMMUNICATION**
**Subject Code** **PCE 504**

| **L –T –P –C** | **L –T –P –H** |
|---|---|
| **1- 0– 0 - 1** | **1+2*- 0 –0- 3** |

| **Course Outcome** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | To choose and apply different styles to various forms of business communication. | C (Knowledge) |
| **CO2** | Identify the proper tone of language required in writing and speaking in business communication. | C (Understand) |
| **CO3** | Display knowledge on grammar and other linguistic features in writing various forms of business communication. | C (Understand) |
| **CO4** | To distinguish between letters and memos and various forms of Business Communication. | C (Grasp) |
| **CO5** | Learn how to write business reports, minutes, proposals. | P (Apply) |

**COURSE CONTENT**

**UNIT I** **9 hrs**

Introduction to business communication; modern developments in the style of writing letters memos and reports: block letters, semi block letters, full block letters, simplified letters etc.,

**UNIT II** **9hrs**

The language used in memos/minutes/telephone memos/ letters/ assignments art of writing E-mail etc. Advantages of written and spoken communication.

**UNIT III** **9 hrs**

The use of active and passive voice; the use of grammar, propriety,accuracy , exactness , the tone & other elements of language used in these writings.

**UNIT IV** **9 hrs**

The format of various types of Reports/ projects etc.,

**UNIT V** **9 hrs**

Writing Business reports, proposals and minutes.

**L = 15hrs SS = 30 hrsTotal = 45hrs**

**Text books&References**


1. John Sealy, Writing and Speaking Author:, Oxford University Press, New Delhi Third Edition 2009.
2. Williams K S, Communicating in Business (8th Edition) Engage Learning India Pvt. Ltd.; 2012
3. John Sealy, Writing and Speaking, Oxford University Press, New Delhi Third Edition 2009.


**Mapping of COs with GAs**

| | **GA1** | **GA2** | **GA3** | **GA4** | **GA5** | **GA6** | **GA7** | **GA8** | **GA9** | **GA10** | **GA11** | **GA12** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | 2 | | | 2 | | |
| **CO2** | | | | | | | 2 | | | 2 | | |
| **CO3** | | | | 2 | | | 2 | | | 1 | | 1 |
| **CO4** | | | | 2 | | | 2 | | | | | 1 |
| **CO5** | | | | | | | 2 | | | 1 | 2 | |
| | | | | 4 | | | 10 | | | 6 | 2 | 2 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VI**
**Subject Name** **CONSTRUCTION PROJECT MANAGEMENT**
**Subject Code** **PCE601**
**Prerequisite** **NIL**

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3- 0 – 1- 4** | **2:0.5:0.5** | **3- 0 -2- 5** |

**Course Outcome:**

| | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Formulate and execute the construction projects | C&P |
| **CO2** | Schedule the activities using network diagrams. | C & P |
| **CO3** | Plan the resources like materials, men and machine. | C&P |
| **CO4** | Understand the aspects of quality control | C |
| **CO5** | Know about safety measures to be adopted in the construction field. | C&A |

**COURSE CONTENT**

**` UNIT-I CONSTRUCTION PROJECT FORMULATION 12hrs**

Introduction to Construction Management - Project organization – Construction Economics - Economic Decision Making - Time value of money - cash flow diagrams - Evaluation Alternatives –BOT, BOOT, BOM, DBOT Projects.

**UNIT –II CONSTRUCTION PLANNING AND SCHEDULING 12hrs**

Basic concepts in the development of construction plans– types of project plans - work breakdown structure – planning techniques - bar charts - preparation of network diagram - critical path method -program evaluation and review technique -.

**UNIT-III RESOURCE PLANNING 12 hrs**

Materials- inventory control: types of inventory, EOQ - different tools for inventory controls. Equipment: Classification of construction equipment- planning and selecting of equipment. Manpower: Classes of labour - cost of labour- labour productivity.

**UNIT -IV TENDERING AND CONTRACT ADMINISTRATION 12 hrs**

Tender notice-Tender document-EMD-SD-Prebid conference-Award and signing of contract agreement-Site meeting-Payment of bills-Breach of contract-Liquidated damages-Project closure

**UNIT V QUALITY CONTROL AND SAFETY MANAGEMENT 12 hrs**

Introduction to construction quality - Inspection, quality control and quality assurance – Quality circle - Quality management system. - Construction safety – accidents and injuries - Personal protective equipments - Health and safety act and OSHAS regulations - Safety and health management system- Safety manual.

**Text books**


1. Kumar NeerajJha, "Construction Project management", Dorling Kindersley, Publishers, New Delhi.2013
2. Sengupta .B, Guha .H, "Construction Management and Planning", Tata McGraw Hill, New Delhi, 2001.
3. Sharma.S.C, "Construction Engineering and Management",Khanna Publishers,Delhi,2008.
4. Chitkara.K.K, Construction Project Management planning, Scheduling and control, Tata McGraw Hill Publishing Company, New Delhi, 2010


**References**


1. Joy.P.K, Total Project Management - The Indian context, Macmillan India Ltd, New Delhi, 2000
2. Vohra.N.D., Quantitative Techniques in Management, Tata McGraw Hill Publishing Company, New Delhi, 2010
3. Billy E.Gillett., Introduction to Operations Research - Computer Oriented Algorithmic Approach, Tata McGraw Hill, 2005


**Practicals 15hrs**

**1.** Introduction to Microsoft projects and Primavera

**L-60 hrs P-15hrs Total – 75 hrs**

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | 1 | 3 | 2 | 1 | 1 | **1** | | | | | 1 |
| **CO2** | 2 | 1 | | | | | | 2 | 1 | 1 | | 1 | 1 | 1 |
| **CO3** | 2 | 1 | | 2 | | 1 | 1 | 1 | 2 | | 1 | | 1 | |
| **CO4** | | | | | | 2 | 1 | 1 | 1 | 1 | | | 1 | |
| **CO5** | | | 2 | | | | 1 | | | | | | | |
| | 4 | 2 | 2 | 3 | 3 | 5 | 4 | 5 | 5 | 2 | 1 | 1 | 3 | 2 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VI**
**Subject Name** **ACADEMIC WRITING**
**Subject Code** **PCE 604**

| **L –T –P –C** | **L –T –P –H** |
|---|---|
| **0- 0– 0 - 0** | **0- 0 –0- 2** |

| **Course Outcome** | | **Domain/Level C or P or A** |
|---|---|---|
| **CO1** | Ability to identify the features of a technical project report and knowledge on the linguistic competence to write a technical report | C (Comprehension) |
| **CO2** | Ability to integrate both technical subject skill and language skill to write a project. | C (Synthesis) |
| **CO3** | Confidence to present a project in 10 to 15 minutes | A (Response) |
| **CO4** | The learner identifies and absorbs the pronunciation of sounds in English Language and learns how to mark the stress in a word and in a sentence properly | C (Comprehension) |
| **CO5** | The program enables the speaker speaks clearly and fluently with confidence and it trains the learner to listen actively and critically | P (Palpate) |

**COURSE CONTENT**

**UNIT I** **10hrs**

Basic principles of good technical writing, Style in technical writing, out lines and abstracts, language used in technical writing: technical words, jargons etc

**UNIT II** **10 hrs**

Special techniques used in technical writing: Definition, description of mechanism, Description of a process, Classifications, division and interpretation

**UNIT III** **25hrs**

Report/ project layout the formats: chapters, conclusion, bibliography, annexure and glossary, Graphics aids etc - Presentation of the written project 10 – 15 minutes

**UNIT IV** **15hrs**

Sounds of English Language; vowels, consonants, diphthongs , word stress, sentence stress, intonation patterns, connected speech etc. - Vocabulary building – grammar, synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, idioms and phrases.

**UNIT V** **15 hrs**

Reading comprehension – reading for facts, meanings from context, scanning, skimming, inferring meaning, critical reading, active listening, listening for comprehension etc.

**L - 45hrs P - 30 hrs Total - 75 hrs**

**Text books&References**


1. Gordon H. Mills, Technical Writing – April, 1978, Oxford University Press
2. Barun K. Mitra, Effective Technical Communication: A Guide for Scientists and Engineers. Author, Publication: Oxford University press. 2007

**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | | | | |
| **CO2** | 1 | 1 | | | | | | | 1 | 2 | | | | |
| **CO3** | | | | 2 | | | | | | 2 | | 2 | | |
| **CO4** | | | | 2 | | | | | | 2 | 1 | 2 | | |
| **CO5** | | | | | | | | | | 2 | 1 | 2 | | |
| | 1 | 1 | | 4 | | | | | 1 | 8 | 2 | 6 | | |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VII**
**Subject Name** **COST ESTIMATION AND VALUATION**
**Subject Code** **PCE 701**

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3- 1 – 1- 5** | **2:0.5:0.5** | **3- 2 – 2- 7** |

**Course Outcome:**

| | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Understand and test the concept of " components" of a project | C |
| **CO2** | Understand the principles and methods of measurements | C |
| **CO3** | Understand the methodology of pricing and to determine the unit cost of "components" | C&P |
| **CO4** | Learning from Laboratory demonstration and field visits | C & P |
| **CO5** | Prepare the actual estimate of any property/project | C&A |

**COURSE CONTENT**

**UNIT I** **ESTIMATION OF BUILDINGS** **20hrs**

Process of estimating - Construction activities and sequence – Units of measurements – Methods of estimating – Calculation of quantities of brick work, PCC, RCC, wood work, plastering, white washing, colour washing, painting, varnishing etc., relating to residential and non-residential multi- storeyed buildings.

**UNIT II** **ESTIMATION OF OTHER STRUCTURES** **20hrs**

Estimation of services – Sanitary and water supply installations –Estimation of other structures – Bituminous and cement concrete roads –Irrigation works - Retaining walls and culverts – Steel structures.

**UNIT III** **SPECIFICATION** **10 hrs**

Specifications – Sources – Detailed and general specifications – Introduction of estimation software.

**UNIT IV** **RATE ANALYSIS** **15 hrs**

Analysis of rates using standard data and schedule of rates for conventional items – Principles of pricing of new items.

**UNIT V** **VALUATION** **10hrs**

Necessity – Basics of valuation – Capitalized value – Depreciation – Escalation – Value of property – Calculation of Standard rent – Report preparation.

**Practical** **30 hrs**

1. Building marking
2. Estimation using Spread Sheet

**L- 45 hrs** **T - 30hrs** **P -30hrs** **Total – 105hrs**

**Text books**


1. Dutta, B.N., "Estimating and Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributors Pvt. Ltd.,New Delhi, 2010.
2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand& Company Ltd., New Delhi, 2004
3. M.Chakraborty,"Estimating,Costing, Specification and Valuation in Civil Engineering",Kolkata,1997.


**References**


1. Birdie.G.S., "A Text Book on Estimating and Costing", DhanpatRai and Sons, New Delhi, 2000
2. Rangwala. S.C., "Elements of Estimating and Costing", Charotar Publishing House,Anand,2011
3. IS 1200-1974, Parts 1-25, Methods of Measurements of Building and Civil Engineering works – Bureau of Indian Standards, New Delhi.
4. Standard Data Books and Schedule of rates of Central and State Public Works Departments.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | | | 1 | 2 | | | | 2 | | | | |
| **CO2** | 2 | | | | 2 | 3 | | | | 3 | | | | |
| **CO3** | 2 | | | | 3 | | | **1** | | | 3 | 3 | 1 | |
| **CO4** | 2 | | | 2 | 3 | | | **1** | 3 | | | | 1 | |
| **CO5** | 2 | | | 2 | | | 2 | **1** | | 2 | 3 | 3 | 1 | 3 |
| | 10 | | | 4 | 9 | 5 | 2 | 3 | 3 | 7 | 6 | 6 | 3 | 3 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **V**
**Subject Name** **REPAIR AND REHABILITATION OF STRUCTURES**
**Subject Code** **PCE 501A**
**Prerequisite** **NIL**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2.5:0: 0.5 | 3- 0 – 0- 3 |

| **Course Outcome:** | | **Domain** (C or P or A) |
|---|---|---|
| **CO1** | Understand the concept of quality assurance of concrete properties | C |
| **CO2** | Understand the various materials used for repair works | C |
| **CO3** | Knowledge in the application of repair techniques in concrete construction | C |
| **CO4** | Prepare concrete investigation reports for repair and rehabilitation projects. | C & A |

**COURSE CONTENT**

**UNIT I GENERAL** **9hrs**

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking. Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.

**UNIT II MAINTENANCE AND REPAIR STRATEGIES** **9hrs**

Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

**UNIT III MATERIALS FOR REPAIR** **9hrs**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro-cement, Fibre reinforced concrete.

**UNIT IV TECHNIQUES FOR REPAIR** **9hrs**

Rust eliminators and polymers coating for rebars during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete - Epoxy injection, Mortar repair for cracks, shoring and underpinning.

**UNIT V REPAIRING OF STRUCTURES** **9hrs**

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure – Engineered demolition techniques for Dilapidated structures - case studies

**L- 45 hrs Total – 45 hrs**

**Text books**


1. Denison Campbell, Allen and Harold Roper, "Concrete Structures", Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. Norbert Delatte, "Failure, Distress and Repair of Concrete Structures", Woodhead Publishing, 2009.
3. M.S.Shetty, "Concrete Technology - Theory and Practice", S.Chand and Company, New Delhi, 2009.


**References**


1. Deterioration, maintenance and repair of structures, Johnson SM McGraw Hill International Publishers, New York.
2. Santhakumar, A.R., "Training Course notes on Damage Assessment and repair in Low Cost Housing", "RHDC-NBO" Anna University,1992.
3. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R & D Centre (SDCPL), RaikarBhavan, Bombay, 1987.


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | | | 2 | | | | | | | | | | 1 |
| **CO2** | 1 | 2 | | | | 2 | | | | | | | 1 | 1 |
| **CO3** | 3 | 1 | | | | | | **1** | | **1** | | 2 | 1 | 2 |
| **CO4** | 1 | | | | 2 | | **1** | **3** | | 1 | | 3 | 2 | 3 |
| | 7 | 3 | | 2 | 2 | 2 | **1** | **4** | | 2 | | 5 | 4 | 7 |

***1 - Low , 2 – Medium , 3 – High***

**Semester** V
**Subject Name** SMART MATERIALS AND STRUCTURES
**Subject Code** PCE 501B
**Prerequisite** NIL

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2.5:0:0.5 | 3- 0 – 0- 3 |

**Course Outcome:**

| | | Domain (C or P or A) |
|---|---|---|
| **CO1** | Understand the physical principles and the behaviour of smart materials | C |
| **CO2** | Understand the engineering principles in sensor, actuator and transducer technologies | C |
| **CO3** | Use principles of measurement, drive and control techniques necessary to developing smart structures and products | C |
| **CO4** | Suggest improvement in integrating smart materials and smart structures. | C & A |

**COURSE CONTENT**

**UNIT I INTRODUCTION9hrs**

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effects..

**UNIT II MEASURING TECHNIQUES 9hrs**

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

**UNIT III SENSORS 9hrs**

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVOT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

**UNIT IV ACTUATORS9hrs**

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electro orheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

**UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS9hrs**

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and NonLinear.

**L- 45 hrs Total – 45 hrs**

**Text books**

1. Brain Culshaw – Smart Structure and Materials Artech House – Borton.London-1996.
2. Dally, J. W., Riley, W.F., Experimental Stress Analysis, Tata McGraw-Hill, 1998.
3. Gauenzi,P.,Smart Structures, Wiley, 2009

**References**


1. Srinath, L. S., Experimental Stress Analysis, Tata McGraw-Hill, 1998.
2. Srinivasan, A.V. and Michael McFarland, D., Smart Structures: Analysis and Design, Cambridge University Press, 2000.
3. Yoseph Bar Cohen, Smart Structures and Materials 2003, The International Society for Optical Engineering 2003.


**Mapping of CO's with PO's:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | | | 1 | | | | | | | 1 | |
| **CO2** | 2 | 2 | | 1 | 1 | 2 | 1 | 1 | | | | | 1 | 2 |
| **CO3** | 2 | | 1 | 1 | | | | 1 | 1 | | 2 | 3 | 1 | 2 |
| **CO4** | 1 | | 2 | 1 | 2 | | | | | 3 | | | 2 | 1 |
| | 7 | 4 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 3 | 5 | 5 |

***1 - Low , 2 – Medium , 3 – High***

**Semester** V
**Subject Name** INDUSTRIAL WASTE WATER MANAGEMENT
**Subject Code** PCE501C
**Prerequisite** Environmental Engineering

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2.5:0:0.5 | 3- 0 –0- 3 |

| **Course Outcome:** | | **Domain** (C or P or A) |
|---|---|---|
| **CO1** | Explain the pollution effects of Industrial waste water disposal | C |
| **CO2** | Understand the principle and concept of physico-chemical and Biological treatment methods. | C |
| **CO3** | Describe the manufacturing process in various Industries. | C |
| **CO4** | Identify and analyse the treatment and disposal options for wastewater from various industries | C |
| **CO5** | Formulate environmental Management plan | C & A |

**COURSE CONTENT**

**UNIT I INTRODUCTION 9 hrs**

Effects of industrial waste water on streams - water quality criteria- Effluent standards. Reduction of Waste and Strength of the waste-Process modifications- Methods and materials changes-Housekeeping-Recovery methods for by-products within the plant operations.

**UNIT II PHYSICO CHEMICAL TREATMENT METHODS 9 hrs**

Equalization – Neutralization-Separation of solids- Sedimentation-Filtration – Coagulation- Flocculation- Adsorption- Absorption and Precipitation.

**UNIT III BIOLOGICAL TREATMENT METHODS 9 hrs**

Biological treatment methods- Aerobic and Anaerobic-Digestion-Trickling filters-Stabilization ponds-Fluidization- Activated sludge process - Oxidation ditch.

**UNIT IV INDUSTRIAL POLLUTION PREVENTION 9 hrs**

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse , Present status and issues.

**UNIT V PRODUCTION, TREATMENT AND DISPOSAL METHODS IN INDUSTRIES 9 hrs**

Industry of Mineral Products: Oil, Steel industries, Oil Refineries Food Processing Industries: Dairy, Sugar, Distillery Processing Industries: Pulp and Paper, Tannery, Textile, Metal Finishing industry, etcMiscellaneous Industries: Atomic Power Plant, Radioactive Industry.

**L- 45 hrs Total- 45 hrs**

**Text books**


1. Nelson Leonard Nemerow, Industrial Waste Treatment , Elsevier Inc., 2011
2. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill, 1999.
3. Metcalf and Eddy, Wastewater Engineering – Collection, Treatment, Disposal and Reuse, McGraw Hill Pub. Co., 2006
4. Arceivala, S.J., “Wastewater Treatment for Pollution Control”, Tata McGraw-Hill, 2004

**References**


1. A.D.Patwardhan, Industrial Waste Water Treatment, prentice-Hall of India Private Limited, New Delhi, 2008.
2. John P. Samuelson, "Industrial Waste, Environmental Impact, Disposal and Treatment" Nova Science Publishers, 2009
3. Woodard & Curran, "Industrial Waste Treatment Handbook", Elsevier Inc., 2006


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | 1 | 2 | | | | | | | | | | |
| **CO2** | 1 | 3 | 2 | 1 | | | | | | | | 1 | 1 | 1 |
| **CO3** | 1 | 2 | 1 | 1 | | | | | | | | | 1 | |
| **CO4** | 1 | 3 | 2 | 2 | | 1 | | | | | | | 1 | |
| **CO5** | 1 | 1 | 2 | 1 | | 2 | | | | | | 2 | | 3 |
| | 6 | 10 | 8 | 7 | | 3 | | | | | | 3 | 3 | 4 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **V**
**Subject Name** **SOLID AND HAZARDOUS WASTE MANAGEMENT**
**Subject Code** **PCE501D**
**Prerequisite** **Environmental Engineering**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2:0:1 | 3- 0 –0- 3 |

**Course Outcome:**

| | | **Domain** (C or P or A) |
|---|---|---|
| **CO1** | Characterize the physical and chemical composition of Solid and Hazardous waste | C & A |
| **CO2** | Explain the functional elements for solid waste management | C |
| **CO3** | Identify the methods of collection, segregation and transport of solid and Hazardous waste | C |
| **CO4** | Understand the techniques and methods used in energy recovery and recovery of materials from solid wastes | C & A |
| **CO5** | Describe methods of disposal of solid and hazardous waste. | C |

**COURSE CONTENT**

**UNIT I** **SOURCES, CLASSIFICATION AND REGULATORY FRAMEWORK9 hrs**

Types and Sources of solid wastes - Need for solid waste management – Elements of integrated waste management and roles of stakeholders - Salient features of Indian legislations on management and handling of municipal solid wastes , hazardous wastes, biomedical wastes, E-wastes, Lead Acid batteries, plastics and fly ash - Financing waste management

**UNIT II** **WASTE CHARACTERIZATION AND SOURCE REDUCTION9 hrs**

Waste generation rates and variation - Composition, physical, chemical and biological properties of solid wastes –Hazardous characteristics - TCLP tests – waste sampling and characterization plan - Source reduction of wastes –Waste exchange - Extended producer responsibility - Recycling and reuse

**UNIT III** **STORAGE, COLLECTION AND TRANSPORT OF WASTES9 hrs**

Handling and segregation of wastes at source – storage and collection of municipal solid wastes – Analysis of Collection systems - Need for transfer and transport – Transfer stations Optimizing waste allocation –compatibility, storage, labeling and handling and Transport of hazardous wastes.

**UNIT IV** **WASTE PROCESSING TECHNOLOGIES9 hrs**

Course Objectives: of waste processing – material separation and processing technologies – biological and chemical conversion technologies – methods and controls of Composting - thermal conversion technologies and energy recovery – incineration-solidification and stabilization of hazardous wastes – bio medical waste treatment.

**UNIT V** **WASTE DISPOSAL9 hrs**

Waste disposal options – Disposal in landfills - Landfill Classification, types and methods – site selection - design and operation of sanitary landfills, secure landfills and landfill bioreactors – leachate and landfill gas management – landfill closure and environmental monitoring – Rehabilitation of open dumps – landfill remediation

**L- 45 hrs Total-45 hrs**

**Text books**

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill International edition, New York, 1993.
2. Michael D. LaGrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001

**References**

1. CPHEEO, "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000.
2. Vesilind P.A., Worrell W and Reinhart, Solid waste Engineering, Thomson Learning Inc., Singapore, 2002.

**Mapping of CO's with PO's:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | | 1 | | | | | | | | 1 | 2 | 1 |
| **CO2** | 2 | 2 | 1 | 1 | | | | | | | | 2 | 3 | 2 |
| **CO3** | 1 | 3 | 1 | | | 1 | 1 | | | 1 | | 1 | 2 | 3 |
| **CO4** | 2 | 2 | 3 | 2 | | 1 | | | | | | | 1 | 3 |
| **CO5** | 2 | 1 | 3 | 1 | | | | | | | | 2 | 1 | 2 |
| | 9 | 10 | 8 | 5 | | 2 | 1 | | | 1 | | 6 | 9 | 11 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **V**
**Subject Name** **BASICS OF EARTHQUAKE ENGINEERING AND SEISMIC DESIGN**
**Subject Code** **PCE502A**
**Prerequisite** NIL

| **L –T –P –C** | **C :P:A** | **L –T –P –H** |
|---|---|---|
| **2– 1– 0–3** | **3:0:0.5** | **2– 2– 0– 4** |

**Course Outcome:**

| | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Differentiate the static and dynamic analysis. | C |
| **CO2** | Analyse SDOF and MDOF systems with distributed mass for continuous system. | C |
| **CO3** | Quantify the effect of seismic waves. | C & A |
| **CO4** | Understand the concept of response spectrum and application of structural dynamics. | C |
| **CO5** | Design Earthquake resistant structures withcodal recommendations. | C |

**COURSE CONTENT**

**UNIT-I** **THEORY OF VIBRATIONS** **12hrs**

Concept of inertia and damping – Types of Damping – Difference between static forces and dynamic excitation – Degrees of freedom – SDOF idealisation – Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral

**UNIT –II** **MULTIPLE DEGREE OF FREEDOM SYSTEM** **12hrs**

Two degree of freedom system – Normal modes of vibration – Natural frequencies - Mode shapes - Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).

**UNIT-III** **ELEMENTS OF SEISMOLOGY** **12hrs**

Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicentre – Hypocentre – Primary, shear and Raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes

**UNIT -IV** **RESPONSE OF STRUCTURES TO EARTHQUAKE** **12hrs**

Response and design spectra – Design earthquake – concept of peak acceleration – Site specific response spectrum – Effect of soil properties and damping – Liquefaction of soils – Importance of ductility – Methods of introducing ductility into RC structures.

**UNIT - V** **DESIGN METHODOLOGY** **12hrs**

IS 1893, IS 13920 and IS 4326 – Codal provisions – Design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquake on structures.

**L-30hrs T-15 hrsTotal-45 hrs**

**Text books**


1. Biggs, J.M., "Introduction to Structural Dynamics", McGraw– Hill Education India Pvt.Ltd - New Delhi
2. Dowrik., "Earthquake Resistant Design"Willey,2012
3. Paz,M.,"Structural Dynamics-Theory & Computattions''Shahdara,Delhi,2010
4. Anil k chopra " Dynamics of structures '' Theory and application to Earthquake Engineering,2014


**References**


1. George G.Penelis and AndreasJ.Kappos,Earthquake Resistant Concrete Structures,E& FN Spon.London,UK
2. Kavitha S., Damodarasamy S. R. "Basic of Structural Dynamics and Aseismic Design" PHI Learning Private Limited publishers,2009.
3. Shashikant k. Duggal "Earthquke resistant design of structures"India, 2013


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 2 | | | 1 | | | | 1 | | | 2 | |
| **CO2** | 2 | 3 | | | | | | | | | | | 1 | |
| **CO3** | 2 | 1 | 1 | | | 2 | | | | 1 | | | 1 | 1 |
| **CO4** | 1 | 2 | | | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | | |
| **CO5** | 2 | | 3 | | 1 | | 1 | 1 | | | | 1 | 2 | 1 |
| | 10 | 8 | 6 | | 2 | 3 | 2 | 2 | 1 | 3 | 1 | 2 | 6 | 2 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **V**
**Subject Name** **TALL BUILDINGS**
**Subject Code** **PCE502B**
**Prerequisite** Design of Concrete Structures, Design of Steel Structures

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **2- 1 – 0- 3** | **2: 0: 2** | **2- 2 – 0- 4** |

| **Course Outcome:** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Explain hybrid structural systems widely used in tall buildings and conduct conceptual design | C |
| **CO2** | Understand advanced methods of computational mechanics, analysis, structural optimisation and design for resilience, safe construction, reliability in-service phases | C |
| **CO3** | Evaluate wind sensitivity, user comfort and dynamic response of structures | A |
| **CO4** | Analyse various structural systems of tall buildings constructed using Concrete, Steel and Steel/Concrete Composite material | A |

**COURSE CONTENT**

**` UNIT-I DESIGN CRITERIA AND MATERIALS 9hrs**

Development of High Rise Structures – General Planning Considerations – Design philosophies- Materials used for Construction – High Strength Concrete – High Performance Concrete – Self Compacting Concrete – Glass – High Strength Steel

**UNIT –II LOADING 8 hrs**

Dead Loads -Live Loads-Construction Loads -Snow, Rain, and Ice Loads - Wind Loads-Seismic Loading –Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes ofMaterial - Impact and Dynamic Loads - Blast Loads - Combination of Loads.

**UNIT-III STRUCTURAL FORMS 9hrs**

Factors affecting growth, Height and Structural form. High rise behaviour of Various structural systems – Rigid frames, Braced frames, Infilledframes,Wall frames, Tubular structures, Cores, Outriggersystems and Hybrid Mega systems.

**UNIT -IV ANALYSIS AND DESIGN OF TALL STRUCTURES 10hrs**

Wind tunnel-Chimney-Design Factors, Stresses, Components, Refractory linings, Caps and foundation - Cooling towers: Types, components, design forces, analysis and design - Transmission Line and Microwave towers:Load types, Tower Configuration, Analysis and Design of towers

**UNIT - V STABILITY OF TALL BUILDINGS 9hrs**

Overall buckling analysis of frames, wall-frames, Approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first-order and P-Delta analysis, Translational,Torsional instability, out of plumb effects, stiffness of member in stability, effect of foundation rotation.

**L- 30hrs T- 15hrs Total - 45 hrs**

**Text books**

1. B.S.Taranath, "Reinforced Concrete Design of Tall Buildings", CRC Press, 2009,
2. Sarkisian, M.P., Designing Tall buildings: Structure as Architecture,Routledge, 2011,

**References**

1. IS:6533 (Part 2) –Code of Practice for Design and Construction of Steel Chimney
2. IS:4998 (Part 1)- Criteria for Design of Reinforced Concrete Chimneys
3. IS: 4091 Code of Practice for Design and Construction of Foundations for Transmission Line Towers and Poles
4. Handbook of Concrete Structures - Mark Fintel

**Mapping of COs with POs:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | 3 | 2 | | | | | | | | | | 3 | |
| CO2 | 1 | 3 | | 2 | | | 1 | 1 | | | | | 2 | |
| CO3 | 1 | | 2 | | 1 | 1 | 1 | 1 | 1 | | 1 | | 1 | |
| CO4 | | 3 | | 2 | 1 | 2 | | | | | | | 3 | 1 |
| | 2 | 9 | 4 | 4 | 2 | 3 | 2 | 2 | 1 | | 1 | | 9 | 1 |

***1 - Low, 2 – Medium, 3 – High***

| | |
|---|---|
| **Semester** | **V** |
| **Subject Name** | **ADVANCED PAVEMENT DESIGN** |
| **Subject Code** | **PCE 502C** |
| **Prerequisite** | **TRANSPORTATION ENGINEERING** |

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **2 – 1 –0–3** | **2:0:1** | **2 – 2 – 0 – 4** |

| **Course Outcome:** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Adopt the right principles of pavement design | C & A |
| **CO2** | Utilize identified traffic factors efficiently in the pavement design. | C & A |
| **CO3** | Simulate the behavioural characteristics of input pavement materials considering various physical conditions. | C & A |
| **CO4** | Optimally design pavements using competent methods. | C & A |
| **CO5** | Assess pavement performance and suggest rectification options. | C & A |

**COURSE CONTENT**

**UNIT I** **INTRODUCTION: PRINCIPLES OF PAVEMENT DESIGN12 hrs**

Pavement types – Pavement performance characteristics – performance criteria – Pavement failures – stress, strain and deflections in pavements - pavement design approaches – Conceptual framework for pavement design.

**UNIT II** **TRAFFIC FACTORS IN PAVEMENT DESIGN12hrs**

Vehicle types – Axle configurations – contact shapes and contact stress distributions – Traffic loading and volume – Vehicle damage factor – Axle load surveys – Lateral placement characteristics of wheels – estimation of design traffic.

**UNIT III** **PAVEMENT MATERIAL CHARACTERIZATION 12 hrs**

Identification of material inputs needs in analysis and design of pavements – Selection of appropriate conditions such as temperature, moisture content, loading, etc for characterizing pavement materials – Overview of principles of different laboratory and field methods adopted for characterizing pavement materials.

**UNIT IV** **ANALYSIS AND DESIGN OF PAVEMENTS12 hrs**

Analysis : Introduction to various theoretical pavement analysis models and selection criteria – linear elastic layered theory of flexible pavement – analysis of wheel load stresses, curling/warping stresses and critical stress combinations – need for advanced analytical techniques for flexible pavements – review of various pavement analysis softwares.

Design : Introduction on various pavement design methods – IRC guidelines for pavement design (IRC:37 and IRC:58) – AASHTO ( 1993) method of pavement design - TRRL method – PCA method – concept of continuously reinforced concrete – salient features of the AASHTO 2002 draft design guidelines for flexible and rigid pavement design - -comparison of design concepts.

**UNIT V PAVEMENT EVALUATION AND REHABILITATION 12 hrs**

Functional and Structural Evaluation of pavements – roughness concept – international roughness index – Pavement evaluation techniques – roughness measurement – Benkleman beam and falling weight deflectometer methods. Overlay design methods – IRC guidelines (IRC: 81) and AASHTO 1993 guidelines. Drainage design for pavements.

**L - 45hrs T- 15 hrs Total – 60 hrs**

**Text books**


1. Yang H. Huang : Pavement Analysis and Design, prentice Hall; second edition, August 18, 2003.
2. L. Collis , R.A. Fox , M.R. Smith: Aggregates: Sand, Gravel and Crushed Rock Aggregates for Construction Purposes, Geological Society Engineering Geology Special Publication,**2001**
3. T. Papagiannakis, E. A. Masad, Pavement Design and Materials, John Wiley & Sons, 2008.


**References**


1. S.K Khanna, C.E.G Justo, A Veeraragavan.Highway Engineering , Nem Chand and Brothers, 10th Edition, Roorkee, 2015.
2. Pavement design from AASHTO American Association of State Highway and Transportation Officials, 2010.
3. IRC-37–2001.Guidelines for the Design of Flexible Pavements, New Delhi, 2012.
4. IRC 58-2002. Guideline for the Design of Rigid Pavements for Highways, New Delhi, 2002.


**Mapping of CO's with PO's**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | | | | | | | | | | | 1 | |
| **CO2** | | 1 | | 1 | 1 | | | 1 | | | | | 1 | |
| **CO3** | 1 | | | 1 | | | | 1 | 1 | | 1 | | 1 | |
| **CO4** | 2 | | 3 | 3 | | 1 | 1 | | | 1 | | 2 | 3 | |
| **CO5** | | 2 | 1 | | 3 | 1 | 1 | | | 1 | | | | 2 |
| | 4 | 4 | 4 | 5 | 4 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 6 | 2 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **V**

**Subject Name** **DESIGN OF PLATE AND SHELL STRUCTURES**

**Subject Code** **PCE502D**

**Prerequisite** **NIL**

| **L –T –P –C** | **C : P: A** | **L: T:P: H** |
|---|---|---|
| **2 –1 –0 – 3** | **2:0:1** | **2 – 2- 0 - 4** |

**Course Outcome:**

| | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Perform analysis of thin plates for various boundary conditions. | C |
| **CO2** | Analyse rectangular plates by different methods for various loading conditions. | C & A |
| **CO3** | Understand the structural importance of shells. | C |
| **CO4** | Examine the cylindrical shells and form differential equation. | C & A |

**COURSE CONTENT**

**` UNIT-I** **INTRODUCTION TO PLATES** **9hrs**

Laterally loaded thin plates - Governing differential equation, various boundary conditions.

**UNIT –II** **RECTANGULAR PLATES** **9hrs**

Simply supported rectangular plates - Navier solution and Levy's method – Loading.

**UNIT-III** **CIRCULAR AND FOLDED PLATES** **9hrs**

Circular Plates - Symmetrical bending - Differential equations - Uniformly loaded and concentrically loaded plates with various boundary conditions. Folded plate - structural behaviour - various types.

**UNIT -IV** **THEORIES OF SHELLS** **9hrs**

Structural behaviour of shells - classification of shells - methods of generating the surface of different shells. Gaussian curvature-synclastic and anticlastic surfaces.

**UNIT - V** **CYLINDRICAL SHELLS** **9hrs**

Cylindrical Shells-Membrane theory of singly curved shells - cylindrical shells-free body diagram of a cylindrical shell element-formulation of equilibrium equation.

**L=30hrs T- 15 hrs Total –45 hrs**

**Text books**


1. Stephen .P. Timoshenko &Woinowsky Krieger, "Theory of Plates and Shells", McGraw Hill, 2010.
2. AnselC.Ugural, "Stresses in Plate and Shells", CRC press, Third Edition, 2010.
3. G.S. Ramaswamy, Design and Construction of Shell Structures, CBS Publishers, New Delhi, Revised Edition.
4. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2007


**References**


1. N. K. Bairagi, "Plate Analysis," Khanna Publishers, New Delhi, Revised Edition.
2. Rudolph Szilard, R., "Theory and Analysis of Plates Analysis", Prentice Hall Inc., 2004.
3. Chatterjee.B.K. - "Theory and Design of Concrete Shell", - Chapman & Hall, New York, 2007.

**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | 2 | | | | | | | | | | 2 | |
| **CO2** | 2 | 3 | 2 | | | | | 1 | | | | | 2 | |
| **CO3** | 2 | 1 | 1 | | 1 | 1 | **1** | 1 | 1 | | 1 | | 1 | |
| **CO4** | 2 | 3 | 1 | | 1 | 1 | **1** | | | | | | 1 | |
| | 8 | 10 | 6 | | 2 | 2 | **2** | 2 | 1 | | 1 | | 6 | |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VI**
**Subject Name** **PREFABRICATED STRUCTURES**
**Subject Code** **PCE602 A**
**Prerequisite** **Structural Analysis**

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3 - 0 – 0 - 3** | **2:0:1** | **3- 0 –0- 3** |

**Course Outcome:** **Domain C or P or A**

| | | |
|---|---|---|
| **CO1** | Gain knowledge on prefabrication of structures. | C |
| **CO2** | Identify the components of prefabricated structures. | C& A |
| **CO3** | Design the structures based on prefabrication elements. | C |
| **CO4** | Handle the prefabricated structures in the field. | C |

**COURSE CONTENT**

**UNIT I** **INTRODUCTION – PREFABRICATED STRUCTURES9 hrs**

General Civil Engineering requirements in the prefabrication techniques – material used in prefabrication - Modular co-ordination, standardization, Disuniting, of Prefabricates, production, transportation, erection.

**UNIT II** **PREFABRICATED COMPONENTS9 hrs**

Prefabricated structures - Long wall and cross-wall large panel buildings - one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, - columns – shear wall.

**UNIT III** **DESIGN PRINCIPLES9 hrs**

Loading criteria - Disuniting of structures- Design of cross section based on efficiency of material used –Problems in design because of joint flexibility – Allowance for joint deformation – Code books used in practice.

**UNIT IV** **DESIGN OF JOINTS9 hrs**

Joints for different structural connections – Dimensions and detailing – Design of expansionjoints

**UNIT V** **DESIGN OF INDUSTRIAL BUILDINGS 9 hrs**

Components of single-storey industrial sheds with crane gantry systems, Design of R.C. Roof Trusses, Roof Panels, Design of R.C. crane - gantry girders, corbels and columns, wind bracing design-case study of industries. Case study in prefabrication industries.

**L- 45hrs Total- 45 hrs**

**Text books**


1. Hubert Bachmann, Alfred Steinle, “Precast Concrete Construction”, Wiley-vchVerlagGmbh, 2011.
2. WaiKwong Lau, Building Construction with Precast Concrete Structural Elements, Lap Lambert Academic Publishing, 2011.


**References**


1. B.Lewicki, “Building with Large Prefabricates”, Elsevier Publishing Company, New York, 2009.
2. Kim Elliott,“Precast Concrete Structures”, Spons Architecture Price Book, April, 2012.
3. Benjamin Pavlich, “Evaluation of Prefabricated Composite Steel Box Girder Systems for Rapid Bridge Construction”, Proquest, Umi Dissertation Publishing, 2011.

**Mapping of CO's with PO's**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | 1 | | | | | | | 2 | | 1 | 3 |
| **CO2** | | 3 | 1 | 1 | 1 | 1 | | | | | 1 | 1 | 2 | 1 |
| **CO3** | | | 3 | 2 | 1 | | | | 1 | 1 | 1 | 1 | 2 | 3 |
| **CO4** | 2 | 2 | | 1 | 1 | 2 | | | 1 | 1 | 1 | 1 | 2 | 2 |
| | 4 | 7 | 7 | 5 | 3 | 3 | | | 2 | 2 | 5 | 3 | 7 | 9 |

*1 - Low, 2 – Medium, 3 – High*

| | | |
|---|---|---|
| **Semester** | **VI** | |
| **Subject Name** | **DISASTER MANAGEMENT** | |
| **Subject Code** | **PCE 602B** | |
| **Prerequisite** | **NIL** | |

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3- 0 – 0- 3** | **3:0:0** | **3- 0 –0- 3** |

| **Course Outcome** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Understanding the concepts of application of types of disaster preparedness | C(Application) |
| **CO2** | On completion of this course the students will be able to understand planning essentials of disaster. | C(Analyze) |
| **CO3** | Have a good understanding of importance of seismic waves occurring globally | C(Analyze) |
| **CO4** | On completion of this course, the students will be able to perform drill essential for disaster mitigation | C(Application) |
| **CO5** | Have a keen knowledge on essentials of risk reduction | C(Application) |

**COURSE CONTENT**

| | | |
|---|---|---|
| **UNIT I** | **INTRODUCTION** | **9 hrs** |
| | Introduction – Disaster preparedness – Goals and objectives of ISDR Programme- Risk identification – Risk sharing – Disaster and development: Development plans and disaster management –Alternative to dominant approach – disaster-development linkages -Principle of risk partnership | |
| **UNIT II** | **APPLICATION OF TECHNOLOGY IN DISASTER RISK REDUCTION** | **9 hrs** |
| | Application of various technologies: Data bases – RDBMS – Management Information systems – Decision support system and other systems – Geographic information systems – Intranets and extranets – video teleconferencing. Trigger mechanism – Remote sensing-an insight – contribution of remote sensing and GIS - Case study. | |
| **UNIT III** | **AWARENESS OF RISK REDUCTION** | **9 hrs** |
| | Trigger mechanism – constitution of trigger mechanism – risk reduction by education – disaster information network – risk reduction by public awareness | |
| **UNIT IV** | **DEVELOPMENT PLANNING ON DISASTER** | **9 hrs** |
| | Implication of development planning – Financial arrangements – Areas of improvement – Disaster preparedness – Community based disaster management – Emergency response. | |
| **UNIT V** | **SEISMICITY** | **9 hrs** |
| | Seismic waves – Earthquakes and faults – measures of an earthquake, magnitude and intensity – ground damage – Tsunamis and earthquakes | |
| | | **L - 45 hrs Total-45 hrs** |

**Text books**

1. Siddhartha Gautam and K Leelakrisha Rao, "Disaster Management Programmes and Policies", Vista International Pub House, 2012
2. Arun Kumar, "Global Disaster Management", SBS Publishers, 2008

**References**


1. Encyclopaedia Of Disaster Management, Neha Publishers & Distributors, 2008
2. Pardeep Sahni, Madhavi malalgoda and ariyabandu, "Disaster risk reduction in south asia", PHI, 2002
3. Amita sinvhal, "Understanding earthquake disasters" TMH, 2010.
4. Pardeep Sahni, Alka Dhameja and Uma medury, "Disaster mitigation: Experiences and reflections", PHI, 2000


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | | | | | 5 | 2 | | | | | | | |
| **CO2** | 2 | | | | | 1 | 2 | | | | | 1 | | |
| **CO3** | 1 | | | | | 2 | 2 | 1 | | | | 2 | | |
| **CO4** | 1 | | | | | 2 | 2 | 1 | | | | 1 | | |
| **CO5** | | | | | | 5 | 2 | 3 | | | | 1 | | |
| | 5 | | | | | 15 | 10 | 5 | | | | 5 | | |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VI**

**Subject Name** **WATER RESOURCE PLANNING AND MANAGEMENT**

**Subject Code** **XCE 602 C**

**Prerequisite** **Mathematics, Science and their applications**

| **L –T –P –C** | **C: P: A** | **L –T –P –H** |
|---|---|---|
| **3 – 0- 0- 3** | **2.5: 0 : 0.5** | **3 – 0- 0- 3** |

| Course Outcome: After the completion of the course, students will be able to | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Understanding the concept of reservoir planning | C |
| **CO2** | Familiarize the drainage system | C |
| **CO3** | Develop the model of rain water harvesting | C & A |
| **CO4** | Gain knowledge about various types and methods of Irrigation | C |
| **CO5** | Understand the Diversion and Impounding Structures | C |

**COURSE CONTENT**

**` UNIT-I RESERVOIR PLANNING** **9 hrs**

River regions and their characteristics – classification of rivers on alluvial plains – meandering of rivers – Reservoir planning – Investigations – zones of storage in a reservoir single purpose and multipurpose reservoir – determination of storage capacity and yield – reservoir sedimentation – Reservoir life.

**UNIT –II WATER LOGGING** **9 hrs**

Water logging – causes and effects of water logging- remedial measures- land reclamation – land drainage – benefits- classification of drains- surface drains- subsurface drains- design principles and maintenance of drainage systems.

**UNIT-III RAINWATER HARVESTING AND RECYCLING OF WATER** **9 hrs**

Rainwater Harvesting and Management – Different Types and Methods of Harvesting in urban and agricultural areas - Recycling of harvested water - runoff collection and conservation of ground water - Types of storage structures- yield from a catchment – Losses of stored water.

**UNIT –IV IRRIGATION METHODS** **9 hrs**

Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop seasons – Consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies – Planning and development of irrigation projects. Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits –Sprinkler irrigation – Drip irrigation.

**UNIT – V DIVERSION AND IMPOUNDING STRUCTURES9 hrs**

Weirs – Elementary profile of a weir – Weirs on pervious foundations – Types of impounding structures – Tanks, sluices and weirs – Gravity dams – Earth dams – Arch dams – Spillways –Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams.

**L- 45 hrs Total – 45 hrs**

**Text books**


1. Punmia,B.C., Irrigation and Water Power Engineering, Laxmi Publications, Ltd., 2009
2. Ragunath.H.M., Hydrology, Willey Eastern Limited, New Delhi,2006
3. Asawa, G.L., "Irrigation Engineering", New Age International Publishers, 2005.
4. Sharma, R.K. and Sharma,T.K., "Irrigation Engineering", S.Chand and Company, 2007.
5. Gupta, B.L., and Amir Gupta, "Irrigation Engineering", SatyaPraheshan, 2000.


**References:**


1. Subramanya, Engineering Hydrology, Tata –McGraw Hill,2008
2. Dilip Kumar Majumdar, Irrigation Water Management (Principles & Practices), prentice Hall of India(p),Ltd,2009
3. Vedula&Mujumdar, Water Resources Systems, McGraw Hill, 2005
4. Daniel P.Loucks, Water Resources Systems Planning and Management (Studies and Reports in hydrology),2006
5. Majumdar, D.K., "Irrigation Water Management – Principles and Practices", Prentice Hallof India (P) Ltd., 2004.
6. Basak, N.N., "Irrigation Engineering", Tata McGraw-Hill Publishing Co, 2006.


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 3 | | | | | | | | 3 | | | | 2 |
| **CO2** | 2 | 3 | 2 | 1 | | | | | **1** | **3** | | 1 | 1 | 3 |
| **CO3** | | 3 | 1 | 1 | | 1 | | **1** | **1** | **3** | | 1 | 2 | 3 |
| **CO4** | | 2 | 1 | 1 | | 1 | | **1** | | **1** | 1 | 1 | 2 | 3 |
| **CO5** | 2 | 2 | 1 | 1 | | 1 | | **1** | | | 1 | | 2 | 1 |
| | 6 | 13 | 5 | 4 | | 3 | | **3** | **2** | **7** | 2 | 3 | 7 | 12 |

| | | |
|---|---|---|
| **Semester** | **VIII** | |
| **Subject Name** | **ENVIRONMENTAL IMPACT ASSESSMENT** | |
| **Subject Code** | **XCE602D** | |
| **Prerequisite** | **NIL** | |
| **L –T –P –C**<br>**3 – 0- 0- 3** | **C: P: A**<br>**3: 0 : 0** | **L –T –P –H**<br>**3 – 0- 0- 3** |

| **Course Outcome:** | | **Domain**<br>**C or P or A** |
|---|---|---|
| **CO1** | Identify environmental attributes for the EIA study. | C |
| **CO2** | Identify methodology and prepare EIA reports. | C |
| **CO3** | Specify methods for prediction of the impacts. | C |
| **CO4** | Formulate environmental management plans. | C |
| **COURSE CONTENT** | | |

| | | |
|---|---|---|
| **UNIT I** | **UNIT I-INTRODUCTION TO EIA** | **9 hrs** |
| | Environmental Impact Assessment (EIA)- Environmental Impact Statement - Environmental Risk assessment -Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of reference in EIA - Issues in EIA - National - Cross sectoral - social and cultural. | |
| **UNIT II** | **METHODOLOGIES** | **9 hrs** |
| | Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives – Case Studies. | |
| **UNIT III** | **PREDICTION AND ASSESSMENT** | **9 hrs** |
| | Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA. | |
| **UNIT IV** | **ENVIRONMENTAL MANAGEMENT PLAN** | **9 hrs** |
| | Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000 | |
| **UNIT V** | **CASE STUDIES** | **9 hrs** |
| | EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects | |
| | | **L – 45 hrs Total – 45 hrs** |

**Text books**


1. Canter, L.W., “Environmental Impact Assessment”, McGraw-Hill, New York. 2006.
2. Lawrence, D.P., “Environmental Impact Assessment - Practical solutions to recurrent problems”, Wiley-Interscience, New Jersey 2003.
3. Petts, J., “Handbook of Environmental Impact Assessment”, Vol., I and II, Conwell Science London. 2009.

| **References** |
|---|
| 1. Biswas, A.K. and Agarwala, S.B.C., "Environmental Impact Assessment for Developing Countries", Butterworth Heinemann, London. 2004.<br>2. The World Bank Group, "Environmental Assessment Source Book Vol. I, II and III. The World Bank, Washington. 2001. |

**Mapping of CO's with PO's:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 1 | 2 | | | 3 | 1 | 1 | | 1 | | | | 2 | | |
| **CO2** | 1 | 3 | 1 | 1 | | 3 | | 1 | | | 1 | 1 | | 1 | | |
| **CO3** | 1 | 2 | 2 | | | 2 | | 1 | | | 1 | 1 | | 1 | | |
| **CO4** | 1 | 2 | | | | 1 | 1 | | | | | | | 3 | | |
| | 4 | 8 | 5 | 1 | | 9 | 2 | 3 | | 1 | 2 | 2 | | 7 | | |

***1 - Low, 2- Medium, 3- High***

**Semester** **VI**
**Subject Name** **PRESTRESSED CONCRETE STRUCTURES**
**Subject Code** **PCE 603A**
**Prerequisite** **DESIGN OF CONCRETE STRUCTURES**

| L –T –P –C | C-P-A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2-0.5-0.5 | 3- 0 – 0- 3 |

| **Course Outcome:** | | **Domain** |
|---|---|---|
| | | C or P or A |
| **CO1** | Identify and apply the applicable industry design codes relevant for the design of prestressed concrete members | C |
| **CO2** | Discuss and appraise the recent advances in the prestressed concrete technology including the use of advanced materials and application of new technologies | C & P |
| **CO3** | Accomplish design calculations to predict service behaviour of prestressed concrete structures | A |

**COURSE CONTENT**

**` UNIT-I** **INTRODUCTION – THEORY AND BEHAVIOUR** **9 hrs**

Basic concepts – Advantages – Materials required – Systems and methods of prestressing –Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections –Losses of prestress – Estimation of crack width

**UNIT –II** **DESIGN CONCEPTS** **9 hrs**

Flexural strength – Simplified procedures as per codes – Strain compatibility method – Basic concepts in selection of cross section for bending – Stress distribution in end block-Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing – Applications.

**UNIT-III** **CIRCULAR PRESTRESSING** **9 hrs**

Prestressed Concrete Pipes- Advantages ,Loads –Codal Provisions-Design of cylinder and non cylinderPipes.Prestressed Concrete Tanks-Choice of types of tanks.

**UNIT –IV** **COMPOSITE CONSTRUCTION** **9 hrs**

Types of composite Construction - Analysis of stresses – Differential Shrinkage Estimation of Deflection Flexural and shear strength of composite members

**UNIT – V** **PRE-STRESSED CONCRETE BRIDGES** **9 hrs**

General aspects – Pretensionedprestressed bridge decks – Post tensioned prestressed bridge decks – Principles of design only.

**L - 45hrs Total-45 hrs**

**Text books**


1. Krishna Raju. N, Prestressed Concrete, Tata McGraw Hill Publishing Co. Ltd, New Dehi, 2012
2. Fundamentals of Prestressed Concrete by N.C.Sinha&S.K.Roy, S.Chand&Co,New Delhi,2011
3. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.
4. Libby J.R., Modern Prestressed Concrete, 3e,CBS Publishers & Distributors, New Delhi, 2007
5. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd. 2007.
6. Rajagopalan, N, "Prestressed Concrete", Alpha Science, 2002


**References**


1. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
2. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990
3. David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete – A design guide, McGraw Hill, New Delhi 1992
4. IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012
5. IS 3370-3 (1967): Code of Practice Concrete structures for the storage of liquids, Part 3: Prestressed concrete structures, Bureau of Indian Standards, New Delhi, 2008
6. IS 3370-4 (1967): Code of practice for concrete structures for the storage of liquids, Part 4: Design tables, Bureau of Indian Standards, New Delhi, 2008


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 2 | 1 | | 1 | 1 | **1** | **1** | | 2 | 1 | 1 | 2 | 4 |
| **CO2** | 1 | | 2 | 1 | 1 | 1 | **1** | **1** | | **1** | | 2 | 1 | 3 |
| **CO3** | 2 | 2 | 3 | 1 | 1 | 2 | | **1** | | | | | 2 | 1 |
| | 4 | 4 | 6 | 2 | 3 | 4 | **2** | **3** | | **3** | 1 | 3 | 5 | 8 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VI**

**Subject Name** **EARTH RETAINING STRUCTERS**

**Subject Code** **PCE603 B**

**Prerequisite** **Strength of Materials, Theory of Structures, Soil Mechanics and Concrete Structures.**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2:1:0 | 3- 0 – 0- 3 |

**Course Outcome:**

| | | Domain C or P or A |
|---|---|---|
| **CO1** | To describe the main concepts related with the behavior of flexible earth retaining structures. | C |
| **CO2** | To identify the appropriated methods of analysis and design and to select the adequate constructive solutions | C |
| **CO3** | To discuss the selection, design and performance evaluation of reinforced earth retaining structures. | C |
| **CO4** | To formulate solutions on the basis of alternative quality criteria and construction sustainability according to site constraints. | C &P |

COURSE CONTENT

**UNIT I** **EARTH DAMS AND EMBANKMENTS9 hrs**

Different types of earthen dams with sketches and their suitability. Hydraulic fill and rolled fill methods of construction – Causes of failure of earth dam – Design criteria of earth dams– Stability analysis of earthen dams – Seepage control in earthen dams. Role of Filters in Earth Dam Design.

**UNIT II** **RETAINING WALLS9 hrs**

Types of retaining walls, failure of retaining walls by sliding, overturning and bearing. Stability analysis and Principles of the design of retaining walls – Gravity retaining walls, Cantilever retaining walls, Counter fort retaining walls (no structural design) – Modes of failure of retaining walls – Drainage from the backfill

**UNIT III** **SHEET PILE WALLS- BULK HEADS9 hrs**

Types of sheet pile walls –Free cantilever sheet pile - cantilever sheet pile in cohesion-less soils –cantilever sheet pile in clay. Anchored sheet pile with free earth support in cohesion-less and cohesive soil. Bulkheads with fixed earth support method – Types, locations and design of anchors.

**UNIT IV** **BRACED CUTS AND ROCK FILL DAMS9 hrs**

Introduction, Lateral earth pressure on sheeting, Different types of sheeting and bracing systems – design of various components of bracings. Introduction, Origin and usage of rock fill dams, types of rock fill dams, and design of rock fill dams and construction of rock fill dams.

**UNIT V** **COFFER DAMS9hrs**

Introduction – Types of coffer dams - Design of cellular coffer dam on soil -safety against sliding, slipping, overturning, vertical shear and stability against bursting

**L- 45 hrsTotal -45 hrs**

**Text books**

1. Dr. Arora, "Soil mechanics and foundation Engineering", Standard Publishers and Distributors, 2nd edition, – 2014.
2. Dr. V.N.S. Murthy, "Soil mechanics and foundation Engineering"- Engg. Publishers & Distributions 1st edition, 2007.
3. Chris R.I. Clayton, Rick I. Woods, Andrew J. Bond , JarbasMilititsky"Earth Pressure and Earth-Retaining Structures", Third Edition,2014.
4. Foundations and Earth Retaining Structures, 1st Edition - Muni Budhu , December 2007.

**References**


1. P.C.Varghese, Foundation Engineering, Prentice Hall India Pvt Ltd, New Delhi, 2005.
2. Swami Saran, Analysis and design of substructures, Oxford and IBH Publishing Company Pvt. Ltd. 2008
3. Das S. C., Som N. N, "Theory And Practice of Foundation Design", PHI Learning Private Limited, 2009.
4. P.C.Varghese, "Design of Reinforced Concrete Foundations", PHI Learning Private Limited, 2009.
5. GopalRanjan, "Basic and Applied Soil Mechanics", New Age International, 2000.
6. V. N. S. Murthy, **"**Soil Mechanics And Foundation Engineering Geotechnical Engineering", CBS Publishers & Distributors, 2008.
7. B. C. Punmia, "Soil Mechanics and Foundations", Laxmi Publication Ltd, 2008.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 1 | 2 | 1 | 1 | | | | | 1 | 2 | 1 | 2 | 2 |
| **CO2** | 1 | 3 | 2 | | 2 | 1 | 1 | | 1 | 1 | 1 | 2 | 1 | 1 |
| **CO3** | 2 | 3 | 3 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 3 | |
| **CO4** | 2 | 3 | 3 | | 1 | | | 1 | 1 | | | | 3 | |
| | 8 | 10 | 10 | 1 | 4 | 2 | 2 | 2 | 3 | 3 | 4 | 3 | 9 | 3 |

***1 - Low, 2 – Medium, 3 – High***

| | |
|---|---|
| **Semester** | **VI** |
| **Subject Name** | **FINITE ELEMENT METHOD** |
| **Subject Code** | **PCE603C** |
| **Prerequisite** | **Structural Analysis** |

| **L –T –P –C** | **C:P:A** | **L –T –P –H** |
|---|---|---|
| **3 - 0 – 0 - 3** | **2:0:1** | **3- 0 –0- 3** |

| **Course Outcome:** | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Gain knowledge on basic concepts of FEM | C |
| **CO2** | Determine stresses and displacements for one and two dimensional elements under various loading. | C |
| **CO3** | Analyse the higher order elements using Isoparametric mapping and numerical integration. | C |
| **CO4** | Identify and Apply concepts of FEM in fluid mechanics. | C& A |

**COURSE CONTENT**

**UNIT I INTRODUCTION – VARIATIONAL FORMULATION9 hrs**

Methods of Engineering analysis – Basic concept of FEM and its procedure- Advantages and Disadvantages - Weighted Residual Method – Principle of Stationary Total Potential – Rayleigh Ritz method.

**UNIT II ONE DIMENSIONAL FINITE ELEMENT ANALYSIS9 hrs**

Finite element: modelling, coordinates, shape functions, stiffness matrix, stiffness equation, finite element equation for onedimensional element. Load or force vector – Temperature effects.

**UNIT III TWO DIMENSIONAL FINITE ELEMENT ANALYSIS9 hrs**

Finite element modelling, coordinates, shape functions, stiffness matrix, stiffness equation, finite element equation for twodimensional elements. Plane stress and plane strain – Constant Strain Triangular element – Linear Strain Triangular elements - Temperature effects.

**UNIT IV ISOPARAMETRIC ELEMENTS AND FORMULATION9 hrs**

Shape function for 4 noded elements using natural coordinate system and transformation – element stiffness matrix equations –Higher order two dimensional element – Shape function derivation for rectangular and triangular element – Lagrangean and Serendipity elements.

**UNIT V APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSION9 hrs**

Heat Transfer – Application to Heat Transfer in two dimensions – Application to Fluid Mechanics in two dimensions.

**L-45hrs Total- 45 hrs**

**Text books**


1. Krishnamoorthy,C.S.,"Finite Element Analysis –Theory and Programming", Second Edition,TataMcGraw Hill, 2015.
2. Bhavikati , S.S., "Finite Element Analysis ", New Age International Publishjers , 2016.
3. S.S.Rao, "The Finite Element Method in Engineering", Pergaman Press, 2011.

**References**


1. J.N.Reddy, "An Introduction to Finite Element Method", McGraw-Hill, Intl.Student
2. Edition, 2013.
3. Chandrupatla, T.R., and Belegundu, A.D., "Introduction to Finite Element in Engineering", Third Edition, Prentice Hall, India, 2012.
4. O. C. Zienkiewicz, Robert Leroy Taylor, PerumalNithiarasu, "The Finite Element Method for Fluid Dynamics", Butterworth-Heinemann, 2013.


**Mapping of CO's with PO's:**

| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | **PSO 1** | **PSO2** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | 3 | 2 | | | 1 | | | | | | | 1 | 2 |
| **CO2** | 2 | 2 | 3 | 1 | | 1 | | | | | | | 2 | 2 |
| **CO3** | 3 | 1 | 1 | 1 | | 2 | | | | 2 | | 1 | 1 | 2 |
| **CO4** | 3 | 2 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 3 | 2 |
| | 9 | 8 | 7 | 2 | 1 | 5 | 1 | 1 | 1 | 3 | 1 | 1 | 7 | 8 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VI**
**Subject Name** **EXPERIMENTAL STRESS ANALYSIS**
**Subject Code** **PCE603D**
**Prerequisite** **Mechanics of solids**

| L –T –P –C | C: P:A | L –T –P –H |
|---|---|---|
| 3– 0– 0– 3 | 2:1:0 | 3 - 0 –0 - 3 |

**Course Outcome:**

| | | Domain C or P or A |
|---|---|---|
| **CO1** | Calibrating the machineries and equipment used in the laboratory. | C(Understand) |
| **CO2** | Determine stresses and displacements under given loading by various gauges. | C(Apply) |
| **CO3** | Illustrate the basic concepts of 3D photo elasticity. | C(Understand) |
| **CO4** | Recognize the strength of the existing structural elements | C & P(Application) |

**COURSE CONTENT**

**` UNIT I** **MEASUREMENTS** **9 hrs**

Principles of measurements, Accuracy, Sensitivity and Range of measurements

**UNIT –II** **EXTENSOMETERS** **9 hrs**

Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages

**UNIT-III** **ELECTRICAL RESISTANCE STRAIN GAUGES** **9 hrs**

Principle of operation and requirements - Types and their uses- Materials for Strain Gauge. Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

**UNIT IV** **PHOTOELASTICITY** **9 hrs**

Two dimensional photo elasticity, Concept of light – photo elastic effects, stress optic law, Interpretation of fringe pattern - Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

**UNIT V** **NON – DESTRUCTIVE TESTING** **9 hrs**

Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods, Introduction to Moiré techniques, Holography, ultrasonic C- Scan, Thermograph, Fiberoptic Sensors.

**L=45hrs Total=45hrs**

**Text books**


1. Sadhu Singh, “Experimental Stress Analysis”, Khanna Publishers, New Delhi, 2013.
2. L.S.Srinath, “Experimental Stress Analysis”, Tata McGraw-Hill Publishing Company Limited, 2011.
3. James.W.Dally& William F.Riley – “Experimental Stress Analysis”, McGraw Hill, Fourth edition, 2005.

**References**


1. Hetyenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., New York, 1972.
2. Pollock A.A., “Acoustic Emission in Acoustics and Vibration Progress”, Ed. Stephens R.W.B., Chapman and Hall, 1993.
3. Ramesh, K., Digital Photoelasticity, Springer, New York, 2000.


**Mapping of CO’s with PO’s:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 1 | | | | | | | | 1 | | | | |
| **CO2** | 3 | 1 | 1 | | | | | | | 1 | | 1 | | 1 |
| **CO3** | | 2 | | | | | | | | | | 2 | | 1 |
| **CO4** | | | | | | 1 | | | | | 1 | 1 | | 1 |
| **CO5** | | | | | 1 | | | | **1** | | 1 | 2 | | 1 |
| | 5 | 4 | 1 | | 1 | 1 | | | **1** | 2 | 2 | 6 | | 4 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VII**

**Subject Name** **AIR QUALITY MANAGEMENT**

**Subject Code** **PCE 702A**

**Prerequisite** **NIL**

| **L –T –P –C** | **C:P:A** | **L : T: P: H** |
|---|---|---|
| **3- 0 – 0 - 3** | **2:0:1** | **3 – 0 –0-3** |

**Course Outcome:**

| | | **Domain C or P or A** |
|---|---|---|
| **CO1** | Identify the impact on human being , identifying sampling and analysis techniques for air quality management | C |
| **CO2** | Knowledge in the measurements of the dispersion of pollutants in the atmosphere | C & A |
| **CO3** | Select suitable equipment for air pollution control | C |
| **CO4** | Implement town planning rules and regulation with respect to air pollution | C |
| **CO5** | Assess the ill effects of noise pollution | C& A |

**COURSE CONTENT**

**UNIT-I** **SOURCES AND EFFECTS OF AIR POLLUTANTS** **10 hrs**

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution -Source inventory – Effects of air pollution on human beings, materials, vegetation, animals –global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling –Source and ambient sampling – Analysis of pollutants – Principles

**UNIT –II** **DISPERSION OF POLLUTANTS** **10 hrs**

Meteorology and Air Pollution: Factors influencing air pollution, Wind rose, Mixing Depths, Lapse rates and dispersion - Atmospheric stability, Plume rise and dispersion, Prediction of air quality, Box model - Gaussian model - Dispersion coefficient - Application of tall chimney for Pollutant dispersion**.**

**UNIT-III** **AIR POLLUTION CONTROL** **10 hrs**

Control of Particulate Pollutants: Properties of particulate pollution - Particle size distribution - Control mechanism - Dust removal equipment - Design and operation of settling chambers, cyclones, wet dust scrubbers, fabric filters & ESP.

**UNIT -IV** **AIR QUALITY MANAGEMENT10 hrs**

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion –Pollution control for specific major industries.

**UNIT -V** **NOISE POLLUTION** **5hrs**

Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

**L – 45 hrs Total – 45 hrs**

**Text books**

1. Fundamentals of Air Pollution- Daniel Vallero(2009)
2. Air Pollution- M.N.Rao,H.V.N.Rao&David H.F. Liu, Bela G. Liptak (2000)
3. Air Pollution Control: A Design Approach- F. C. Alley, C. David Cooper
4. Air Pollution Prevention And Control: Bioreactors And Bioenergy- Christian kennes, Maria.Cveiga(2002)
5. Environmental Noise Pollution- Enda Murphy and Eoin King

**References**


1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai,2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi,1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi,1996.
4. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark,1997.
5. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill PublishingCompany, New Delhi, 1991.
6. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGrawHill, New Delhi, 1985.


**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | 3 | | 2 | 3 | | 3 | | | | | |
| **CO2** | | | 2 | 3 | | | 3 | | 3 | | | | | 2 |
| **CO3** | 1 | | 1 | 3 | | | 3 | | 3 | 1 | | | 1 | 1 |
| **CO4** | 1 | | | 3 | 2 | | 3 | 2 | 3 | | 1 | | 1 | 1 |
| **CO5** | | | | 3 | | | 3 | 3 | 3 | | 1 | | | |
| | 2 | | 3 | 15 | 2 | 2 | 15 | 5 | 15 | 1 | 2 | | 2 | 4 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VII**
**Subject Name** **URBAN AND REGIONAL PLANNING – FUTURE TRENDS**
**Subject Code** **PCE702B**
**Prerequisite** **NIL**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3- 0 – 0- 3 | 2:1:0 | 3- 0 – 0- 3 |

**Course Outcome:**

| | | Domain C or P or A |
|---|---|---|
| **CO1** | Explain the serviceable fundamentals for urban and regional planning – future trends. | C |
| **CO2** | Distinguish the rural and urban concepts and developments. | P |
| **CO3** | Make out the methods of gathering and generating new modern transportation. | C |
| **CO4** | Appreciate the techniques and methods used in Modern Planning Concepts and Role of Information Technology In Regional Planning. | C |

**COURSE CONTENT**

**UNIT-I** **INTRODUCTION TO LAND USE PLANNING AND PRINCIPLES** **9 hrs**

Basics and Importance of land use planning-zoning principles-zoning laws-Infrastructure parameters: population, size of the city, road, water supply and sanitation-growing trends.

**UNIT –II** **MODERN PLANNING CONCEPTS** **9hrs**

Urban growth-migration and population explosion-need of modern planning-garden city, radiant city and linear city concepts-development of new towns and cities-organizational structure of municipalities, corporation and urban development.

**UNIT-III** **FUTURE TRANSPORTATION AND SOCIAL LIFE IN CITIES** **9 hrs**

Redevelopment strategy of city, transport in future city-new transport technology-Integrated transport-Future communities-Gated communities.

**UNIT IV** **ROLE OF INFORMATION TECHNOLOGY IN REGIONAL PLANNING** **9hrs**

Telemetrically concepts and its impacts on city land use-suitability of software for urban analysis-Modelling with software-simulated city-decision support systems for urban regional analysis- change detection and mapping through software.

**UNIT V** **URBAN UTOPIA** **9 hrs**

Global cities-Underground cities- Floating cities- Under Water cities- Visionary cities-clean air Parks- Skyscraper world.

**L- 45 hrs Total – 45 hrs**

**Text books**


1. Clements D, Donald A , Earnshaw M and Williams A The Future of Community, Pluto Press, London, 2013
2. Boeri S, BiswasRK . Future City, Routledge, New York, 2012
3. Richards B, Future Transport in Cities, Spon Press, London, 2013


**References**


1. Read S, Rosemann J and Dldijk J V Future City, Spon Press New York,2012
2. Wagner CG, Seeing through Future New Eyes, 2012
3. Gallian.B. Arthur and Simon Eisner, the urban pattern-City Planning and Design,Affiliated Press PvtLtd,New Delhi,2010

**Mapping of CO's with PO's:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | | | | | | | | | | | | | |
| **CO2** | 1 | 2 | | | | | | | | | | | | |
| **CO3** | 1 | | | | 2 | | | | | | | 1 | 1 | 1 |
| **CO4** | 1 | | 3 | | | | 2 | | | **1** | 1 | 1 | 1 | 1 |
| **CO5** | 2 | 1 | | | 1 | | **1** | | | 1 | 1 | 1 | 1 | 1 |
| | 6 | 3 | 3 | | 3 | 2 | 3 | | | 2 | 2 | 3 | 3 | 3 |

***1 - Low, 2 – Medium, 3 – High***

**Semester** **VII**
**Subject Name** **DOCKS, HARBOUR AND AIRPORT ENGINEERING**
**Subject Code** **PCE 702D**
**Prerequisite** **Transportation Engineering**

| L –T –P –C | C:P:A | L –T –P –H |
|---|---|---|
| 3 – 0 –0–3 | 1.5:0:1.5 | 3 – 0 – 0 – 3 |

**Course Outcome:**

| | | Domain C or P or A |
|---|---|---|
| **CO1** | Get clear picture on airport components and requirements. | C |
| **CO2** | Plan and design airports successfully. | C & A |
| **CO3** | Understand and follow the airport operations and control. | C & A |
| **CO4** | Plan Water transportation system components. | C & A |
| **CO5** | Effectively take coastal protection measures to prevent coast erosion. | C & A |

**COURSE CONTENT**

**UNIT I** **INTRODUCTION TO AIR TRANSPORT** **9 hrs**

Air Transportation: Aircraft Characteristics - Airport Planning: Airport surveys, Site selection, Airport Obstructions, layouts, zoning laws, Environmental considerations - Airport classification: utility airports, transport airports, Geometric Design of the Airfield - ICAO and FAA design standards; Aprons: holding aprons, terminal, Terminal Area - Passenger terminal system and its components, Apron gate system: number of gates, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft. Terminal Buildings: Site selection, facilities.

**UNIT II** **RUNWAY AND TAXIWAY** **9 hrs**

Runways: runway configurations, runway orientation, wind rose, estimating runway length, sight distance and longitudinal profile, transverse gradient, Taxiways and taxilanes: widths and slopes, taxiway and taxilane separation requirements, sight distance and longitudinal profile, location of exit taxiways, design of taxiway curves and intersections, end-around taxiways.

**UNIT III** **AIRPORT VISUAL AIDS AND AIR TRAFFIC CONTROL** **9 hrs**

Requirements of visual aids - Airport Lighting, Marking, and Signage - Control tower visibility requirements., - approach lighting system configurations, visual approach slope aids, threshold lighting, Runway and taxiway lighting and marking, airfield signage. Air Traffic Control: Control Tower, VFR, IFR. Hangars, Helicopters – helipads.

**UNIT IV** **WATER TRANSPORTATION** **9 hrs**

Water Transportation: - water transportation in India - Types of water transportation - Requirements - Introduction to Inland water transport in India - tides , waves, erosion, beach drift, littoral drift, sand bars - coast protection - ship characteristics, classification of ports and harbours, Port facilities: general layout, development, planning, facilities, terminals.

**UNIT V** **DOCKS AND HARBOUR 9 hrs**

Harbour works: breakwaters, jetties, fenders, piers, wharves, dolphins, etc. - Docks, Dredging, Coastal Erosion and Protection - Docks and repair facilities: design, dry docks, wet docks, slipways, Locks and lock gates: materials, size, Dredging: classification, dredgers, uses of dredged materials, Coastal erosion and protection: seal wall, revetment, and bulkhead. Navigational aids: types, requirements, light house, beacon lights, buoys.

**L - 45 hrs Total – 45 hrs**

**Text books**


1. Khanna, S. K., Arora, M. G. and Jain, S. S. Airport planning and Design, Sixth Edition, Nem Chand and Bros, Roorkee, India, 2012.
2. Dock and Harbor Engineering – Oza ,sixth edition, Chartor publishing House pvt limited, 2011.


**References**


1. Ashford, N. J., Mumayiz, S. A., and Wright, P. H. Airport Engineering: Planning, Design and Development of 21st Century Airports, Fourth Edition, John Wiley & Sons, New Jersey, USA, 2011.
2. Kazda, A., and Caves, R. E. Airport Design and Operation, Second Edition, Elsevier, Oxford, U.K., 2007.


**Mapping of COs with POs**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | | | | | | | | | | | | 3 | |
| **CO2** | | | | | | | | | | 3 | 1 | | 3 | **2** |
| **CO3** | | | | | 1 | | 3 | 1 | 1 | 3 | 1 | | 3 | 3 |
| **CO4** | 1 | | | | 1 | 1 | 1 | 2 | 1 | 3 | 3 | | 3 | 3 |
| **CO5** | 1 | 1 | | | | | 1 | 1 | | 3 | | | 3 | 3 |
| | 2 | 1 | | | 2 | 1 | 5 | 4 | 2 | 15 | 5 | | 13 | 11 |

***1 - Low, 2 – Medium, 3 – High***