## Syllabus for
# Final Year B. Tech.
# Civil Engineering (Pattern 2018)

# Department of
# Civil Engineering

**Vision:**

Excellence in Civil Engineering Education

**Mission:**

**M1:** Make competent Civil Engineers with high level of professional, moral and ethical values

**M2:**Impart highest standards in theoretical as well as practical knowledge and skill set

**M3:** Establish Center of Excellence in major areas of Civil Engineering to respond to the current and future needs of the industry, higher studies as well as research

# PROGRAM EDUCATIONAL OBJECTIVES

**PEO 1:** Graduates will have  successful career in the  field of Civil Engineering

**PEO 2:** Graduates will respond to growing demands of society through professional and ethical practices

**PEO 3:** Graduates will pursue lifelong learning including higher studies in the field of Civil Engineering

## PROGRAM OUTCOMES (POs)

**Engineering Graduates will be able to:**

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, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, 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 reportsand 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 (PSO):

**PSO1:** Engineering graduates will be able to plan and execute the activities of construction projects

**PSO2:** Engineering graduates will be able to analyze and design components of Civil Engineering Systems.

## Department of Civil Engineering

**FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VII (PATTERN 2018)**
**MODULE-I**

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/OR/TW | | |
| CVUA40181 | Professional Elective IV* | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA40182 | Professional Elective V* | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| IOEUA40183 | Open Elective II | TH | 3 | 1 | - | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| IOEUA40184 | Open Elective-III | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA40185 | Intellectual Property Rights | CE | 2 | - | - | - | - | 50 | - | - | 50 | 2 |
| CVUA40186 | Project Work* | CE-PR/OR | - | - | 10 | 100 | - | - | - | 50 | 150 | 5 |
| M4 | Mandatory Course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | 14 | 1 | 16 | 180 | 120 | 130 | 120 | 150 | 700 | 23 |

**\*Course has Oral Exam**

| Professional Elective – IV: | Professional Elective V: |
|---|---|
| 1. CVUA40181A: Advanced Foundation Engineering | 1. CVUA40182A: Air Pollution and Control |
| 2. CVUA40181B: Advanced Transportation Engineering | 2. CVUA40182B: Finite Element Method |
| 3. CVUA40181C: Design of Prestressed Concrete Structures | 3. CVUA40182C: Dam Engineering |

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| Open Elective II: | Open Elective III: |
|---|---|
| 1. IOEUA40183A: Project Planning and Management | 1. IOEUA40184A: Robotics[#] |
| 2. IOEUA40183B: Software Testing | 2. IOEUA40184B: Quantum Computing[#] |
| 3. IOEUA40183C: 5G Mobile Networks | 3. IOEUA40184C: Business Intelligence# |
| 4. IOEUA40183D: Cloud Computing | 4. IOEUA 40184F: Business Analytics |
| 5. IOEUA40183E: Solar and Wind Energy | |

[#]For Circuit Branches

**Mandatory Course**: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).

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### FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VII
### (PATTERN 2018)

### MODULE II

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/OR/TW | | |
| CVUA40187 | Semester Internship | CE-PR/OR | - | - | 24 | 100 | - | - | - | 50 | 150 | 12 |
| M4 | Mandatory Course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | - | - | 24 | 100 | - | - | - | 50 | 150 | 12 |

**Mandatory Course**: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).

BoS Chairman

Dean Academics

Director

**FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VIII (PATTERN 2018)**
**MODULE-III**

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/OR/TW | | |
| CVUA42181 | Professional Elective VI* | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| IOEUA42182 | Open Elective IV | CE-TH | 2 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 3 |
| IOEUA42183 | Open Elective V | CE-TH | 2 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 3 |
| CVUA42184 | Introduction to Research | CE | 1 | - | 2 | - | - | - | - | 25 | 25 | 2 |
| M4 | Mandatory Course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | 8 | - | 8 | 60 | 90 | 60 | 90 | 100 | 400 | 12 |

**\*Course has Oral Exam**

| Professional Elective – VI: |
|---|
| 1. CVUA42181A: Architectural Town Planning |
| 2. CVUA42181B: Environmental Impact Assessment |
| 3. CVUA42181C: Advanced Design of R.C. Structures |

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| Open Elective IV: | Open Elective V: |
|---|---|
| 1. IOEUA42182A: Engineering Economics | 1. IOEUA42183A: Inferential Statistics for Data Science |
| 2. IOEUA42182B: Computational Biology | 2. IOEUA42183B: E- Commerce |
| 3. IOEUA42182C: Software Quality Assurance System | 3. IOEUA42183C: Rural Technology |
| 4. IOEUA42182D: Technology and Financial Management | 4. IOEUA42183D: Product Design Engineering |
| 5. IOEUA42182E: Non Destructive Techniques and Engineering Diagnosis | 5. IOEUA42183E: Numerical Methods |

Mandatory Course**: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).**

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### FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VIII
### (PATTERN 2018)

### MODULE IV

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/ OR/ TW | | |
| CVUA40187 | Semester Internship | CE-PR/OR | - | - | 24 | 100 | - | - | - | 50 | 150 | 12 |
| M4 | Mandatory Course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | - | - | 24 | 100 | - | - | - | 50 | 150 | 12 |

**Mandatory Course**: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).

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**FINAL YEAR B. TECH (CIVIL ENGINEERING), SEMESTER VIII (PATTERN 2018)**
**MODULE-V**

| Course Code | Course Title | Course Type | Teaching Scheme | | | Examination Scheme | | | | | Total | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CIE | ISE | SCE | ESE | PR/OR/TW | | |
| CVUA40181 | Professional Elective IV* | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA40182 | Professional Elective V* | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA40183 | Open Elective II | TH | 3 | 1 | - | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA40184 | Open Elective-III | TH | 3 | - | 2 | 20 | 30 | 20 | 30 | 25 | 125 | 4 |
| CVUA40185 | Intellectual Property Rights | CE | 2 | - | - | - | - | 50 | - | - | 50 | 2 |
| CVUA40186 | Project Work* | CE-PR/OR | - | - | 10 | 100 | - | - | - | 50 | 150 | 5 |
| M4 | Mandatory Course | AU | - | - | - | - | - | - | - | - | - | - |
| | Total | - | 14 | 1 | 16 | 180 | 120 | 130 | 120 | 150 | 700 | 23 |

**\*Course has Oral Exam**

| Professional Elective – IV: | Professional Elective V: |
|---|---|
| 1. CVUA40181A: Advanced Foundation Engineering | 1. CVUA40182A: Air Pollution and Control |
| 2. CVUA40181B: Advanced Transportation Engineering | 2. CVUA40182B: Finite Element Method |
| 3. CVUA40181C: Design of Prestressed Concrete Structures | 3. CVUA40182C: Dam Engineering |

## Department of Civil Engineering

| Open Elective II: | Open Elective III: |
|---|---|
| 1. IOEUA40183A: Project Planning and Management | 1. IOEUA40184A: Robotics[#] |
| 2. IOEUA40183B: Software Testing | 2. IOEUA40184B: Quantum Computing[#] |
| 3. IOEUA40183C: 5G Mobile Networks | 3. IOEUA40184C: Business Intelligence# |
| 4. IOEUA40183D: Cloud Computing | 4. IOEUA 40184F: Business Analytics |
| 5. IOEUA40183E: Solar and Wind Energy | |

**Mandatory Course**: Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge, Online certification course (minimum two weeks).

**NOTE: Students who will register for Module-I in Semester VII have to register either of Module-III or Module IV in Semester VIII. Students who will register for Module-II in Semester VII have to register for Module-V in Semester VIII.**

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**Department of Civil Engineering**

# MODULE I & V

## Department of Civil Engineering

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### Professional Elective IV
### Advanced Foundation Engineering (CVUA40181A)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 <br> Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA <br> Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Course Objectives:**
- To inculcate necessary engineering skills to analyze and design of different types of foundation systems under different loading and soil conditions.

**Course Outcomes:** Upon completion of the course, students will be able to
1. Select and appraise suitable regulatory codes for various subsurface investigation related to different civil engineering structures
2. Analysis and design pile foundation subjected to complex loading
3. Design stone columns and sand drains for ground improvement
4. Design shallow foundation subjected to complex loading
5. Students will be able to analysis and design well foundation by using regulatory codes
6. Students will be able to illustrate and explain various stress associated to tunnels, shaft in soil

**Unit I: Regulatory codes for various subsurface investigation**

IS code provision in respect of subsoil exploration for dams, canals, tunnels and bridges. IRC (IRC: SP:19-2001) provisions for exploration in respect of roads. Case studies of failures of foundation

**Unit II: Design of pile foundation for complex loading**

Design of pile based on cyclic load test. Study of provision made in different IS codes related to deep foundation, various types of pile. Design of Racer piles & piles subjected to lateral load. Testing and Design of piles subjected to tensile loads

**Unit III: Design of under reamed and sand drains**

Design of under reamed pile foundation subjected to tensile loads. Design of sand drains and stone columns

**Unit IV: Design of shallow foundation subjected to complex loading**

Design of shallow foundations subjected to inclined loads. Design of Raft foundation on different types of soil. Design of combined and isolated footing based on field test including calculation of settlement. Introduction to software available for geotechnical foundation design.

**Unit V: Design of well foundation**

Study of various provisions made as per IRC and as per IS in respect of design of well foundation. Case studies of failure of well foundation. Design of Rock fill coffer Dams

**Unit VI: Stresses associated with underground construction**

Stress distribution in the shaft, tunnels, underground conduits, classification, load on ditch conduits, positive and negative projecting conduits, and Imperfect ditch conduits

**Term Work:**

Term work shall consist of the following:
A) **Practical** (Any three):

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1 Hydrometer Analysis.

2 Consolidation test.

3 Swelling Pressure Test.

4  Triaxial test with measurement of pore pressure.

**B) Assignments**

1. Computations of Bearing capacity and Settlement of a Shallow Foundation (Take data from sample Geotechnical investigation report)
2. Design of Pile foundations subjected to compression and tensile load (Take data from sample Geotechnical investigation report)
3. Design of any one type of Deep foundation using computer software

**C) Site visit and Case study**

1. One site visit to any important deep foundation and submission of report on the same giving details of design and construction.
2. Any one case study of failure of foundation from the published literature

### Text Books

1. Fang, H. Y. (1991)," Foundation Engineering Handbook", Chapman &Hall,NY.
2. Teng. W. C. (1962), "Foundation Design" , Prentice Hall International.
3. Nayak N. V.  (2001), "Foundation Design Manual", Dhanpat Rai & Sons

### Reference Books:

1. Joseph E. Bowels (1958), "Foundation Analysis and Design", TATA Mc-Graw hill
2. Shenbage R Kaniraj (2017), "Design Aids in Soil Mechanics and Foundation Engineerimg", TATA Mc- Grawhill
3. Tamlinson M. J. (2003), "Foundation Design & Construction" ELBS publication.
4. G. A. Leonards (1962), "Foundation Engineering", McGraw-Hill,
5. R.B. Peck, W.E. Hanson and T.H. Thornburn (1974), "Foundation Engineering",2nd Edition, John Wiley and Sons.
6. Das B M (1985),"Principles of Foundation Engineering" Cengage Learning

### I S Codes:

1. IS: 1892-1979 – "Code of Practice for Subsurface Investigation for Foundation". New Delhi: Bureau of Indian Standards.
2. IS: 2131-1981 (Reaffirmed 1997), "Method for Standard penetration Test for Soils".New Delhi: Bureau of Indian Standards.
3. IS: 6403-1981 – "Code of Practice for Determination of B.C. of Shallow Foundation".New Delhi: Bureau of Indian Standards.
4. IS: 8009 (Part-1) 1976, "Code of Practice for Calculation of settlements of foundations".New Delhi: Bureau of Indian Standards.
5. IS: 1904-1986, "Code of Practice for Design and Construction of Foundations in Soils, General Requirements". New Delhi: Bureau of Indian Standards.
6. IS: 2911-1979, "Code of Practice for Design and Construction of Pile Foundation,".New Delhi: Bureau of Indian Standards

### IRC:

1. IRC:SP:19-2001, "Manual for Survey, Investigation and Preparation of Road Projects"
2. IRC:45-1975, "Recommendation for Estimating the Resistance of Soil below the Maximum ScoreLevel in the Design of Well Foundation of Bridges"

**Handbooks**

1. Fang , H.Y.,(1991)," Foundation Engineering Handbook", Chapman &Hall,NY.

2. Teng .W.C.(1962), "Foundation Design" , Prentice Hall International.

3. Nayak N. V.  (2001), "Foundation Design Manual", Dhanpat Rai & Sons

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## Department of Civil Engineering

### Professional Elective IV
### Advanced Transportation Engineering (CVUA40181B)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T):   NA<br>Practical (P):   2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Course Objectives:**
- To learn the fundamentals of transportation
- To be aware of the development of urban  transport technology
- To understand economics and Environmental Impact assessment method of transport projects
- To be aware of various methods of collecting traffic data
- To design the flexible and rigid pavements using IRC 37 and IRC 58 and MORTH

**Course Outcomes:** Upon  completion of the course, students will be able to
1. Describe the transport system planning
2. Explain the urban transport technology
3. Explain the finance & economics of transport And Describe Environmental Impact Assessment
4. Describe the traffic systems
5. Design the flexible pavement as per IRC 37 and MORTH
6. Design the rigid pavement as per IRC 58 and MORTH

**Unit I - Transport System Planning:**

Transportation planning process and types of surveys. Travel demand forecasting - trip generation, modal spilt analysis, trip distribution and route assignment analysis, Transportation System Management (TSM), application in Comprehensive Mobility Plan (CMP) and DPR.

**Unit II - Urban Transport Technology:**

Classification- light, medium, mass and rapid transit system, Introduction to Intelligent Transportation System (ITS) and its components, Public Transport Policy. Introduction to BRT, Mono rail, Metro rail, Bullet train and Hyperloop. Concept of Integrated Inter Model Transit System and freight transportation.

**Unit III - Transport Economics & Financing AND Environmental Impact Assessment:**

**Transport Economics & Financing:** Road user cost **-** Vehicle operations cost, running cost, value of travel time, road damage cost, accident cost. Economic evaluation – Benefit cost method, Net present value method, First year rate of return method, Internal rate of return method & comparison of various methods.
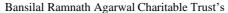
**Environmental Impact Assessment:** EIA requirement of highway projects, procedure and guidelines, pollution cost and concept of congestion pricing.

**Unit IV- Traffic Engineering:**

Traffic studies, basic traffic theory, traffic analysis process, level of service, intersection studies- turning movements, grade separated intersection, signal design- IRC method and Webster's method, parking study and analysis, bicycle and pedestrian facility design, instrumentation of traffic monitoring.

**Unit V- Study of flexible pavement:**

Philosophy of design and design criteria, design of flexible pavement using IRC 37-2012, Distresses in flexible pavement, evaluation of pavement – Benkelmen beam, Falling Weight Deflectometer (FWD), Pavement Management Systems (PMS).

## Department of Civil Engineering

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|---|
| **Unit VI - Study of rigid pavement and Overlay types and their design as per IRC:** |

**Study of rigid pavement:** Philosophy of rigid pavement, comparison of rigid pavement over flexible pavement, types of rigid pavements, design of rigid pavement using IRC 58-2015 including design of joints, distresses in rigid pavement.
**Overlay types and their design as per IRC:** Types of overlays, design of overlay using IRC 81-1997.

**Term Work:**

**Term work shall consist of:**
1. Traffic counts using Manual Methods.
2. Design of a flexible pavement using IRC: 37-2012 using IITPAVE.
3. Design of rigid pavement using IRC: 58-2015.
4. Road deflections measurement using Benkelmen Beam method.
5. Design of an overlay using IRC: 81-1997.
6. Conduct of distress surveys on a flexible pavement or a rigid pavement and determining its Condition index (PCI).
7. Study of any two softwares related to transportation engineering.
8. Study of format of household survey and recording sample measurements.
9. Parking survey and analysis.

**Reference Books:**

1. Laurence I Hewes & Clarkson H Oglesby, (1958)"Highway Engineering" John Wiley & Sons.
2. L R Kadiyali, (2013), "Traffic Engineering and Transport Planning" Khanna Publishers, Delhi
3. David Croney, Paul Croney, (1997) "The Design and Performance of Road Pavements",McGraw Hill Professional.
4. Michel A Taylor, William Young, Peter W. Bonsall, "Understanding Traffic System", Taylor and Francis Group.
5. B. G. Hutchinson, (1974) "Principles of Urban Transport Systems Planning", Washington, D.C. : Scripta Book Company, : New York ; Montreal : McGraw-Hill Book Company
6. M. J. Bruton, "Introduction to transport planning", Hutchinson Technical Education, London
7. C. Jotin Khisty, B. Kent Lall, (2003) "Transportation Engineering An Introduction", Pearson Publication.
8. C. S. Papacostas, P. D. Prevedouros, (2000) "Transportation Engineering & Planning", Pearson Publication.
9. E.F. Yoder (1975) "Principles of Pavement Design"(John Wiley & Sons, lnc USA),
10. C. S. Papacostas, (1987) "Fundamentals of Transportation Engineering", Prentice Hall.
11. Huang Y H, (1993) "Pavement analysis and Design",Prentice Hall, Englewood Cliff, New Jersey.
12. Morlok E K, "Introduction to Transportation Engg. And Planning", McGraw-Hill company.
13. Drew, (1971) "Fundamentals of Traffic flow Theory", McGraw-Hill book Co.
14. Saxena Subhash, "A course in Traffic Planning and design", Dhanpat Rai &sons, Delhi
   Taylor M P, "Traffic analysis (New technologies new solutions", Hargreen Pub. Co. New Delhi.

**Handbooks:**

1. Lay M. G. Gorden, (1978) "Handbook of Road Technology", Breach Science Pub. Newyork.

**Codes:**

1. IRC 37-2012, "Guidelines For The Design Of Flexible Pavements", INDIAN ROADS CONGRESS, Kama Koti Marg,Sector-6, R.K. Puram, New Delhi-110 022

2.  IRC:58-2015, "Guidelines for the design of plain jointed rigid pavements for highways" 4th revision, Indian Roads Congress, New Delhi.
3.  IRC 81-1997 IRC 81-1997, "Guidelines For Strengthening Of Flexible Road Pavements Using Benkelman Beam Deflection Technique", Indian Roads Congress, New Delhi
4.  IRC 82-2015, "Code Of Practice For Maintenance Of Bituminous Road Surfaces", Indian Roads Congress, New Delhi
5.  IRC 115-2014, "Guidelines. For. Structural Evaluation. And. Strengthening of Flexible Road Pavements Using. Falling Weight Deflectometer (FWD)", Indian Roads Congress, New Delhi

**e-Resources:**

1.  www.nptel.iitm.ac.in/courses/iitkanpur
2.  www.cdeep.iitb.ac.in/nptel

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## Department of Civil Engineering

## Professional Elective IV
## Design of Prestressed Concrete Structures (CVUA40181C)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Prerequisite course(s):** Strength of Materials, Analysis of structures, Design of structures.

**Course Objectives:** The course will help students
- To understand basic concepts, analysis, design, maintenance and rehabilitation of prestressed concrete structures

**Course Outcomes:** Upon completion of the course, students will be able to
1) Understand basic concepts and compute losses in prestressed concrete
2) Analyze prestressed concrete sections
3) Design pre-tensioned beams with rectangular sections
4) Design post tensioned beams of flanged section
5) Design pre and post tensioned one way and two way slabs
6) Explain the aspects of maintenance and rehabilitation of prestressed concrete structures
7) Develop structural drawings of the designed structural elements

### Unit I: Introduction to pre-stressed concrete

Introduction, basic concepts and general principle, materials used, prestressing systems and losses of prestress in pre-setressed concrete, Concept of cable profile and cable zone.

### Unit II: Analysis of pre-stressed concrete section

Concepts of pre-stressing. Analysis of prestress and bending stresses using stress concept. Resultant stress at a section. Permissible stresses in concrete and steel. Philosophy of limit state design for pre-stressed concrete members. Flexural and shear strength of a pre-stressed concrete section.

### Unit III: Design of pre-tensioned members

Deflections in pre-stressed concrete members. Design of rectangular pre-tensioned beams.

### Unit IV: Design of post-tensioned members

Design of flanged (T or I) section post-tensioned simply supported beam for flexure, shear and bearing including end block.

### Unit V: Design of pre-stressed concrete slabs

Design of pre-tensioned and post-tensioned one way and two way slabs

### Unit VI: Maintenance and rehabilitation of pre-stressed concrete structures

General aspects of maintenance and rehabilitation. Inspection of structures. Use of NDT equipment's in the inspection. Cracks in pre-stressed concrete structures: remedy and repair. Repair and rehabilitation of pre-stressed concrete structures. Strengthening of pre-stressed concrete structures.

| **Termwork:** |
| Students are required to submit at least one assignment on each unit. |

| **Textbooks:** |
| 1. N. Krishna Raju(2018), "Prestressed Concrete", 6th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.<br>2. T. Y. Lin and Ned H. Burns (2010), "Design of Prestressed Concrete Structures", 3rd Edition, John Wiley & Sons, United States of America.<br>3. P. Dayaraman (2018), "Prestressed Concrete Structures", CBS Publishers & Distributors Pvt. Ltd., India |

| **Reference Books:** |
| 1. Y. Guyon (1960), "Prestressed Concrete", John Wiley & Sons, United States of America.<br>2. M. K. Hurst (1998), "Prestressed Concrete Design", CRC Press. |

| **IS Codes:** |
| 1. IS: 1343 – 2012 – "Code of Practice for Prestressed Concrete", New Delhi: Bureau of Indian Standards. |

## Department of Civil Engineering

### Professional Elective V
### Air Pollution and Control (CVUA40182A)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA<br>Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Prerequisites**: Applied Physics and Chemistry, Environmental Science, Environmental Engineering

**Course Objectives:**
- To develop an ability to understand the sources and effects of air pollution, meteorological aspects andambient air sampling and monitoring.
- To develop an ability to understand control of air pollution, legislation and regulation in India andEnvironmental Impact Assessment.

**Course Outcomes:**
Upon completion of this course, students will be able to:
1. **classify** air pollutants, their sources and effects on human beings, animals, materials, vegetation and global environment.
2. **understand** meteorological aspects in civil engineering and **calculate** minimum and effective stack height as per CPCB.
3. **explain** site selection criteria, methods, techniques, procedures, devises for sampling of gases and particulates and understand National Ambient Air Quality Standards (NAAQS) 2009
4. **understand** control of outdoor air pollution by natural processes, change in process, operational practices, by use of equipments and indoor air pollution by cleansing systems.
5. **explain** legislation and regulation in India to control air pollution
6. **understand** components, methods, processes, legislation of Environmental Impact Assessment and procedure, agencies involved with their role in environmental clearance in India

**Unit I: Sources and effects of air pollution**

Classification of air pollutants-primary and secondary, natural and manmade, stationary and mobile, indoor and outdoor, particulates and gaseous pollutants. Sources of air pollution. Effects of air pollution on human beings – sick building syndrome, materials, vegetation, animals. Global effects-Greenhouse effect, acid rain,
ozone depletion, global warming. Photochemical smog. Economic effects.

**Unit II: Meteorological aspects**

Definition, Zones of atmosphere, Scales of meteorology, Meteorological parameters, Atmospheric stability. Dispersion of pollutants, Air pollution dispersion models-Gaussian dispersion model. Wind rose diagram.
Lapse rate, Inversions, Temperature inversion. Mixing height, Plume behaviour, Plume rise. Determinationof minimum stack height and effective stack height as per CPCB norms.

**Unit III: Ambient air sampling and monitoring**

Basic consideration of air sampling, Sampling devices, sites and methods for sampling of gases and particulates. Stack sampling techniques, Isokinetic sampling. Procedure for particulate matter and gaseous sampling. Methods of air sampling- chemical and instrumental methods. Emission inventory. National
Ambient Air Quality Standards (NAAQS) 2009.

## Department of Civil Engineering

| Unit IV: Control of air pollution |
|---|
| Natural air controlling processes, Control at source, Control of air pollution by process changes-substitution of raw material, process modification, replacement of equipment, changes in operational practices. Control of particulate matter using equipments – working principle, construction and operation, advantages and <br> disadvantages of settling chamber, cyclones, fabric filters, Electrostatic precipitator, scrubbers. Control of gaseous pollutants. Control of indoor air pollutants and cleansing systems. |
| **Unit V: Legislation and regulation in India** |
| Land use planning, Economics of air pollution and control– Cost Benefit Ratio and optimization. Legislation and Regulation – Objectives, Penalties drawbacks of Air (Prevention and Control) Pollution Act 1981. The Environment (Protection) Act 1986. Functions of state and central boards. Emission standards forstationary and mobile sources |
| **Unit VI: Environmental Impact Assessment and Management** |
| Need and objectives of Environmental Impact Assessment. EIA legislation in India. Components, process and methods of EIA. Public hearing. Environmental Management Plan. Environmental clearance (EC) procedure, Agencies involved and their role in obtaining environmental clearance for project. <br> Environmental (Sitting for Industrial Projects) rules 1999. |
| **Term Work:** |
| **Assignment on each unit.** |
| **Textbooks:** |
| 1. H. V. N. Rao and M. N. Rao, "Air Pollution", McGraw Hill Education, 1st edition, New Delhi. <br> 2. K.V.S.G. Murali Krishna, "Air Pollution and Control", Laxmi Publications Private Limited; First edition. <br> 3. H.C. Perkins, "Air Pollution", McGraw Hill Higher Education. <br> 4. Mackenzie Davis and David Cornwell, "Introduction to Environmental Engineering", 5 th Edition, McGraw Hill Education, New Delhi. |
| **Reference Books:** |
| 1. Martin Crawford, "Air Pollution Control Theory", McGraw Hill Education, US. <br> 2. Wark Kenneth, Warner Cecil Francis and Davis Wayne T., "Air pollution: its origin and control", Menlo Park, California, Addison-Wesley, <br> 3. Richard W. and Donald L., "Fundamentals of Air Pollution", ELSEVIER, Academic Press |

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## Department of Civil Engineering

## Professional Elective V
## Finite Element Method (CVUA40182B)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA Practical (P) 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Prerequisite course(s):** Mechanics of structures I, Mechanics of structures II, Engineering Mathematics I, Engineering Mathematics II, Engineering Mathematics III

**Course Objectives**
- To analyze some real problem and to formulate the conditions of FEA application
- To execute a reasonable choice of parameters and variables of the FEA model (geometry, material properties, boundary conditions)

**Course Outcomes:**
Upon completion of the course, students will be able to
1 Recognize the importance and limitations of FEA
2. Execute the generalized stiffness matrix for bar and beam element for boundary conditions to get stress and reactions in elements
3. Execute the generalized stiffness matrix for plane truss for boundary conditions to get stress and reactions in elements
4. Understand the displacement function and its synthesis with type of elements
5. Identification of various type of elements for Two and Three Dimensional solids
6. Comprehend the use of FEM software

### Unit I: Introduction

Theory of elasticity: Strain-displacement relations, compatibility conditions in terms of strain, plane stress and plane strain problems, differential equations of equilibrium, compatibility condition in terms of stresses, stress-strain relations in 2D and 3D problems. General steps of the finite element method, Applications and advantages of FEM, concept of finite element for continuum problems, discretization of continuum, use of polynomial displacement function, Pascal's triangle, convergence criteria.

### Unit II: Stiffness Matrix and Boundary Conditions for bar and beam

Bar element: stiffness matrix ,load vector, assembly of element matrices implementing boundary conditions, stress calculations , support reactions ,Member Stiffness with Varying Cross Section
Beam element : Introduction, Derivation of Element Stiffness Matrix, Member Stiffness with Varying Cross Section, Generalized Stiffness Matrix of a Beam Member, stress calculations ,support reactions

### Unit III: Stiffness Matrix and Boundary Conditions for Truss

Introduction, Element Stiffness of a Truss Member, Generalized Stiffness Matrix of a Plane Truss Member, Analysis of Truss.

### Unit IV: Finite Element Formulation Techniques

Choice of Displacement Function: Convergence criteria, Compatibility, Geometric invariance, Shape Function, Degree of Continuity, Introductory concept of Iso parametric Elements

### Unit V: Two- and Three-Dimensional Elements

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Two-dimensional element: Constant Strain Triangle: Element Stiffness Matrix for CST, Nodal Load Vector for CST, Linear Strain Triangle: Element Stiffness Matrix for LST, Nodal Load Vector for LST, Numerical Example using CST. Three dimensional element (only introduction) : Tetrahedron element

**Unit VI: FEM software**

Working of FEM, Steps, algorithm flow charts, sequence of procedure followed in software, description of various softwares ,common mistakes, validation study

**Term Work:**

Students are required to submit at least one assignment on each unit.

**Textbooks:**

1.S.S. Bhavikatti, (2015), "Finite Element Analysis", New Age International Publishers, Delhi
2.Thompson, (2004) ''Introduction to the Finite Element, Method Theory, Programming and Applications '', Wiley, India
3.S.S. Rao , (2010),  ''The Finite Element Method in Engineering 4th Edition'', Elsevier Publication
4.G.R. Buchanan , (2004), ''Finite Element Analysis Schaum's outlines'', Tata McGraw Hill Publishing Co. Ltd
5.Iriving Shames & Clive Dym, (1985), ''Energy & Finite Element Methods in Structural Mechanics '', New Age International Publishers, Delhi

**Reference Books:**

1.Zienkiewiczand Taylor, (1969), ''The Finite Element Method 4th Edition ,Vol –I & II'', McGraw Hill International Edition

2.Robert D. Cook, D.S. Malkus, M.E. Plesha, (1988), ''Concepts & Applications of Finite Element Analysis '', Wiley,India.

3.J.N. Reddy, (2005), ''An Introduction to the finite element method'', Tata McGraw Hill Publishing Co. Ltd

4.Segerlind L.J., 1976, ''Applied Finite Element Analysis'', John Wiley & Sons.

5.C.S. Krishnamoorthy, (1987), ''Finite Element Analysis ,Theory & Programming'',Tata McGraw Hill Publishing Co. Ltd

# Vishwakarma Institute of Information Technology, Pune-48

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## Department of Civil Engineering

| Professional Elective-V Dam Engineering (CVUA40182C) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | | | | | | |
| Credits: 4 Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Course Objective(s):**

- To make the students aware of types of dams, spillways, and their suitability along with their hydraulic design
- To give students clarity about the hydraulic structures allied to the dams as well as Cross Drainage works along with their suitability and hydraulic design.

**Course Outcomes:**

Upon completion of the course, students will be able to:

1. Classify dams based on purpose, hydraulic action, structural action, materials, size of project understand socio-economic problems associated with construction of large dams, terms related to layout of hydropower generation
2. Explain working of instrumentation, equipment for dam safety,
3. Explain components of Gravity dams with forces acting on it and perform its stability analysis and Design Gravity dam.
4. Classify Spillways and Spillway gates based on operation, provision of gates, main features, and Design Ogee spillway along with Energy dissipator.
5. Classify Earth dams based on materials, its methods of construction, components and Check stability of homogeneous, non- homogeneous earthen dams.
6. Describe functions of components of diversion roadworks, cross- drainage works and Analyze flow below weir in permeable foundation using Khosla's Theory.

**Unit I: Introduction**

Review of basic concepts from fluid mechanics, Need & historical development of dams, important terms related to dams, Classification of dams: Based on purpose, hydraulic action, structural action, materials, and size of project. Factors governing the selection of type of dam, Selection of site for a dam, Environmental and socio-economic issues related to large dams and small dams. Displacement and rehabilitation, Dams and climate change. Hydropower generation: Necessity, Important Terms related to Hydropower, layouts.

## Department of Civil Engineering

| Unit-II: Dam Safety and Instrumentation |
|---|
| Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles of instruments, Selection of Equipments, Different Instruments, Piezometers, Porous tube piezometer (Determination of uplift pressure), Pneumatic piezometer (Determination of ground water pressure), Vibrating wire piezometer (Determination of pore water pressure) ,Settlement measurement system Vibrating wire settlement cell (Determination of settlement of earth dam embankments) Magnetic settlement system (Determination of settlement and lateral movements) Inclinometer (Determination of shear plane and lateral movements) ,Jointmeter Determination of movement of joints),Pendulums (Determination of tilt and rotation) ,Inverted Pendulum, Hanging Pendulum, Automatic pendulum coordinator ,Vibrating wire pressure cell (Determination of total pressure and stress distribution),Extensometer (Determination of internal deformation and cracking), Embedment strain gauge (Determination of internal strain), Temperature gauge (Determination of temperature),Distributed fiber optics temperature tool, Seismograph (Determination of earthquake shaking) |

| Unit-III: Gravity Dam , Arch Dam and Other Types of Dams |
|---|
| Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile Design methods of gravity dam, Details of Gravity method or 2 D method, ,Construction of gravity dams, Colgrout masonry, Roller Compacted Concrete (R.C.C.),Temperature control in mass concreting, Crack formation in gravity dam, Control of crack formation in dams, Construction joints, Keys, Water seal, Retrofitting. Introduction, Concept of Arch Dam, Conditions favoring an arch dam, Classification of an arch dam, Constant angle arch dam, Constant radius arch dam, Variable radius arch dam, Arch gravity dam, Double curvature arch dam, Buttress dams, Advantages of Buttress dams, Limitations of Buttress dams, Types of buttress dams. |

| Unit-IV: Spillways and Gates for Dams |
|---|
| Introduction, Need and location of spillway, Different key levels (heads) of spillway, Components of spillway: Approach channel, Control structure, Discharge channel, Energy dissipation device, Tail channel. Classification of spillways: Based on operation, based on provision of gates, based on main features (Straight drop spillway, Free overflow spillway, Saddle spillway, Side channel spillway, Ogee spillway, Chute or open channel or trough spillway, Shaft or morning glory spillway, Siphon spillway, Conduit or tunnel spillway, Stepped spillway. Design of Ogee spillway: shape of the crest, spillway profile on upstream and downstream. Energy dissipation below spillway (Through buckets, Solid roller bucket, Slotted roller bucket, Ski jump bucket), Correlation between Jump Height and Tail Water Depth, Classification of energy dissipation devices, Energy dissipation in stilling basin, Stilling basin components, Indian Standard stilling basins. |

| Unit-V: Earth Dams |
|---|
| Classification of earth dam, Classification based on---materials, method of construction, height; Selection of type of earth dam, Limitations of earth dam, Components of an earth dam, Requirementsforsafedesignofearthdam,Hydraulic(Seepage)Analysis,Plottingofseepageline and determination of seepage discharge for Homogeneous earth dam with horizontal drainage blanket,Compositeearthdamwithcasingandhearting,Propertiesofphreaticline,Determination of seepage discharge through earth dam using flow-net, Stability analysis of homogeneous and zoned earth dam, using Swedish slip circle method, Fellenius Method of Locating Centre of Critical Slip circle, Failure of earth dam, Types of failure of earth dams: Hydraulic, Seepage failure, Structural failure, Other failures. Causes of seepage and seepage control, Construction of earth dam. |

## Department of Civil Engineering

| Unit-VI: Diversion Headworks and C.D. Works |
|---|

Diversion headworks: Functions, Selection of site, typical layout, and components. Analysis of weir on permeable foundation using, Khosla's theory. Exit gradient and design criteria of weirs on permeable foundations. Cross-Drainage Works: Necessity, Selection of site, Data required for design, Classification (Drain over canal – Siphon, Super passage, Canal over drain – Aqueduct, Siphon aqueduct, Drain and Canal at the same level – Level crossing, Inlet and Outlet).Suitable type of C. D. Work. Design considerations for C. D. Work.

**Term Work:**

**List of Practicals:**

**Part (A): Analysis /Design Assignments (Any three):** *Each exercise is to be completed in the allotted Lab. Hence requires two practical sessions each.*

1) Stability analysis of gravity dam

2) Design of Ogee of spillway and energy dissipation device below the spillway

3) Stability analysis of earthen dam

4) Analysis of weirs on permeable foundations

**Part (B): Any two site visits** (Out of the following and individual reports with photographs)

1) Gravity dam

2) Earthen dam

3) C. D. Work

4) Canal structure

**Note:** *Visit report should clearly mention Name of project, date of visit, need and practical significance of project, its salient features, technical details, description and figures of different components, special features, and photographs at the site wherever allowed.*

**Textbooks:**

1. Modi, P.N, (2008) "Irrigation, Water Resources and Water Power Engineering", Standard Book House, New Delhi, 7$^{th}$e.
2. S. K. Garg, (2014), "Irrigation Engineering and Hydraulic Structures",Khanna Publishers N.D.
3. S.R.Sahasrabudhe, (2011), "Irrigation Engineering and Hydraulic Structures", S.K. Kararia & Sons, Katson Books, 3$^{rd}$edition.

**Reference Books:**

1. R. K. Sharma, (2007) "Irrigation Engineering", S. Chand. Publications
2. N.N. Basak, (1999) "Irrigation Engineering", Tata McGraw Hill.
3. G. L. Asawa, (2005) "Irrigation and Water Resources Engineering", New Age International (P) Ltd. Publishers, 1$^{st}$edition.

# Vishwakarma Institute of Information Technology, Pune-48

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## Department of Civil Engineering

### Open Elective II
### Project Planning and Management (IOEUA40183A)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): 1 hr/week<br>Practical (P): NA | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To impart knowledge of project life cycle.
- To introduce students to Project Identification Process, Project Initiation, Pre-Feasibility Study and Project feasibility Studies,
- To construct CPM, PERT network for a project.
- To introduce students to Steps in Risk Management, Risk Identification, Risk Analysis and Reducing Risks
- To introduce students to process of project Performance Measurement, Evaluation and closeout.

**Course Outcomes:**
Upon completion of the course, students will be able to
1. Understand what a Project is, Essential of Project Management.
2. Understand the Project Identification Process, Project Initiation, Pre-Feasibility Study and Project feasibility Studies,
3. Learn and Apply project planning and controlling techniques.
4. Identify risks in a project and strategies for managing the project risks
5. Understand project risk Management and Quality control in a project.
6. Understand the process of project Performance Measurement, Evaluation and closeout.

**Unit I: Basics of Project Management**

Introduction, Need, Project Management Knowledge Areas and Processes, Concept of Organizational Structure and types, The Project Life Cycle (preferably with case study), Essentials Project Management Principles.

**Unit II: Project Identification and Selection**

Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point. Case study is preferred

**Unit III: Project Planning and controlling**

Introduction, Need for Project Planning, Work Breakdown Structure (WBS), LOB, CPM and PERT, Resource Allocation, Monitoring and Control of project, Crashing, Resource Leveling, Updating

**Unit IV: Project Risk Management**

Identifying potential risks in a project, categorizing of project risks, and defining the strategies for managing the project risks

**Unit V: Project Monitoring**

Project monitoring Progress reporting, review meetings and report. Common causes of schedule delays, measuring productivity, methods of enhancing productivity, issue in project delays, Concept of quality, aspects of quality, quality control and assurance, inspection, preparation of manuals and checklists

| **Unit VI: Project Performance Measurement, Evaluation and closeout** |
|---|
| Introduction, Performance Measurement, Productivity, Project Performance Evaluation, Benefits and Challenges of Performance Measurement and Evaluation, Project Close-out, Steps for Closing the Project, Project Termination, and Project Follow-up.Case study is preferred |
| **Term Work:** |
| Assignments on all units |
| **Textbooks:** |
| 1. Premkumar Gupta and D.S.Hira, "Operations Research", S. Chand Publications (2014)<br>2. K Nagrajan, "Project Management",New age International Ltd.<br>3. Ahuja H.N, "Project Management", John Wiely, New York.<br>4. Rory Burkey, "Project Management-Planning and Control", 4th ed.—Wiley,India. |
| **Reference Books:** |
| 1. Bruce Barkley, "Project Risk Management", McGraw-Hill, 2004 |

## Department of Civil Engineering

## Open Elective II : Software Testing  (IOEUA40183B)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L):  3 hrs./week<br>Tutorial (T): 1 hr/week<br>Practical (P):    NA | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To study and understand software testing terminologies and framework,
- To study and understand the basics of software testing life cycle.
- To study and understand test and defect management
- To study and understand an automation testing
- To study and understand an automation testing tools
- To study and understand automation testing for web application

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Understand complete software testing life cycle and various terms and technologies used in testing domain
2. Demonstrate understanding of generating test plan and designing test cases
3. Demonstrate understanding of test and defect management process
4. Demonstrate understanding of automation testing
5. Create test script and execute automated tests using Selenium IDE
6. Create test script and execute automated tests using TestNG Framework

**Unit I: Introduction to Testing**

Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of Software Testing Life Cycle, V model, SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing

**Unit II: Basics of test design techniques**

Static techniques, reviews, walkthroughs, Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

**Unit III: Test and Defect Management**

**Test Management:** Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management. **Defect Management** Test Execution, logging defects, defect lifecycle, fixing / closing defects. Use of Bugzilla for logging and tracing defects.

**Unit IV: Basics of Automation testing**

Introduction to automation testing, why automation, what to automate, tools available for automation testing.

**Unit V: Automation testing using Selenium**

Understanding to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing.

**Unit VI: Automation testing using Test NG Framework**

Understanding TestNG framework,  Automation testing using TestNG Framework.

## Department of Civil Engineering

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**Term Work**

With intent to get some exposure in the software testing domain, students apply Technical, Behavioral, Process concepts learnt in the course by executing near real-life project and working in teams (project teams will ideally comprise of 4 members)

There will be 3 projects:

**Project 1:** Use of Testopia for test case management. The project will consists of test plan, test design for a sample web application and maintaining Requirement Traceability Matrix using the tool

**Project 2:** Use of Bugzilla for defect management. The project will include execution of tests designed in previous project, identifying, logging and tracing the defect and maintaining the Requirement Traceability Matrix

**Integrated Project:** Use of Selenium for automation testing. The project will consists of identifying which tests from project 1 can be automated, then creating script for those tests using tool, executing the tests with the help of tool and generating report for the tests cases.

**Text Books**

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata Mcgraw Hill, ISBN: 9780070139909 0070139903
2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X

**Reference Books**

1. Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2. Dr.K.V.K. Prasad , "Software Testing Tools", Dreamtech Press ISBN: 10:81-7722-532-4

## Open Elective II : 5G Mobile Networks (IOEUA40183C)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L):  3 hrs./week<br>Tutorial (T): 1 hr/week<br>Practical (P):    NA | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To understand evolution of 5G technologies with its challenges
- To describe 5G cellular structure and design to achieve appropriate gain
- To discuss fundamentals of 5G functional and physical architecture and its requirements
- To understand design principles for multi-user communications
- To design and interpret the 5g Use cases

**Course Outcomes:**
Upon completion of the course, students will be able to
1. Understand evolution of 5G technologies with its challenges
2. Interpret the 5G cellular structure and design to achieve appropriate gain
3. Illustrate and explain the 5G functional and physical architecture and its requirements
4. Comprehend the Radio access technology in 5G
5. Understand Cooperation in 5G systems and analysis in terms of QOS
6. Design and analysis  of 5G Use Cases

**Unit – I: Drivers For 5G**

Historical Trend for Wireless Communication - Mobile Communications Generations: 1G to 4G – Evolution of LTE Technology to Beyond 4G – Pillars of 5G – Standardization Activities -Use cases and Requirements – System Concept – Spectrum and Regulations: Spectrum for 4G – Spectrum Challenges in 5G – Spectrum Landscape and Requirements – Spectrum Access Modes and Sharing Scenarios(R1)

**Unit- II: Small Cells for 5G Mobile Network**

Introduction to Small Cells, WiFi and Femtocells as Candidate Small-Cell Technologies ,performance-Indoor and Outdoor, Capacity Limits and Achievable Gains with Densification , Gains with Multi-Antenna Techniques, Gains with Small Cells,Demand vs Capacity,Small Cell challenge (R1)

**Unit –III: 5G Architecture And Channel Models**

5G Architecture: Software Defined Networking, Network Function Virtualization , Basics about RAN Architecture ,High-Level Requirements for 5G Architecture ,Functional Architecture and 5G Flexibility ,Physical Architecture and 5G Deployment
5G wireless propagation channel models: Modeling requirements and scenarios, Channel model requirements, Propagation scenarios, The METIS channel models, Map-based model, Stochastic model(R2)

**Unit IV : - 5G Radio-Access Technologies and Millimeter wave communication**

Access design principles for multi-user communications, Multi-carrier with filtering: a new waveform, Non-orthogonal schemes for efficient multiple access, Radio access for dense deployments, Radio access for V2X communication
Millimeter Wave Communication: Channel Propagation – Hardware Technologies for mmW Systems – Deployment Scenarios – Architecture and Mobility – Beamforming – Physical layer Techniques

**Unit V: Cooperation for Next Generation Wireless Networks**

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Introduction to Cooperative Diversity and Relaying Strategies, Cooperation and Network Coding, Cooperative ARQ MAC Protocols, PHY Layer Impact on MAC Protocol Analysis, Impact of Fast Fading and Shadowing on Packet, Reception for QoS Guarantee, Impact of Shadowing Spatial Correlation

**Unit VI: 5G Use Cases and Deployment**

NB-IoT Devices, Smart Parking, Smart City, Smart Home, Message Queue Telemetry Transport (MQTT), MQTT telemetry. NB-IoT Baseline Deployment, Deployment bands and modes

**Term Work**

1. NS-3 simulation basics. Basic client server paradigm

2. Study of TCP internals and the difference between each of the variants. NS-3 tracing mechanism

3. Study of Queues, packet drops and their effect on congestion window size

4. Study of Optimised Link State Routing(MANETS)

5. Study of 802.11 working with and without RTS/CTS. An insight into why its hard to setup efficient wireless networks.

6. Study of effect of Radio channel models transmission. An insight into Identifying the channel model that is more appropriate for each case (indoor, outdoor, LoS, NLoS, etc.).

Mm

7. Wave network simulator project implementation

**Text Books**

1. Jonathan Rodriguez "Fundamentals of 5G Mobile Networks",Wiley Publication
2. Afif Osseiran, Jose F . Monserrat, Patrick Marsch "5G Mobile and Wireless Communications Technology", Cambridge University Press.
3. Hossam Fattah "5G LTE Narrowband Internet of Things(NB-IoT) ,CRC Press

**Reference Books**

1. Fei Hu, "Opportunities in 5G Networks: A research& development perspective", CRC Press
2. Krzysztof Wesolowski, "Mobile Communication Systems", Wiley Student Edition
3. Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press
   Aditya Jagannatham, "Principles of Modern Wireless Communication Systems"

# Vishwakarma Institute of Information Technology, Pune-48

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## Department of Civil Engineering

## Open Elective II : Cloud Computing (IOEUA40183D)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): 1hr/week<br>Practical (P):    NA | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To understand cloud computing concepts.
- To study supporting technologies of cloud.
- To study open research problems of cloud computing.
- To study various platforms for cloud computing.
- To explore the applications based on cloud computing.
- To study and evaluate the contemporary technologies in cloudcomputing.

**Course Outcomes:**
Upon completion of the course, students will be able to
1. Summarize the basic concepts of cloud computing (Remember)
2. Explore the supporting technologies of cloud computing (Understand)
3. Analyze the challenges and opportunities in the cloud computing  (Analyze)
4. Use the cloud services for deployment of his own applications  (Create)
5. How technologies are interrelated and use with each other  (Apply)
6. To explore future trends of cloud computing (Evaluate)

### UNIT I - Basics of Cloud Computing

Overview, Applications, Intranets and the Cloud. Your Organization and Cloud Computing-Benefits, Limitations, Security Concerns. Software as a Service (SaaS)- Understanding the Multitenant Nature of SaaS Solutions, Understanding SOA. Platform as a Service (PaaS)-IT Evolution Leading to the Cloud, Benefits of Paas Solutions, Disadvantages of PaaS Solutions. Infrastructure as a Service (IaaS)-Understanding IaaS, Improving Performance through Load Balancing, System and Storage Redundancy.Case Study: Google Cloud Platform

### UNIT II – Virtualization

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management, Virtualization for Data-Center Automation.
Common Standards: The Open Cloud Consortium, Open Virtualization Format. Standards for Security.
Case study : VirtualBox, vmware

### UNIT III - Data Storage and Security in Cloud

Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo Cloud data stores: Datastore and Simple DB Cloud Storage-Overview, Cloud Storage Providers. Case study: Firebase. Securing the Cloud- General Security Advantages of Cloud-Based Solutions, Introducing Business Continuity and Disaster Recovery. Disaster Recovery- Understanding the Threats. Case study: Discuss research problems of cloud security

### UNIT IV - Amazon Web Services

Services offered by Amazon Hands-on Amazon, EC2 - Configuring a server, Virtual Amazon Cloud, AWS Storage and Content Delivery Identify key AWS storage options Describe Amazon EBS Creating an Elastic Block Store Volume Adding an EBS Volume to an Instance Snap shooting an EBS Volume and Increasing Performance Create an Amazon S3 bucket and manage associated objects. AWS Load Balancing Service Introduction Elastic Load Balancer Creating and Verifying Elastic Load Balancer.

### UNIT V - Ubiquitous Clouds and the Internet of Things

Introduction to Ubiquitous computing, Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management)

### UNIT VI -Future of Cloud Computing

Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, The Docker Workflow. Docker compose file, Docker volume, Docker storage. Kubernetes : introduction to Kubernetes, Features of Kubernetes, Kubernetes API, Basic Architecture, Minikube.

### Term Work

1. Case study on Case Study: Google Cloud Platform
2. Write a web based application and use Firebase.
3. Create a sample web based application using PhP/Pyhton and deploy it on AWS.
4. Assignment to install and use Docker. Create Docker file.
5. Assignment to install and use Kubernetes.

### Text Books

1. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", 2010, The McGraw-Hill.

2. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", Wiley Publications, ISBN: 978-0-470-97389-9

3. Gautam Shrof, "ENTERPRISE CLOUD COMPUTING Technology Architecture, Applications, Cambridge University Press, ISBN: 9780511778476

4. Docker Documentation (https://docs.docker.com/get-started/)
5. Kubernetes Documentation (https://kubernetes.io/docs/home/)

### Reference Books

1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication, ISBN10: 8126536039

2. Buyya, "Mastering Cloud Computing", Tata McGraw Hill, ISBN-13: 978-1-25-902995-0

3. Barrie Sosinsky,"Cloud Computing", Wiley India, ISBN: 978-0-470-90356-8
4. Kailash Jayaswal, "Cloud computing", Black Book, Dreamtech Press

5. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, "Cloud Computing: Concepts,
6. Technology and Architecture", Pearson, 1st Edition, ISBN :978 9332535923, 9332535922

7. Tim Mather, Subra K, Shahid L.,Cloud Security and Privacy, Oreilly, ISBN-13 978-81-8404-815-5

Bansilal Ramnath Agarwal Charitable Trust's
# Vishwakarma Institute of Information Technology, Pune-48
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

## Open Elective II : Solar and Wind Energy (IOEUA40183E)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 <br> Lecture (L): 3 hrs./week <br> Tutorial (T): 1hr/week <br> Practical (P): NA | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To understand fundamentals of solar and wind energies
- To understand constructions, working principle and design procedure of solar and wind power plants
- To apply basic engineering principle to design a simple solar and wind power system

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Understand solar radiation and geometry principles.
2. Apply aspects of solar thermal system and its practical applications.
3. To aware design process of solar food drier/solar cooker/solar pv system for domestic purpose.
4. Design miniature wind mill for domestic purpose referring existing system.

**Unit I : Solar Energy Basics**

Present solar energy scenario in India, governing bodies (self-study), solar radiations and its measurements, solar constant, solar radiation geometry, solar radiation data, estimation of average solar radiation, solar radiation on tilted surface.

**Unit II: Solar Cell Operation**

Solar Spectrum, Solar Radiation Spectrum, Worked Problem - Total Irradiance, Solar Cell Fundamentals, Worked Problem - The I-V Characteristic, Solar Cell Types and Technologies, Multi-junctions. Conversion Efficiency Limitations, Worked Problem - Solar Cell under Concentration, From Cell to Module, Energy Audit of Home/Residence

**Unit III: Design of Solar PV Systems**

PV Sizing and Output, Orientation and Tilt, Temperature Dependent Output, Temperature Dependent Output as a Percent, Module and array conditions, Shading calculations using PV Watts, PV Sizing and output under different conditions, Inverter Sizing and Selection, Case Studies

**Unit IV: Wind Energy and its assessment**

Wind power scenario in India, Characteristics of Wind Energy: Wind movement, wind profile, roughness, effects of obstacles in wind path. wind data and site selection considerations, Comparison with Solar Energy, Types of Wind Turbine Blades, Blade Profile

**Unit V: Wind Power Plants**

Types of Wind Power Plants (WPPs): Small and large wind turbines; Horizontal and Vertical axis; Upwind and Downwind, One, Two and Three blades; constant and variable Speed; Geared, Direct-Drive and Semi-Geared (Hybrid) WPPs; WECS, WEGs, WTs, WPPs.
WPP Tower Types: Lattice; tubular: steel, concrete, hybrid, ladders, cables WPP substation: Switchgear, transformers, electronic components.

**Unit VI: Design and Control Aspects of Wind Mill/Plant**

Design: horizontal and vertical axis wind turbines, blades, control mechanisms, drive train, tower,

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## Department of Civil Engineering

nacelle, foundation, choice of materials, manufacture, adaptation to different climates
Control: control targets, system modelling, control strategies (pitch and stall regulation), hardware
Systems: wind power parks, transports, erection, grid connection, operation, maintenance

**Term Work**

1. Design of solar food drier for domestic purpose referring existing system.
   2: Measurement of Solar Insolation at Residence.
2. Design of Solar Pump for Farm Irrigation.
3. Design of solar photovoltaic system for domestic/ commercial building purpose.
4. Design of Solar Operated home appliance.
5. Case study on designing miniature wind mill for domestic purpose referring existing system.
6. Visit to Solar PV System/wind power system used in commercial building.

**Text Books**

1. S. P. Sukhatme, 'Solar Energy: Principles of thermal collections and storage', McGraw Hill
2. G. D. Rai, 'Non-Conventional Energy Sources', Khanna Publisher
3. Tiwari G N. 'Solar Energy: Fundamentals, design, modeling and Applications', Narosa, 2002

**Reference Books**

1. Mukund R. Patel, 'Wind And Solar Power Systems: Design, Analysis and Operation, Second Edition', CRC Press
2. Kreith And Kreider, Solar Energy Handbook, McGraw Hill
3. Ray Hunter, 'Wind Energy Conversion: From Theory to Practice', John Wiley and Son Ltd
4. Gary L Johnson, 'Wind Energy Systems', Prentice-Hall Inc., New Jersey
5. Martin O L Hansen, 'Aerodynamics of Wind Turbines', James & James/Earthscan.
6. Goswami D Y, Kreith F, Kreider J F, 'Principles of Solar Engineering', Taylor & Francis
7. Robert Gasch, 'Wind Power Plant Fundamentals, Design, Construction And Operations', Springer
8. C S Solanki, 'Solar Photovoltaic: Fundamentals, Technology And Applications', PHI Learning

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

### Open Elective III : Robotics (IOEUA40184A)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hr/week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To acquire basic understanding of Industrial Robots and its technological applications
- To understand peripherals of Robotic system and their use.

**Course Outcomes:**
Upon completion of the course, students will be able to:
1. Recognize and differentiate between different types of Robots, and their features.
2. Understand industrial applications of Robots.
3. For the given industrial application students will be capable of selecting the apropriate Robot considering all the parametrs.
4. Recognize different concepts related to industrial Robotics like end effecros, sensors, actuators etc.
5. Generate Robot Programming
6. Understand the social relevance of Robos

**Unit I: Fundamental of Robotics**

Evolution of Robots, Types of Robots, Reason behind use of Robot, Robot Uses cases, Advantages of Robot, Disadvantages of Robot, Defining Robot, Laws of Robotics, Future of Robot,

**Unit II: Performance Specifications of Industrial Robots**

DOF of Robot, Joints and Links in Robot, Singularity in Robots, Industrial Applications of Robot, Selection parameters and Robot Specification.

**Unit III: Insight Industrial Robot and System Peripherals**

Actuators: Pneumatic, Hydraulic and Electric, Brakes, Transmission, Gears, Soft limits and Hard Limits. Controller, Teach Pendant, End Effectors, Fixtures, Pneumatic System, Communication between System Peripherals.

**Unit IV: Automation and Control Systems**

Introduction to Automation, Introduction to Artificial Intelligence, Industry 4.0, Fundamentals of PLC, Relay, Encoder, Field Sensors, Communication Protocols, HMI, SCADA, IIOT.

**Unit V: Robot Programming**

Robot Programming Concepts, Programming Methods, Offline Programming, Programming Languages, Program Organization, Writing Robot Program of Instructions, Robot Simulation, Coordinate Systems.

**Unit VI: Social Issues Related to Robotics**

Reasons for installing Robots, Economic costs and benefits of installing industrial Robots, Acceptability of industrial Robots by the workforce, Employment and Other social issues of Robotics

## Department of Civil Engineering

| **Term Work** |
|---|
| 1. System Peripherals<br>2. Control system for robotics<br>3. Drives system used in robots<br>4. Forward Kinematics<br>5. Backward kinematics<br>6. Robot Programming<br>7. Robot proposal preparation with costing<br>8. Industrial visit |
| **Text Books** |
| 1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012.<br>2. Craig. J. J. "Introduction to Robotics- mechanics and control", Addison- Wesley, 1999. |
| **Reference Books** |
| 1. Saeed B. Niku, "Introduction to Robotics – Analysis, Systems and Application" : PHI 2006<br>2. D J Todd, "Fundamentals of Robot Technology" Kogan Page, 1986 |

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

### Open Elective III: Quantum Computing (IOEUA40184B)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hr/week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To provide introduction and necessary expertise to the learner in the upcoming discipline of Quantum Computing and Machine Learning.
- To enable the students to learn Quantum Computing and Quantum Machine Learning in practical-oriented learning sessions so that he/she can independently use existing open-source Quantum Computing Hardware and Software Frameworks.
- To teach the students to develop hybrid solutions by applying Quantum Machine Learning to potential business application areas.
- To study Quantum Information Theory and Quantum Computing Programming Model of Computation.
- To study Quantum Algorithms and apply these to develop hybrid solutions .
- To study Quantum Concepts necessary for understanding the Quantum Computing Paradigm and compare the available hardware and software infrastructure and frameworks made available open source by major players in the Industry and Academia

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Explain the working of a Quantum Computing program, its architecture and programming model.
2. Develop quantum logic gate circuits.
3. Develop quantum algorithm(s).
4. Program quantum algorithm on major toolkits.
5. Develop Hybrid Solutions in Quantum Machine Learning for potential applications / use cases
6. Compare existing features provided by potential hardware and software infrastructure and frameworks service providers.

**Unit I: Introduction to Quantum Computing**

Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing, Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

**Unit II: Mathematical Foundation of Quantum Computing**

Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigenvectors.

### Unit III: Building Blocks for Quantum Program

Architecture of a Quantum Computing platform, Hybrid Approach for Application Development, Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perspective e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc., Programming model for a Quantum Computing Program, Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits, Models of Computation used by key players as OEMs in Quantum Computing

### Unit IV: Quantum Algorithms

Basic techniques exploited by quantum algorithms, Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks, Major Algorithms, Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm, OSS Toolkits for implementing Quantum program, IBM quantum experience, Microsoft Q#, Rigetti PyQuil (QPU/QVM) OR Cambridge Quantum Computing, Google's Tensorflow Quantum, Amazon Bracket, D-Wave Frameworks

### Unit V: Machine Learning and Deep Learning

Machine Learning, Deep Learning and Artificial Intelligence Basics, Machine Learning Algorithms, Deep Learning Algorithms, Evolutionary Learning Algorithms

### Unit VI: Quantum Machine Learning

Quantum Machine Learning and Quantum AI, Quantum Neural Networks, Quantum Natural Language Understanding, Quantum Cryptography, Application Domains for Quantum Machine Learning: Chemistry/Material Science, Space Tech, Finance related Optimisation Problems, Swarm Robotics, Cyber security

### Term Work:

1. Building Quantum dice
2. Building Quantum Random Number Generator
3. Composing simple quantum circuits with q-gates and measuring the output into classical bits.
4. Implementation of Shor's Algorithms
5. Implementation of Grover's Algorithm
6. Implementation of Deutsch's Algorithm
7. Implementation of Deutsch-Jozsa's Algorithm
8. Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm
9. Graph Partitioning using Quantum Machine Learning
10. Implementing Quantum Neural Network
11. Basics program implementing Quantum Natural Language Understanding Solution
12. Comparative study of Quantum Software Frameworks

## Department of Civil Engineering

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**Textbooks:**

1. Quantum Machine Learning (What Quantum Computing Means to Data Mining) by Peter Wittek, University of Boras, Sweden - Elsevier Publications
2. Principles of Quantum Artificial Intelligence by Andreas Winchert, Instituto Superior Técnico - Universidade de Lisboa, Portugal - World Scientific Publishing, British Library Cataloguing-in-Publication Data

**Reference Books:**

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley
3. IBM Quantum Experience: https://quantumexperience,ng,bluemix.net https://quantum-computing.ibm.com/docs/
4. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit
5. Forest SDK PyQuil: https://pyquil.readthedocs.io/en/stable/
6. Amazon Bracket Documentation on AWS: https://aws.amazon.com/braket/
7. D-Wave Systems Documentation: https://docs.dwavesys.com/docs/latest/index.html

## Department of Civil Engineering

### Open Elective III : Business Intelligence (IOEUA40184C)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA Practical (P): 2 hr/week | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To study and understand the importance of Business Intelligence and need of data Visualisation for Business Intelligence.
- To study and understand the different components of analytics landscape and project cycle aligned with these components.
- To study and understand different data transformations, data modelling steps and visualize the data on the data models.
- To study and understand the ways of adding custom calculations needed and understanding the applications of different statistical concepts.
- To study and understand the BI deployments, administration cycle of BI implementations using Power BI
- To study and understand various topics and concepts in the areas of analytics and their industrial applications through study of different use cases.

**Course Outcomes:**
Upon completion of the course, students will be able to
1. Describe the importance of Business Intelligence and need of data visualisation for Business Intelligence.
2. Identify, describe, relate to the concepts of different components of analytics landscape and project cycle aligned with these components.
3. Design and develop different data transformations, data models, analyse and visualize the data.
4. Design and develop custom calculations based on business and technical needs and demonstrate and implement different statistical concepts.
5. Author BI deployments, BI environments.
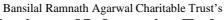6. Describe and compare industrial BI implementations, use cases and current and future trends.

**Unit I : Introduction to Analytics and Data Preparation**

**Introduction to Analytics:** What is Analytics? Need of Analytics, Types of Analytics, Role of Analytics in Business

**Data Sources:** Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation

**Power BI Desktop:** Need of visualisation, Different Visualisation tools, Why Microsoft Power BI? Installation and configuration of Power BI Desktop, Setup of required connector

**Data Visualization:** What are KPIs? Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations

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### Unit II: Data& BI Landscape and Project Cycle

**Understanding Data and Databases:** What is a database? What is a DBMS? What is SQL? What are tables? Organization of tables in databases, Types of Data, Database Keys, Relationships between tables, Joins and Unions, Type of Data: Structured, Unstructured and Semi-structured

**BI Architecture:** BI Architecture, Data Security and Governance, Administration

**BI Project Lifecycle:** Requirements Understanding, Data Understanding, Data Integration and Data warehouse, Reporting and Analysis, Dashboard development, Deployment, Documenting, Project Team and Roles, Challenges in Projects

### Unit III: Data Preparation and Data Modelling

**Data Integration and Data Warehouses:** What is Data Integration?Need of DataIntegration, ETL, what is Data Warehouse? Need of Data Warehouse, Facts and Dimensions, Star Schema and Snowflake Schema, Data Marts

**Need of Data Preparations:** What is Data Preparation?Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing

**Data Transformation [Basics]:** Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data

**Data Modelling:** Setting Relationships, Creating Data Models

### Unit IV : Custom Calculations And Analytics

**Data Transformations [Advanced]:** Pivot/Unpivot data, Split data, Handling inconsistent data, Conditional Column, Custom column

**Calculations:** Introduction to DAX, Calculated Column, Calculated Measures, M-Query calculations, YTD, QTD, MTD calculations, Moving Averages and Running Total

**Statistical Analysis:** Central Tendency: Mean, Mode, Median, Dispersion: Variance and Standard Deviation, Summarization data by using histogram

### Unit V: Power BI Deployment, Administration And Mobility

**Power BI Deployment:** Overview of Power BI Service, Publishing reports to Power BI Service, Understanding the Power BI Service User Interface, Creating Dashboards in Power BI Service, Subscriptions, Comments and Data Driven Alerts, authoring reports within Power BI Service, sharing dashboards across your organization, Configuring Power BI Gateway, scheduling automated refresh of your reports using Data Gateway

**Power BI Mobile:** Creating Dashboards for Mobiles, using dashboards and reports using Mobile App

**Power BI Advanced Features:** Using NLP to creating dashboards, Influencers, Delivering Insights, Explain Analysis

### Unit VI: Industry Analytics Landscape

**Tableau Overview:** Introduction to Tableau, Tableau Products, Tableau architecture, Installation and Setup of Tableau Desktop, Visualizing with Tableau, Tableau online and Tableau server, Publish and share reports on Tableau online

**Applications of Business Intelligence:** Manufacturing Use Cases, Retail Use Cases, Marketing use Cases, Banking use cases, Future Trends of Analytics

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**Term Work**

1. Creating multiple sample tables and joining them in Power BI
2. Connecting to data source and transforming data in Power BI
3. Connecting to data source and creating data models by establishing relationships
4. Connecting to data source and visualizing and analysing data
5. Connecting to data source and creating custom calculations
6. Deploying the dashboards and reports to Power BI Service
7. Administering and using advanced features of Power BI Service
8. Creating Mobile layouts in Power BI Desktop

**Text Books**

1. Business Intelligence Guidebook: From Data Integration To Analytics" by Rick Sherman, Elsevier Inc.
2. Successful Business Intelligence, Second Edition: Unlock The Value Of BI & Big Data" by Cindi Howson, McGraw Hill Edition
3. "Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finch
4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, Koganpage Publicaitons, Auva Press

**Reference Books**

1. "Performance Dashboards – Measuring, Monitoring, And Managing Your Business" by Wayne Eckerson, John Wiley & Sons, Inc
2. "Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications" by Larissa T. Moss & Shaku Atre, Addison-Wesley information Technology Series
3. "Artificial Intelligence: Building Intelligent Systems" by Dr. Parag Kulkarni, Dr. Prachi Joshi, PHI publication

## Department of Civil Engineering

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### Open Elective III : Business Analytics (IOEUA40184F)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA<br>Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Prerequisite course(s):** Database Management System, MS-Excel

Course Objective(s):
1. To study and understand the importance of Business Analytics and need of data Visualisation for Business Analytics
2. To study and understand the different components of analytics landscape and project cycle aligned with these components
3. To study and understand different data transformations, data modelling steps and visualize the data on the data models
4. To study and understand implementation and evaluation ways of adding custom calculations needed and BI deployments
5. To study and understand the descriptive statistics, inferential statistics, normal distribution and prediction analysis by performing regression
6. To study and understand Tableau background and concepts in the areas of analytics and their industrial applications through study of different use cases

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Describe the importance of Business Analytics and need of data visualisation and analysis for Business
2. Identify, describe, relate to the concepts of different components of analytics landscape and project cycle aligned with these components
3. Design and develop different data transformations, data models, analyse and visualize the data
4. Design and develop custom calculations based on business requirements and Author BI deployments, BI environments
5. Perform descriptive and inferential statistics and prediction analysis by performing regression
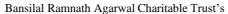6. Describe and compare industrial BA implementations, use cases and current and future trends

**Unit-I: Introduction to Analytics and Data Preparation**

**Introduction to Analytics:** What is Analytics? Need of Analytics, Types of Analytics, Role of Analytics in Business

**Data Sources:** Data Collection, Transactions Entry, Organizational Systems, Data Sources and Data Source Categories, Issues in Data and Need of Data Preparation

**Power BI Desktop:** Need of visualisation, Different Visualisation tools, Why Microsoft Power BI? Installation and configuration of Power BI Desktop, Setup of required connector

**Data Visualization:** What are KPIs? Dashboards, Reports and Scorecards, Types of Dashboards, Slicers and Filters, Setting interactivity, Drilldowns and Drill-through, Formatting your visualizations, Best practices of visualizations

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## Department of Civil Engineering

### Unit II: Data & Analytics Landscape and Project Cycle

**Understanding Data and Databases:** What is a database? What is a DBMS? What is SQL? What are tables? Organization of tables in databases, Types of Data, Database Keys, Relationships between tables, Joins and Unions, Type of Data: Structured, Unstructured and Semi-structured

**BI Architecture:** BI Architecture, Data Security and Governance, Administration

**BI Project Lifecycle:** Requirements Understanding, Data Understanding, Data Integration and Data warehouse, Reporting and Analysis, Dashboard development, Deployment, Documenting, Project Team and Roles, Challenges in Projects

### Unit III: Data Preparation and Data Modelling

**Data Integration and Data Warehouses:** What is Data Integration? Need of Data Integration, ETL, what is Data Warehouse? Need of Data Warehouse, Facts and Dimensions
Star Schema and Snowflake Schema, Data Marts

**Need of Data Preparations:** What is Data Preparation? Joining data, Appending Data, New Calculations, Removing Inconsistencies, Transposing

**Data Transformation [Basics]:** Merging and Appending Data, Filtering, Cleaning Data, Fixing Errors, Transforming Data, Aggregating Data

**Data Modelling:** Setting Relationships, Creating Data Models

### Unit IV: Calculations And Power BI Deployment

**Data Transformations [Advanced]:** Split data, Handling inconsistent data, Conditional Column, Custom column

**Calculations:** Introduction to DAX, Calculated Column, Calculated Measures, M-Query calculations, YTD, QTD, MTD calculations

**Power BI Deployment:** Overview of Power BI Service, Publishing reports to Power BI Service, Understanding the Power BI Service User Interface, Creating Dashboards in
Power BI Service, Subscriptions, Comments and Data Driven Alerts, authoring reports within Power BI Service, sharing dashboards across your organization,

**Power BI Mobile:** Creating Dashboards for Mobiles, using dashboards and reports using Mobile App

### Unit V: Business Analytics using Excel

**Statistical Analysis:** Central Tendency: Mean, Mode, Median, Central Tendency exercise in Excel. Dispersion: Variance and Standard Deviation, Dispersion exercise in Excel. Coefficient of variation, rule of thumb for Standard deviation. Outliers.
Summarization data by using histogram, Descriptive Statistics. Interpretation of excel result of descriptive statistics. Inferential statistics, Sample and population, Point estimate, true value, sampling error, Normal Distribution,

**Regression and forecasting:** Simple Regression Model and Type, Regression line, Relationship between two variables, Forecasting using Excels, Interpreting Regression Result, Example of single regression in Excel and forecasting.

### Unit VI: Industry Analytics Landscape

**Tableau Overview:** Introduction to Tableau, Tableau Products, Tableau architecture, Installation and Setup of Tableau Desktop, Visualizing with Tableau, Tableau online and Tableau server, Publish and share reports on Tableau online

**Applications of Business Analytics:** Manufacturing Use Cases, Retail Use Cases, Marketing use Cases, Banking use cases, Future Trends of Analytics

## Department of Civil Engineering

**Term Work:**

**List of Assignments (Any 6)**
1. Creating multiple sample tables and joining them in Power BI
2. Connecting to data source and transforming data in Power BI
3. Connecting to data source and creating data models by establishing relationships
4. Connecting to data source and visualizing and analysing data
5. Performing Descriptive statistics in Excel
6. Numerical based on normally distributed data.
7. Performing regression in Excel and forecast by interpreting results
8. Deploying the dashboards and reports to Power BI Service
9. Administering and using advanced features of Power BI Service
10. Creating Mobile layouts in Power BI Desktop

**Text Books:**

1. "Business Intelligence Guidebook: From Data Integration To Analytics" by Rick Sherman, Elsevier Inc.
2. "Successful Business Intelligence, Second Edition: Unlock The Value Of BI & Big Data" by Cindi Howson, McGraw Hill Edition
3. "Data Analytics For Beginners: Your Ultimate Guide To Learn And Master Data Analysis. Get Your Business Intelligence Right – Accelerate Growth And Close More Sales" by Victor Finch
4. Data Strategy: How To Profit From A World Of Big Data, Analytics And The Internet Of Things" by Bernard Marr, Koganpage Publicaitons, Auva Press

**Reference Books:**

1. "Performance Dashboards – Measuring, Monitoring, And Managing Your Business" by Wayne Eckerson, John Wiley & Sons, Inc
2. "Business Intelligence Roadmap: The Complete Project Lifecycle For Decision-Support Applications" by Larissa T. Moss & Shaku Atre, Addison-Wesley information Technology Series
3. "Artificial Intelligence: Building Intelligent Systems" by Dr. Parag Kulkarni, Dr. Prachi Joshi, PHI publication (for understanding of concepts)

## Department of Civil Engineering

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### Intellectual Property Rights (CVUA40185)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 2<br>Lecture (L): 2 hrs./week<br>Tutorial (T): NA<br>Practical (P): NA | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | - | - | 50 | - | - | - | 50 |

**Course Objectives:** The course will help students
- To understand concept, need, importance, types, international and national scenario, administration and documentation of Intellectual Property Right.

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Understand basic concepts, need and importance of IPR
2. Explain types of IPR and infringement
3. Describe International scenario of IPR and IPR Acts in India
4. Explain administration and documentation of IPR in India.

**Unit I: Introduction to Intellectual Property Rights**

Introduction and types of Intellectual property. Understanding, need, objectives, importance and nature of Intellectual Property Rights.

**Unit II: Types of IPR and Infringement**

Copyright, Patent, Trademarks, Trade secret, Traditional knowledge, Geographical indications, Industrial designs, Layout designs, Semiconductor IC Layout Design. Traditional Knowledge Digital Library (TKDL). Infringement: Copyright, Patents, Trademarks and Trade secret, Case studies. Remedies for Infringement.

**Unit III: International scenario of IPR and IPR Acts in India**

New developments in IPR. WIPO, WTO, TRIPS. International application for patenting: PCT. Rules and Acts in India: Copyright Act 1957 and its amendments, Patent Act 1970 and its amendments, Trademark Act 1999, Geographical Indications of Goods (Registration and Protection) Act, 1999, Design Act 2000, Protection of Plant Varieties and Farmers' Rights Act, 2001, Biological Diversity Act 2002, Licensing and transfer of technology, Patent information and database.

**Unit IV: IPR and its administration in India**

IPR in India. India's new IPR policy. Patent offices in India. Types of patent application in India. IPRprocesses, its administration and documentation in India: Copyright, Patent, Trademark.

**Textbooks:**

1. Debora J. Halbert (2006), "Resisting Intellectual Property", Taylor & Francis Ltd.
2. Neeraj Pandey and Khushdeep Dharni(2014), "Intellectual Property Rights", PHI Learning Pvt. Ltd., India.
3. Robert P. Merges, Peter S. Menell and Mark A. Lemley (2006), "Intellectual Property in New Technological Age", 4th Edition, ASPEN Publishers, NewYork.

**Reference Books:**

1. T. Ramappa (2016), "Intellectual Property Rights Law in India", 2nd Edition, Asian Law House, India.
2. Dr. VikasVashishth (2006) "Laws and Practice of Intellectual Property in India", 3rd Edition, Bharat Law House Pvt. Ltd., India.

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# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

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### Architecture and Town Planning (CVUA42181A)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Prerequisite course(s):** Introduction to Infrastructure Engineering, Transportation Engineering.

**Course Objectives**
- To impart basic knowledge of Architecture and Planning as an important and integral field of Civil Engineering to the students.
- To introduce acts, laws, rules as well as some modern techniques relevant to town planning.
- To make the students prepare a neighbour-hood plan.

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Demonstrate principles and elements of architecture as well as explain the role of urban planner/ designer and architect in Civil engineering discipline.
2. Apply the concepts of beautification of cities, urban planning and renewal for sustainability.
3. Describe planning hierarchy in India, legislative procedure, significance and contents of Maharashtra Regional and Town Planning Act 1966; and Develop neighborhood plan.
4. Explain various surveys role and organizational structure of planning agencies and organizations with reference to town planning.
5. Examine acts, laws and rules relevant to town planning.
6. Discuss special provisions related to town planning such as SEZ, CRZ, Smart City, AMRUT guidelines, modern techniques in planning.

   **T .W.**
7. Apply the knowledge in preparing planning of town/city.

### Unit I: Fundamentals of Architecture

Meaning, Necessity and Objectives of Architecture, Principles and elements of Architecture, Seven Lamps of Architecture (Only significance & necessity).

Role of Urban Planner/ Designer and Architect for conservation and preservation, spatial organization, utility, demand of the area and supply.

Characteristics of Architecture: Simplicity, user friendly, contextual, eco-friendly, maintaining special character/ identity of the areas, utility of spaces, future growth .

### Unit II: Human Psychology, Beautification of cities and Sustainability

Meaning, Need of breathing spaces in modern urban areas and their uses, Necessity of beautification of cities and applications, Livability in Urban Areas, Considerations for Human Psychology and Quality of Life. Urban planning and renewal: Development and sustainability.

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| **Unit III: Planning Hierarchy in India** |
|---|
| Meaning and History of Town and Country Planning (Only brief overview). Necessity and Objectives of Town and Country Planning, Advantages of Town Planning. and Principles and components of Town Planning. New Town Development.<br>Levels (Hierarchy) of Planning in India. Regional Planning, Development Plan, Town Planning, Town Planning Schemes and Neighborhood planning.<br>Legislative procedure and contents of Maharashtra Regional and Town Planning Act 1966. |
| **Unit IV: Surveys, Planning Agencies and Urban Transportation** |
| Meaning, Necessity and Objectives of Surveys for Town Planning: Land-use, Housing, Demography, Industry, Transportation, Water Supply, Drainage and Sanitation (Including Treatment Plants)<br>Planning Agencies and Organizations at various Levels of Planning such as CIDCO, HUDCO, MIDC, MHADA, SRA, MMRDA/PMRDA, Purpose, Relevant Acts, Their Organizational structures (Constitution), and working.<br>Urban transportation Management: Hierarchy of urban roads, traffic management systems, BRT, Details of Intelligent Transport System, Parking. |
| **Unit V: Acts, Laws and Rules Relevant to Town Planning** |
| D.C. Rules. Land Acquisition Act 1896, Land Acquisition Rehabilitation and Resettlement Act.<br>URDPFI Guidelines for Land-use and Infrastructure.<br>Real Estate (Regulation and Development) Act 2016 and MAHA-RERA |
| **Unit VI: Special Provisions Relevant to Town Planning** |
| New and Special towns, township development with study of minimum one case study each.<br>SEZ, CRZ, Smart City, AMRUT Guidelines.<br>Modern Techniques in Planning: Application of GIS, GPS, Drones, remote sensing, in planning. |
| **Term Work:** |
| **Any four exercises from Sr. No. 5 through 11 as allotted (Decided) by concerned faculty member.** |

1) **Group work (Compulsory Exercise):** Study and analysis of Development Plan of any city/ town (Available either on website OR procures from relevant Office) with respect to land-use, services, infrastructure, Transportation, housing.
2) **Individual work (Compulsory Exercise):** Neighborhood Planning (Area and major features/ characteristics to be provided by concerned faculty member)
3) **Individual work (Compulsory Exercise):** Study and report writing for Smart City or AMRUT guidelines with report on one case study.
4) **Group work (Compulsory Exercise):**e- learning and individual report writing for MAHA- RERA. (https://maharera.mahaonline.gov.in)
5) **Group work\*:** Study and individual report writing for an existing town planning scheme.
6) **Group work\*:** Study and individual report writing for the salient features of urban renewal/ TPscheme.
7) **Group work\*:** Study and individual report writing of urban conservation and/or housing and changesin housing over a decade or so.
8) **Group work\*:** Study and individual report writing for application and success/ failure of BRT and/orIntelligent Transport System.
9) **Group work\*:** Study and individual report writing for Any Relevant Act/ Laws/ Rules with respectto planning.

10) **Individual Exercise\*:** Report on the brief life-sketch and contribution of Engineer/ Planner/ Architectin post-independence India.

11) **Individual Exercise\*:** Study and report on an existing new town and planned town like New Mumbai,Gandhinagar, PCNTDA,Mainly with reference to Infrastructure and disaster management).

**Textbooks:**

1. G K Hiraskar, (2018), "Fundamentals of Town Planning", Dhanpat Rai Pubications
2. S Rangwala, (2009 ),"Town Planning", Charoter Publishing House Pvt Ltd
3. Arvind Krishnan, "Climate Responsive Architecture", Tata McGraw-Hill Publishing Company
4. Michael Laurie, "Introduction To Landscape Architecture" Elsevier,Publishing company New York

**Reference Books:**

1. Gallion and Eisner, "The Urban Pattern: City planning and design" Van Nostrand Reinhold, Publishing company
2. Edmond bacon, "Design of cities" Thames and Hadson, Publishing company
3. MRTP Act 1966
4. Sustainable Building Design Manual
5. UDPFI Guidelines
6. CIDCO, HUDCO, MIDC, MHADA, SRA, MMRDA/PMRDA, Acts and their websites.
7. LARR Act 2013

**e-Resources:**

https://maharera.mahaonline.gov.in

## Department of Civil Engineering

### Professional Elective VI
### Environmental Impact Assessment (CVUA42181B)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA<br>Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Prerequisite:** Environmental Engineering I & II at UG level

**Course Objectives**
1. To create awareness among the students for environmental impact assessment technique
2. To prepared the students for EIA norm and provisions.

**Course Outcomes:**

Upon completion of this course, students will be able to –

1. Understand the concept of EIA
2. Analyse components and methods of EIA
3. To impart the knowledge of EIA for water quality.
4. To impart the knowledge for EIA in various industries.
5. Study provision of EIA.
6. Study a project for EIA.

**TW CO**

7. Understand the concept of EIA, methods and EIA project.

**Unit I : Introduction**

Environmental impact assessment (EIA),environmental impact statement (EIS).Environmental Risk Assessment (ERA), Legal and Regulatory aspects in India, Types and limitations of EIA, Terms of Reference in EIA. Issues of EIA – National – cross sectoral –social and cultural.

**Unit II :  Components and methods**

Components, screening, setting, analysis, prediction of impacts, mitigation. Matrices , Networks –, Checklists. Importance assessment techniques , cost benefit analysis , analysis of alternatives , methods.

**Unit III: Impact assessment (Water quality)**

Water Quality Impact Assessment – attributes, water quality impact assessment of water resources projects, data requirements of water quality impact assessment, Case studies

**Unit IV: EIA for various industries**

Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring.

**Unit V: Provisions of EIA**

Latest EIA notification by Ministry of Environment and Forest (Govt. of India): Provisions in the EIA notification, Procedure for public hearing, post environmental monitoring, Procedure for obtaining Environmental clearance for construction projects.

## Department of Civil Engineering

**Unit VI : Case study**

Case study of EIA construction project or any other project.

**Text Books:**

1. S R Khandeshawr N S Raman, A R Gajbiye (2019) ," Environmental Impact Assessment ", Willey Publication.
2. David P. Lawarance , " Environmental Impact Assessment ", Willey Publication.
3. Dr R.R. Bharatwal, " Environmental Impact Assessment ", by New Age Publication, New Delhi.

**Reference Books**

1. Y. Anjaneyulu, Valli Manickam, " Environmental Impact Assessment ", CRC  Publication.
2. Anjali Reddy , " Environmental Impact Assessment ",BS Publicaiton.

**Term Work**

Construction project based on EIA of construction project or any other project.

## Professional Elective VI
## Advanced Design of R.C. Structures (CVUA42181C)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4 Lecture (L): 3 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA Practical (P): 2 hrs./week | 20 | 30 | 20 | 30 | 25 | - | 125 |

**Prerequisite:** Structural Analysis, Design of RC Structures

**Course Objectives:** The course will help students to understand design of RC structures constructed for specific purpose.

**Course Outcomes:**

Upon completion of the course, students will be able to

1. **Explain** the concept of yield line theory and analyse the RC slabs using yield line theory.
2. **Design** the flat RC slabs as per guidelines given in Indian Standard Code.
3. **Design** the circular RC ground water tanks as per guidelines given in Indian Standard Code.
4. **Design** the rectangular RC ground water tanks as per guidelines given in Indian Standard Code.
5. **Design** the RC cantilever retaining walls as per guidelines given in Indian Standard Code.
6. **Design** RC combined footing as per guidelines given in Indian Standard Code.
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**Unit I : Yield Line Theory**

Introduction, assumptions, methods of analysis and basic principles, illustrative example of slab design

**Unit II: Flat Slabs**

Advantages and Disadvantages, design requirements, direct design method, equivalent frame method

**Unit III: Design of circular ground water tanks**

Introduction, types, function, codal provisions, methods of analysis, Design of circular water tanks resting on ground by Limit State method.

**Unit IV: Design of rectangular ground water tanks**

Design of square and rectangular water tanks resting on ground by Limit State method.

**Unit V: Design of cantilever retaining wall**

Introduction, Functions and types of retaining walls, Analysis and design of RCC cantilever type of retaining wall for various types of backfill conditions, Introduction and concept of counter fort retaining walls.

**Unit VI: Design of Combined Footing**

Introduction, design of slab type combined footing, design of beam & slab type of combined footing

**Term Work:**

Students are required to solve at least two assignments on each unit.

| **Textbooks:** |
| --- |
| 1) Pillai S. and Menon Devdas, 3$^{rd}$ Edition (2017), "Reinforced Concrete Design", Tata McGrawHill, New Delhi.<br><br>2) Punmia, Jain and Jain, (2001),"Comprehensive Design of R.C. Structures", Standard Book House, New Delhi.<br>3) Shah V. L. and Karve S. R., 6$^{th}$ Edition (2013),"Limit state theory and Design of Reinforced Concrete", Structures publications, Pune, India.<br>4) Sinha N. C.and Roy S.K., 4$^{th}$ Edition (2013),"Fundamentals of Reinforced Concrete", S. Chand Publishing, New Delhi. |
| **Reference Books:** |
| 1) VargheseP.C., 2$^{nd}$Edition, (2005), "Advanced reinforced concrete design", Prentice Hall of India, New Delhi,<br>2) M. L. Gambhir, "Design of design of reinforced Concrete structures", PHI.<br>3) Shah V. L. and Karve S. R., 6th Edition (2013),"llustrated Design of Reinforced Concrete Buildings (G+3)", Structures Publications', Pune 411009.<br>4) Shah H. J., 11$^{th}$ Edition (2016), "Reinforced Concrete, Vol I",Charotar Publishing House, India. |
| **Reference codes and standards:** |
| 1. IS: 456-2000 – "Plain and Reinforced Concrete – Code of Practice", New Delhi: Bureau of Indian Standards.<br>2. SP 34 – "Handbook on Concrete Reinforcement and detailing", New Delhi: Bureau of Indian Standards.<br>3. SP 16 – "Design Aids for Reinforced concrete to IS 456:1980 Code Book", New Delhi: Bureau of Indian Standards.<br>4. IS: 3370 – "Indian Standard code of practice for concrete structures for storage of liquids", New Delhi: Bureau of Indian Standards. |

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

| Open Elective IV: Engineering Economics (IOEUA42182A) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | | | | | | |
| Credits: 4<br>Lecture (L): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA<br>Practical (P): 2 hr/week | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To learn the basics of economics and cost analysis relevant to engineering
- To identify conditions for present worth comparison and future worth comparison and find appropriate solutions for the information challenges.
- To learn and calculate the Rate of interest, different costs and overheads ,profit and loss accounts

**Course Outcomes:**

Upon completion of the course, students will be able to:

1.Understand the economics and cost analysis

2.Compare  present worth and future worth

3.Identify rate of return and different taxes

4.Calculate  profit and loss

### Unit- I: Introduction

Engineering and Economics, Law of demand and supply, Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income), Law of returns, Interest and Interest factors: Interest rate, Simple interest, Compound interest, Cash - flow diagrams, Personal loans and EMI Payment. Price Indices(WPI/CPI),

### Unit- II: Present-Worth and Annual Worth Comparisons

Present-Worth Comparisons: Conditions for present worth comparisons, Basic Present worth comparisons, Present-worth equivalence, Net Present worth, Future-worth comparison, Pay-back comparison, Exercises, Discussions and problems. Equivalent Annual-Worth Comparison methods, Situations for Equivalent Annual-Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fund method.

### Unit –III: Rate-Of-Return And Depreciation

Rate of return, Minimum acceptable rate of return, Investment Analysis – NPV, ROI, IRR, Payback Period, Time value of money, Components of costs such as Direct Material Costs, Direct Labor Costs Causes of Depreciation, Basic methods of computing depreciation charges, Tax concepts, corporate income tax.

### Unit IV: Finance and Banking

Statements of Financial Information: Introduction, Source of financial information, financial statements, Balance sheet, and Profit and Loss account, relation between Balance sheet and Profit and Loss account. Financial Institutions, Finance Commissions, Budget Analysis. Indian Banking, Role of Reserve bank of India International Economy

## Department of Civil Engineering

| Term Work |
|---|
| 1. Study of cash flow diagram and interest rates<br>2. Study of Present worth Comparison<br>3. Study of  Annual worth Comparison<br>4. Study of Investment Analysis<br>5.Study of  Financial statements and Balance sheet |

| Text Books |
|---|
| 1  Leland T. Blank and Anthony J. Tarquin , "Engineering Economy" 4th Edition ,McGraw Hill Publication .<br>2  Chan S. Park "Contemporary Engineering Economics", 3rd Edition,PHI  Publications.<br>3  Dr.K.K.Dewett and M. H. Navalur ," Modern Economic Theory"RevisedEdition,S Chand Publication. |

| Reference Books |
|---|
| 1.  V. Mote, S. Paul, G. Gupta(2004), Managerial Economics, Tata McGraw Hill<br>2.  Misra, S.K. and Puri (2009), Indian Economy, Himalaya |

# Vishwakarma Institute of Information Technology, Pune-48

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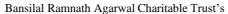
## Department of Civil Engineering

### Open Elective IV: Computational Biology (IOEUA42182B)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 2 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hr/week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To study and understand the concept of information generation from protein sequences, DNA sequences, whole genome.
- To study information extraction from large databases and Computer modelling
- To study and understand various elements of computational biology such as genomic networks, algorithms, and models
- To design and develop current applications of computational biology

**Course Outcomes:**

Upon completion of the course, students will be able to:
1. Demonstrate the concept of information generation from protein sequences, DNA sequences, whole genome
2. Extract information from large databases and to use this information in computer modelling
3. Evaluate various elements of computational biology such as genomic networks, algorithms, and models
4. Design and develop current applications of computational biology

**Unit 1: Introduction**

Molecular Biology Introduction, Cell, Nucleus, Genes, DNA, RNA, Proteins, And Chemical structure of DNA, RNA, Transcription and Translation Process. Protein Structure and Functions, Nature of Chemical Bonds Molecular Biology tools, Polymerase chain reaction

**Unit 2: Sequence Alignment**

Simple alignments, Gaps, Scoring Matrices, Global and Local Alignments, Smith-Waterman Algorithm, Multiple sequence Alignments, Gene Prediction, Statistical Approaches to Gene Prediction

**Unit 3: Genome Algorithms**

Genome Rearrangements, Sorting by Reversals, Block Alignment and the Four-Russians Speedup, Constructing Alignments in Sub-quadratic Time, Protein Sequencing and Identification, the Peptide Sequencing Problem

**Unit 4: Microarray Data Analysis**

Microarray technology for genome expression study, Image analysis for data extraction, Data analysis for pattern discovery, gene regulatory network analysis
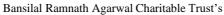
**Term Work**

**Assignments based on above units**

**Text Books**

1. Dan E. Krane, Michael L. Raymer, "Fundamental Concepts of Bioinformatics,", Pearson Education, Inc. Fourth Edition, 9780805346336. •Harshvardhan P. Bal, "Bioinformatics Principles and Applications", Tata McGraw-Hill, seventh reprint, 9780195692303. Reference Books
2. Teresa Attwood, David Parry-Smith, "Introduction to Bioinformatics", Pearson Education Series, 9788180301971

**Reference Books**

1. R. Durbin, S. Eddy, A. Krogh, G. Mitchison., "Biological Sequence Analysis: Probabilistic Models of proteins and nucleic acids", Cambridge University Press9780521629713.,

## Department of Civil Engineering

### Open Elective IV: Software Quality Assurance System (IOEUA42182C)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T): NA<br>Practical (P): 2 hr/week | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**
- To study and understand software testing terminologies and framework
- To study and understand the basics of software testing life cycle
- To study and understand test and defect management
- To study and understand an automation testing
- To study and understand an automation testing tools
- To study and understand automation testing for web application

**Course Outcomes:**

Upon completion of the course, students will be able to
1. Understand complete software testing life cycle and various terms and technologies used in testing domain.
2. Demonstrate understanding of generating test plan and designing test cases.
3. Demonstrate understanding of test and defect management process.
4. Demonstrate understanding of automation testing.
5. Create test script and execute automated tests using Selenium IDE.

**Unit 1: Introduction to Testing**

Why is testing necessary? What is testing? Role of Tester, Testing and Quality, Overview of Software Testing Life Cycle, V model, SDLC vs STLC, different stages in STLC, document templates generated in different phases of STLC, different levels of testing, different types of testing

**Unit 2: Basics of test design techniques**

Static techniques, reviews, walkthroughs, Various test categories, test design techniques for different categories of tests. Designing test cases using MS-Excel.

**Unit 3: Test and Defect Management**

**Test Management:** Documenting test plan and test case, effort estimation, configuration management, project progress management. Use of Testopia for test case documentation and test management. **Defect Management** Test Execution, logging defects, defect lifecycle, fixing / closing defects. Use of Bugzilla for logging and tracing defects.

**Unit 4: Basics of Automation testing**

Introduction to automation testing, why automation, what to automate, tools available for automation testing. Understanding to Selenium, using Selenium IDE for automation testing, using Selenium Web driver for automation testing.

**Term Work**

With intent to get some exposure in the software testing domain, students apply Technical, Behavioral, Process concepts learnt in the course by executing near real-life project and working in teams (project teams will ideally comprise of 4 members)

There will be 3 projects:

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## Department of Civil Engineering

**Project 1:** Use of Testopia for test case management.

The project will consists of test plan, test design for a sample web application and maintaining Requirement Traceability Matrix using the tool

**Project 2:** Use of Bugzilla for defect management.

The project will include execution of tests designed in previous project, identifying, logging and tracing the defect and maintaining the Requirement Traceability Matrix

**Project 3:** Use of Selenium for automation testing.

The project will consists of identifying which tests from project 1 can be automated, then creating script for those tests using tool, executing the tests with the help of tool and generating report for the tests cases.

**Text Books**

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata Mcgraw Hill, ISBN: 9780070139909 0070139903
2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X

**Reference Books**

1. Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
2. Dr. K. V. K. Prasad , "Software Testing Tools", Dreamtech Press ISBN: 10:81-7722-532-4

## Department of Civil Engineering

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### Open Elective IV: Technology and Financial Management (IOEUA42182D)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 4<br>Lecture (L): 2 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hr/week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective(s):**

The rapid strides in competitiveness in global markets, it is felt that successful corporate managers will be those who can take advantage of the growing sophistication of financial markets, cost accounting, management of projects, human resources and quality.

To make mechanical engineers a successful corporate manager in their professional career this course is introduced.

**Course Outcomes:**

Upon completion of the course, students will be able to:

1. Understand the importance of budget and impact of it.
2. Implement various costing techniques.
3. Learn analysis of engineering economics.
4. Implement various Human Resource and quality management techniques

**Unit I - Finance**

Definition and scope of finance; Real & financial assets, Investment Decision, Financing decisions, Dividend decisions and liquidity decisions. Long term financing, Primary & secondary capital markets, Role of merchant banking, Types of shares and debentures. Need, sources and functions - Investment banks, portfolio management, Domestic institutional investors, ADB, IMF, World bank and IMF, Importance of finance Methods of capital budgeting, Production, sales, production cost budget and flexible budget along with the numerical problems related to these budgets.

**Unit II – Costing**

Concept of cost centre and profit centre, Elements of cost with illustrations. Procedure/Methodology, limitations of absorption costing along with numerical problems. Marginal costing concept, CVP analysis along with numerical problems, Applications and limitations of marginal costing. Methodology, Recording cost in contracts, value and profit of contract, Profit of incomplete contracts along with numerical problems. Meaning, stages and flow of costs in ABC, classification of activities, advantages and limitations (No numerical problems) Characteristics, procedures, process costing having no opening and closing WIP along with numerical problems.

**Unit III – Engineering Economic Analysis**

Macro and micro economics differences and price theory. Law of demand and supply, Elasticity of demand, Methods to measure elasticity, Exceptions to the law of demand and assumptions. Utility analysis & indifferent curve analysis, Marshalians law of diminishing marginal utility, Income effect and substitution effect Law of production, Law of variable proportion, Law of return to scale for long term production Monopoly, oligopoly, monopolistic and pure competition & their equilibrium Inflation and its effect on business and economy, types Importance of foreign trade & hedging Balance of payments – exchange rates, Fixed and flexible exchange rates

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**Unit IV -  Human Resource and Quality Management**

Definition of HR and personnel management, significance and the differences. Describe the HR manager's role. Objectives, importance & process of manpower planning. Merit rating methods, need and benefits. Need, importance and methods of training & development. Meaning of retirement and separation, types of separation like VRS, resignation, sacking etc., Meaning and fundamentals of Organizational Behavior (OB), OB models MBO, Process of MBO and benefits.

Characteristics of quality, TQM principles and critical processes, TQM cycle, Deming fourteen points of QM, PCDA, Juran ten steps to quality improvement and trilogy diagram Concept of Kaizen Concept and components of JIT, push and pull system, Kanban, Critical success factors in JIT, Application of JIT and JIT cycle Quality management system, ISO – 9001-2000 series, Objectives, principles and categories ISO 14000 family of standards, Benefits of implementing ISO 14000.

**Term Work**

Case Study on each unit.

**Text Books**

1. Pandey, Financial Management, Tata McGraw-Hill publications, New Delhi. ISBN: 812591658X.
2. A.R. Aryasri, Managerial Economics and Financial Analysis, Tata McGraw-Hill Publications, New Delhi. ISBN: 0070078033

**Reference Books**

1. Prasanna Chandra, Financial Management, Tata McGraw-Hill publications, ISBN:0070656657
2. Jawaharlal, Cost Accounting, Tata McGraw-Hill publications, New Delhi.  ISBN: 0070221626.
3. K. K. Dewett, Modern Economic Theory, S. Chand publications, New Delhi. ISBN: 8121924634.
4. J. Juran, Juran's Quality handbook, McGraw-Hill International. ISBN: 0-07-034003-X.
5. Sahay and Saxena, World Class Manufacturing, McMillan publications, New Delhi. ISBN: 9780333934746.
6. Vohra, Quantitative Techniques in Management, ISBN: 0070611939.
7. C.B. Mamoria, Personnel Management, Himalaya publishing house, ISBN: 8178669951.
   French & Bell, Organizational Behavior, ISBN: 013242231X.

# Vishwakarma Institute of Information Technology, Pune-48
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

## OPEN ELECTIVE – IV
## Non-Destructive Techniques and Engineering Diagnosis (IOEUA42182E)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L):   2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| Tutorial (T):   NA<br>Practical (P):  2 hrs./week | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Prerequisite: Applied Physics, Basic Electronics, Engineering Chemistry**

**Course Objectives:** The course will help students
1. To **understand** basic concepts and need of health monitoring.
2. To **recognize** the purpose of specific non-destructive technique and **interpret** its results for damage evaluation.

**Course Outcomes:**
Upon completion of the course, students will be able to
1. **Understand** and **explain** the need for health monitoring in the field of engineering.
2. **Explain** working principle and applications of transducers under stress.
3. **Demonstrate** use of ultrasonic pulse velocity technique for damage detection.
4. **Demonstrate** use of acoustic emission technique for damage detection.

**Unit I: Concept of Health monitoring**

Basic concepts of health monitoring with regard to structures, machines and electronic components.

**Unit II: Transducers**

Introduction, types of transducers, working principle of transducers, applications of transducers to various fields of engineering.

**Unit III: NDT - Ultrasonic pulse velocity**

Introduction, working principle of ultrasonic pulse velocity technique, application to various fields of engineering.

**Unit IV:NDT- Acoustic Emission**

Introduction, working principle of acoustic emission technique, application to various fields of engineering.

**Term Work:**

1) At least two assignments on each unit
2) Demonstration of NDT for damage detection

**Reference Books:**

1. Ian R. Sinclair, (2001), "Sensors and Transducers", Oxford: Newnes, UK.
2. Christian u. Grosse and Masayasu Ohtsu,(2008) "Acoustic Emission Testing Basics for Research – Applications in Civil Engineering", Le-tex publishing services oHG, Leipzig, Germany.
3. IS13311 (Part1 ):1992 "Non-destructive testing of concrete - methods of test- Part 1 Ultrasonic Pulse Velocity", New Delhi: Bureau of Indian Standards.

## Department of Civil Engineering

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### Open Elective -V: Inferential Statistics for Data Science  (IOEUA42183A)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T):   NA<br>Practical (P): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective:**
- To equip students with the basic understanding of the fundamental concept of data and the nature of data sets
- To understand the fundamentals of probability distributions and their application for data analysis
- To derive the conclusions from the data sets with Bayesian and Inferential statistics

**Course Outcomes:**
Upon completion of the course, students will be able to
1. Comprehend and correlate the nature and central tendency of given data sets using appropriate probability distribution for the given data set.
2. Implement the fundamentals of Bayesian statistics to find out probability of unknown parameters of statistical model
3. Analyze and conclude the hypothesis using inferential statistical tests
4. Evaluate the prominent characteristics of data sets with exploratory data analysis methods

### Unit I: Understanding Data and probability distributions

Understanding Data, Frequency Tables, Distributional Shapes, Central Tendency Describing Spread: Range, Interquartile Ranges and Standard Deviation ,Measuring Data ,Measurements of Central Tendency, Measurements of Dispersion, Bi-variate Data and Covariance ,Pearson Correlation Coefficient, Uniform Distribution, Binomial Distribution, Poisson Distribution, Normal Distribution, Normal Distribution - Formulas and Z Scores

### Unit II: Bayesian Statistics

Likelihood function and maximum likelihood, The minimaxity, Computing the MLE, Computing the MLE: examples ,Continuous version of Bayes' theorem, Priors and prior predictive distributions Prior predictive: binomial example, Posterior predictive distribution, Bernoulli/binomial likelihood with uniform prior, Conjugate priors

### Unit III: Inferential analysis

Central limit theorem and Hypothesis Testing , t-tests, Sensitivity Analysis ,chi square test,  Correlation-values and confidence intervals, Use Analysis of Variance (ANOVA) or Analysis of Covariance (ANCOVA),Regression analysis

### Unit IV: Exploratory Data Analysis

Univar ate data: measures of center and spread, transformations, visualization. – Bivariate data: Simple regression, curve fitting, – Trivariate/Hypervariate data: Multiple regression, model selection, principal components. – Binary responses: Logistic regression, residuals. – Categorical data: Contingency tables, correspondence analysis. – Distance data: Multi-dimensional scaling, non-linear dimensionality reduction. – Graph data: Descriptive statistics, spectral methods, visualization

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## Department of Civil Engineering

| Term Work: |
| --- |
| **1.** Study of Hypothesis testing(One sample t test, z test)<br><br>**2.** Analysis of variance (ANOVA)<br>**3.** To study Linear regression to predict the outcome of a variable<br>4.Study of outlier in Predictive analysis<br>5.Finding the most important predictor variable in a dataset for feature Selection<br>6.Model selection and analysis for a real world dataset<br>7.Study of Logistic Regression<br>8.To build an application: Time series forecasting |

| Textbooks: |
| --- |
| 1.Sahu, Pradip Kumar, Pal, SantiRanjan, Das, Ajit Kumar, "Estimation and Inferential Statistics", Springer<br> 2 S.C. Gupta and V. K. Kapoor : Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 88, Daryaganj, New Delhi, 2.<br>3.Manoj Kumar Srivastava, Abdul Hamid Khan, Namrata Srivastava, "Statistical Inference, Theory of estimation", PHI |

| Reference Books: |
| --- |
| 1. George Casella, Roger Berger," Statistical Inference ",CENGAGE Learning, Second Edition<br>2. Malcom O, Asadoorian, Demetri Kantarelis, "Essentials of Inferential Statistics", University Press of America |

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

| Open Elective -V: E-Commerce (IOEUA42183B) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | | | | | | |
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T):   NA<br>Practical (P): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective:**

- Demonstrate an understanding of the foundations and importance of E-commerce
- Understand the impact of Information and Communication technologies, especially of the Internet in business operations
- Comprehend risk, legal issues and privacy in E-Commerce and Assess electronic payment systems
- Analyze the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders
- Evaluate the opportunities and potential to apply and synthesize a variety of ECommerce concepts and solutions to create business value for organizations, customers, and business partners

**Course Outcomes:**

Upon completion of the course, students will be able to

1. Demonstrate an understanding of the foundations and importance of E-commerce
2. Understand the impact of Information and Communication technologies, especially of the Internet in business operations
3. Comprehend risk, legal issues and privacy in E-Commerce and Assess electronic payment systems
4. Analyze the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders
5. Evaluate the opportunities and potential to apply and synthesize a variety of ECommerce concepts and solutions to create business value for organizations, customers, and business partners

**Unit I: Introduction**

E-Commerce: meaning advantages & disadvantages, incentives for engaging in electronic commerce, impact of e-commerce on business and e business, electronic commerce framework, types of e-commerce, web background

**Unit II: Risk and Legal Issues in E-Commerce**

Risks and barriers in the adoption of e-business environment, the impact of ICT in contemporary business operations, entrepreneurial development in e commerce, cloud computing and e Commerce, e-commerce in India – laws for e-commerce in India, cryptocurrency and e commerce

**Unit III: Ethical and Social and Political issues related to Electronic Commerce**

Protecting privacy, protecting Intellectual property, copyright, trademarks and patents, taxation, and encryption policies

**Unit IV: E-Commerce Business Models**

Key element of a business model, major B2C business models, major B2B business models, business models in emerging e-commerce areas E-Government: issues in e-governance applications, benefits, and reasons for the introduction of e- governance, e-governance models

## Department of Civil Engineering

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**Term Work:**

1. Study of different e Commerce Platform e.g. Prestashop, WooCommerce, Kickstart, OpenCart or any other. Installation of any one EC platform (Any one you want)
2. Adding categories, product and product details, attributes, tags to the e commerce development tool you have chosen in activity 1.
3. Adding header, footer, slider and any other design as per your project to the e commerce development tool you have chosen in activity
4. Adding theme and various module management to the e commerce development tool you have chosen from activity 1
5. Restoring DB, payment taxes promotion discount to the e commerce development tool you have chosen from activity 1
6. Adding order management to the e commerce development tool you have chosen from activity 1

**Textbooks:**

1. Kenneth C Lauden, Carol G. Traver, "E-Commerce", Perason Education, ISBN 97881317812
2. Doing Business on the Internet E-COMMERCE (Electronic Commerce for Business): S. Jaiswal, Galgotia Publications, ISBN 9788175153059
3. E-Business, Bookseller Code (AG) OXFORD, 1st edition ParagKulkarni, Sunita Jainabadkar & Pradip Chande, ISBN 9780198069843

**Reference Books:**

1. P. T. Josef, "Electronic Commerce- A managerial perspective" Prentice-Hall International, ISBN 8120320891
2. Kamlesh K. Bajaj, Debjani Nag, "Electronic Commerce: The cutting edge of business", Tata McGraw-Hill Publishing Co. Ltd, 2000, ISBN 9780070585560
3. Jeffrey F. Rayport, Bernard J. Jaworski, "e-Commerce", Tata McGraw Hill, 2002, ISBN 9780072510249
4. Pete Loshin, Paul A. Murphy, "Electronic Commerce", Jaico Publishing House, 2000, ISBN 9788172246662
5. Ravi Kalakota, Andrew B. Whinston, "Frontiers of Electronic Commerce", Addison Wesley,2002, ISBN 0201845202

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## Department of Civil Engineering

### Open Elective – V: Rural Technology (IOEUA42183C)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective:**
- Understand theories and practices in the rural development model.
- Learn and analyze rural life and rural economy.
- Understand different measures and technologies used in rural development.
- Participate in visits and case studies for better understanding for rural development and its impact on overall economy

**Course Outcomes:**

Upon completion of the course, students will be able to:

1. Understand rural development model
2. Learn different measures in rural development and its impact on overall economy
3. Understand and learn importance of technologies in rural and community development
4. Understand challenges and opportunities in rural development

**Unit I: INTRODUCTION TO RURAL DEVELOPMENT**

Concepts and connotations, Basic Elements, Growth Vs. Development, Why rural development, Rising expectations and development, Development and Change, Human beings as cause and consequences of development.

**RURAL ECONOMY OF INDIA** - Introduction, size and structure, The characteristics of rural sector, The role of agricultural sub-sector, The role of non-agricultural sub-sector, Challenges and opportunities.

**Unit II: RURAL DEVELOPMENT – MEASURES AND PARADIGMS**

**Measures Of Development** - Introduction, Measures of level of rural development, Measures of income distribution, Measures of development simplified, Concepts and measures of rural poverty

**Paradigms Of Rural Development** - Introduction, The modernization theory, The dependency theory of Marxist School, Rosenstein- Rodan's theory of 'Big Push', Lewis' model of economic development,The human capital model of development, The Gandhian Concept of Rural Development theories from other social sciences.

**Unit III: TECHNOLOGIES FOR RURAL DEVELOPMENT**

**Using Water Resources -** Water quality testing, Water filtering ,Extraction from Groundwater ,Pumps Rope and washer pump ,Manuel pumps, Treadle pump, Irrigation for agriculture, Channel systems, Sprinkler systems, Drip systems Water diversion ,Water storage

**Building Infrastructures, Creating Energy** - Basic energy uses , Energy Sources - Firewood, Solar Energy, Hydroelectricity, Hydromechanical, Wind Energy, Energy Storage,Connecting to the Electrical Network, Environmental Considerations

### Unit IV: COMMUNITY DEVELOPMENT – RURAL ENTREPRENEURSHIP

**-** Introduction, Service Learning and community development, Theory and practice of community development, Community development issues. The diverse meaning of community development, The knowledge base of community development, International community development,
Different forms of Rural Entrepreneurship, Significance , Business planning for a new venture: the concept of planning paradigm, Forms of business enterprises-Sole proprietorship, partnership and corporations, Product and Process development, Marketing analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises

**Term Work:**

**Case Studies and Field Visit :**

1. **Use of ICT in Rural and agricultural development** - Education, Healthcare, Agriculture, Business, Resource Mapping, Digital and Social Media Marketing
2. **Decision Support Systems for soil conservation and farm management**
3. **Waste Management and Sanitation**
4. **Water management :** Watershed Management - Water-Cup Competition by Paani Foundation,Community Safe Water Solutions
5. **Energy resources**
6. **Role of Micro-Finance institutions in rural development:** Visit to a 'Woman Self help group' nearby and study of its functioning and its role in development.
7. **Visit to model villages in nearby region -** Ralegan-Siddhi, Dist - Ahemadnagar, Hiware BazarDist - Ahemadnagar, Tikekarwadi - Dist. - Pune, Buchekarwadi Dist- Pune etc.

**Textbooks:**

1. "Rural Development: Principles, Policies and Management" - Katar Singh , Sage Publications
2. "Introduction to Community Development - Theory, Practice and Service Learning", Edited by J W Robinson, Sage Publications
3. G. N. Tiwari, Solar Energy: Fundamentals, Design, Modeling and Applications, Narosa, 2002.
4. "Fundamentals of Entrepreneurship", H. Nandan, Third Edition, PHL Learning Pvt. Ltd.,
5. "Monetary Economics-Institutions, Theory and Policy" , First Edition, S B Gupta, S Chand Publications, ISBN – 9788121904346

**Reference Books:**

1. KURUKSHETRA" - A Journal on Rural Development
2. "Energy conversion" , R. Y. Goswami, Frank Kreith, CRC Press, 2007.
3. "Solar Energy: Fundamental and Application" , H. P. Garg and S. Prakash,Tata McGraw Hill, 1997.
4. "Technologies for Sustainable Rural Development: Having Potential of Socio Economic Upliftment" , TSRD 2014 , edited by Jai Prakash Shukla, Allied Publishers Pvt. Ltd.

# Vishwakarma Institute of Information Technology, Pune-48

## Department of Civil Engineering

| Open Elective – V: Product Design Engineering (IOEUA42183D) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Teaching Scheme** | **Examination Scheme** | | | | | | |
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T): NA<br>Practical (P): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective:**
- To understand basic techniques for particular phases of product development.
- To understand basic Customer needs, satisfaction and commercialization of product.
- To understand Forward and Reverse Engineering and its role in designing a product

**Course Outcomes:**

Upon completion of the course, students will be able to:

1. Describe an engineering design and development process.
2. Design product as per customer needs and satisfaction.
3. Apply engineering, scientific, and mathematical principles to execute a design from concept to finished product.
4. Analyze methods and processes of Forward and Reverse engineering and methods of Design for manufacturing and analysis.

**Unit I : Introduction to Product Design**

Definition of product design, Essential Factors for product design, Modern approaches to product design, Characteristics of Successful Product Development, Innovative Thinking, Challenges to Product Development, product development versus product design. Customer Needs and Satisfaction.

**Unit II: Product Development Process**

Product development process- Identification of customer needs- customer requirements, product development process flows, Product specifications, concept development and concept generation, concept selection, concept screening, concept scoring, concept testing.

**Unit III: Reverse Engineering**

Introduction of reverse engineering, Product Teardown Process, Tear Down Methods, Force Flow Diagrams, Measurement and Experimentation, Applications of Product Teardown, Benchmarking Approach and Detailed Procedure, Tools Used in Benchmarking, Indented Assembly Cost Analysis, Function –Form Diagrams, Trend Analysis, Setting Product Specifications, Introduction to Product Portfolio and Product Architecture.

**Unit IV: Design for X**

Design for manufacture, Design for assembly, Design for robustness, Design for safety, Design for reliability, Design for environment, Design for piece part production, manufacturing cost analysis. Local, Regional and Global issues, basic life cycle assessment - basic method, Design Failure mode effect analysis.

**Term Work:**

1) Design of concept of Innovative product.
2) Development of concept of Innovative product using any modelling software.
3) Development of standard process for gathering customer needs related to new product.
4) Prepare product development process flows for new innovative product.
5) Application of reverse engineering technique using benchmarking of product.
6) Application for design for manufacturing and assembly.

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**Textbooks:**

1. Product Design-Techniques in Reverse Engineering and New Product Development, Kevin Otto, Kristion Wood, Pearson Education, ISBN 978-81-7758-821-7.
2. Karl T.U. And Steven D.E., Product Design and Development, McGraw Hill, Ed 2000
3. K. Chitale; R.C. Gupta, Product Design and Manufacturing, Prentice Hall India.

**Reference Books:**

1. Dieter George E., Engineering Design McGraw Hill Pub. Company, 2000
2. Grieves, Michael, Product Lifecycle Management McGraw Hill
3. Bralla, James G., Handbook of Product Design for Manufacturing, McGraw Hill Pub

# Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

## Department of Civil Engineering

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### Open Elective – V : Numerical Methods (IOEUA42183E)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 3<br>Lecture (L): 2 hrs./week<br>Tutorial (T):   NA<br>Practical (P): 2 hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | 20 | 30 | 20 | 30 | - | 25 | 125 |

**Course Objective:**
- To prepare the students to apply numerical methods to solve differential equations, integrations and simultaneous equations and perform regression analysis.

**Course Outcomes:**
Upon completion of the course, students will be able to
1. Apply curve fitting techniques; carry out regression and interpolation analysis of any engineering problem.
2. Solve simultaneous equations using numerical technique.
3. Perform numerical integration for any engineering problem.
4. Solve differential equation of any engineering problem using numerical technique.

**Unit I: Curve Fitting, Regression and Interpolation**

Curve fitting with Linear Equation, Criteria for a Best Fit, Linear Least Square Regression,
Linear Regression Analysis, Coefficient of Determination, Polynomial Regression, Multiple Linear Regression, Lagrange's Interpolation, Newton's Forward Interpolation, Hermit Interpolation, Inverse Interpolation

**Unit II: Simultaneous Equations**

Gauss Elimination Method, Partial Pivoting, Gauss Seidel Method, Gauss Jordan Method and Thomas Algorithms for Tridiagonal Matrix.

**Unit III: Numerical Integration**

Trapezoidal rule, Simpson's Rule (1/3$^{rd}$ and 3/8$^{th}$ ), Gauss Quadrature2 point and 3 point method, Double Integration- Trapezoidal Rule, Simpson's 1/3$^{rd}$ Rule

**Unit IV: Numerical Solution of Differential Equations**

Euler Method, Modified Euler Method (Iterative), Runga-Kutta Fourth Order Method, Simultaneous Equations using Runga-Kutta Second Order Method, Introduction to Finite Difference  Method.

**Term Work:**

Students are required to submit at least two assignments on each unit.

**Textbooks:**

1.  Rao V. Dukkipati, (2011), "Numerical methods", New Age International Publishers
2. S. S. Sastry, (2012), "Introductory Methods of Numerical Analysis", PHI Learning Private Limited.

**Reference Books:**

1.  Jaan Kiusalaas, (2013), "Numerical Methods in Engineering with Python 3", Cambridge University Press
2.  S. BalachandraRao and C.K.Shantha (2004), "Numerical Methods", University Press

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## Department of Civil Engineering

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### Introduction to Research (CVUA42184)

| Teaching Scheme | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|
| Credits: 2<br>Lectures: 1 Hr/week<br>Tutorial(T): NA<br>Practical(P): 2 Hrs./week | CIE | ISE | SCE | ESE | PR/OR | TW | Total |
| | - | - | - | - | - | 25 | 25 |

**Course Objectives:**
1. To introduce to the concept of research and research problem
2. To understand research ethics
3. Get introduced to the concept of Intellectual property rights.
4. To understand the basics of writing a research proposal

**Course Outcomes:**
Upon completion of this course, students will be able to –
1. Define research and formulate a research problem
2. Discuss the importance of Research Design and Literature Review
3. Discuss classification of data and preliminary data analysis
4. Write a research proposal to a suitable funding agency

**Unit I: Introduction to Research and Research problem**

Meaning of research, types of research, process of research, Objectives of research, Research and Scientific Method, Sources of research problem, Criteria / Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, defining a research problem (Real life example or case study), formulation of research hypotheses, Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis

**Unit II:  Research Design and Literature review**

Research Design- Concept and Importance in Research, different research designs in research studies, Literature survey- Definition of literature and literature survey, need of literature survey, elements and objectives of literature survey, sources of literature-monographs-patents – web as a source, Critical literature review – Identifying gap areas from literature review and strategies of literature survey, Errors in research.

**Unit III: Data and Data Analysis**

Data: Classification of data, methods of data collection, types of data analysis, Sampling, sample size, sample design, Processing and Analysis of Data - Statistics in Research –Min-Max, Standard Deviation, Measures of Central Tendency -Measures of Dispersion -Measures of Asymmetry (Skewness) – Error Analysis. Hypothesis and Testing of hypothesis: Parametric and Non parametric testing of Hypothesis, Regression Analysis – Simple Linear Regression, Multiple linear Regression

**Unit IV: Report, Research proposal and funding agencies**

Need of effective documentation, types of reports and their format. Essentials of a research proposal. Different funding agencies for research. Research briefing, presentation styles, elements of effective presentation, writing of research paper, presenting and publishing paper, ethical issues, Plagrisim

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Term Work:
1. Discuss a Problem and state the same.
2. Design a Design Process for the Problem
3. Discuss the Literature Review for the problem stated in 1
4. Collect data from for the above problem and discuss its sample size
5. Processing and Analysis of Data
6. Discuss parametric and Non-Parametric testing of Hypothesis
7. Write a Proposal to a funding agency

**Text books:**
1. Kothari,C.R. (1990)," Research Methodology: Methods and Trends", New Age International Publishers, Mumbai.
2. Goddard W. and Melville, S. (2004), "Research Methodology: An Introduction", Juta and Company Ltd, 2004, Cape Town.
3. Kumar, R.(2011)," Research Methodology: A Step-by-Step Guide for Beginners', Sage Publications (CA), New Delhi.

**Reference Books:**
1. Chawla D. and Sondhi,N. (2016), "Research Methodology: concepts and cases", Vikas Publishing House Pvt. Ltd. New Delhi
2. Cohen, L. and Morrison M. (2007)," Research Methods in Education", Routledge(Taylor & Francis Group) /Cambridge University Press India Pvt. Ltd, London.