**ACADEMIC REGULATIONS**

**COURSE STRUCTURE AND SYLLABUS**

**B.TECH.**

**CIVIL ENGINEERING**

*Effective for the B.Tech. Students admitted into first year For The academic year*

*2020-2021*

PRAGNANAM BRAHMA
ANITS
(AUTONOMOUS)

**ANIL NEERUKONDA INSTITUTE OF TECHNOLOGY & SCIENCES (AUTONOMOUS)**
*Approved by AICTE & Affiliated to Andhra University*
SANGIVALASA-531162, BHEEMUNIPATNAM MANDAL, VISAKHAPATNAM DISTRICT

**INSTITUTE VISION**

- To emerge as a world class technical institution

**INSTITUTE MISSION**

- To impart holistic technical education by providing
- The state of the art infrastructure
- Exceptional technical and teaching expertise
- Best of human value

**VISION OF THE DEPARTMENT**

- To emerge as a leading Civil Engineering Department globally

**MISSION OF THE DEPARTMENT**

- Empower our students with contemporary and industry relevant skills in Civil Engineering using outstanding technical and teaching expertise and best of infrastructure
- Nurture holistic development of our students inculcating universal human values and life skills for serving the society as leaders of their profession

**Program Educational Objectives (PEOs)**

**PEO1:** Successfully practice Civil Engineering in construction industry, public sector and entrepreneurship, ensuring a prosperous professional career.

**PEO2:** Pursue higher education and Research for professional development contributing to the advancement of civil engineering through lifelong learning

**PEO3:** Demonstrate leadership abilities actively contributing to societal needs with a focus on sustainable development and human values.

**Program Outcomes**

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilitiesrelevant 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 society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**Program Specific Outcomes**

1. Plan and develop safe, economical and sustainable buildings and other structures based on applicable professional standards, codes and ethics.
2. Analyze and solve stability problems in soils for design of foundations and earth structures and plan and design highway, railway and other transportation systems based on applicable safety standards, codes and ethics.
3. Plan and develop irrigation and water supply systems and analyze and solve problems due to pollution of air, water and land leading to a nourished, richer and healthy society.

## Semester - I

| Course Code | Title of the course | Category | Periods | | | | | | Sessionals Marks | Semester end Exam marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | E | O | Total | | | | |
| CIV411 | Open Elective-III# | OE | 2 | 1 | 0 | 1 | 2 | 6 | 40 | 60 | 100 | 3 |
| CIV412 | Estimation & Costing | PC | 2 | 1 | 0 | 2 | 3 | 8 | 40 | 60 | 100 | 3 |
| CIV413 | Professional Elective – II | PE | 3 | 0 | 0 | 1 | 2 | 6 | 40 | 60 | 100 | 3 |
| CIV414 | Professional Elective – III | PE | 3 | 0 | 0 | 1 | 2 | 6 | 40 | 60 | 100 | 3 |
| CIV415 | Professional Elective – IV | PE | 2 | 1 | 0 | 2 | 3 | 8 | 40 | 60 | 100 | 3 |
| CIV416 | Project work-I | PR | 0 | 0 | 6 | 0 | 6 | 12 | 100 | – | 100 | 2 |
| CIV417 | Summer Internship-II* | PR | 0 | 0 | 0 | 0 | 4 | 4 | 100 | – | 100 | 1.5 |
| **Total** | | | **12** | **3** | **6** | **7** | **22** | **50** | **400** | **300** | **700** | **18.5** |

## Semester – II

| Course Code | Title of the course | Category | Periods | | | | | | Sessionals Marks | Semester end Exam marks | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | E | O | Total | | | | |
| CIV421 | Open Elective - IV#(MOOCs) | OE | 2 | 1 | 0 | 1 | 2 | 6 | 40 | 60 | 100 | 3 |
| CIV422 | Professional Elective – V(MOOCs) | PE | 2 | 1 | 0 | 1 | 2 | 6 | 40 | 60 | 100 | 3 |
| CIV423 | Project Work –II | PR | 0 | 0 | 9 | 0 | 9 | 18 | 50 | 50 | 100 | 8 |
| **Total** | | | **4** | **2** | **9** | **2** | **13** | **30** | **130** | **170** | **300** | **14** |

*** Summer Intership-II** *to be conducted after III year-II semester and evaluated in IV year-I semester*

*# Open Electives can be either interdisciplinary subjects/emerging subject/MOOCs as decided by the Department*

# R 20 IV Year I Sem
# Detailed Syllabus

## LIST OF PROFESSIONAL ELECTIVES (CIVIL ENGINEERING) (R 20)

1. Transportation engineering - II
2. Disaster Management
3. Design of RCC Bridges
4. RS & GIS application in Civil Engineering
5. Pre stressed concrete
6. Advanced Fluid Mechanics
7. Advanced Design of structures
8. Water Resource Engineering - II
9. Soil Dynamics and Machine Foundation
10. Introduction to Finite Element Methods
11. Advanced Transportation Engineering
12. Watershed management
13. Advanced Building Construction
14. Earthquake Engineering
15. Environment Impact Analysis
16. Air Pollution Control
17. Engineering Economics and Finance

## ESTIMATION & COSTING

**CIV 412 - PC** **Credits : 3**
Instruction : 3 Lectures & 1 Tutorial / week Sessional Marks : 40
End Exam : 3 Hours End Exam Marks : 60

**Prerequisites:**

Civil Engineering Materials, Building Technology, Building Planning and Design.

**Course Objectives:**

1. To understand the types of estimates
2. To understand rate analysis and process of preparation of bills
3. To study about the specification writing

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Apply the types and methods of estimation through basic terminology.
2. Apply the types and methods of specifications of framed buildings.
3. Analyze the abstract estimate of a building utilizing the standard schedule of rates and developing the estimation of various items of work.
4. Analyze the detailed estimate of load bearing and framed buildings by applying the different methods of estimation
5. Analyze the detailed estimate of RCC buildings and prefabricated buildings by identifying the various components of the building.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | | | | | | | | | | | | 3 | | |
| | **2** | 3 | | | | | | | | | | | | 3 | | |
| | **3** | 3 | 3 | | | | 2 | | | | | | | 3 | | |
| | **4** | 3 | 3 | | | | 2 | | | | | | | 3 | | |
| | **5** | 3 | 3 | | | | 2 | | | | | | | 3 | | |

## SYLLABUS

**UNIT – I** 12 Periods

**Introduction**: Standard units, Units of measurement of different items of work. Meaning of estimating. Errors in estimation, Different types of estimates. Contingencies and related terms in the estimate, different types of approvals. Plinth area and related terms used in the estimation of various structures, rules and methods of measurements of different works.

**Learning Outcomes:**

1. Understand the basic concepts of estimation
2. Know the methods of measurements of different works

**UNIT – II** 12 Periods

**Specifications**: Specifications for framed buildings: Meaning, purpose, types of specifications, Method of preparation of specification, general specification, detailed specifications of different items of framed buildings and other structures.

**Learning Outcomes:**

1. Prepare specifications for different items of buildings.
2. Able to identify the quality of different items of buildings.

**UNIT – III** 12 Periods

**Rate analysis:** Data sheet for materials and various items of work in buildings and other structures, schedule of rates, abstract estimate of buildings.

**Learning Outcomes:**

1. Analyze the rates of various items of work in building.
2. Prepare abstract estimate of building.

**UNIT – IV** 12 Periods

**Estimation:** Estimation of load bearing structures by Long wall - short wall method and Centre line method.

Detailed estimate of framed buildings - Estimation of Different items of works in substructure, Earthwork, P.C.C, Foundation Concrete, D.P.C in R.C.C building- Single Bedroom, Double Bed Room and Triple bedroom with partition walls and verandah.

**Learning Outcomes:**

1. Learn how to estimate the different items of works in substructure and superstructure.
2. Prepare a detailed estimate of building.

**UNIT – V** 12 Periods

**Estimation of Superstructure:** Estimation of various items of R.C.C building works in superstructure: Super structure walls and columns, slab beams, plinth beam, columns, Deductions, Plastering and White Washing and Color Washing, Sloped Roof Buildings; G.I. and A.C. Sheet, Electricity and water supply. Sanitation works etc, Estimation of Prefabricated structures.

**Learning Outcomes:**

1. Learn how to estimate the different items of R.C.C building works.
2. Prepare a bar bending schedule.

**TEXT BOOKS**


1. Datta, B.N. (2002), "Estimating and costing", Charator Publishing House, 27th Edition, Gujarat
2. Chakraborti, M. (2006), "Estimating, Costing, Specification and Valuation in Civil Engineering, 28th Edition,


**REFERENCES**


1. Birdie .G.S. (2000), "A Text Book on Estimating and Costing", Dhanpat Rai and Sons, New Delhi.
2. Bhasin, P.L. (2000), "Quantity Surveying", S. Chand & Co., 2nd Edition, New Delhi.
3. Relevant NPTEL Courses.

## TRANSPORTATION ENGINEERING - II

**Credits: 3**

Instruction: 3 Lectures / week — Sessional Marks: 40

End Exam: 3 Hours — End Exam Marks: 60

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**Prerequisites:**

Nil

**Course Objective:**

1. To study various components and their functions in a railway track.
2. To acquire design principles of geometrics in a railway track.
3. To study various elements in points and crossings.
4. To acquire design principles of airport geometrics and pavements.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Analyse the factors affecting for the selection of gauge system in railways
2. Design geometrics of railway track and analyse the criteria for fixing the alignment
3. Apply the railway engineerng principles to classify the points and crossings, track junctons and station yards
4. Design geometrics of runway based on te topgraphical and climate conditions
5. Analyse the various components of port by applying its natural phenomenon.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | 3 | | | | | | | | | | | | 2 | |
| | **2** | 3 | 2 | 3 | | | | | | | | | | | 3 | |
| | **3** | 3 | | | | | | | | | | | | | 2 | |
| | **4** | 3 | 2 | 3 | | | | | | | | | | | 3 | |
| | **5** | 3 | 2 | | | | | | | | | | | | 2 | |

## SYLLABUS

**UNIT – I** 12 Periods

**Railway Engineering – 1:** Role of railways in transportation - classification of modes - Comparison of railway and highway transportation - Historical development of railways in India - Advantages of Railways – Classification of Indian Railways – Engineering Surveys for Track Alignment – Obligatory points – Gauges in railway track - Permanent way - Components and their functions – Types of Rails - Rail joints – Welding of Rails – Creep of Rails – Rail fixtures & Fastenings - Coning of Wheels.

**UNIT – II** 12 Periods

**Railway Engineering – 2:** Track alignment – requirements of good alignment, factors in selection of good alignment; Geometric design of the track – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal/Vertical Curves.

**UNIT – III** 12 Periods

**Railway Engineering – 3:** Points and crossings – Necessity – Types, component parts and their functions; Track junctions – types of track junctions; Track drainage – Layout of Railway stations and yards – Signals – Interlocking – Track circuiting – Track Maintenance.

**UNIT – IV** 12 Periods

**Airport Engineering:** Layout of Airports – Components functions – Aircraft characteristics – Airport site selection – Airport obstructions and zoning – Runway design – Visual aids – Air traffic control.

**UNIT – V** 12 Periods

**Dock & Harbour Engineering:** Layout of Port components – Functions – Classification of Ports – Site selection – breakwaters - Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – warehouses - Navigational aids.

**TEXT BOOKS**

1. Saxena S.C and Arora S.P "Railway Engineering", Dhanapat Rai Publications, 7th Edition, (2010)
2. Khanna, S.K. and Arora, M.G. "Airport Planning and Design" Nemchand & Bros., 6th Edition (2017).

**REFERENCES**

1. K.P.Subramanian (2003), "Highway, Railway, Airport and Harbour Engineering" Scitech Publications (India) Pvt. Ltd.
2. Rangwala S.C & K.S. "Railway Engineering", Charotar Publications, 14th Edition, 2005.
3. Robert M. Horonjeff, "Planning and Design of Airports", Mc Graw Hill Publications, 2008.
4. Chadula, S.P. "Railway Engineering–A text book of Transportation Engineering", S.Chand & Co. Ltd. (2001).
5. Relevant NPTEL Courses.

## DISASTER MANAGEMENT

**Credits: 3**

Instruction: 3 Lectures / week — Sessional Marks: 40

End Exam: 3 Hours — End Exam Marks: 60

**Course Objectives:**

From this course students will learn the following

1. Learn about the nature of disasters
2. Understand about administrative management of disasters
3. Learn about the importance of pre disaster measures

**At the end of the course, the students will be able to:**

1. Explain the affects of natural and man-made disasters
2. Illustrate the administrative setup and risk management strategies of disasters
3. Select the suitable disaster relief measures with specific considerations
4. Analyze the environmental and health affects of hazards
5. Describe the case studies of natural and man-made disasters scross the world.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO | 1 | 3 | 3 | | | | | | | | | | | 2 | | |
| | 2 | 3 | 2 | | | | | | | | | | | 2 | | |
| | 3 | 3 | | | | | | | | | | | | 2 | | |
| | 4 | 3 | 2 | | | | | | | | | | | 2 | | |
| | 5 | 3 | 2 | | | | | | | | | | | 2 | | |

## SYLLABUS

**UNIT – I** 12 Periods

**Disasters:** Nature and extent of disasters, Natural disasters like earthquakes, floods, drought, volcanoes, forest fires, hazards, landslides, tsunami, etc. Manmade disasters like chemical and industrial hazards, nuclear hazards, fire hazards etc.

**UNIT – II** 12 Periods

**Disaster Management:** Administrative setup and organization, Risk management, strategies of risk reduction, disaster resilience, emergency management programme, Information management.

**UNIT – III** 12 Periods

**Disaster Monitoring & Mitigation:** Relief measures (short-term and long-term), financing the relief expenditure, legal aspects, rescue and refugee operations, disaster recovery,

mitigation measures.

**UNIT – IV** 12 Periods

**Hazard Analysis:** Training of personnel, Emergency facilities and equipment necessary, public awareness creation, Impact of disasters on environment and poverty, health hazards of disasters.

**UNIT – V** 12 Periods

**Case studies:** Detailed case studies on Earth-quakes, floods, landslides, industrial hazards and fire accidents in India, INCOIS (Hyd), NIDM (Delhi).

**TEXT BOOKS**


1. Guptha, H.K. (2003), "Disaster management", University Press, New Delhi, 3F$^{nd}$ Edition.
2. Singh, R.B (2000), "Disaster management", Rawat Publications, New Delhi, 2$^{nd}$ edition.


**REFERENCES**


1. Krishnamurthy, R.R (2002), "Disaster Management", University Press, New Delhi, 1$^{st}$ edition.
2. Seetharaman, S (1999), "Construction Engineering and Management", Umesh Publications, New Delhi, 4th Edition.
3. Gupta, M.C (2002), "Manuals on Natural Disaster management in India", National Centre for Disaster Management, IIPA, New Delhi,.
4. Relevant NPTEL Courses.

## DESIGN OF RCC BRIDGES

**Credits: 3**

Instruction: 3 Lectures / week — Sessional Marks: 40
End Exam: 3 Hours — End Exam Marks: 60

**Prerequisite:**

Design of Concrete Structures

**Course Objective:**

1. Familiarize Students with different types of Bridges and IRC standards
2. Equip student with IRC standards
3. Equip student with concepts and design of Slab Bridges
4. Equip student with concepts and design of T Beam Bridges
5. To familiarize student with the knowledge of bridge sub structure

**At the end of the course, the students will be able to:**

1. Explain the principles of working stress method, design and draw the reinforcement detailing of beams, underground water tanks and tanks resting on ground.
2. Design and draw the reinforcement detailing of RCC overhead water tanks.
3. Design and draw the reinforcement detailing of RCC concrete bridges.
4. Design and draw the detailing of plate girders.
5. Analyse beams and frames by applying the concept of plastic analysis.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | 3 | 2 | | | | | | | | | | 3 | | |
| | **2** | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| | **3** | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| | **4** | 3 | 2 | 2 | | | | | | | | | | 3 | | |
| | **5** | 3 | 2 | 2 | | | | | | | | | | 3 | | |

## SYLLABUS

**UNIT – I** 12 Periods

**Introduction:** Components of Bridges – Classification – Importance of Bridges -Selection of Bridge site – Economical span – Location of piers and abutments – Choice of bridge type: Subsoil exploration – Scour depth. Importance of Bearings

**UNIT – II** 12 Periods

**Loading Standards:** Types of loading - Dead load - Live load (IRC Standards) - Impact Load - Tractive forces - Centrifugal forces - wind forces – temperature stresses – Seismic forces.

**UNIT – III** 12 Periods

**Slab bridges:** Introduction- Wheel load on slab- effective width method (IS Method) - slabs supported on two edges- cantilever slabs- dispersion length

**UNIT – IV** 12 Periods

**Beam & Slab Bridge (T-Beam Girder Bridge):** General features – Design of interior panel of slab – Pigeaud's method – Courbon's method – Analysis and design of T-beam longitudinal girder subjected to IRC loading – Analysis and design of Cross Girder

**UNIT – V** 12 Periods

**Substructure:** General features of Abutments – forces acting on abutments – Design and Stability analysis of abutments. General features - Types of piers – Forces acting on piers – Design and Stability analysis of piers. Types of Bearings.

**TEXT BOOKS**


1. Johnson victor D, "Essentials of Bridge Engineering", 7th Edition, Oxford, IBH publishing Co., Ltd., 2006.
2. Ponnuswamy, S. (2008), "Bridge Engineering" Mc Graw Hill Inc.


**REFERENCES**


1. Krishna Raju N., "Design of Bridges", 4th Edition, Oxford and IBH Publishing Co., Ltd., 2008.
2. Jagadish T.R. & M.A. Jayaram, "Design of Bridge Structures", 2nd Edition, 2009
3. Relevant – IRC & Railway bridge Codes.
4. Relevant NPTEL Courses.

## RS & GIS APPLICATIONG IN CIVIL ENGINEERING

**Credits: 3**

Instruction: 3 Lectures / week — Sessional Marks: 40
End Exam: 3 Hours — End Exam Marks: 60

**Prerequisites:**

Nil

**Course Objectives:**

1. To Learn about the principles of remote sensing and Electromagnetic radiations
2. To know about satellites, satellite parameters
3. To learn about the image interpretation and processing techniques
4. To study about GIS and various data models.
5. To know the applications of remote sensing and GIS in civil engineering projects.

**At the end of the course, the students will be able to:**

1. Explain various ranges of spectrum in Electro Magnetic Radiation
2. Demonstrate the working principles of satellites.
3. Interpretate and analyse the images from GIS Analysis
4. Describe overlay operations of maps in GIS
5. Apply the tools of GIS in various civil engineering applications.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | 2 | | | | | | | | | | | 3 | 3 | 3 |
| | **2** | 3 | 2 | | | | | | | | | | | 3 | 3 | 3 |
| | **3** | 3 | 2 | | | | | | | | | | | 3 | 3 | 3 |
| | **4** | 3 | 2 | | | | | | | | | | | 3 | 3 | 3 |
| | **5** | 3 | 2 | | | | | | | | | | | 3 | 3 | 3 |

### SYLLABUS

**UNIT – I** 12 Periods

**Remote Sensing:** Principle - Electro-magnetic energy, spectrum - EMR interaction with atmosphere – Atmospheric Windows and its Significance – EMR interaction with Earth Surface Materials – Spectral Signature and Spectral Signature curves for water, soil and Earth Surface, Energy sources and radiation principles.

**UNIT – II** **12** Periods

**Satellites:** Classification – Satellite Sensors – satellite and sensor parameters - Resolution – Types of sensor systems used in RS, RS satellites, land sat, spot, IRS, IKONOS, QUICKBIRD., RS data products.

**UNIT – III** 12 Periods

**Image interpretation:** Elements of image interpretation, concepts of digital image processing image Rectification and Restoration, Image enhancement, Image classification. Characteristics of different platforms, Radar, LIDAR, SAR, MODIS, AMSRE, Sonar remote sensing systems.

**UNIT – IV** 12 Periods

**GIS:** Introduction, GIS overview, Introduction to GIS - elements of GIS, Computer hardware - Software. Data Input, Verification, data storage and database management and output applications, Map Overlay - Vector and raster data model , overlay operation Errors and quality control.

**UNIT – V** 12 Periods

**RS and GIS in civil engineering projects:** Soil mapping and characteristics. Application in water resource engineering. Environmental pollution monitoring. Regional and urban mapping, planning systems and waste disposal sites.

**TEXTBOOKS**


1. Lillesand, T.M. & Kiefer R.W. (2007), "Remote Sensing and image interpretation", John Wiley & Sons (Asia), Newyork.


**REFERENCES**


1. Anji Reddy, M. (2011), "Remote sensing and Geographical information system", B.S Publications.
2. Burrough, P. A. (1998), "Principles of Geographical information systems for land resource assessment", Clarendon Press, Oxford, 2nd Edition.
3. Stan Aronoff, (1991), "Geographic Information Systems - A Management Perspective", WDL Publications, Ottawa, Canada, Reprint Edition.
4. Kennie, J.J.M., Matthews, (2005), "Remote sensing in Civil Engineering", Mc-Millan.
5. Floyd F. Sabins, (2005), "Remote Sensing Principles and Interpretation", Jr. W.H. Freeman & Co., 3rd Edition.
6. Relevant NPTEL Courses.

## PRESTRESSED CONCRETE

**Credits: 3**

Instruction: 3 Lectures / week — Sessional Marks: 40
End Exam: 3 Hours — End Exam Marks: 60

**Pre-requisites:**

Strength of materials, Concrete technology, Reinforced Concrete Structures

**Course objectives:**

The objective of this course is to

1. To know the different pre-stressing systems and the losses in pre-stressing
2. To analyse and design the sections for flexure and shear.
3. To evaluate the stresses at the end blocks of a pre-stressed member

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Explain the principles and methods of prestressed concrete
2. Analyze prestress losses in concrete members
3. Perform elastic analysis of prestress concrete sections for flexure
4. Design prestress concrete sections for flexure and shear
5. Analyze and design anchorage zones in prestress concrete.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | 2 | | | | | | | | | | | 3 | | |
| | **2** | 2 | 3 | 2 | 3 | | | | | | | | | 3 | | |
| | **3** | 2 | 3 | 2 | 3 | | | | | | | | | 3 | | |
| | **4** | 3 | 3 | 3 | 2 | | | | | | | | | 3 | | |
| | **5** | 2 | 3 | 3 | 3 | | | | | | | | | 3 | | |

## SYLLABUS

**UNIT – I** — 12 Periods

**Introduction:**

Historic development – General principles of pre-stressing – pre-tensioning and post tensioning – Advantages and limitations of pre-stressed concrete – Materials – High strength concrete and high tensile steel and their characteristics.

Prestressing Methods: I.S.Code provisions, Methods and Systems of Pre-stressing; Pre-tensioning and post tensioning methods – Different systems of pre-stressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford Udall System.

**UNIT – II** 12 Periods

**Losses of Prestress:**
Loss of pre-stress in pre tensioned and post tensioned members due to various causes like elastic shortage of concrete, shrinkage of concrete, creep of concrete, Relaxation of steel, slip in anchorage bending of member and frictional losses.

**UNIT – III** 12 Periods

**Analysis of Sections for Flexure:**
Analysis of sections for flexure; Elastic analysis of concrete beams pre-stressed with straight, Concentric, eccentric, bent and parabolic tendons.

**UNIT – IV** 12 Periods

**Design of Sections for Flexure and Shear:**
Allowable stress, Design criteria as per I.S.Code – Elastic design of simple rectangular and I-section for flexure, shear, and principal stresses.

**UNIT – V** 12 Periods

**Analysis of End Blocks:**
Analysis of end Blocks by Guyon's method and Magnel method, Anchorage zone stress – Approximate method of design – Anchorage zone reinforcement – Transfer of pre- stress in pre-tensioned members.

**TEXT BOOKS**


1. Krishna Raju N. (2012) "Prestressed Concrete", Tata Mc.Graw Hill Publications, 5th Edition.
2. Ramamrutham S. (2015) Prestressed Concrete, Dhanpatrai Publications, 4th Edition.


**REFERENCES**


1. Lin T.Y, and Ned H. Burns, (2010) "Design of Prestressed Concrete Structures", Wiley Publications
2. Rajagopalan. N (2006) "Prestressed Concrete", Narosa publications, 2nd Edition.
3. I.S. 1343-2012 "Indian Standard Code of Practise for Prestressed Concrete", Bureau of Indian Standards.
4. Relevant NPTEL Courses.

## ADVANCED FLUID MECHANICS

**Credits : 3**

Instruction : 3 Lectures / week — Sessional Marks : 40
End Exam : 3 Hours — End Exam Marks : 60

**Prerequisites:**

Fluid Mechanics – I & Fluid Mechanics – II

**Course Objectives:**

1. To develop an insight into engineering problems related to fluids.
2. Student is expected to learn about the viscous effects on fluid motion to solve complex problems in engineering.
3. Student shall be able to know different types of fluid flows and apply the principles of conservations of mass, momentum and energy.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Explain the viscous effects on fluid motion.
2. Compute the forces on submerged bodies and induced drag on bodies.
3. Analyze canal transitions using the principles of momentum and energy conservation.
4. Analyze gradually varied flow in open channels.
5. Analyze unsteady fluid flow in open channels..

**Mapping of course outcomes with program outcomes:**

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| | **2** | 2 | 3 | | | | | | | | | | | | | 2 |
| | **3** | 2 | 3 | | | | | | | | | | | | | 2 |
| | **4** | 3 | 3 | | | | | | | | | | | | | 2 |
| | **5** | 2 | 3 | | | | | | | | | | | | | 2 |

## SYLLABUS

**UNIT – I** 12 Periods

**Viscous Effects on Fluid Motion:** Navier-Stokes Equations (No Derivation) – N.S. equations for standard cases of Plane Two Dimensional and Axisymmetric Flows. Steady Flow between Parallel Plates- Couette and Poiseuille Flows- Unsteady Laminar Flow Past a Flat Plate,Flow through a Circular Annulus- Flow without and with Pressure Gradient- Hagen-Poiseullie Equation, Relationship between Friction factor and Reynolds Number for Laminar Flow through Pipes.

**UNIT – II** 12 Periods

**Drag & Lift:** Drag of immersed bodies - Variation of Drag Coefficient with Reynolds Number; Resistance diagram for bodies of revolution- Drag Coefficient of Practical Bodies. Effect of Circulation in Irrotational Flow- Computation of Lift Force- Lift on Airfoil- Lift Coefficient and its Variation with Angle of Attack- Jukowsky Profile- Polar Diagram- Stall - Induced Drag

**UNIT – III** 12 Periods

**Uniform Flow in Open Channels:** Uniform Flow Computation- Conveyance of a Channel Section – Section Factor and Hydraulic Exponent. Flow Characteristics in a Closed Conduit with Open Channel Flow. Determination of Normal Depth and Velocity. Design of Channels for Uniform Flow – Design of Non-erodible Channels (Rectangular & Trapezoidal Sections only). Canal Transitions- Change of Depth in Channels with (a) Change in Cross-section and (b) Hump in the Bed- Control Sections- Venturi Flume and Parshall Flume.

**UNIT – IV** 12 Periods

**Varied Flow in Open Channels:** Definition of G.V.F. and Derivation of Governing Equation- Mild, Steep, Critical, Horizontal and Adverse Slopes- Classification of G.V.F. Profiles- Backwater and Drawdown Curves- G.V.F. Profiles for Channels with Changing Slopes. Computation of G.V.F. Profiles- Graphical Integration Method and method of Direct Integration(Procedures Only), Direct Step and Standard Step Methods – Computation of G.V.F. Profiles in rectangular channels using Direct and Single Step methods (Simple Slope cases only).

**UNIT – V** 12 Periods

**Unsteady Flow in Open Channels:** Gradually Varied Unsteady Flow –Dynamic Equation for Unsteady Flow – Monoclinical Rising Wave –Dynamic Equation for Uniformly Progressive Flow. Wave Profile of Uniformly Progressive Flow- Dam Break Problem - Wave Propagation.(Solution of Unsteady-flow equations and Spatially varied Unsteady Flow are excluded). Rapidly Varied Unsteady Flow - Uniformly Progressive Flow – Moving Hydraulic jump – Positive and Negative Surges–Pulsating Flow.

**TEXT BOOKS**


1. Modi, P.N.& Seth, S.M. (2009),"Fluid Mechanics and Hydraulic Machinery", Standard Book House, New Delhi, 19th Edition.
2. Subramanyam, K. (2008), "Flow in Open Channels", McGraw Hill Education, New Delhi, 3rd Edition.


**REFERENCES**


1. Jain, A.K. (2008), "Fluid Mechanics", Khanna Publishers, New Delhi, 4th Edition.
2. Kumar, K.L., Chand, S. & Co. (2008), "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd, New Delhi, 8th Edition.
3. Chow, V.T. (2009), "Open-Channel Hydraulics", The Blackburn Press, Caldwell, NJ USA, 1st Edition
4. White, F. M. (2011) "Fluid Mechanics", Tata McGraw Hill Publication, New Delhi, 7th Edition.
5. Relevant NPTEL Courses.

## DESIGN OF RCC & STEEL STRUCTURES

**Credits : 3**

Instruction : 3 Lectures / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Prerequisites:**

Strength of materials, Concrete technology, Reinforced Concrete Structures, Steel Structures

**COURSE OBJECTIVES:**

From this course students will learn the following

1. To learn how to design RCC water tanks and Concrete bridges
2. To learn how to design plate girders
3. To analyse beams and frames

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Explain the principles of working stress method, design and draw the reinforcement detailing of beams, underground water tanks and tanks resting on ground.
2. Design and draw the reinforcement detailing of RCC overhead water tanks.
3. Design and draw the reinforcement detailing of RCC concrete bridges.
4. Design and draw the detailing of plate girders.
5. Analyse beams and frames by applying the concept of plastic analysis..

**Mapping of course outcomes with program outcomes:**

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| | 3 | 2 | 3 | 3 | | | | | | | | | | 3 | | |
| | 4 | 3 | 3 | 3 | | | | | | | | | | 3 | | |
| | 5 | 2 | 3 | 3 | | | | | | | | | | 3 | | |

## SYLLABUS

**UNIT – I** 12 Periods

**Introduction To Working Stress Method:** Introduction – Design for bending –Analysis and design of singly reinforced and doubly reinforced beams.

**Rectangular RC Water Tanks-I:** Introduction – General design requirements according to Indian standard code of practice – Design of on ground and underground water tanks.

**UNIT – II** 12 Periods

**Rectangular RC Water Tanks-II:** Introduction – General design requirements according to Indian standard code of practice –Design of over head water tanks.

**UNIT – III** 12 Periods

**RC Bridges:** Components of a bridge in sub structure and super structure. Classification of bridges. Loads on Highway bridges, IRC loading, Design of slab bridge.

**UNIT – IV** 12 Periods

**Steel Bridges:** Bridges: Classification, Loadings, Types of bridges – Deck Type and Through Type, Design of Through Type Bridge - Stringer, Cross Girders.
Bearings & Expansion Joints: Types of bearings, plate bearing, Rocker bearing, Roller bearing, Knuckle pin bearing. Expansion Joints: Introduction and classification.

**UNIT – V** 12 Periods

**Plastic analysis:** Introduction, Upper and Lower bound theorems, Uniqueness theorem, Shape factor, Load factor; Collapse load for fixed and continuous beams, Collapse load for a frame of single bay single storey frame.

**TEXT BOOKS**


1. Punmia, B.C , Ashok Kumar Jain and Arun Kumar Jain,(2016) "Limit State Design of Reinforced Concrete " Laxmi Publications (P) Ltd. New Delhi, 16th Edition
2. Duggal, S.K. (2014) "Limit State Design of steel structures", McGraw Hill Education Private Ltd.


**REFERENCES**


1. Varghese, P.C., (2009) " Advanced Reinforced Concrete Design", Prentice Hall of India Pvt.Ltd, New Delhi
2. Ramamrutham, S. (2015) "Design of Reinforced Concrete Structures", Dhanpat Rai publishing company (P) Ltd.
3. Pillai, S.U. & Devdas Menon, (2009) "Reinforced concrete design", Tata McGraw Hill. New Delhi, Third Edition.
4. Jain, A.K., (2016) "Reinforced Concrete Design", Charotor Publications. Anand Gujarat, 16th Edition
5. Subramanian, N. (2011) "Design of Steel structures", Oxford University Press.
6. Relevant Indian Standard Code.
7. Relevant NPTEL Courses

## WATER RESOURCES ENGINEERING - II

**Credits : 3**

Instruction : 3 Lectures / week — Sessional Marks : 40
End Exam : 3 Hours — End Exam Marks : 60

**Prerequisites:**

Fluid Mechanics – II; Water Resources Engineering - I

**Course Objective:**

To provide the necessary background for understanding the storage of water, various Head, Regulation and Cross drainage works and Hydel Power production.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Analyze the Stress and stability of Gravity dams, by understanding the basic concepts of dams & design them
2. Analysis of seepage in earthen dams and design of suitable spillway
3. Examine the necessity of diversion head works and design weirs on permeable foundations
4. Examine the necessity of regulatory works on canals and design different types of falls
5. Identify the availability of Hydro power and its utilization & choose the suitable river training works depending on river conditions.

**Mapping of course outcomes with program outcomes:**

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| | **3** | 3 | 3 | 3 | | | 3 | | | | | | | | | 3 |
| | **4** | 2 | 3 | 3 | | | 3 | | | | | | | | | 3 |
| | **5** | 3 | 2 | | | | 2 | | | | | | | | | 3 |

## SYLLABUS

**UNIT– I** — 12 Periods

**Storage Works**: Classification of dams, factors governing selection of type of dam, selection of site, preliminary investigations.

**Gravity Dams:** Types, Forces acting on a gravity dam, stability criteria, modes of failure, elementary and practical profiles, stability analysis, stress analysis, Construction joints, openings in dams - galleries, foundation treatment of gravity dam.

**UNIT– II** 12 Periods

**Earth Dams**: Types, foundation for earth dams, causes for failure of earth dams, criteria for safe design, phreatic line, seepage analysis – seepage control through body and foundation

Spillways: Essential requirements, spillway capacity, components, types of spillways and their working, design of ogee spillway, spillway crest gates, energy dissipation below spill way, scour protection, use of hydraulic jump as energy dissipater.

**UNIT – III** 12 Periods

**Diversion Head Works**: Location and components, effects of construction of weirs on permeable foundation, Bligh's, Lane's and Khosla's theories, weirs and barrages, weirs on permeable foundations, design of weir, silt control devices.

**UNIT – IV** 12 Periods

**Regulation Works:** Canal falls, definition, necessity and location, classification of falls, design principles of notch fall (Sarda Type & Trapezoidal Type only), canal head regulator, cross regulator and off-take alignment.

**Cross Drainage Works**: Types, factors affecting the suitability of each type, classification, design principles of Aqueduct (Type-III).

**UNIT – V** 12 Periods

**Water Power Engineering**: Development of hydro power in India, assessment of available power, utilization factor, load factor, diversity factor, storage and pondage, types of hydro power schemes, components of hydel schemes – forebay, intake structure, trash racks, water hammer, surge tanks, substructure and super structure of power house.

**River Engineering:** Classification of Rivers, River Training and its objectives, Classification of River Training Works, Methods for River Training, Marginal Embankments or Levees, Guide Banks or Guide Bunds, Groynes or Spurs, Cut-offs, Bank Pitching and Launching Aprons, Pitched Islands, Miscellaneous Methods.

**TEXT BOOKS**


1. Punmia, B.C. and Lal Pande B.B. (2021), "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 12th edition.
2. Garg, S.K. (2018), Irrigation Engineering and Hydrology Structures, Khanna Publishers, Delhi, 16 $^{th}$Edition.


**REFERENCES**


1. Modi, P.N. (2004), "Irrigation, Water Resources and Water Power Engineering", Standard Book House, Delhi, 6$^{th}$ Edition.
2. Relevant NPTEL Courses

## SOIL DYNAMICS AND MACHINE FOUNDATION

**Credits : 3**

Instruction : 3 Lectures / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Prerequisites:**

Geotechnical Engineering-II

**Course Objectives:**

From this course students will learn the following

1. To understand the fundamentals of soil dynamics
2. To know the behaviour of the machine foundations and its design
3. To understand the techniques of isolation

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Analyse the dynamics of machine foundations
2. Illustrate Natural frequency of foundation and dynamic properties of soils
3. Describe the concepts of apparent soil mass and foundation-soil system analogies
4. Summarize the principles and requirements of various machine foundations
5. Explain different types of Vibration Isolation Techniques

**Mapping of course outcomes with program outcomes:**

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| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
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| | **3** | 3 | 2 | | | | | | | | | | | | 2 | |
| | **4** | 3 | 2 | 1 | | | | | | | | | | | 2 | |
| | **5** | 3 | 2 | | | | | | | | | | | | 2 | |

## SYLLABUS

**UNIT – I** 12 Periods

**Theory of Vibrations:** Free and forced vibrations with and without damping for single mass system with single degree freedom, Logarithmic Decrement and Damping Ratio, Principles of Design of Vibration measuring Devices, Transmissibility of force, vibrations of Two degree freedom system, vibrations of Systems under transient loads.

**UNIT – II** 12 Periods

Natural frequency of foundation soil system- Barkan's Method, Pressure Bulb Concept, Pauw's Analogy, Tschebetorioff's concept of reduced natural Frequency

**UNIT – III** 12 Periods

**Dynamic Soil Properties:** Tests for determination of dynamic soil properties - Cyclic Plate load test, Block vibration test, Up Hole, down Hole and Cross Hole wave Propagation tests, Hammer Test, Resonant Column Test, Seismic Reflection and Refraction tests.

**UNIT – IV** 12 Periods

**Design of Machine Foundations:** Types of Machine Foundations, design criteria, Degrees of Freedom of Block foundation, Analysis of Block foundations under sliding, rocking, yawing and coupled motions, Design Aspects and Construction details of foundations for reciprocating and Impact machines.

**UNIT – V** 12 Periods

**Vibration Isolation:** Vibration Isolation - Passive and active isolation - use of springs and damping materials construction aspects.

**TEXT BOOKS**


1. Narasinga Rao, B.N.D.(2015), Soil Mechanics and Foundation Engineering, Chapter-22, Wiley Publishers
2. Srinivasulu, P. and Vaidyanathan, C.V. (2017), "Hand-book of machine foundations", Structural Engineering research Centre.


**REFERENCES**


1. Swami Saran (1999), Soil Dynamics and Machine Foundations, Galgotia Publications Pvt Ltd..
2. B M Das, (1992),"Principles of Soil Dynamics", Thomsons Engineering.
3. Shamsher Prakash, Gopal Ranjan and Swami Saran (1979), Analysis and design of Foundations and Retaining Structure,M/s Saritha Prakashan., Meerut.
4. N. S. V. Kameswara Rao, (1998),"Vibration Analysis and Foundation Dynamics", Wiley New Delhi.
5. Richart F.E., Hall, J.R. Woods, R.D. (1970), Vibrations of soils and Foundation by Richart Hall, Woods Prentice Hall Inc., New Jersey.
6. Relevant I.S. Codes.
7. Relevant NPTEL Courses

## INTRODUCTION TO FINITE ELEMENT METHODS

**Credits : 3**

Instruction : 3 Lectures / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Course Objective:**

1. To study the strain- displacement and linear constitutive relation.
2. To understand the numerical techniques applied in FEM Establishment of element stiffness and load vector.
3. To study about the 2-D isoperimetric concepts.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Derive the differential equilibrium equations for various elements
2. Analyze stresses and strains for various elements
3. Analyze plane stress/strain conditions for triangular and quadrilateral elements
4. Compute the stiffness matrix for isoperimetric elements
5. Construct finite element models for simple elements under different load conditions

**Mapping of course outcomes with program outcomes:**

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| | **2** | 3 | 2 | | | | | | | | | | | 3 | | |
| | **3** | 3 | 2 | | | | | | | | | | | 3 | | |
| | **4** | 3 | 2 | 1 | | | | | | | | | | 3 | | |
| | **5** | 3 | 2 | | | | | | | | | | | 3 | | |

## SYLLABUS

**UNIT – I** 12 Periods

Introduction Of Finite Element Method – Concept of an element – Various element shapes**.**

**UNIT – II** 12 Periods

Displacement Models – Element stresses and strains – Direct formulations of element stiffness and loads**.**

**UNIT – III** 12 Periods

Plane stress/strain triangular elements – Quadrilateral elements – Modelling and mesh refinement**.**

**UNIT – IV** 12 Periods

Construction of stiffness matrix and loads – boundary conditions**.**

**UNIT – V** 12 Periods

Finite Element modelling and solution techniques – symmetry in Finite Element method– nature of Finite Element method solution – errors– convergence and adaptively.

**TEXT BOOKS**


1. Krishnamurthy, C.S, (1995), "Finite Element Analysis Theory & Programming", McGraw-Hill.
2. Bhavikatti, S.S. (2015), "Finite Element Analysis", New Age International Pvt. Ltd


**REFERENCES**


1. Zienkiewcz, O.C., and Taylor, R.L., (2002), "The Finite Element method", Butterworth Heinemann, New Delhi.
2. Cook, R.D., (2002), "Concept and Applications of Finite Element Analysis", John Wiley & Sons
3. Chandrakant. S. Desai, and John. F. Abel.,(2002), "Introduction to the Finite Element method", CBS Publishers & Distributors, New Delhi.
4. Chandraputla, T.R. and Belegundu A.D., (2003), "Introduction to Finite Elements in Engineering", Prentice Hall, Indian, Edn.
5. Relevant NPTEL Courses

## ADVANCED TRANSPORTATION ENGINEERING

**Credits : 3**

Instruction : 3 Lectures / week — Sessional Marks : 40
End Exam : 3 Hours — End Exam Marks : 60

**Prerequisite:**

Highway and Railway Engineering

**Course Objective:**

1. To study the different elements and their functions in layout of port and harbour.
2. To learn the various tunneling methods and its applications.
3. To study the different distresses and highway maintenance of pavements.
4. To study the traffic engineering principles and components of ITS.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Interpret the various components in port and harbour, and their functions
2. Analyse the various tunnelling methods
3. Identify the various distresses in flexible and rigid pavements and importance of highway maintenance
4. Analyse flow,speed, density relationship by measuring traffic
5. Summarize the components of Intelligent Transportation Systems

**Mapping of course outcomes with program outcomes:**

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| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
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| | **3** | 3 | 2 | | | | | | | | | | | | | 2 |
| | **4** | 3 | 2 | | | | | | | | | | | | | 2 |
| | **5** | 3 | 2 | | | | | | | | | | | | | 2 |

## SYLLABUS

**UNIT – I** 9 Periods

**Dock & Harbour Engineering:** Layout of Port components – Functions – Classification of Ports – Site selection – breakwaters - Natural Phenomenon – Tides, Winds, Waves, Currents – Drift – warehouses - Navigational aids.

**UNIT – II** 9 Periods

**Tunnel Engineering:** Introduction - Alignment of tunnels – Cross-section of tunnels – Construction methods of Tunnels – Tunnel lining – Ventilation – Drainage – Muck disposal.

**UNIT – III** 9 Periods

**Highway Maintenance:** Pavement failures, causes, failures in flexible pavements and rigid pavements. Maintenance of highways, routine maintenance, periodic maintenance, special repairs.

**UNIT – IV** 9 Periods

**Traffic Engineering Principles:** components of traffic stream: flow-speed - Density, measurement and analysis, q-k-v relationships, design hourly volume, concept of EPCU, capacity and level of service, Parking studies and accident studies.

**UNIT – V** 9 Periods

**Intelligent Transportation Systems:** Components of ITS, Traffic Management - Incident Management, Advanced vehicle control and safety systems, Electronic toll collection, Traveller Information System, Benefits and costs of ITS**.**

**TEXT BOOKS**


1. Seetharaman "Dock & Harbour Engineering", Umesh Publications, 1st Edition, 2008.
2. Rangwala, K. "Railway, Bridge and Tunnel Engineering", Charotar Publishing HousePvt. Ltd. Second Edition (2016)
3. Khanna, S. K. & Justo, C. E. G. (1973), "Highway Engineering" Nemchand & Brothers, Roorkee, (3rd Edition).
4. Kadiyali, L.R. Traffic Engineering, Khanna Publishers, 7th edition 2007.
5. Pradeep Kumar Sarkar "Intelligent Transport System" PHI Learning Pvt. Ltd. (2017).


**REFERENCES**


1. Subramanian, K.P. (2003), "Highway, Railway, Airport and Harbour Engineering"Scitech Publications (India) Pvt. Ltd.
2. Srinvasan, Docks & Harbour Engineering, Charotar Publishing House, 7th edition,1983.
3. Relevant NPTEL Courses.

## WATERSHED MANAGEMENT

**Credits: 3**

Instruction: 2 Lectures & 1 Tutorial / week — Sessional Marks: 40

End Exam: 3 Hours — End Exam Marks: 60

**Prerequisites:**

Water Resources Engineering – I

**Course Objectives:**

From this course students will be able to

1. Understand the concept of watershed management
2. Identify the characteristics of watershed
3. Study the principle of soil erosion and methods controls soil erosion
4. Study different techniques for water harvesting
5. Study different factors responsible for land management

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Explain objectives and concept of watershed management
2. Analyse watershed characteristics to take appropriate management action
3. Select a suitable erosion control method for the given site conditions
4. Describe the techniques for conservation of water.
5. Summarize land use and land capability methods and techniques for reclamation of soils

**Mapping of course outcomes with program outcomes:**

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## SYLLABUS

**UNIT – I** 8 Periods

**Introduction:** Concept of watershed development, objectives of watershed development, need for watershed development, Integrated and multidisciplinary approach for watershed management.

**UNIT – II** **8** periods

**Characteristics of Watersheds:** Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics, basic data on watersheds.

**UNIT – III** 8 Periods

**Principles of Erosion:** Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation.

**Measures to Control Erosion:** Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, Gabion.

**UNIT – IV** **8** Periods

**Water Harvesting:** Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

**UNIT – V** **8** Periods

**Land Management:** Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.

**TEXT BOOKS**


1. Murthy, J. V. S, (2006) "Watershed Management" New Age International Publishers, New Delhi
2. Murthy, V.V.N (2007 ) "Land and Water Management" Kalyani Publications, New Delhi


**REFERENCES**


1. Das M.M. and Saikia M.D (2013) "Watershed Management", PHI Learning Pvt. Ltd
2. Wurbs R A and James R A (2002) "Water Resource Engineering", Prentice Hall Publishers Upper Saddle River, N.J.
3. Black P E (1996) "Watershed Hydrology" Prentice Hall, Upper Saddle River, N.J.
4. Relevant NPTEL courses.

## ADVANCED BUILDING CONSTRUCTION

**Credits : 3**

Instruction : 2 Lectures & 1 Tutorial / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Course Objectives:**

From this course students will learn the following

1. Learn about advanced developments in building constructions
2. Understand the role of technology in building constructions
3. Learn about the modern electrical installations

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Analyse building configuration by applying the Concepts of Earthquake Engineering
2. Analyse Various Fire zones by Applying the concepts of Fire Resistance of materials
3. Plan aganist Outdoor & Indoor Noises in a building
4. Apply the concept of Smart Systems in Building
5. Analyse the different Electrical Installations, Lifts & Escalators for various types of structures.

**Mapping of course outcomes with program outcomes:**

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### SYLLABUS

**UNIT – I** 12 Periods

**Earthquake resistant buildings:** Occurrence of earthquakes, plate-tectonic theory, seismic waves, magnitude and intensity, seismic zones of India, plan & vertical configurations of buildings, shear walls, dampers, base-isolation, strong column-weak beam concept.

**UNIT – II** **12** Periods

**Fire resistant buildings:** Introduction, Importance of fire resistance to buildings, ISO 834 standard heating conditions, grading or classifications, effect of high temperature on steel and concrete, effect of high temperature on different types of structural members.

**Fire protection of buildings:** Fire zones, general requirements, exit requirements, requirements of residential, educational, business, industrial and storage buildings

**UNIT – III** **12** Periods

**Acoustic buildings:** planning and design against outdoor and indoor noise for - residential, educational, office, hostel and industrial buildings.
**Thermal Insulated buildings:** Introduction, designating thermal properties, Insulation materials, construction techniques for thermal insulation, super Insulation.

**UNIT – IV** **12** Periods

**Smart buildings:** materials used in smart systems, different types of smart materials, characteristics and behaviour of smart materials, Components of smart systems, system features and interpretation of sensor data, features of control systems.

**UNIT – V** **12** Periods

**Electrical installations:** general requirements, planning of electrical installations for earthing, tele-communication and other miscellaneous services
**Installations of lifts & Escalators:** essential requirements, design considerations for lifts and escalators

**REFERENCES**


1. Pankaj Agarwal (2011), "Earthquake Resistant Design of structures", Prentice Hall of India, New Delhi, 2nd edition.
2. Varghese,P.C (2009), "Advanced Reinforced Concrete Design" , Prentice Hall of India, New Delhi, 2nd edition.
3. SP-7 (1983), National building code of India,Group-1, part-4&8
4. Srinivasan, A. V and Michael McFarland, D (2000), "Smart Structures: Analysis and Design", Cambridge University Press, New Delhi, 1st edition.
5. William Spence, P (2012), "Construction materials, methods and Techniques", Cengage learning India pvt ltd, New Delhi, 2nd edition.
6. Relevant NPTEL Courses

## EARTHQUAKE ENGINEERING

**Credits : 3**

Instruction : 2 Lectures & 1 Tutorial / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Prerequisite:**

**Course Objective:**

1. To create a strong understanding on application of single degree and multi-degree of freedom systems.
2. To impart the knowledge on causes and effects of earthquakes.
3. To familiarize with seismic codal and detailing provisions.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Explain the basic concepts related to earthquake engineering.
2. Analyze problem on structures subjected to vibrations.
3. Apply various concepts related to plan configurations to a framed structure having plan irregularities.
4. Illustrate the structural detailing of structures affected by seismic forces.
5. Explain various methods adopted in strengthening and retrofitting of structures..

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | 2 | | | | | | | | | | | 2 | | |
| | **2** | 3 | 2 | | | | | | | | | | | 2 | | |
| | **3** | 3 | 2 | | | | | | | | | | | 2 | | |
| | **4** | 3 | 2 | | | | | | | | | | | 2 | | |
| | **5** | 3 | 2 | | | | | | | | | | | 2 | | |

### SYLLABUS

**UNIT – I** 12 Periods

**Introduction:** Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic Regions, Intensity and Iso-seismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zones.

**UNIT – II** 12 Periods

**Vibrations:** Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Un damped and damped free vibration, Multiple Degree of Freedom (MDOF) Systems Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode shapes

**UNIT – III** 12 Periods

**Plan Configurations** – Torsion Irregularities – Re-entrant corners – Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of adjacent buildings.

**UNIT – IV** 12 Periods

**Ductile Detailing**: Ductility of R.C structures- Confinement- detailing as per IS-13920-1993- moment redistribution – principles of design of beams, columns – beam column joints – soft story concept.

**UNIT – V** 12 Periods

Cyclic loading behaviour of RC and steel elements, Base isolation, Retrofitting and restoration of buildings subjected to damage due to earthquakes, effects of earthquakes, factors related to building damages due to earthquake, methods of seismic retrofitting, restoration of buildings.

**TEXT BOOKS**

1. Pankaj Agarwal and Manish Shri Khande, Earthquake Resistant Design of Structures, Prentice Hall of India, 2007, New Delhi.

**REFERENCES**

1. Chopra A.K., "Dynamics of Structures", 5th Edition, Pearson Education, Indian Branch, Delhi, 2007
2. Duggal, S.K. "Earth Quake Resistant Design of Structures", Oxford university Press, 1st Edition, 2012
3. IS Codes: IS: 1893, IS: 4326 and IS:13920, Bureau of Indian Standards, New Delhi.
4. Relevant NPTEL Courses.

## ENVIRONMENTAL IMAPCT ASSESSMENT

**Credits : 3**

Instruction : 2 Lectures & 1 Tutorial / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Prerequisites:**

Environmental Sciences.

**Course objectives:**

The objectives of this course are to

1. To study about the basics, methods of assessment and importance of Environmental Impact Assessment.
2. To know about the Environmental Management and Prediction Methods
3. To study about the Environmental Management Plan
4. The broad education necessary to understand the impact of engineering solutions in global economic, environmental and social context

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Explain the importance of Environmental Impact Assessment
2. Describe the effect of a activities on various environmental attributes
3. Identify and Analyse Environmental Impacts of projects
4. Evaluate the criteria for selection of method
5. Analyse impact studies and demonstrate control measures.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
| CO | 1 | 3 | 2 | | | | | | | | | | | | 2 | |
| | 2 | 3 | 2 | | | | | | | | | | | | 2 | |
| | 3 | 3 | 2 | | | | | | | | | | | | 2 | |
| | 4 | 3 | 2 | | | | | | | | | | | | 2 | |
| | 5 | 3 | 2 | | | | | | | | | | | | 2 | |

## SYLLABUS

**UNIT – I** 9 Periods

**Introduction**: Introduction to EIA. Definition of E IA and EIS, preparation of EIS, Elements of EIA, Agency Activities, Environmental setting.

**UNIT – II** 9 Periods

**Environmental attributes:** Environmental attributes, air, water, soil, ecology, noise Socio-

Economic aspects, Culture and human aspects (Human Settlements-Rehabilitations)

**UNIT – III** 9 Periods

**Environmental impacts**: Identification, measurement, Aggregation, Secondary and Cumulative Impacts.

**UNIT – IV** 9 Periods

**Impact Assessment Methodologies:** Criteria for selection of methodology, impact assessment methodologies, procedure for reviewing environment impact statement.

**UNIT – V** 9 Periods

**Case studies:** Economic impact analysis, energy production impact analysis, cost benefit analysis, Environmental impact mitigation and control measures.

**TEXT BOOKS**


1. Ravi Jain, Urban, L.V., Gary S. Stacey and Harold Balbach (2001), "Environmental Impact Analysis", McGraw Hill Professional, New York, 2nd Edition.
2. Anjaneyulu, Y., Valli Manickam (2011), "Environmental Impact Assessment Methodologies", B.S. Publication, New Delhi, 2nd Edition.


**REFERENCES**


1. Larry W. C. (1996), "Environmental Impact Analysis", Mc. Graw Hill Publishers, New York, 2nd Edition.
2. John Glasson, Riki Therivel and Andrew Chadwick. (2005), "Introduction to Environmental Impact Assessment" Routledge Publication, London, 3rd Edition.
3. Relevant NPTEL Courses.

## AIR POLLUTION CONTROL

**Credits : 3**

Instruction : 2 Lectures & 1 Tutorial / week — Sessional Marks : 40

End Exam : 3 Hours — End Exam Marks : 60

**Prerequisites:**

Environmental Sciences

**Course Objectives:**

The objective of this course is to:

1. To impart the knowledge on air pollution.
2. To analyse causes and effects of air pollution.
3. To familiarize with strategic planning for control of air pollution.

**Course outcomes:**

**At the end of the course, the students will be able to:**

1. Identify the Sources of Air pollutants and its classification.
2. Analyse meteorological parameters and its effect on air pollutants
3. Predict various effects of air pollutants on humans, animals, plants and materials in terms of health, safety, societal and cultural issues
4. Analyse suitable control equipment for gaseous air pollutants
5. Analyse suitable control equipment for particulate air pollutants.

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
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| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | | | | | | | | | | | | | | 1 |
| | **2** | 2 | 3 | | | | | | | | | | | | | 2 |
| | **3** | 1 | 2 | 3 | | | 1 | | | | | | | | | 3 |
| | **4** | 2 | 3 | | | | | | | | | | | | | 2 |
| | **5** | 2 | 3 | | | | | | | | | | | | | 2 |

## SYLLABUS

**UNIT – I** 12 Periods

**Air Pollution** and its definition, Factors influencing air pollution, Classification of pollutants particulates, Sources of pollution, Air qualities standards, effects - Global warning

**UNIT – II** 12 Periods

**Meteorology**: Wind rose diagrams, lapse rates, mixing depth, atmospheric dispersion, plume behaviour, Effective stack height, stack monitoring and ambient air quality monitoring.

**UNIT – III** 12 Periods

**Air Pollution effects:** On human beings, animals, plants and materials, Air Pollution Episodes in India (Bhopal, Kanpur, Delhi and Agra) and abroad (London, Beijing).

**UNIT – IV** 12 Periods

**Control of air pollutants (Gaseous)**: Control of COx, NOx - setting chamber, cyclones, electrostatic precipitators, absorption, adsorption, Diffusion.

**UNIT – V** 12 Periods

**Control of air pollutants (Particulate)**: Air pollution control equipment's (units) such as wet scrubbers/collectors, centrifugal scrubbers, spray towers, packed beds.

**TEXT BOOKS**


1. Rao, M.N. and Rao, H.V.N. "Air Pollution", Tata McGraw Hill Company.
2. Elements of Air Pollution Control by Prof. T. Shivaji Rao
3. Murali Krishna, K.V.S.G. "Air pollution", Kaushal Publications – Kakinada.


**REFERENCES**


1. Air Pollution Control Technology by T. Painter.
2. Wark and Warner, "Air pollution", Harper & Row, New York.
3. Air Pollution Control by K.V.S.G. Murali Krishna.
4. Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H.
5. Relevant NPTEL Courses.

## ENGINEERING ECONOMICS AND FINANCE

**CIV 415 F** **Credits : 3**

Instruction : 2 Lectures & 1 Tutorial / week Sessional Marks : 40

End Exam : 3 Hours End Exam Marks : 60

**Course Objective:**

To explain the basic principles of managerial economics, accounting practices and financial management techniques for effective business decision making and to promote entrepreneurial abilities among the budding engineers.

**Course Outcomes:**

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

1. Assess the quantifying alternatives by applying compounding factors and cash flow diagrams
2. Recommend the best option through analysing the alternatives by Present, Future and Annual worth methods
3. Choose the best alternative by Performing Break-even, Benefit- Cost and Capitalized cost analysis
4. Apply the concepts of depreciation and equipment economics
5. Differentiate types of financial estimates and their suitability for effective financial management

**Mapping of course outcomes with program outcomes:**

| | | PO | | | | | | | | | | | | PSO | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **1** | **2** | **3** |
| **CO** | **1** | 3 | | | | | | | | | | | | | | 1 |
| | **2** | 2 | 3 | | | | | | | | | | | | | 2 |
| | **3** | 1 | 2 | 3 | | | 1 | | | | | | | | | 3 |
| | **4** | 2 | 3 | | | | | | | | | | | | | 2 |
| | **5** | 2 | 3 | | | | | | | | | | | | | 2 |

## SYLLABUS

**UNIT – I** 9 Periods

**Engineering economics:** Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A,A/P), Future payment compared to uniform series payments (F/A,A/F),Arithmetic gradient, Geometric gradient.

**UNIT – II** 9 Periods

**Comparison of alternatives – I:** Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return.

**UNIT – III** 9 Periods

**Comparison of alternatives – II:** Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.

**UNIT – IV** 9 Periods

**Depreciation, Inflation and Taxes:** Depreciation, Inflation, Taxes.
**Equipment economics:** Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.

**UNIT – V** 9 Periods

**Cost estimating:** Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, parametric estimate and Life cycle cost.
**Financial management:** Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.

**Note:** The student is expected to gain only elementary knowledge of the subject. Numerical Problems are for Internal Valuation only.

**REFERENCES**


1. Bulu Pradhan, "Construction Economics and Finance", NPTEL Course, IIT Guwhati.
2. Peterson, S. J., 2011, "Construction Accounting and Financial Management", Pearson Education, Upper Saddle River, New Jersey,
3. Blank, L.T. and Tarquin, A.J., 2011 "Engineering Economy", Seventh Edition, WCB/McGraw-Hill,.
4. Bose, D. C., 2010 "Fundamentals of Financial management", 2nd ed., PHI, New Delhi.
5. Gould, F. E., 2002 "Managing the Construction Process", 2nd ed., Prentice Hall, Upper Saddle River, New Jerse