



गोंय विद्यापीठ

ताळगांव पठार

गोंय - ४०३ २०६

फोन: +९१-८६६९६०९०४८



(Accredited by NAAC)

**Goa University**

Taleigao Plateau, Goa - 403 206

Tel : +91-8669609048

Email : registrar@unigoa.ac.in

Website: www.unigoa.ac.in

GU/Acad-PG/BoS-ENGG-Minor/2023/764

Date:16/02/2023

## CIRCULAR

The Scheme of Instruction and Examination along with the Syllabus for the Honours/ Minor Degree Programme in the various branches of Engineering recommended by the Boards of Studies and approved by the Academic Council is attached.

The Scheme is open to all Engineering/ Technology Undergraduates who have registered for the B.E. Programme under RC 2019-20, for the academic year 2021-22 onwards.

- Students shall be eligible to register for the Honours/Minor Programme at the beginning of Semester IV provided s/he has acquired a minimum of 6.5 CGPA at the end of Semester II.
- Students who have been admitted in the 2<sup>nd</sup> year on completion of a Diploma/B.Sc, with an aggregate of 60% or equivalent Grade Point in the final year (excluding marks obtained in Training) shall be eligible to register for the Honours/Minor Programme.

The Dean, Faculty of Engineering and the Principals of Affiliated Colleges offering Bachelor of Engineering Programmes are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

Digitally signed by  
DONALD AGNELO  
ERASMO RODRIGUES  
Date: 2023.02.16  
12:59:11 +05'30

**(Donald A. E. Rodrigues)**  
**Joint Registrar – Academic**

To,

1. The Dean, Faculty of Engineering, Goa University.
- 2.. The Principals of Affiliated Colleges offering the Bachelor of Engineering Programme.

Copy to:

1. The Chairperson, All the Boards of Studies in Engineering.
2. The Controller of Examinations, Goa University.
3. The Assistant Registrar, Professional Examinations, Goa University.
4. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.
5. The Director, Directorate of Technical Education, Government of Goa.

# HONOURS/MINOR DEGREE CERTIFICATION SCHEME

## I N D E X

| Sr. No. | Engineering Branch                                                                          | Minor/ Honours (Specialization) Subject                             | Page No.  |
|---------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-----------|
| 1       | Electronics and Computer Engineering/<br>Electronics and Computer Science Engineering       | <a href="#"><u>Robotics and Artificial Intelligence</u></a>         | 3 – 8     |
| 2       | Mechanical Engineering                                                                      | <a href="#"><u>Energy</u></a>                                       | 9 – 19    |
|         |                                                                                             | <a href="#"><u>Smart Manufacturing</u></a>                          | 20 – 32   |
| 3       | Civil Engineering                                                                           | <a href="#"><u>Lean Construction Technology</u></a>                 | 33 – 42   |
|         |                                                                                             | <a href="#"><u>Construction Management</u></a>                      | 43 – 52   |
| 4       | Computer Engineering                                                                        | <a href="#"><u>Artificial Intelligence and Machine Learning</u></a> | 53 – 69   |
| 5       | Electrical & Electronics Engineering                                                        | <a href="#"><u>Electric</u></a>                                     | 70 – 81   |
| 6       | Electronics and Telecommunication Engineering/<br>Electronics and Communication Engineering | <a href="#"><u>Internet of Things</u></a>                           | 82 – 96   |
| 7       | Information Technology                                                                      | <a href="#"><u>Advanced Web Development</u></a>                     | 97 – 106  |
|         |                                                                                             | <a href="#"><u>Data Science</u></a>                                 | 107 - 117 |

**Engineering Branch: Civil Engineering****Minor/ Honours (Specialization) Subject: Construction Management****SCHEME OF INSTRUCTION AND EXAMINATION**

| Course Code  | Semester | Nomenclature of the Course                           | Scheme of Instruction Hrs/Week |          |          | Scheme of Examination |            |            |           |           |            |           |
|--------------|----------|------------------------------------------------------|--------------------------------|----------|----------|-----------------------|------------|------------|-----------|-----------|------------|-----------|
|              |          |                                                      | L                              | T        | P        | Duration (Hrs)        | Marks      |            |           |           |            | Credits   |
|              |          |                                                      |                                |          |          |                       | TH         | IA         | TW        | O         | Total      |           |
| CM-01        | IV       | Construction Economics, Finance and Budgeting        | 3                              | 1        | 2        | 3                     | 100        | 25         | 25        | 25        | 175        | 5         |
| CM-02        | V        | Construction Contracts Management and Specifications | 3                              | 0        | 2        | 3                     | 100        | 25         | 25        | -         | 150        | 4         |
| CM-03        | VI       | Corporate Laws and Arbitration                       | 3                              | 0        | -        | 3                     | 100        | 25         | -         | -         | 125        | 3         |
| CM-04        | VII      | Quality & Safety Management in Construction          | 3                              | 0        | -        | 3                     | 100        | 25         | -         | -         | 125        | 3         |
| CM-05        | VIII     | Infrastructure Planning and Management               | 3                              | 1        | 2        | 3                     | 100        | 25         | 25        | 25        | 175        | 5         |
| <b>TOTAL</b> |          |                                                      | <b>15</b>                      | <b>2</b> | <b>6</b> | <b>-</b>              | <b>500</b> | <b>125</b> | <b>75</b> | <b>50</b> | <b>750</b> | <b>20</b> |

**L-Lecture, T-Tutorial, P-Practical, O-Oral, Th-Theory, TW-Term Work, IA-Internal Assessment**

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| <b>Construction Economics, Finance and Budgeting</b> |              |           |                |              |          |
|------------------------------------------------------|--------------|-----------|----------------|--------------|----------|
| <b>Course Code</b>                                   | <b>CM-01</b> |           | <b>Credits</b> | <b>5</b>     |          |
| <b>Scheme of Instruction<br/>Hours/ Week</b>         | <b>L</b>     | <b>T</b>  | <b>P</b>       | <b>Total</b> |          |
|                                                      | 3            | 1         | 2              | 42 hrs/sem   |          |
| <b>Scheme of Examination<br/>TOTAL = 175 marks</b>   | <b>IA</b>    | <b>TW</b> | <b>TH</b>      | <b>P</b>     | <b>O</b> |
|                                                      | 25           | 25        | 100            | -            | 25       |

**Course Objective:**

|   |                                               |
|---|-----------------------------------------------|
| • | To understand concept of financial management |
| • | To understand the time value of money         |
| • | To understand the importance of budgeting     |

**Course Outcomes:** After completion of course, students would be able to:

|     |                                                                                        |
|-----|----------------------------------------------------------------------------------------|
| CO1 | Prepare income, profit and loss statements and implement construction accounting       |
| CO2 | Evaluate construction project economics, cost-benefit analysis and breakeven analysis. |
| CO3 | Analyse and evaluate construction risks and uncertainties.                             |
| CO4 | Understand the importance of working capital management, budgeting and control.        |

**Course Contents:**

|                                                                                                                                                                                                                                 | <b>Lectures</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Total Theory Duration:</b>                                                                                                                                                                                                   | <b>42</b>       |
| <b>Unit 1</b>                                                                                                                                                                                                                   |                 |
| <b>Financial Management:</b> Meaning and Scope, Economics and Scope, Supply and Demand Mechanism, analysis and forecasting. Balance sheet, profit & loss account, fund flow statement.                                          | <b>10</b>       |
| <b>Unit 2</b>                                                                                                                                                                                                                   |                 |
| Production and Cost theory, analysis. Pricing; objectives, determinants, absorption, marginal costing. Financial analysis, Decisions. Capital Budgeting, budgetary control, standard costing and variance, investment appraisal | <b>10</b>       |
| <b>Unit 3</b>                                                                                                                                                                                                                   |                 |
| Engineering economics, Time value of money, discounted cash flow, NPV, ROR, Bases of comparison, Incremental analysis, Benefit-Cost analysis, Replacement analysis, Break-even analysis.                                        | <b>10</b>       |
| <b>Unit 4</b>                                                                                                                                                                                                                   |                 |
| <b>Construction Finance:</b> Accounting information and application, project appraisal. Project yield, risk and uncertainty, Turnkey activities; finance and working capital, cost control, equipment rentals.                  | <b>12</b>       |

**Lab Work (Any 5):**

|    |                                                               |
|----|---------------------------------------------------------------|
| 1. | Prepare a balance sheet for a construction firm.              |
| 2. | Prepare a fund flow statement for a construction firm.        |
| 3. | Prepare a budget for a construction project.                  |
| 4. | Case study on Cost Benefit analysis in construction Projects. |
| 5. | Case study on Break-even Analysis in Construction Projects.   |
| 6. | Working out of Equipment rentals in construction Projects     |

| <b>Text Books</b> |                                                                                                                 |
|-------------------|-----------------------------------------------------------------------------------------------------------------|
| 1.                | Myers, D.; Construction Economics: A New Approach, Taylor and Francis Publisher, 2004.                          |
| 2.                | Ofori, G.; The Construction Industry Aspects of its economics and Management, Singapore University Press, 1990. |
| 3.                | Parkin, M., Bade, R.; Modern Macroeconomics, 4 <sup>th</sup> Edition, Prentice Hall, 1996                       |

| <b>Reference books</b> |                                                                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| 4.                     | de Valence, G.; Modern Construction Economics-Theory and Application, 1 <sup>st</sup> Ed., Routledge, Taylor Francis Group, 2011. |
| 5.                     | Chandra, P.; Financial Management: Theory and Practice; 10 <sup>th</sup> Ed., McGraw Hill Education, New Delhi, 2017.             |
| 6.                     | Panneerselvam, R.; Engineering Economics, PHI Learning Pvt. Ltd., 2012.                                                           |

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| Construction Contracts and Specifications  |                                                                                                       |    |         |            |   |
|--------------------------------------------|-------------------------------------------------------------------------------------------------------|----|---------|------------|---|
| Course Code                                | CM-02                                                                                                 |    | Credits | 4          |   |
| Scheme of Instruction<br>Hours/ Week       | L                                                                                                     | T  | P       | Total      |   |
|                                            | 3                                                                                                     | 0  | 2       | 42 hrs/sem |   |
| Scheme of Examination<br>TOTAL = 175 marks | IA                                                                                                    | TW | TH      | P          | O |
|                                            | 25                                                                                                    | 25 | 100     | -          | - |
| <b>Course Objective:</b>                   |                                                                                                       |    |         |            |   |
| •                                          | To understand basics of contracts and the acts related to contracts                                   |    |         |            |   |
| •                                          | To understand EPC and other contracts                                                                 |    |         |            |   |
| •                                          | To understand the drafting of specification                                                           |    |         |            |   |
| •                                          | To understand different types of contracts MES, CPWD, FIDIC, EPC, PPP.                                |    |         |            |   |
| •                                          | To understand different provisions of contracts: Scope, GCC, SCC, Specifications, Drawings, Site-data |    |         |            |   |

|                                                                                |                                                                               |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Course Outcomes:</b> After completion of course, students would be able to: |                                                                               |
| CO1                                                                            | Understand basics on construction contracts.                                  |
| CO2                                                                            | Carry out the tendering process.                                              |
| CO3                                                                            | Draft the specifications and relating them to the site conditions & estimates |
| CO4                                                                            | Create awareness about RERA                                                   |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Course Contents:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Lectures</b> |
| <b>Total Theory Duration:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>42</b>       |
| <b>Unit 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |
| <b>Construction Contracts Overview:</b> a) Indian Contract Act (1872): Definition of the contract as per the ACT. Valid, Voidable, Void contracts, Objectives of the act.<br>b) Brief introduction to Clauses of Contract - its performance and valid reasons for non-performance. Breach of contract, effects of breach- understanding the clauses and applying them to situations/scenarios on construction projects. Importance of the Workmen's Compensation Act on construction projects.                                         | <b>10</b>       |
| <b>Unit 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |
| <b>Overview of Contract Formation:</b> a) Standard forms of contracts, methods of inviting tenders, pre-bid meetings, pre-qualification system, scrutiny of tenders and comparative statement.<br>b) conditions of contracts, contracts with various stakeholders on a major construction project, contract pricing by the client, project management consultants and the contractor, contract correspondence and contract closure.                                                                                                    | <b>10</b>       |
| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |
| <b>Overview of Contract Conditions:</b> a) General, Special and Particular conditions<br>b) Conditions of Ministry of Statistics and Program Implementation- Government of India. Model forms of contract.<br>c) Standard Forms of Contracts in MES, CPWD, NHAI (EPC contract). Design Build (Own) Operate and Transfer contract.<br>d) FIDIC Form of Contracts: Introduction, FIDIC conditions- evolution of FIDIC document, types based on whether design is of employer or contractor, Colour Code. Various conditions of Red Book. | <b>12</b>       |
| <b>Unit 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |

|                                                                                                                                                                                                                                                                                                                                                     |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Specifications for building works:</b> Preparation of specifications, types, organisation of specifications, examples of wordings, planning specification for workmanship and material discretionary powers of engineer, specification of special items.<br>RERA: Establishment and incorporation of RERA, offences, penalties and Adjudication. | <b>10</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|

| <b>Lab Work:</b> |                                                                                                                                  | <b>28 hrs.</b> |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1.               | Drafting of tender notice and report on detailed procedure of tendering including filling procedure by taking one sample tender. |                |
| 2.               | Drafting of Contract document as per CPWD guidelines for any construction project                                                |                |
| 3.               | Drafting of Contract document as per FIDIC for any construction project                                                          |                |
| 4.               | Drafting of specifications for any two items of major building works.                                                            |                |
| 5.               | Study of legal & technical interpretation of contract clauses.                                                                   |                |

| <b>Text Books</b> |                                                                                                                   |
|-------------------|-------------------------------------------------------------------------------------------------------------------|
| 1.                | Patil, B. S. ; Civil Engineering Contracts and Estimates, Universities Press, 2009.                               |
| 2.                | The Indian Contract Act (9 of 1872), 1872- Bare Act, Professional Book Publishers, 2006.                          |
| 3.                | Bangia, R.K.; Law of contract Part I and Part II, Allahabad Law Agency, 2005.                                     |
| 4.                | Markanda, P.C.; Building and Engineering Contracts: Law and Practice, 5 <sup>th</sup> Edition, Lexis Nexis, 2017. |

| <b>Reference books</b> |                                                                                                                                                                |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.                     | Bureau of Indian Standard Specifications: Relevant specifications                                                                                              |
| 6.                     | Latest Goa Schedule of Rates                                                                                                                                   |
| 7.                     | RERA User Manual, Govt. of India                                                                                                                               |
| 8.                     | The Workmen's Compensation Act, 1923 (8 of 1923) Bare Act- 2005- Professional Book Publishers.                                                                 |
| 9.                     | Standard General Conditions for Domestic Contracts, Ministry Of Statistics and Program Implementation, Government of India, 2005.                              |
| 10.                    | Bockrath, J., Plotnick, F.; Contracts and Legal Environment for Engineers and Architects, 7 <sup>th</sup> Edition, Mc Graw Hill Education (India) Private Ltd. |
| 11.                    | Contract Labour & Minimum Wages Act.                                                                                                                           |
| 12.                    | CPWD: Publications: Specifications, Analysis of Rates, Forms of Contracts, Works Manual & SOP.                                                                 |

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| Corporate Laws and Arbitration       |       |    |         |            |   |
|--------------------------------------|-------|----|---------|------------|---|
| Course Code                          | CM-03 |    | Credits | 3          |   |
| Scheme of Instruction<br>Hours/ Week | L     | T  | P       | Total      |   |
|                                      | 3     | 0  | -       | 42 hrs/sem |   |
| Scheme of Examination                | IA    | TW | TH      | P          | O |
| TOTAL = 125 marks                    | 25    | -  | 100     | -          | - |

| Course Objective: |                                                                                                                                     |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| •                 | To understand the basics and importance of corporate laws.                                                                          |
| •                 | To introduce fundamental aspects of Intellectual Property Rights and to disseminate knowledge on patents, trademarks and copyrights |
| •                 | To provide necessary solution to settle the disputes between people.                                                                |
| •                 | To understand concept of disputes and methods of resolving them                                                                     |
| •                 | To ensure that the rules are laid down for international as well as domestic arbitration and conciliation.                          |

| Course Outcomes: After completion of course, students would be able to: |                                                                                                                                                                                                              |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                     | Understand the key characteristics of Corporate Social Responsibility (CSR), company law and the partnership act                                                                                             |
| CO2                                                                     | Comprehend IPR, patent, trademark and copyright law                                                                                                                                                          |
| CO3                                                                     | Identify techno-legal-commercial linkages in contracts and draft contract clauses related to dispute resolution methods including expert determination, mediation / conciliation, arbitration and litigation |
| CO4                                                                     | Acknowledge the significance of consumer, competition law and MSMED Act                                                                                                                                      |

| Course Contents:                                                                                                                                                                                                                                                                                                                                                                                                                              |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                               | Lectures  |
| <b>Total Theory Duration:</b>                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>42</b> |
| <b>Unit 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |
| <b>Corporate Social Responsibility:</b> Introduction to CSR- Concept of Corporate Social Responsibilities- Government Initiatives and CSR- Business Ethics- Corporate Governance<br><b>Company Law and The Partnership Act:</b> Introduction- Procedure for Incorporation of Companies- Indian Partnership Act 1932- Rights and Duties of Partners- Relation of Partners to Third Parties- Dissolution of a Firm.                             | <b>10</b> |
| <b>Unit 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |
| <b>Intellectual Property Rights and Patent Law:</b> Concept and importance of Intellectual Property - Need, Development and Essentials of Patent Law, Procedures for Grant of Patent Application- Drafting of Patent Specifications.<br><b>Trademark and Copyright Law:</b> Introduction to Trademark Law- The Trademark Act 1999- Introduction to Copyright Law- The Norms of International Copyrights- Indian Copyright Act 1957 and Rules. | <b>12</b> |
| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |
| <b>Alternative Dispute Resolution:</b> Methods - pros and cons over litigation.<br><b>Amicably resolving the disputes:</b> Expert determination, mediation / conciliation and relevant laws.<br>The Arbitration and Conciliation Act 1996. History of Law of Arbitration and process of evolution of Act 1996 and amendments till date. Introduction to UNCITRAL 1996 and its                                                                 | <b>10</b> |

|                                                                                                                                                                                                                                                                                                             |           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| importance. Arbitration- Important aspects of process of Arbitration leading to Award and subsequent scenario.                                                                                                                                                                                              |           |
| <b>Unit 4</b>                                                                                                                                                                                                                                                                                               |           |
| <b>Consumer Protection and Competition Policy/Act:</b> Introduction and Overview of Competition Act 2002- Important terms and its interpretation- The Consumer Protection Act 1996<br><b>Micro, Small and Medium Enterprises Development Act:</b> Objectives, Necessity and Significance of MSMED Act 2006. | <b>10</b> |

| <b>Text Books</b> |                                                                                                                                                                                                                              |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                | William, B., Werther Jr., Chandler, D.; Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, 2 <sup>nd</sup> Edition, Sage Publications, 2011.                                                   |
| 2.                | Cornish, L., Aplin, Intellectual Property: Patents, Copyrights, Trademarks & Allied Rights, Sweet and Maxwell, 8 <sup>th</sup> Edition, 2013.                                                                                |
| 3.                | Reddy,- G. B., Intellectual Property Rights and The Law (Copyright Law, Patent Law, Designs Law, Trademarks Law, Farmers Rights Law, Biological Diversity Law, Information Technology Law, etc. - Comprehensive Book), 2020. |
| 4.                | Singh, A.; Introduction to Law of Partnership Including Limited Liability Partnership, 2019.                                                                                                                                 |
| 5.                | Markanda, P.C.; Arbitration: Step by step, 2 <sup>nd</sup> Edition, LexisNexis, 2017.                                                                                                                                        |

| <b>Reference books</b> |                                                                                                                      |
|------------------------|----------------------------------------------------------------------------------------------------------------------|
| 6.                     | Chakraborty, A.; Law & Practice of Alternative Dispute Resolution in India – A Detailed Analysis, Lexis Nexis, 2016. |
| 7.                     | Malhotra, O. P., Malhotra, I., The Law and Practice of Arbitration and Conciliation, 3 <sup>rd</sup> Edition, 2014.  |
| 8.                     | Singh, A.; Competition Law, Eastern Book Company, 2012.                                                              |
| 9.                     | Reddy, G. B., Baglekar, A. K.; Consumer Protection Act, Eastern Book Company, 2021.                                  |
| 10.                    | Taxmann, Micro, Small and Medium Enterprises in India, MSME, Taxmann Publications Private Limited, 2017.             |

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| <b>Quality &amp; Safety Management in Construction</b> |              |           |                |              |          |
|--------------------------------------------------------|--------------|-----------|----------------|--------------|----------|
| <b>Course Code</b>                                     | <b>CM-04</b> |           | <b>Credits</b> | <b>3</b>     |          |
| <b>Scheme of Instruction<br/>Hours/ Week</b>           | <b>L</b>     | <b>T</b>  | <b>P</b>       | <b>Total</b> |          |
|                                                        | 3            | 0         | -              | 42 hrs/sem   |          |
| <b>Scheme of Examination<br/>TOTAL = 125 marks</b>     | <b>IA</b>    | <b>TW</b> | <b>TH</b>      | <b>P</b>     | <b>O</b> |
|                                                        | 25           | 0         | 100            | -            | -        |

|                           |                                                                                      |
|---------------------------|--------------------------------------------------------------------------------------|
| <b>Course Objectives:</b> |                                                                                      |
| •                         | To provide a structured management approach to control safety risks in operation     |
| •                         | To determine the effectiveness and efficiency of each process towards its objectives |

|                                                                                |                                                            |
|--------------------------------------------------------------------------------|------------------------------------------------------------|
| <b>Course Outcomes:</b> After completion of course, students would be able to: |                                                            |
| CO1                                                                            | Understand the tools and techniques for quality management |
| CO2                                                                            | Meet the quality requirements                              |
| CO3                                                                            | Execute quality control at the structural site             |
| CO4                                                                            | Ensure safety measures at construction site                |

|                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Course Contents:</b>                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Lectures</b>                                                                                                                                       |
| <b>Total Theory Duration:</b>                                                                                                                                                                                                                                                                                                                                                                              | <b>42</b>                                                                                                                                             |
| <b>Unit 1</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                       |
| Introduction to quality; Importance of quality; Quality transition - quality control and inspection, quality assurance, total quality management; Evolution of quality management.                                                                                                                                                                                                                         | <b>10</b>                                                                                                                                             |
| <b>Unit 2</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                       |
| Planning and control of quality during design of structures; Tools and techniques for quality management; Inspection of materials and machinery.                                                                                                                                                                                                                                                           | <b>10</b>                                                                                                                                             |
| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                       |
| Quality assurance in construction; Systems quality management; Quality standards/codes in design and construction; (ISO:9000), Total quality management (TQM) - principles, tools and techniques.                                                                                                                                                                                                          | <b>10</b>                                                                                                                                             |
| <b>Unit 4</b>                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                       |
| Introduction to safety; Safety and health programs in construction industry; Planning for safety provisions; Analysis of construction hazards and accidents; Construction hazards and safety guidelines; Prevention techniques for construction accidents; Site management with regard to safety recommendations, Training for safety awareness and implementation; Construction safety and health manual. | <b>12</b>                                                                                                                                             |
| <b>Text Books</b>                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                       |
| 1                                                                                                                                                                                                                                                                                                                                                                                                          | Dale, B. G.; Managing quality, 4 <sup>th</sup> Ed., Blackwell Publishing, Oxford, 2003.                                                               |
| 2                                                                                                                                                                                                                                                                                                                                                                                                          | Reese, D., Eidson, J. V.; Handbook of OSHA construction safety and health, 2 <sup>nd</sup> ed., CRC Press, Bocaaton, 2006.                            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                          | Harris, F., McCaffer, R., Edum-Fotwe, F.; Modern construction management, 6 <sup>th</sup> ed., Blackwell Publishing, Oxford, 2006                     |
| <b>Reference books</b>                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                       |
| 4.                                                                                                                                                                                                                                                                                                                                                                                                         | Knutson, K., Schexnayder, C. J., Fiori, C. M., Mayo, R.; Construction management fundamentals, 2 <sup>nd</sup> Edition, Mc Graw Hill, New York, 2008. |
| 5.                                                                                                                                                                                                                                                                                                                                                                                                         | Holt, S. J. ; Principles of construction safety, Blackwell Publishing, Oxford, 2008.                                                                  |

| Infrastructure Planning and Management |       |    |         |            |    |
|----------------------------------------|-------|----|---------|------------|----|
| Course Code                            | CM-05 |    | Credits | 5          |    |
| Scheme of Instruction<br>Hours/ Week   | L     | T  | P       | Total      |    |
|                                        | 3     | 1  | 2       | 42 hrs/sem |    |
| Scheme of Examination                  | IA    | TW | TH      | P          | O  |
| TOTAL = 175 marks                      | 25    | 25 | 100     | -          | 25 |

| Course Objectives: |                                                                                                                          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------|
| •                  | To understand and explain concepts of infrastructure, private involvement in infrastructure,                             |
| •                  | To understand challenges to successful infrastructure planning and implementation                                        |
| •                  | To understand strategies for successful infrastructure project implementation, sustainable development of infrastructure |

| Course Outcomes: After completion of course, students would be able to: |                                                                                                                   |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| CO 1                                                                    | Understand the basic concepts related to Infrastructure Projects, role of private sector in infrastructure growth |
| CO 2                                                                    | Describe the strategies for successful Infrastructure Project implementation.                                     |
| CO 3                                                                    | Develop Infrastructure modelling and Life Cycle Analysis Techniques.                                              |
| CO 4                                                                    | Practice sustainable infrastructure development                                                                   |

| Course Contents:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Lectures  |
| <b>Total Theory Duration:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>42</b> |
| <b>Unit 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |
| <b>Basic Concepts Related To Infrastructure:</b> Introduction to Infrastructure, an overview of the Power Sector, Water Supply and Sanitation Sector, Road, Rail, Air and Port Transportation Sectors, Telecommunications Sector, Urban Infrastructure, Rural Infrastructure in India. Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Life cycle.                                                                                                                                                  | <b>10</b> |
| <b>Unit 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |
| <b>Private Involvement In Infrastructure:</b> A Historical overview, benefits and problems of Infrastructure Privatization. Challenges in Privatization of Water Supply, Power and road transportation infrastructure in India with case studies.<br><b>Challenges To Successful Infrastructure Planning And Implementation:</b> Mapping and Facing the Risks in Infrastructure Projects, Economic and Demand Risks: The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure. | <b>11</b> |
| <b>Unit 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |
| <b>Strategies For Successful Infrastructure Project Implementation:</b> Planning, Scheduling and control of Infrastructure projects. Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects                                                                                                                                                                        | <b>11</b> |
| <b>Unit 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |           |
| <b>Sustainable Infrastructure Development:</b> Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modelling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation.                                                                                                                                                                                                                                            | <b>10</b> |

| <b>Lab work (Assignments on):</b> |                                                                                |
|-----------------------------------|--------------------------------------------------------------------------------|
| 1                                 | Work Breakdown structure of a sub-Project                                      |
| 2                                 | Drawing a Network and identifying critical path                                |
| 3                                 | Preparation of Line of balance chart for Repetitive works in a project         |
| 4                                 | Preparation of Time and Resource schedule of a Project using Microsoft Project |
| 5                                 | Case study on Time control methods in Construction Projects.                   |

| <b>Text Books</b> |                                                                                                                                                   |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                | Neil, G.; Infrastructure Engineering and Management, Wiley, 1988.                                                                                 |
| 2.                | Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, 1994.                                                                      |
| 3.                | Hudson, Haas, Uddin, Infrastructure Management: Integrating Design, Construction, Maintenance, Rehabilitation, and Renovation, McGraw Hill, 1997. |

| <b>Reference books</b> |                                                                                                                                                            |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4.                     | Munnell, A., Editor, Is There a Shortfall in Public Capital Investment? Proceedings of a Conference Held in June 1990.                                     |
| 5.                     | World Development Report 1994: Infrastructure for Development.                                                                                             |
| 6.                     | Zimmerman, K., Botelho F.; Pavement Management Trends in the United States, 1st European Pavement Management Systems Conference, Budapest, September 2000. |

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