Department of Civil and Environmental Engineering

Birla Institute of Technology, Mesra, Ranchi - 835215 (India)

Institute Vision

To become a Globally Recognized Academic Institution in consonance with the social, economic and ecological environment, striving continuously for excellence in education, research and technological service to the National needs.

Institute Mission

To educate students at Undergraduate, Postgraduate, Doctoral, and Post-Doctoral levels to perform challenging engineering and managerial jobs in industry.

- To provide excellent research and development facilities to take up Ph.D. programmes and research projects.
- To develop effective teaching and learning skills and state of art research potential of the faculty.
- To build national capabilities in technology, education and research in emerging areas.
- To provide excellent technological services to satisfy the requirements of the industry and overall academic needs of society.

Department Vision

To develop quality intellectuals through education, research and motivation so that they can bring a positive contribution to the society in area of Civil and Environmental Engineering

Department Mission

- To develop professional skills through quality education & research.
- To outreach various sectors of society through interdisciplinary programmes and practical oriented approach.
- To create dynamic, logical and effective leaders with inspiring mindsets.

Proposed PEOs and POs for M.Tech. (Civil Engineering)

Programme Educational Objectives (PEOs)

PEO1: To impart students with strong knowledge base through theory courses and sessional that makes them suitable for industries, academics, research, and consultancies.

PEO2: To develop students analytical, computational and research skills through assignments, weekly presentations, and modelling software.

PEO3: To train the students on developing practical, efficient, and cost-effective solutions on problems and challenges on civil engineering.

PEO4: To inculcate among student's sensitivity towards social and corporate responsibilities.

Programme Outcomes (POs)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems.

PO2: An ability to write and present a substantial technical report/document.

PO3: Students should be able to demonstrate a degree of mastery for designing and solving civil engineering problems.

PO4: An ability to use appropriate modern tools in civil engineering. In doing so he should demonstrate sufficient knowledge of competing tools and their relative merits and demerits.

PO5: An ability to demonstrate the traits of learning and unlearning throughout his professional career, and be willing to learn new techniques, methods, and processes.

PO6: Tune his knowledge to be a responsible engineer adhering to all established practices of his profession.

Proposed Course Curriculum for M.Tech. (Civil Engineering)

First Semester

Theory Courses

Course Code	Course	L-T-P	Credits
CE501	Advanced Solid Mechanics	3-0-0	3
CE579	Construction Technology and Project Management	3-0-0	3
CE580	Urban Environmental Management	3-0-0	3
CE581	Numerical Methods and Computational Techniques	3-0-0	3
CE582	Optimization Techniques	3-0-0	3

Laboratory Courses

Course Code	Course	L-T-P	Credits
CE583	Construction Materials and Quality Control	0-0-4	2
CE584	Modern Tools in Civil Engineering	0-0-4	2
MT132	Communication Skills – I	0-0-3	1.5

Total Credits in First Semester = 20.5

COURSE INFORMATION SHEET

Course code	:	**CE501**
Course title	:	**ADVANCED SOLID MECHANICS**
Pre-requisite(s)	:	**B.E. /B. Tech in Civil with basic courses on Solid Mechanics.**
Co- requisite(s)	:	**-**
Credits	:	**3 (L: 3 T: 0 P: 0)**
Class per week	:	**3**
Class	:	**MTech.**
Semester / Level	:	**I/5**
Branch	:	**Civil Engineering**
Name of Teacher	:	

COURSE OBJECTIVES:

The objective of this course is to provide a comprehensive understanding of the fundamental principles of elasticity and plastic deformation, and their application in solving real-world problems.

COURSE OUTCOMES:

CO1	Analyse displacement, strain, and stress fields, including principal strains and compatibility conditions.
CO2	Formulate and solve elasticity equations, understand stress-strain relationships, and address boundary value problems.
CO3	Solve plane stress and plane strain problems using Airy's stress function in Cartesian and polar coordinates.
CO4	Analyse torsional behaviour in prismatic bars using methods like Saint Venant's approach and Prandtl's membrane analogy.
CO5	Understand and apply concepts of plastic deformation, including yield criteria and plastic stress-strain relations.

SYLLABUS

Module I

Analysis of Stress & Strain: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity. Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

(8L)

Module II

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

(8L)

Module III

Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

(8L)

Module IV

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

(8L)

Module V

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

(8L)

RECOMMENDED BOOKS

TEXT BOOKS:

1. Advanced Mechanics of Solids, Srinath L.S., Tata McGraw Hill,2000.
2. Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.
3. Solid Mechanics, Kazimi S. M. A., Tata McGraw Hill,1994.
4. Theory of Elasticity, Sadhu Singh, Khanna Publishers, 2003.
5. Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill, 1961.

REFERENCE BOOKS:

1. Elasticity, Sadd M.H., Elsevier, 2005.
2. Engineering Solid Mechanics, Ragab A.R., Bayoumi S.E., CRC Press,1999.
3. Computational Elasticity, Ameen M., Narosa,2005

Gaps in the syllabus (to meet Industry/Profession requirements)

PO1

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS AND EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 (3 X 10)
Assignment(s)	10
Seminar before a Committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1: Lecture by use of boards/LCD projectors/OHP projectors

CD2: Assignments/Seminars

CD3: Laboratory experiments/teaching aids

CD4: Industrial/guest lectures

CD5: Industrial visits/in-plant training

CD6: Self- learning such as use of NPTEL materials and internets

CD7: Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1		1	3		2	2
CO2		2	3	2	2	2
CO3		2	3	2	2	2
CO4		1	3	2	2	2
CO5		1	3		2	2

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CO1: CD1, CD2, CD6

CO2: CD1, CD2, CD6

CO3: CD1, CD2, CD3, CD6

CO4: CD1, CD2, CD6

CO5: CD1, CD2, CD6

COURSE INFORMATION SHEET

Course code	:	**CE579**
Course title	:	**CONSTRUCTION TECHNOLOGY AND PROJECT MANAGEMENT**
Pre-requisite(s)	:	**-**
Co- requisite(s)	:	**-**
Credits	:	**3 (L: 3 T: 0 P: 0)**
Class per week	:	**3**
Class	:	**MTech.**
Semester / Level	:	**I/5**
Branch	:	**Civil Engineering**
Name of Teacher	:	

COURSE OBJECTIVES:

Equip students with the essential knowledge and skills to effectively manage construction projects, including core concepts, economic considerations, scheduling techniques (PERT & CPM), material and cost management, and risk, insurance, and safety practices.

COURSE OUTCOMES:

CO1	Able to build the basic concepts of project management.
CO2	Able to solve complex problems involving construction economics.
CO3	Able to apply PERT and CPM techniques in construction project management.
CO4	Able to manage efficiently materials and cost related to construction project.
CO5	Able to analyze risk and insurance aspects along with safety management in construction.

SYLLABUS

Module I

Introduction: Phases of a construction project, Relevance of project management, Stakeholders of a construction project, Forms of business organization, Important traits of a project coordinator. Ethical conduct for engineers, Factors behind the success of a construction organization.

(8L)

Module II

Construction Economics: Economic decision making, Cash-flow diagram, Present worth, Future worth, Annual Worth, Rate of return method. Effect of inflation on cash flow.

(8L)

Module III

Network analysis: Event, Activity, Dummy activity, Development of Network, PERT – Time computations, Slack, Critical path. CPM network, Activity time estimate, Earliest event time, Latest allowable occurrence time, Start and Finish times of activity, Critical path.

(8L)

Module IV

Construction Material and Cost Management: Material procurement process, Custody, Material accounting, Transportation, Vendor development, Disposal. Inventory management. Cost budgeting and control, Collection of cost related information, Value management in construction.

(8L)

Module V

Risk, Insurance and Safety management in Construction: Risk identification process, Analysis and evaluation of risk, Response management process, Insurance in construction industry, Fundamental principles, Insurance policies for a typical construction organization. Evolution of safety, Unsafe conditions, Roles of safety personnel, Causes of accidents, Principles of safety.

(8L)

RECOMMENDED BOOKS

TEXTBOOKS:

1. Construction Project Management by Kumar Neeraj Jha, Pearson.
2. Project Planning and Control with PERT And CPM – B.C. Punmia, K.K. Khandelwal. Laxmi Publications.

REFERENCE BOOKS:

1. Construction Project Management, Planning, Scheduling and Controlling – K.K. Chitkara. McGraw Hill Education.

Gaps in the syllabus (to meet Industry/Profession requirements)

Design of real-time industrial projects.

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS AND EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 (3 X 10)
Assignment(s)	10
Seminar before a Committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1: Lecture by use of boards/LCD projectors/OHP projectors

CD2: Assignments/Seminars

CD3: Laboratory experiments/teaching aids

CD4: Industrial/guest lectures

CD5: Industrial visits/in-plant training

CD6: Self- learning such as use of NPTEL materials and internets

CD7: Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		2	1	2	2
CO2	2	2	3	1	2	2
CO3	2		3	2	2	1
CO4	1		3	2	2	2
CO5	2	2	2	1	2	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CO1: CD1, CD2, CD3, CD5, CD6, CD7, CD8

CO2: CD1, CD2, CD3, CD4, CD6, CD8

CO3: CD1, CD2, CD3, CD4, CD6, CD7, CD8

CO4: CD1, CD2, CD3, CD4, CD5, CD6, CD7, CD8

CO5: CD1, CD2, CD3, CD4, CD5, CD6, CD7, CD8

COURSE INFORMATION SHEET

Course code	:	**CE580**
Course title	:	**URBAN ENVIRONMENTAL MANAGEMENT**
Pre-requisite(s)	:	**B.E. /B. Tech in Civil Engineering**
Co- requisite(s)	:	**-**
Credits	:	**3 (L: 3 T: 0 P: 0)**
Class per week	:	**3**
Class	:	**MTech.**
Semester / Level	:	**I/5**
Branch	:	**Civil Engineering**
Name of Teacher	:	

COURSE OBJECTIVES:

Equip students to address urban environmental challenges by integrating sustainability principles, understanding urban ecology, and evaluating efficient urban infrastructure

COURSE OUTCOMES:

CO1	Apply the fundamentals of sustainability to solve the urban environmental challenges
CO2	Explain the critical role played by urban ecology in managing the environmental services
CO3	Critically assess and apply the various approaches for water, wastewater and solid waste management in urban regions

SYLLABUS

Module I

Urbanisation & Environmental Sustainability: Basics of urban environment, sustainable development & UN sustainable development goals, green cities, major laws on the environment - Environmental Protection Act, legislation related to air, water, and waste management, major urban development schemes in India.

(8L)

Module II

Urban Ecology & Environment: Fundamentals of urban ecology, urban biodiversity, urban aquatic systems, urban terrestrial systems (land & forests), atmosphere - urban heat island, aerosols & carbon emissions, sea level rise, ecosystem services, carrying capacity.

(8L)

Module III

Urban Water Infrastructure: Water sources, collection and conveyance, water supply – water treatment, water distribution network, water storage for distribution, rainwater harvesting structures, water supply & revenue.

(8L)

Module IV

Solid Waste Management: Solid waste management approaches across the globe, functional elements of solid waste management, waste processing techniques, waste to resource, landfill, solid waste management in industries.

(8L)

Module V

Liquid Waste Management: Stormwater management, sewage treatment, centralised and decentralized systems, sewer network, industrial effluent treatment, nature-based wastewater treatment systems.

(8L)

Reading Resources:

1. Introduction to Environmental Engineering and Science, G.M. Masters & Wendell Ela, PHI Publishers
2. Wastewater Engineering: Treatment and Reuse, Metcalf & Eddy, McGraw-Hill Publishers
3. Water and Wastewater Engineering – designs, principle and practice, Mackenzie L. Davis. McGraw-Hill Education
4. Nathanson, Jerry A. (2009) Basic environmental technology: water supply, waste management and pollution control, 4th ed. New Delhi: PHI Learning
5. Environmental Planning and Management, Christian N Madu, Imperial College Press.
6. Adler, Frederick and Tanner, Colby. Urban ecosystems: ecological principles for the built environment. Cambridge University Press
7. Ecology and environment – P. D. Sharma
8. Tchobanoglous G., Theisen H., Vigil S.: Integrated Solid Waste Management Engineering Principles and Management Issues (McGraw Hill Education)

Gaps in the syllabus (to meet Industry/Profession requirements)

Application of real-life industrial problems

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS AND EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 (3 X 10)
Assignment(s)	10
Seminar before a Committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1: Lecture by use of boards/LCD projectors/OHP projectors

CD2: Assignments/Seminars

CD3: Laboratory experiments/teaching aids

CD4: Industrial/guest lectures

CD5: Industrial visits/in-plant training

CD6: Self- learning such as use of NPTEL materials and internets

CD7: Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	1	2
CO2	2	1	1	1	1	1
CO3	3	2	2	1	1	1

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CO1: CD1, CD2

CO2: CD1, CD2

CO3: CD1, CD2, CD3, CD5

COURSE INFORMATION SHEET

Course code	**:**	**CE581**
Course title	**:**	**Numerical Methods and Computational Techniques**
Pre-requisite(s)	**:**	**B.E. /B. Tech in Civil Engineering**
Co- requisite(s)	**:**	**-**
Credits	**:**	**3 (L: 3 T: 0 P: 0)**
Class per week	**:**	**3**
Class	**:**	**MTech.**
Semester / Level	**:**	**I/5**
Branch	**:**	**Civil Engineering**
Name of Teacher	**:**	

COURSE OBJECTIVES:

The course aims to equip students with the necessary skills to effectively approximate and solve various computational problems.

COURSE OUTCOMES:

CO1	Apply numerical methods to solve nonlinear and linear equations
CO2	Employ curve fitting and interpolation techniques to accurately model and represent real-world data using polynomial function
CO3	Understand finite difference schemes by explaining how they are used to approximate derivatives and solve ordinary differential equation.
CO4	Implement finite difference methods to solve partial differential equations.
CO5	Select and apply numerical integration techniques to compute integrals.

SYLLABUS

Module I

Approximations and Errors in Computation

Solving Linear Equations: Gauss iteration Methods, Gauss-Jacobi iteration, Gauss-Seidal iteration, Relaxation Method, Eigen values by QR factorization method.

Solving Nonlinear Equations: Bisection method, Regula falsi method, Newton's method, Secant method, Fixed-point iteration method.

(8L)

Module II

Curve fitting and Interpolation: Curve fitting with a linear equation, Curve fitting with quadratic and higher order polynomials, Interpolation using a single polynomial, Lagrange polynomials, Newton's polynomials, Piecewise (spline) interpolation.

(8L)

Module III

Finite Difference Scheme: Finite difference approximation of the Derivative: Forward, backward and central difference formula, Finite Difference Method for Ordinary Differential Equations

(8L)

Module IV

Numerical Solution of Partial Differential Equation: Finite Difference Approximations to Partial Derivatives, Solution of Laplace's Equation, Solution of Poisson's Equation.

(8L)

Module V

Numerical Integration: Trapezoidal and Simpson's rule, Newton-Cotes Quadrature Formula, Gaussian Integration.

(8L)

RECOMMENDED BOOKS

TEXT BOOKS:

1. Numerical Methods in Engineering and Science: C, C++, and MATLAB, B. S. Grewal, Mercury Learning and Information, 2019
2. Numerical methods, V. Rajaraman, Prentice - Hall India Pvt. Ltd., (2003)
3. Numerical methods, S.S. Sastry, Prentice Hall of India Pvt. Ltd., New Delhi (2003).

REFERENCE BOOKS:

1. Numerical Methods for Engineers, Steven Chapra and Raymond Canale, McGraw Hill, 2007.
2. Applied Numerical Analysis, C. F. Gerald and P. O. Wheatley , 7th edition, Addison Wesley, 2009.
3. A Friendly Introduction to Numerical Analysis, Bradie, Brian, Pearson Education India. Dorling Kindersley (India) Pvt. Ltd, 2006.

Gaps in the syllabus (to meet Industry/Profession requirements)

PO1 & PO6

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS AND EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 (3 X 10)
Assignment(s)	10
Seminar before a Committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1: Lecture by use of boards/LCD projectors/OHP projectors

CD2: Assignments/Seminars

CD3: Laboratory experiments/teaching aids

CD4: Industrial/guest lectures

CD5: Industrial visits/in-plant training

CD6: Self- learning such as use of NPTEL materials and internets

CD7: Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1			2	3	2	
CO2		1	2	3	2	
CO3			3	3	2	
CO4			3	3	2	
CO5			2	2	3	

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CO1: CD1, CD2, CD6

CO2: CD1, CD2, CD6

CO3: CD1, CD2, CD3, CD6

CO4: CD1, CD2, CD6

CO5: CD1, CD2, CD6

COURSE INFORMATION SHEET

Course code	:	**CE582**
Course title	:	**OPTIMIZATION TECHNIQUES**
Pre-requisite(s)	:	**B.E. /B. Tech in Civil Engineering**
Co- requisite(s)	:	**-**
Credits	:	**3 (L: 3 T: 0 P: 0)**
Class per week	:	**3**
Class	:	**MTech.**
Semester / Level	:	**I/5**
Branch	:	**Civil Engineering**
Name of Teacher	:	

COURSE OBJECTIVES:

Students will be able to apply various optimization techniques (linear, integer, non-linear) to solve and critically evaluate solutions for civil engineering problems.

COURSE OUTCOMES:

CO1	Apply the fundamentals of optimization to solve the civil engineering related problems.
CO2	Apply linear programming concept to frame engineering minima and maxima problems in the framework of optimization problems.
CO3	Critically assess and apply the various approaches for structural, geotechnical and environmental management in both rural and urban regions.
CO4	Apply nonlinear programming concept to solve optimization problems.
CO5	Critically assess and apply the various approaches of modern methods of optimization for application in civil engineering related problems

SYLLABUS

Module I

Introduction to optimization : Introduction to Optimization: Engineering application of Optimization – Statement of an Optimization problem – Optimal Problem formulation – Classification of Optimization problem. Optimum design concepts: Definition of Global and Local optima – Optimality criteria, Linear programming methods for optimum design, Application of LPP models in Civil engineering.

(8L)

Module II

Linear Programming : Introduction to Linear Programming, Solving Linear Programming Problems, The Simplex Method, Duality Theory and Sensitivity Analysis. Simplex Method – Artificial variable techniques - Big M-Method, Two Phase Method, Degeneracy problem, Method to resolve Degeneracy. Revised Simplex Method.

(8L)

Module III

Integer programming: Some Formulation Examples, The Branch-and-Bound Technique for BIP and Mixed Integer Programming, The Branch-and-Cut Approach, The Incorporation of Constraint Programming.

(8L)

Module IV

Non-linear Programming: Graphical Illustrations of Nonlinear Programming, One Variable and Multi-variable Unconstrained Optimization, The Karush-Kuhn-Tucker (KKT) Conditions, Quadratic Programming, Separable Programming, Convex and non-convex.

(8L)

Module V

Modern methods of Optimization: Genetic Algorithms – Simulated Annealing – Ant colony optimization, Neural-Network based Optimization, Fuzzy optimization techniques

(8L)

TEXT BOOKS:

1. S. Hiller & G.J. Lieberman – Operations Research, 8 th Edn, TMH, New Delhi – 2006
2. H.A.Taha – Operations Research, 8/e , Pearson Education , New Delhi-2007.

REFERENCE BOOKS:

1. J.K. Sharma – Operations Research, 3/e, Mcmillan , India Ltd, 2007
2. Pradeep Prabhakar Pai, “Operations Research Principles and Practice”, Oxford Higher Education,2012.

Gaps in the syllabus (to meet Industry/Profession requirements)

Application of optimization in construction/environmental/ industrial problems

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS AND EVALUATION PROCEDURE

Direct Assessment

Assessment Tool	% Contribution during CO Assessment
Continuous Internal Assessment	50
Semester End Examination	50

Continuous Internal Assessment	% Distribution
3 Quizzes	30 (3 X 10)
Assignment(s)	10
Seminar before a Committee	10

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	✓	✓	✓	✓	✓
Semester End Examination	✓	✓	✓	✓	✓

Indirect Assessment

1. Student Feedback on Faculty
2. Student Feedback on Course

Course Delivery Methods

CD1: Lecture by use of boards/LCD projectors/OHP projectors

CD2: Assignments/Seminars

CD3: Laboratory experiments/teaching aids

CD4: Industrial/guest lectures

CD5: Industrial visits/in-plant training

CD6: Self- learning such as use of NPTEL materials and internets

CD7: Simulation

MAPPING BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	2	2	2
CO2	3	2	1	2	2	3
CO3	3	1	1	2	2	3
CO4	3	2	1	2	2	3
CO5	3	2	3	3	3	3

If satisfying and < 34% = 1, 34-66% = 2, > 66% = 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

CO1: CD1, CD2, CD6

CO2: CD1, CD2, CD6

CO3: CD1, CD2, CD6

CO4: CD1, CD2, CD6

CO5: CD1, CD2, CD6