

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.



**Scheme of Teaching and Examinations and Syllabus
M.Tech INFRASTRUCTURE ENGINEERING AND MANAGEMENT (CEM)
(Effective from Academic year 2020 - 21)**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI											
Scheme of Teaching and Examinations – 2020 - 21											
M.Tech - INFRASTRUCTURE ENGINEERING AND MANAGEMENT											
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)											
I SEMESTER											
Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination			Credits	
				Theory	Practical	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PCC	20CEM11	Statistical Methods	03	--	02	03	40	60	100	4
2	PCC	20 CEM 12	Infrastructure Planning And Management	03	--	02	03	40	60	100	4
3	PCC	20 CEM 13	Modern Construction Materials And Technology	03	--	02	03	40	60	100	4
4	PCC	20 CEM 14	Construction Equipments And Management	03	--	02	03	40	60	100	4
5	PCC	20 CEM 15	Prefabrication And Construction Technology	03	--	02	03	40	60	100	4
6	PCC	20 CEM L16	Construction Materials Laboratory	--	04	--	03	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	01	--	02	03	40	60	100	2
TOTAL				17	04	12	21	280	420	700	24
Note: PCC: Professional core.											
Skill development activities:											
Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills.											
The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem.											
The students shall											
(1) Gain confidence in modelling of systems and algorithms.											
(2) Work on different software/s (tools) to Simulate, analyse and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations, etc.											
(3) Handle advanced instruments to enhance technical talent.											
(4) Involve in case studies and field visits/ field work.											
(5) Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.											
All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.											
Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.											
Note: (i) Four credit courses are designed for 50 hours Teaching – Learning process.											
(ii) Three credit courses are designed for 40 hours Teaching – Learning process.											
(iii) Two credit courses are designed for 25 hours Teaching – Learning process.											

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M.Tech INFRASTRUCTURE ENGINEERING AND MANAGEMENT											
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II SEMESTER											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Seminar	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PCC	20CEM21	Project Management For Infrastructure	03	--	02	03	40	60	100	4
2	PCC	20CEM22	Advance Concrete Technology	03	--	02	03	40	60	100	4
3	PCC	20CEM23	Resource Management	03	--	02	03	40	60	100	4
4	PEC	20CEM24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20CEM25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20CEML26	Project Management Lab	--	04	--	03	40	60	100	2
7	PCC	20CEM27	Technical Seminar	--	02	--	--	100	--	100	2
TOTAL				17	06	06	18	340	360	700	24
Note: PCC: Professional core, PEC: Professional Elective.											
Professional Elective 1						Professional Elective 2					
Course Code under 20CEM24X			Course title			Course Code under 20CEM25X			Course title		
20CEM241			Infrastructure For Smart City Planning			20CEM251			Analysis And Design Of Pavement		
20CEM242			Pavement Maintenance & Management Systems			20CEM252			Energy Conservation Techniques In Building		
20CEM243			Disaster Mitigation & Management			20CEM253			Advance Structural Design And Detail		
20CEM244			Urban Hydrology, Storm Drainage And Management			20CEM254			Composite And Smart Materials		
Note:											
<p>1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the programme shall be mandatory.</p> <p>The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.</p> <p>2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.</p>											

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III SEMESTER											
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination			Credits	
				Theory	Practical/ Mini-Project/ Internship	Skill Development activities	Duration in hours	CIE Marks	SEE Marks		Total Marks
				L	P	SDA					
1	PCC	20CEM31	Construction Quality And Safety Management	03	--	02	03	40	60	100	4
2	PEC	20CEM32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20CEM33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20CEM34	Project Work phase -1	--	02	--	--	100	--	100	2
5	PCC	20CEM35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20CEMI36	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
TOTAL				09	04	02	12	360	240	600	20
Note: PCC: Professional core, PEC: Professional Elective.											
Professional elective 3						Professional elective 4					
Course Code under 20CEM32X			Course title			Course Code under 20CEM33X			Course title		
20CEM321			Professional Practice			20CEM331			Eco-Friendly Constructions		
20CEM322			Value Engineering and Valuation			20CEM332			Infrastructure Development		
20CEM323			Steel & Composite Construction Technology			20CEM333			Highway Infrastructure		
20CEM324			Bridge And Grade Separated Structures			20CEM334			Sustainable Development And Urban Planning		
Note:											
<p>1. Project Work Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present a seminar.</p> <p>CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25.</p> <p>SEE (University examination) shall be as per the University norms.</p> <p>2. Internship: Those, who have not pursued /completed the internship shall be declared as fail in internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.</p>											

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M.Tech INFRASTRUCTURE ENGINEERING AND MANAGEMENT										
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IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	20CEM41	Project work phase -2	--	04	03	40	60	100	20
TOTAL				--	04	03	40	60	100	20
Note:										
1. Project Work Phase-2:										
CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25.										
SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.										



STATISTICAL METHODS			
Course Code	20CEM11	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
DESCRIPTIVE STATISTICS - Definition of Statistics, Methods of collection of data, Presentation of data, Types of variables, Scales of measurement, Measures of Central tendency, Measures of Variation.			
Module-2			
PROBABILITY AND DISTRIBUTION. - Basic probability, sample space, events, axioms of probability conditional probability, independent events. Random variables, continuous/Discrete random variables, exception, Variance, covariance, conditional distributions, Baye's Theorem.			
Module-3			
TESTING OF HYPOTHESIS -Sampling distributions - Small and large samples -Tests based on Normal, t, Chi square, and F-distributions for testing of means, variance and proportions – Analysis of r x c tables – Goodness of fit.			
Module-4			
DESIGN OF EXPERIMENTS -Analysis of variance – One way and two way classifications – Completely randomized design Randomized block design – Latin square design - 22 Factorial design.			
Module-5			
CORRELATION AND REGRESSION -Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co - efficient.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem. • Use statistical tests in testing hypotheses on data. • Concept of linear regression, correlation, and its applications. • List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments. • Perform exploratory analysis of multivariate data, such as multivariate normal density, Calculating descriptive statistics, testing for multivariate normality. 			
The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 			

Textbook/ Textbooks

1. Gupta.S.C., and Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 11th Edition, 2002.10
2. Jay L. Devore, "Probability and statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.

Reference Books

1. Johnson, R.A. and Wichern, D. W. "Applied Multivariate Statistical Analysis", Pearson Education, Asia, 6th Edition, 2007.
2. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
3. Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.

INFRASTRUCTURE PLANNING AND MANAGEMENT			
Course Code	20CEM12	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE			
Introduction to Infrastructure, an overview of the Power Sector in India., an Overview of the Water Supply and Sanitation Sector in India., an overview of the Road, Rail, Air and Port Transportation Sectors in India. , an overview of the Telecommunications Sector in India. ,an overview of the Urban Infrastructure in India, an overview of the Rural Infrastructure in India, an Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle., an overview of Infrastructure Project Finance.			
Module-2			
PRIVATE INVOLVEMENT IN INFRASTRUCTURE			
A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.			
Module-3			
CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION			
Mapping and Facing the Landscape of 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, Challenges in Construction and Maintenance of Infrastructure.			
Module-4			
STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION			
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.			
Module-5			
SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE			
Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Explain the basic concepts related to Infrastructure Projects • Explain the role of private sector in infrastructure growth. • Describe the strategies for successful Infrastructure Project implementation. • Develop Infrastructure modeling and Life Cycle Analysis Techniques. • Explain Sustainable development of Infrastructure 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbook/ Textbooks

1 A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.

2 J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.

3 P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.

Reference Books

1. Grigg, Neil, 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).

4. Munnell, Alicia, 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 (1994).

6. Zimmerman, K. and F. Botelho, "Pavement Management Trends in the United States," 1st European Pavement Management Systems Conference, Budapest, September (2000).

MODERN CONSTRUCTION MATERIALS AND TECHNOLOGY			
Course Code	20CEM13	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
SPECIAL CONCRETES			
Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete on high performance & high Strengthconcrete.			
Module-2			
METALS			
Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties and advantages of aluminium and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.			
Module-3			
COMPOSITES AND OTHER MATERIALS			
Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers–Types of FRP–FRP on different structural elements – Applications of FRP -Types and properties of Water Proofing Compounds – Types of Non- weathering Materials and its uses – Types of Flooring and Facade Materials and its application Types & Differences between Smart and Intelligent Materials - Special features – Case studies showing the applications of smart & Intelligent Materials.			
Module-4			
SUB STRUCTURE CONSTRUCTION			
Box jacking- pipe jacking- under water construction of diaphragm walls and basement- tunnelling Techniques - cable anchoring and grouting-driving diaphragm walls, sheet piles, laying operations for built up offshore system- shoring for deep cutting- large reservoir construction –trenchless technology.			
Module-5			
SUPERSTRUCTURE CONSTRUCTION FOR BUILDINGS			
Vacuum dewatering of concrete flooring - concrete paving Technology, Techniques of construction for continuous concreting , Operation in tall buildings of various shapes and varying sections – launching techniques- suspended form work -erection techniques of tall structures, Large span structures- launching techniques for heavy decks, In situ pre-stressing in high rise structures, aerial transporting, handling, erecting lightweight components on tall structures			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Explain the properties and applications of special concretes, composites, smart and intelligent materials • Identify and explain advanced construction techniques used for sub structure construction • Select appropriate techniques for super structure construction of buildings • Select suitable techniques for construction of special structures • Choose relevant technique for demolition and dismantling works 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbook/ Textbooks and Reference Books

1. ACI Report 440.2R-02, "Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures", American Concrete Institute, 2002.
2. Aitkens, High Performance Concrete, McGraw Hill, 1999
3. Ashby, M.F. and Jones, D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
4. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
5. Ganapathy, C. "Modern Construction Materials", Eswar Press, 2015.
6. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
7. Santhakumar, A.R. "Concrete Technology", Oxford University press, New Delhi.
8. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
9. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.
9. Jerry Irvine, "Advanced Construction Techniques", C.A. Rockett, 1984
10. Sankar S.K. and Saraswathi. S, "Construction Technology", Oxford University Press, New Delhi, 2008.

CONSTRUCTION EQUIPMENTS AND MANAGEMENT			
Course Code	20CEM14	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Plants and Equipment for production of materials- Crushers, mixers, bituminous mixing plants, concrete mixing plants, transit mixers, advantages, choice, production rate calculation.			
Module-2			
Construction Equipment – Operations, applications and performance of dozers, excavators, graders, compactors, pavers, haulers, crawler, wheel tractors, power shovels, pile driving equipments, hauling equipments, and drilling, blasting and tunnelling equipment.			
Module-3			
Miscellaneous Equipments - Equipment for: Dredging, tunneling, dewatering. Equipment for flooring-dewatering and floors finishing. Sprayers, kerb casting equipment, screening equipment.			
Module-4			
Selection of Construction Equipment- Task considerations, cost considerations, engineering considerations, equipment acquisition options.			
Module-5			
Management Of Construction Equipment: Need for mechanization of construction – planning and financing construction plant and equipment – Owning and operating equipment versus hiring – planning for infrastructure mechanization equipment management – equipment maintenance and repair, log maintenance, safety during operation, economical life of equipment.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of Planning and management of construction Equipments. • Understand the selection of equipments used for construction. • Develop equipment management skills. • Summarize the solution of Equipment inventory. Understand the concepts of usage standards and equipment management.			
Question paper pattern:			
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ • 			

Text Book & References:

1. Peurifoy, R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co.,
2. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co.
3. Smith, R.C, Andres, C.K., Principles and Practive of Heavy Construction, Prentice Hall
4. SC Sharma 'Construction equipment'
5. Chitkara, K. K. Construction Project Management: Panning, Scheduling and Control, Tata McGraw Hill Publishing Company, New Delhi,1998.

PREFABRICATION AND CONSTRUCTION TECHNOLOGY			
Course Code	20CEM15	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Types of RC Prefabricated Structures: Long wall and cross wall large panel buildings- One way and two way prefabricated slabs - Framed buildings with partial and curtain walls, single storey industrial buildings with trusses and shells - Crane – Gantry systems.			
Module - 2			
Functional Design Principles: Modular coordination – Standardization - Disuniting, Diversity of prefabricates – Production – Transportation – Erection - Stages of loading and codal provisions Safety factors - Material properties - Deflection control - Lateral load resistance - Location and types of shear walls.			
Module - 3			
Floors, Stairs and Roofs: Types of floor slabs – Methods of Analysis and design example of cored and panel types and two-way systems - Staircase slab design - Types of roof slabs and insulation requirements - Description of joints, behavior and requirements - Deflection control for short term and long term loads - Ultimate strength calculations in shear and flexure.			
Module - 4			
Walls: Types of wall panels - Blocks of large panels – Curtain partition and load bearing walls Load transfer from floor to wall panels – Vertical loads Eccentricity and stability of wall panels –Use of Design curves -Types of wall joints, their behavior and design – Leak prevention, Joint sealents, sandwich wall panels.			
Module - 5			
Industrial Buildings: Components of single storey industrial sheds with crane gantry systems - Design aspects of R.C. Roof Trusses - Roof panels R.C. Crane - Gantry Girders - Corbels and columns and Wind bracing.			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Understand general principles of pre-fabrication. • Plan simple buildings using various types of prefabricated elements. • Design simple prefabricated elements • Outline the various phases involved in precast/pre-fabricated technology • Distinguish pre-engineered buildings from conventional units 			
Question paper pattern:			
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 			

Text Book & References:

1. L. Makk, "Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. T. Koncz, "Manual of Precast Concrete Construction, Vol. I, II, III & IV", Berlin, 1971.
3. B. Lewicki, "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam, London, New York, 1998.
4. "Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete", Netherland Betor Verlag, 2009.
5. Hass, A.M. "Precast concrete design and Applications", Applied Science Publishers, 1983.
6. "Handbook on Precast concrete for buildings", ICI Bulletin 02, Indian Concrete Institute, 2016
7. "National Building Code of India", BIS, New Delhi, 2005
8. Marashev, V.I. Sigalov, E.Y. Baikov, U.N., "Design of RC Structures", Mir Publishers, Moscow.
9. "SERC, Design & Construction of Prefabricated Residential & Industrial Buildings", Organized by SERC, Chennai.
10. B. Lewicki, "Building with Large Prefabrication", Elsevier Publishing Co.

CONSTRUCTION MATERIALS LABORATORY			
Course Code	20CEML16	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03
Sl. NO	Experiments		
1	Tests on Cement		
2	Tests on aggregate, gradation		
3	Concrete mix design		
4	Tests on Fresh Concrete		
5	Tests on Harden Concrete		
6	Tests on fiber reinforced concrete,		
7	Tests related to self compacting concrete,		
8	Non destructive tests- Rebound hammer test, Ultrasonic Pulse velocity test, Rebar Locator.		
9	Tests on reinforcement steel, Corrosion tests.		
10	Tests on bitumen, marshal mix design		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of Design and development of experimental skills. • Understand the principles of design of experiments. • Design and Develop analytical skills. • Summarize the testing methods of equipments. 			
Text Book & References:			
NOTE: All tests to be carried out as per relevant latest Codes			
1. Raju N Krishna, (2004) "Design of concrete mixes", CBS Publishers, New Delhi.			
2. Gahlot P S, "Concrete mix design", Indian society for technical education, Mysore.			
3. Krishnamurthy S ,Bhattacharjee B, "Concrete mix design and recent technology of placing concrete", Indian society for technical education, Mysore.			
4. Kishore Kaushal, (1992) "Method of concrete mix design with chemical admixtures and for pumped concrete", Standard Publishers, Delhi.			
5. RathoreShailendra Singh, (2003) "Computer aided concrete mix design", Allied Publishers Delhi.			
6. "Fibre reinforced concrete", SERC, 1987.			
7. Raj Baldev, (1997) "Practical non destructive testing", Narosa Publishing House Delhi.			
8. Maldague Xavier P V, Moore Patrick O, (2001) "Non destructive testing Handbook", American Society for Non-destructive Testing, USA.			

RESEARCH METHODOLOGY AND IPR			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03
Module-1			
<p>Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.</p> <p>Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration. ■</p>			
Module-2			
<p>Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.</p> <p>Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. ■</p>			
Module-3			
<p>Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.</p> <p>Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.</p> <p>Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. ■</p>			
Module-4			
<p>Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.</p> <p>Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. ■</p>			
Module-5			
<p>Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.</p> <p>Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority,</p>			

Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights (TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. ■

Course outcomes:

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

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports.
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR. ■

Question paper pattern:

- The question paper will have ten questions.
- Each full question is for 20 marks.
- There will be 2 full questions (with a maximum of four sub questions in one full question) from each module.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting one full question from each module. ■

Textbooks

- (1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.
- (2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications, 3rd Edition, 2011.
- (3) Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books

- (1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.
- (2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

PROJECT MANAGEMENT FOR INFRASTRUCTURE			
Course Code	20CEM21	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
PROJECT MANAGEMENT - AN OVERVIEW			
Introduction, Project Management process, Project Management techniques, Relationship to other management disciplines, Related endeavors, Concentric project management, Project formulation and development			
Module-2			
PROJECT PLANNING AND TIME MANAGEMENT			
Purpose, Project scheduling, activity definition, activity sequencing, activity duration estimating, schedule development, schedule control, project management using CPM/PERT- Network basics, Network development, PERT analysis, advantages. Computerized network analysis- features of PM software, capabilities of PM software, multi project analysis,			
Module-3			
ORGANIZING FOR PROJECT MANAGEMENT			
Project Management – modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer-Constructor Sequence – Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team.			
Module-4			
RESOURCE PLANNING			
Introduction, Inputs, Tools, Outputs, Resource scheduling, Resource leveling, Resource restrained scheduling, strategies for shortening the schedule Assigning resources: Work, duration, resources, Effort driven scheduling, create a resource list, Exercise on resource planning using software, Level now command, levelling Gantt chart, assigning rate to resources, techniques of duration cost trade-off..			
Module-5			
COST ESTIMATION			
Costs Associated with Constructed Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Explain project, project management, life cycle and project formulation • Analyze and Manage time in projects through Gantt charts, and network techniques. • Analyse and manage time in projects through CPM and PERT, update and monitor projects • Optimize resources of projects using scheduling, fast tracking and re-estimation techniques • Explain different approaches for estimating cost 			
Question paper pattern:			
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			

Text Book & References:

1. Harold Kerzner – Project Management – systems approach to planning, scheduling & controlling – 7th edition, John Wiley & Sons, Canada.
2. Microsoft Project for Windows 2000 – Microsoft Press, USA 2000.
3. Tim Pyron – Microsoft Project 2000 in 24 hours – Sama Teach Yourself series- Techmedia Published New Delhi.
4. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 1998.
5. Choudhury S , "Project Management", McGraw-Hill Publishing Company, New Delhi, 1988.
6. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.
7. Frederick E. Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
8. George J. Ritz , "Total Construction Project Management" - McGraw-Hill Inc, 1994.

ADVANCE CONCRETE TECHNOLOGY			
Course Code	20CEM22	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
<p>Principles of concrete mix design : concrete materials, mix proportioning and early age properties, strength, permeability and durability.</p> <p>Concrete mix design procedures : IS/ACI British Standards, mix design procedures using fly ash, fibers and design of high performance concrete.</p>			
Module - 2			
<p>Concreting operations - practices and equipment, batching; mixing; transporting; shuttering and staging; placing and compacting; curing, accelerated curing; finishing and jointing.</p> <p>Properties and techniques of construction: for concrete, admixtures, polymers, epoxy resins, pozzolanic materials and fly ash, fibre reinforced concrete, light weight concrete, heavy weight concrete, foam concrete, high performance concrete.</p>			
Module - 3			
<p>Special cement and concrete -Advances in concrete construction; Non-destructive evaluation of concrete structures; Cement-based composites; Special concrete operations, shotcrete, grouting, under water concreting, hot and cold weather concrete, pumpable concrete, ready mixed concrete.</p>			
Module - 4			
<p>Construction techniques for reinforced concrete elements - materials, principles and procedures for beams, slabs, columns, foundations, walls and tanks, design and fabrication of formwork for R.C.C elements, features of slip forming and precautions, details of special shuttering required for lining of tunnel, procedures and precautions.</p>			
Module - 5			
<p>Inspection and quality control of concrete construction - stages, principles, checklist, statistical controls, procedures.</p> <p>Pre-stressed concrete construction-principle, methods, materials, tools and equipment for the construction of pre-stressed concrete, segmental precast elements, post tensioning.</p>			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Achieve Knowledge of Design and development of problem solving techniques. • Understand the principles of concrete mix design. • Design and Develop analytical skills. • Summarize the light weight concrete, fiber reinforced concrete. <p>Understand the concepts of HPC.</p>			
<p>Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.</p> <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. <p>The students will have to answer five full questions, selecting one full question from each module. ■</p>			
Text Book & References:			

1. Gambhir, M.L. , Concrete Technology, Tata McGraw Hill, New Delhi
2. Orchard, Concrete Technology, Applied Science Publishers Ltd. London
3. Neville, Brooks, Concrete Technology, Addison – Wesley, England
4. Neville A.M., Properties of Concrete, The English Language Book Society and India
5. Publishing , London6. Raina V.K., Concrete for Construction , Tata-McGraw Hill Publishing Co. Ltd. New
7. Delhi.
4. Swamy, . New Concrete Materials, Surrly University Press, London
5. Young, Concrete, Prentice Hall Inc. New Jersey.
6. Waddell, et.al: Concrete Construction Handbook, McGraw Hill Inc.
7. Sood, Hemant et al.; Laboratory manual in Concrete technology M/S CBS
8. Publications and Distributors, New Delhi.
9. Sood, Hemant; Jyoti P.M. ; Software on Concrete Mix Design ConMD – 2000,
11. Shetty, M.S.' Concrete Technology, M/S S. Chand & Co. Ltd. New Delhi

RESOURCE MANAGEMENT			
Course Code	20CEM23	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Resource Planning- Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control- Types of resources, manpower, Equipment Material, Money, Time Systems approach in resource management, Characteristics of resources- Resources Utilization, measurement of actual resources required-Tools for measurement of resources			
Module-2			
Human Resources Management Introduction – Concept- Growth – Role and function. Manpower Planning for Construction Companies – Line and Staff function. Recruitment, selection, placement, induction and training; over staffing; Time office and establishment functions; wage and salary administration – Discipline-Separation Process.			
Module-3			
Materials Management Importance of materials management and its role in construction industry-scope, objectives and functions, integrated approach to materials management, Role of materials manager, Classification and Codification of materials of construction. ABC analysis Procedure and its use, Standardization in materials and their management, Procurement, identification of sources of procurement, vendor analysis, Vendor analysis concept of (MRKP), Material requirement planning, planning, purchase procedure, legal aspects.			
Module-4			
Inventory Management Inventory Control techniques. EOQ, Advantages and limitation of use of EOQ, Periodic ordering, order point control, safety stock, stock outs, application of AC analysis in inventory control, concept of (JIT)- Just in time management, Indices used for assessment of effectiveness of inventory management.			
Module-5			
Stores Management Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing, site layout and site organization, scheduling of men, materials and equipment. Use of MMS Materials Management Systems in materials planning, procurement, inventory, control, cost control etc.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Explain the need and importance of human resource management, labour laws relating to Construction industry • Identify the need and measures the resources in construction industry • Explain the need for applying Materials Management • Enumerate the need, importance, elements of quality and significance of Inventory Management 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each

Textbooks and Reference Books

1. K. S. Menon, "Purchasing and Inventory Control", Wheeler Publication

Dr. Mahesh Verma, "Construction equipment planning and applications"

Robert Peurifoy, "Construction planning, equipment and methods", Tata McGraw Hill.

Biswajeet Pattanayak, "Introduction to Human Resource Management".

Bohlander & Snell, "Managing Human Resources".

INFRASTRUCTURE FOR SMART CITY PLANNING			
Course Code	20CEM241	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
INTRODUCTION			
Understanding – Dimensions – Global experience, Global standards and performance bench marks, Practice codes. India 100 smart cities policy and mission, Smart city planning and development, Financing smart cities development, Governance of smart cities.			
Module-2			
GREEN BUILDING CONCEPTS AND SUSTAINABLE DEVELOPMENT			
Green projects in smart cities, sustainability – green building – Rating system – Energy efficient building – energy saving systems			
Module-3			
WATER SUPPLY AND DRAINAGE			
Water – sources of water, treatment and storage, transportation and distribution, quality, networks, distribution losses, water harvesting, recycling and reuse, norms and standards of provision, institutional arrangements, planning provisions and management issues. Sanitation – points of generation, collection, treatment, disposal, norms and standards, grey water disposal, DEWATS, institutional arrangements, planning provisions and management issues. Municipal and other wastes – generation, typology, quantity, collection, storage, transportation, treatment, disposal, recycling and reuse, wealth from waste, norms and standards, institutional arrangements, planning provisions and management issues. Power – Sources of power procurement, distribution networks, demand assessment, norms and standards, planning provisions and management issues			
Module-4			
SMART URBAN TRANSPORT SYSTEMS			
Elements of Infrastructure (Physical, Social, Utilities and services), Basic definitions, concepts, significance and importance; Data required for provision and planning of urban networks and services; Resource analysis, Provision of infrastructure. Role of transport, types of transport systems, evolution of transport modes, transport problems and mobility issues. Urban form and Transport patterns, land use – transport cycle, concept of accessibility. Hierarchy, capacity and geometric design elements of roads and intersections. Basic principles of Transport infrastructure design. Urban transport planning process –Transport, environment and safety issues. Principles and approaches of Traffic Management, Transport System Management			
Module-5			
E- GOVERNANCE AND IOT			
The concept of management, concept of e-management & e-business, e-Government Principles, Form e-Government to e-governance, e-governance and developing countries, Designing and Implementing e-Government Strategy, E governance: Issues in implementation. IOT fundamentals, protocols, design and development, data analytics and supporting services, case studies.			
Question paper pattern:			
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			
The students will have to answer five full questions, selecting one full question from each module. ■			
Textbooks and Reference Books			

1. Allen G.Noble, (Eds), 'Regional Development and Planning for the 21st Century: New Priorities and New Philosophies', Aldershot, USA, 1988.
2. Andy Pike, Andres Rodriguez-Pose, John Tomaney, 'Handbook of Local and Regional Development', Taylor & Francis, 2010
3. Andreas Faludi and Sheryl Goldberg, 'Fifty years of Dutch National Physical Planning, Alexandrine Press, Oxford, 1991.
4. Daniel G. Parolek, AIA, Karen Parolek, Paul C. Crawford, FAICP, Form Based Codes: A Guide for Planners, Urban Designers, Municipalities, and Developers, John Wiley & Sons, 2008

PAVEMENT MAINTENANCE & MANAGEMENT SYSTEMS			
Course Code	20CEM242	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module-1			
Introduction: Introduction to Pavement Maintenance Management System, Components of Pavement components of pavement management systems, pavement maintenance measures, planning investment, research management Maintenance Measures, PMMS objectives.			
Module-2			
Requirements and Evaluation of flexible pavements – Design requirements, factors affecting structural condition of flexible pavements, structural behavior and evaluation of structural condition of pavements. Design methods for flexible pavements, design of overlays by Benkelman Beam Rebound Deflection Technique. Pavement Serviceability concepts, Evaluation of riding quality by psycho- physical method. Pavement Maintenance Measures, Implementation of Maintenance management programs.			
Module-3			
Pavement Performance Evaluation: general concepts, serviceability, pavement distress survey systems, performance evaluation Pavement Performance Prediction: concepts, modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models. Functional condition deterioration models, unevenness prediction models and other models, comparison. Modeling in rehabilitation budget planning, case studies, Problems.			
Module-4			
Design alternatives and Selection: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, reliability concepts in pavement engineering, life cycles costing, analysis of alternate pavement strategies based on distress and performance, case studies and Problems.			
Module-5			
Expert systems and Pavement Management: role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge – based expert systems, case studies.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills in pavement maintenance and management system. • Understand the principles of pavement maintenance and management system. Fundamentals. • Develop analytical skills. • Summarize the solution of maintenance techniques. • Understand the concepts of pavement maintenance and its management. 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.

The students will have to answer five full questions, selecting one full question from each module. ■

Text & References:

1. Ralph Hass, Ronald Hudson and Zanieswki, "Modern Pavement management"- Krieger Publications.
2. W. Ronald Hudson, Ralph Haas and WaheedUddin, 'Infrastructure Management'- McGraw Hill
3. Proceedings of North American Conference on Managing Pavement.
4. Proceedings of International Conference on Structural Design of Asphalt Pavements.
5. NCHRP, TRR and TRB Special Reports.

Freddy L Roberts, Prithvi S Kandhal et al, "Hot Mix Asphalt Materials, mixture design and construction"- (2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.

DISASTER MITIGATION & MANAGEMENT			
Course Code	20CEM243	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
Introduction To Disasters Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types Of Disasters – Earthquake, Landslide, Flood, Drought, Fire Etc – Classification, Causes, Impacts Including Social, Economic, Political, Environmental, Health, Psychosocial, Etc.- Differential Impacts- In Terms Of Caste, Class, Gender, Age, Location, Disability – Global Trends In Disasters: Urban Disasters, Pandemics, Complex Emergencies, Climate Change- Dos And Don'ts During Various Types Of Disasters.			
Module - 2			
Approaches To Disaster Risk Reduction Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural non structural measures in DRR, Factors affecting Vulnerabilities, , Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Rehabilitation measures and long term reconstruction.			
Module - 3			
Inter-Relationship Between Disasters And Development Factors Affecting Vulnerabilities, Differential Impacts, Impact Of Development Projects Such As Dams, Embankments, Changes In Land-Use Etc.- Climate Change Adaptation- IPCC Scenario And Scenarios In The Context Of India – Relevance Of Indigenous Knowledge, Appropriate Technology And Local Resource			
Module - 4			
Disaster Risk Management In India Hazard And Vulnerability Profile Of India, Components Of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional Arrangements (Mitigation, Response And Preparedness, Disaster Management Act And Policy – Other Related Policies, Plans, Programmes And Legislation – Role Of GIS And Information Technology Components In Preparedness, Risk Assessment, Response And Recovery Phases Of Disaster – Disaster Damage Assessment.			
Module - 5			
Disaster Management: Applications And Case Studies Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, south India Tsunami, Bihar floods, Plague Surat, Landslide in North East, Heat waves of AP& Orissa, 278 Cold waves in UP. Bengal famine, best practices in disaster management, Local Knowledge Appropriate Technology and local Responses, Indigenous Knowledge, Development projects in India (dams, SEZ) and their impacts.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • To provide students an exposure to disasters, their significance and types. • To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction. • To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR). • To enhance awareness of Institutional processes in the country. • To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity. 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- ~~Each full question will have sub question covering all the topics under a module~~

Text Book & References:

- 1 .R.B.Singh (Ed) Environmental Geography, Heritage Publishers New Delhi
- 2 Savinder Singh Environmental Geography, PrayagPustakBhawan
- 3 Kates,B.I& White, G.F The Environment as Hazards, oxford, New York
- 4 R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi
- 5 H.K. Gupta (Ed) Disaster Management, Universiters Press, India
- 6 Dr. Satender , Disaster Management t in Hills, Concept Publishing Co., New Delhi
- 7 A.S. Arya Action Plan For Earthquake,Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi
- 8 R.K. Bhandani An overview on Natural &Man made Disaster & their Reduction CSIR, New Delhi
- 9.M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster Management,IIPA, New Delhi
- 10 Disaster Mitigation Experiences &Reflectios by PardeepSahni, AlkaDhameja, and Uma Medury.
- 11 Disaster Management Report by Department of Agriculture and Cooperation, Govt. of India.

URBAN HYDROLOGY, STORM DRAINAGE AND MANAGEMENT			
Course Code	20CEM244	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
Urban Hydrologic Process :Process of urbanization – Water in Urban ecosystem – Urban water subsystems – Urban hydrologic cycle. Impact of urbanization on urban runoff and stream flow quantity – Impact of urbanization on quality of runoff and stream flow – Erosion due to urban runoff.			
Module - 2			
Storm water Modeling: Analysis of hydrologic changes due to urbanization- Approaches to study – Data collection and analysis – Probabilistic and statistical approaches. Modelling of urban water quantity – Types of models – Rainfall, Runoff modeling ; urban watershed modeling (quantity) – Rational Method (or coefficient method), Runoff hydrograph, unit hydrographs – 10 min synthetic unit hydrograph – Linear reservoir model (Viessman) – Chen and Shubinski model – QUURM Model – TVA model. Urban watershed modellingfor water quality of runoff and stream water quality.			
Module - 3			
Urban Drainage Systems :Sanitary and combined sewer systems – components – Design considerations for fixing sewer capacity – Infiltration into and exfiltration from sewers -causes Infiltration inflow analysis – Field investigations – Control measures. Design consideration of the components of the sewer systems – Performance of the sewer system both under dry weather flow condition and under storm water impact - Sewer sediment.			
Module - 4			
Storm Water Management: Urban storm runoff quantity and quality management – Mitigation of damaging effects of urban storm runoff Structural and non-structural control measures – Storm water management models.			
Module - 5			
Urban Drainage Systems Maintenance: Maintenance management of UDS and its subsystems – Drainage system – Storm drain conveyance system – Pump stations – Open channel – Illicit connections and discharges – Spill response – Other considerations (limitations and regulations).			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills. • Understand the principles of urban hydrology, storm drainage and management. • Develop analytical skills for storm water modeling. • Summarize the solution of advance management techniques. • Understand the concepts urban hydrology, storm drainage and management. 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			
The students will have to answer five full questions, selecting one full question from each module. ■			

Text Books & References :

1. Stephenson.D, “ Stormwater Hydrology and Drainage “, Elsevier Publications, 2nd Edition, 1981
2. Hall.J.M, “Urban Hydrology”, Elsevier Applied Science Publishing Company, 1st Edition, 1984.
3. Overtens D.E., and MedowsM.E., “Storm water Modelling” Academic Press, 2nd Edition. 1976.
4. Grigg, N.S, “Urban Water Infrastructure Planning, Management, and Operations”, John Wiley & Sons, 2nd Edition, 1986.
5. Viessman W.I., Knapp J.W., Lewis G.L., and Henbrough, T.E., “Introduction to Hydrology” Harper and Row Publishing Company, 2nd Edition , 1977.
6. “Manual of Sewerage and Sewage Treatment”, Ministry of works and Housing, Government of India, 2006

ANALYSIS AND DESIGN OF PAVEMENT			
Course Code	20CEM251	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements. Stresses and strains in flexible pavements:			
Module - 2			
Stresses and strains in an infinite elastic half space - use of Boussinesq's equations-Burmister's two layer and three layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors			
Module - 3			
Flexible pavement design methods for highways and airports: Empirical, semi-empirical and theoretical approaches; Development, principle, design steps of the different pavement design methods including AASHTO, Asphalt Institute, Shell Methods. IRC method of pavement design;			
Module - 4			
Stresses in rigid pavements: Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.			
Module - 5			
Rigid pavement design: Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements;			
Use of relevant software in flexible pavement design (KENLAYER, Asphalt Institute, Design Guide 2002) and concrete pavement design (KENSLAB, HIPERPAVE)			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills in pavement design. • Understand the principles of pavement design and analysis. • Develop analytical skills. • Summarize the solution of design techniques. • Understand the concepts of pavement design by various methods. 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 			

Textbooks and References:

1. Yoder and Witczak, "**Principles of Pavement Design**"- John Wiley and sons Inc(second edition) 1975
2. Yang, "**Design of functional pavements**"-McGraw Hill Book Co.
3. Huang, "**Pavement Analysis**"- Elsevier Publications
4. David Croney, Paul Croney, "**Design & Performance of Road Pavements**"-McGraw hill Book Co.
5. W.Ronald Hudson, Ralph Haas and Zeniswki "**Modern Pavement Management**"-McGraw Hill and Co
6. IRC 37-2001, IRC 81-1997, IRC 58 – 2002, IRC 59 – 1976, IRC 101-1988, Indian Roads Congress
7. Khanna and Justo "**Highway Engineering**"- Nemchand& Bros, Roorkee

ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION			
Course Code	20CEM252	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
Fundamentals of Energy -Energy production systems-Heating, Ventilating and Air conditioning Solar Energy and conservation-Energy Economic Analysis-Energy Conservation And Audits Domestic Energy Consumption-Savings-Primary Energy use in Buildings Residential Commercial-Institutional And Public Buildings.			
Module - 2			
Energy Conservation: Energy and resource conservation-Principles, Design of green buildings-rating systems-LEED Standards-Evaluation Tools for Building Energy-Embodied and Operating Energy-Peak demand Comfort and Indoor Air Quality-Visual and Acoustical Quality-Energy Efficient Design Strategies Contextual factors-Longevity and Process Assessment			
Module - 3			
Energy Efficiency: Energy in Building Design-Energy Efficient and Environmental Friendly Building- Climate, Sun and solar radiation-Psychometrics-Passive Heating and Cooling Systems-Energy Audit-Types of Energy audit-Analysis of results. Energy flow diagram-Energy consumption/Unit production Identification of wastage-Priority of conservative measures Maintenance of Energy Management Programme			
Module - 4			
Energy Management : Energy Management of Electrical Equipment-Improvement of Power Factor-Management of Maximum Demand- Energy Savings in Pumps-Fans-Compressed Air Systems-Energy Savings in Lighting Systems-Air Conditioning Systems-Applications-Facility			
Module - 5			
Energy Operation And Maintenance: Facility Modifications-Energy Recovery Dehumidifier-Water Heat Recovery-Steam Plants and Distribution Systems- Energy Savings In Pumps-Fans-Compressed air systems- Applications			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of Design and development of energy conservation techniques. • Understand the fundamentals of energy conservation and energy efficiency. • Design and Develop energy models for construction industry. • Summarize the principles of energy usage and conservation skills. • Select appropriate energy conservation to reduce the wastage of energy. 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			
The students will have to answer five full questions, selecting one full question from each module. ■			

Textbooks and References:

1. Moore F., " Environmental control systems ", McGraw Hill, Inc., 1994.
2. Brown, G.Z, Sun, " Wind and Light: Architectural design Strategies ", John Wiley & Sons., 1985.
3. Cook, J, " Award - Winning Passive Solar Design ", McGraw Hill, 1984.

ADVANCE STRUCTURAL DESIGN AND DETAIL			
Course Code	20CEM253	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
Introduction : Introduction to limit state method of design; provisions in the Indian Standard codes for loading, wind loads and seismic loads, design and detailing of concrete structures. Examples of design using BIS handbook Structural Analysis, Design and Detailing for: Columns with biaxial moments.			
Module - 2			
Structural Analysis, Design and Detailing for: Multi-storey building frame design and Grid floors.			
Module - 3			
Structural Analysis, Design and Detailing for: Silos and bunkers.			
Module - 4			
Structural Analysis, Design and Detailing for: Flat slabs.			
Module - 5			
Structural Analysis, Design and Detailing for: Concrete Chimneys.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of Design and development of problem solving techniques. • Understand the principles of structural design. • Design and Develop analytical skills. • Summarize the principles of structural design and detailing. • Understand the structural performance. 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 			
Textbooks and References:			
<ol style="list-style-type: none"> 1. Dayaratnam, P: Reinforced Concrete Structures. 2. Jain, A.K. : Reinforced Concrete, Limit State Method of Design. NemChand & Bros. 3. Punmia, B.C. Reinforced Concrete Structures, Vol II., Laxmi Publications 4. Jain and Jaikrishna : Plain and Reinforced Concrete Vol II. 5. STAAD Pro- (Software) 			

COMPOSITE AND SMART MATERIALS			
Course Code	20CEM254	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
Introduction: Introduction to Composite materials, classifications and applications. Anisotropic elasticity – unidirectional and anisotropic laminae, thermo – mechanical properties, micro – mechanical analysis, characterization tests. Classical composite lamination theory, cross and angle – play laminae, symmetric, antisymmetric and general symmetric laminates, mechanical coupling. Analysis of simple laminated structural elements ply-stress and strain, lamina failure theories – first ply failure, vibration and buckling analysis. Sandwich structure face and core materials, secondary failure modes environmental effects, manufacturing of composites.			
Module - 2			
Introduction to smart materials and structures – piezoelectric materials – coupled electromechanical constitutive relations – depoling and coercive field – field – strain relation – hysteresis – creep – strain rate effects – manufacturing.			
Module - 3			
Actuators and sensors: single and dual actuators – pure extension, pure bending – bending extension relations – uniform strain beam model – symmetric induced strain actuators – bond			
Module - 4			
Shearing force – Bernoulli Euler (BE) beam model – embedded actuators. Assymmetric induced strain actuators in uniform strain and Euler – Bernoulli models. Uniform strain model – energy principle formulation – BE model – single and dual surface bonded actuators – Extension – bending and torsion model.			
Module - 5			
Introductions to control systems: Open loop and close loop transfer functions – stability criteria – deflection control of beam like structures – using piezoelectric sensors and actuators – shape memory alloys.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of Planning and usage of construction materials. • Understand the behavior of materials. • Develop material manufacture skills. • Summarize the models of material behavior techniques. 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 			

Text Book and References:

1. Mechanics of Composite Materials and Structures by M. Mukhopadhyaya- Universities Press 2009
2. Robert M. Jones, "Mechanics of Composite Materials"- McGraw Hill Publishing Co.
3. Bhagwan D Agarwal, and Lawrence J Brumman, "Analysis and Performance of Fiber Composites"- John Wiley and Sons.
4. Crawley, E and de Luis, J., "Use of Piezoelectric actuators as elements of intelligent structures"- AIAA Journal, Vol.20, No.10, Oct 1987, PP 1373-1385.
5. Crawley, E and Anderson, E., "Detailed models of Piezoceramic actuation of beams" - Proc. of the 30th AIAA/ASME/ASCE/AHS/ASC – Structural dynamics and material conference, AIAA, Washington DC, April 1989.

PROJECT MANAGEMENT LAB			
Course Code	20CEML2 6	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03
SL.N O	Experiments		
1	Spread sheet programming.		
2	Programming management problems for price forecasting, regression analysis, inventory models		
3	Operation Research and project management problems.		
4	Database Management using popular DBMS like Access.		
5	Introduction to Project Management Software's		
6	Defining custom data items, Planning resources and costs.		
7	Resource levelling, Quantity and Cost Estimation		
8	Using MS Project software Working on Practical Projects.		
9	Using Primavera Software Working on Practical Projects.		
10	Modelling / Handling actual practical project management projects.		
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of Design and development of experimental skills. • Understand the principles of design of experiments. • Design and Develop analytical skills. • Summarize the management methods by software's. 			
References:			
1. Raina V.K., (1988), "Construction Management practice", Tata – McGraw Hill publishing co. Ltd.			
2. Punmia B.C. and Khandelwal K.K., (1989), "Project Planning and Control with PERT. and CPM", Laxmi Publication II Edn..			
3. K KChitkara, (1999), "Construction Project Management", Tata- McGraw Hill publishing co. Ltd.Publication.			
4. Rain Diana, "Training Guide to Microsoft Access", BPB Publications, New Delhi			
5. Step by step Microsoft access(CD ROM),PHI Delhi			
6. User Manual- MS Project & Primavera P6			
7. Ang and Tang, (1984) "Probability concepts in engineering planning and design", Vol. I and II, Wiley International.			
8. Kottegoda N.T., Rosso Renzo, (1998) "Statistics, Probability and Reliability for Civil and Environmental Engineers", Mc-Graw Hill International.			
9. AICTE Continuing Education Programme, "Quantitative Methods in Construction Management"			

TECHNICAL SEMINAR			
Course Code	20CEM27	CIE Marks	100
Number of contact	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--
<p>Course objectives: The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course of Specialization. • Carryout literature survey, organize the Course topics in a systematic order. • Prepare the report with own sentences. • Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities. • Present the seminar topic orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as the Chairperson.</p>			
<p>Marks distribution for CIE of the course 20CEM27 seminar: Seminar Report: 30 marks Presentation skill:50 marks Question and Answer:20 marks</p>			

*** END OF II SEMESTER***

CONSTRUCTION QUALITY AND SAFETY MANAGEMENT			
Course Code	20CEM31	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03
Module - 1			
<p>Quality and concept of QM - Necessity for improving quality,, concept of quality control, quality assurance, quality management and total quality management , Total quality management concepts; ISO9000 documentation; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment; Material Quality Assurance; Specifications and Tolerances.</p> <p>Quality Planning - Quality policy, objectives and methods in construction industry - consumers satisfaction -, time of completion - statistical tolerance.</p>			
Module - 2			
<p>Codes and standards quality manuals - documents - contract and construction programming - inspection procedures -processes and products - total QA / QC programme and cost implication.</p> <p>Managing Quality in various projects stages from concept to completion by building quality into design of structures, Inspection of incoming material and machinery In process quality inspections and tests.</p> <p>Reliability & Probability testing, reliability coefficient and reliability prediction - selection of new materials - influence of drawings, detailing, specification, standardization - bid preparation - construction activity, environmental safety and social factors -natural causes and speed of construction - life cycle costing - value engineering and value analysis.</p>			
Module - 3			
<p>Quality Assurance Department -and quality control responsibilities of the line organization, developing quality culture in the organization, training of people,</p> <p>Construction accidents -importance, causes of accident, safety measures, construction industry related laws. human factors in safety – legal and financial aspects of accidents in construction – occupational and safety hazard assessment.</p>			
Module - 4			
<p>Safety Programmes - elements of safety programmes, job-site assessment, safety meetings, safety incentives, contractual obligations, safety in construction contracts</p> <p>Safety in Design- safety culture - Safe Workers- Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company Activities and Safety - Safety Personnel - Sub-contractual Obligation - Project Coordination and Safety Procedures - Workers Compensation , Safety issues; Injury accidents and their causes; Safety program components; Role of workers, Supervisors, Managers and Owners; Safety Procedures for various construction operations; Safety audits; Safety laws.</p>			
Module - 5			
<p>Safety Management - safety and first line supervisors, safety and middle managers, top management practices, safety audit, safety equipment planning and site preparation, safety system of storing construction materials Excavation - blasting- timbering-scaffolding- safe use of ladders- safety in welding. First- aid- Fire hazards and preventing methods</p>			
Module - 5			

Course outcomes:

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

- Achieve Knowledge of problem solving skills.
- Understand the principles of construction quality and safety management.
- Develop analytical skills to maintain quality.
- Summarize the solution of advance quality and safety management techniques.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks and References:

1. James, J.O Brian, Construction Inspection Handbook - Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tenah, Jose, M. Guevara, Fundamentals of Construction Management and Organization, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M, Quality Planning and Analysis, Tata McGraw Hill, 1982.
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 1993.
5. Clarkson H. Ogiesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. IS, IRC, Other codes
7. Jimmy W. Hinze, *Construction Safety, Prentice Hall Inc., 1997*
8. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, *Construction Safety and Health Management, Prentice Hall Inc., 2001.*
9. Hand Book on Construction Safety Practices, SP 70, BIS 2001.

PROFESSIONAL PRACTICE			
Course Code	20CEM321	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module - 1			
Profession: Idea of profession and essential difference among profession, trade and business. Profession of architecture, its essential tenets, duties and liabilities. Types and extent of services offered by architects, scale of fees, stages of payment, and contract between client and architect. Code of Professional Conduct, Architects Act of 1972. Role of Council of Architecture and the Indian Institute of Architects in the functioning of the Profession.			
Module - 2			
Practice: Types of Architectural firms, proprietorship, partnership, associate ship, and private limited concerns. Advantages and disadvantages of each type of firms. Various means of building client base and gaining projects. Architectural competitions, guidelines of COA, procedure of conduct of such competitions. Administration and basic accounting procedures. Taxes and implications of service tax. Implication of GATS on the profession in India.			
Module - 3			
Contract: General Principles, types of contract, definitions of various terms used in the contract document. Contract document, contents and sections dealing with various aspects of contract management. Conditions and Scope of Contract and the role of an architect in ensuring a positive completion of a contract. Contract Management: Overview of procedures in contract management.			
Module - 4			
Supervision & Contract Administration: Site visits, site meeting, co-ordination with various agencies, site book, site instructions, clerk of works and site office. Bill checking, quality auditing, handover procedures and final certification. Disputes in contract and architect's role in resolving such disputes. Case studies from practice highlighting disputes in contract and methods adopted to solve such disputes.			
Module - 5			
Byelaws and easements: Building byelaws, National Building Code, floor area ratio, floor space index, floating FAR, zoning regulations. Easements, various easement rights, architect's role in protecting easement rights. Laws related to Property and Land: Land tenure, types of land holdings, land registration, easement rights, covenants, trespass and nuisance etc.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills. • Understand the principles of Construction Practice. • Develop analytical skills to supervision and administration. Summarize the techniques of byelaws and easements.			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module.■ 			

Textbooks and References:

1. "Professional Practice for Architects & Engineers" by Roshan Namavathi
2. "Legal and Contractual Procedures for Architects" by Bob Greenstreet
3. AJ Legal Handbook 4) "Professional Practice" by KG Krishnamurthy and SV Ravindra.

Value Engineering and Valuation			
Course Code	20CEM322	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module-1			
Value engineering			
Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, economic etc., Difference between value engineering, value analysis & value management, Habits, roadblocks, attitudes & their relevance in value engineering. Introduction, Life cycle of a Product, Definition, objectives and methodology of value Engineering, Comparison with other cost reduction techniques, unnecessary cost.			
Module-2			
Valuation			
Types of value, purposes of valuation factors affecting value, Different methods of valuation for different types of assets such as land and building, horticulture, historical places, Valuation Report: Valuation Report, contents, standard formats, Case study of any one Report			
Module-3			
Job Plan			
Definition & Terms related to Value Engineering Job Plan, Various versions of job plan, Phases involved in job plan- General, information, function, creation/speculation, evaluation, investigation, recommendation and implementation. FAST diagramming: Critical path of function, How, why and when logic, supporting and all time functions, Ground rule for FAST diagram			
Module-4			
Function Analysis			
Function- Definition, Role of function in achieving value, Types of function, relationship between different functions in design of a Product, functional cost, functional worth, test for poor value, aim of value engineering. Function Analysis System Techniques (FAST), Graphical Function Analysis, Systematic approach, Phases of value engineering			
Module-5			
Value Analysis			
Principles of value analysis, Benefits & applications of value analysis, Methods for improving the effectiveness of value analysis, Decision /evaluation Matrix: Quantitative comparison of alternatives, estimation of weight factors and efficiency			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Understand concepts in structural health monitoring and acquire knowledge of smart materials • Understand vibration control methods in structural health monitoring. • Understand electrical impedance methods in structural health monitoring. • Understand wave propagation methods in structural health monitoring. • Understand advanced signal processing techniques in structural health monitoring. • Understand applications of structural health monitoring in different structural systems. 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module. ■

Textbooks and References

1. Value Engineering: Analysis and Methodology By Del Younke
2. Industrial Engg. & Mgt., O.P.Khanna, DhanpatRai Publ.
3. Industrial Organization & Engg. Economics, T.R.Banga, S.C.Sharma, Khanna Publ.
4. Estimating and Costing in Civil Engineering: Theory and Practice B.N Dutta Published
5. Dutta & Company, Lucknow.
6. Estimating, Costing Specifications & valuation in Civil Engineering By: M.Chakraborty Published By: Author.
7. Estimating and Costing By: G.S.Birdie
8. Estimating and Costing By: Rangwala Published By: Charotar Publishing House,
9. Practical Information for Quantity Surveyors, Property valuers, Architects Engineers and
- 10.** Builders, P.T.Joglekar, Pune VidyarthiGrihaPrakashan, 2008 reprint.

STEEL & COMPOSITE CONSTRUCTION TECHNOLOGY			
Course Code	20CEM323	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module - 1			
Introduction: Materials, classification and properties Structural steel sections and data Behavior of steel structures: Steel water tanks, Chimneys and Stacks, Bridge Structures, Building Frames, Steel Space grids.			
Module - 2			
Structural Steel Detailing: Symbols, layout drawings, shop detail drawings, assembly marking. Structural steel fabrication: Methods - tools, equipment and practices, Punching, Reaming and drilling, cutting Operations, fittings, fasteners, bolting, riveting and welding, Assembly, inspection, cleaning, sand blasting and painting: Transportation of fabricated components, Storage and handling.			
Module - 3			
Erection of steel structures : Erection equipment, erection tools, methods of erection, section sequence field connections, detailing to facilitate erection. Specifications, Estimating and costing steel work. Fire protection of steel construction Maintenance and repair of steel structures			
Module - 4			
Composite Constructions Introduction to composite construction, basic concepts, types of composite, Constructions Steel concrete composite, Analysis and of composite beams Composite floors.			
Module - 5			
Shear connectors: functions & types Steel concrete composite columns, columns subjected to axial loads and moments. Encased composite construction of beams and columns, concepts and design.			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills. • Understand the design principles of steel and composite construction technology. • Develop analytical skills of composite structures. • Summarize the solution of problem solving skills. Understand the concepts steel detailing, fabrication, erection and construction.			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module. ■ 			

Textbook/ Textbooks References:

1. Ramachandra, 'Design of steel structures', Standard Book House, New Delhi
2. Bryan E.R., 'The stressed skin design of steel buildings'
3. Malhotra M.M. 'Design of Steel Structures'
4. BreskerBoro, 'Design of steel Structures'
5. Dayaratnam, 'Design of Steel Structures'.
6. IS:11384, IRC-22
7. Composite Structures, G M Sabnis
8. "Composite Construction, Design for Buildings", Viest et al., 1997, ASCE/McGraw-Hill, Inc.
9. "Handbook of Structural Steel Connection Design and Details" Edited by Akbar Tamboli,

BRIDGE AND GRADE SEPARATED STRUCTURES			
Course Code	20CEM324	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module - 1			
Geometry -Traffic lane, road way, footpaths, and clearance for vehicles, kerb, crash barrier, parapet, lighting, horizontal and vertical alignment, super-elevation, drainage Substructures - soil exploration techniques. piling methods, pile types, pile testing, Pile concreting.			
Module - 2			
Caissons or well foundations: Caisson construction and sinking methods,- bed preparation, supporting structures, excavation method, de-watering for freeing a 'hanging' caisson, pneumatic sinking of caissons, methods of staving and bottom plugging			
Module - 3			
Superstructure - reinforced concrete superstructure, prestressed concrete superstructure,- composite and steel superstructure, special superstructures. Slab, T-beam and Box girder deck slab construction: Slab type, T-beam and box-girder bridges Decks Construction methods. Span lengths -deck and stiffening system.			
Module - 4			
Segmental Construction, Cantilever Construction and Successive Launching- Precast segmental construction for long-span bridges- cables and their profiling - deck section - soffit surface -deflection and pre-camber - expansion joint - bearings - aesthetics. Cable-stayed bridge construction - Construction methods - cable configuration - towers - multi span cable stayed bridges - stay tendons - aerodynamic stability.			
Module - 5			
Composite Construction -steel - concrete composite construction - theory of composite structures - Introduction to steel - concrete - steel sandwich construction. RE Panel Structures - geosynthetics, functions and applications, reinforced retaining walls, construction methods, benefits .			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills. • Understand the design principles of bridge construction technology. • Develop analytical skills of caissons and RE panels. • Summarize the solution of problem solving skills. Understand the concepts geometry, substructures, superstructures and composite construction.			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module.■ 			

References:

1. Chew Yit Lin, Michael, Construction Technology for Tall Buildings, Singapore University Press, World Scientific, Hong Kong,
2. Victor.D.J, Essentials of Bridge Engineering, Oxford IBH
3. Ponnuswamy.S, Bridge Engineering, Tata McGraw Hill
4. Raina V.K. Concrete Bridge practice, Tata McGraw Hill Publishing Co.
5. Derrick Beckett, An Introduction to Structural Design of Concrete Bridges, Surrey University Press, Oxford Shire
6. Fleming. W. G. K., et al., Piling Engineering, Surrey University Press, London.
7. E.C. Hambly, Bridge deck behaviour, Chapman and Hall, London
8. N.KrishnaRaju, Design of bridges, Oxford & IBH publishing Co. Ltd., New Delhi.
9. IRC: 5, Standard specifications and code of practice for road bridges, Sections I to V, Indian Roads Congress, New Delhi.
10. Indian railway standard code of practice for the design of steel or wrought iron bridge carrying Rail, road or pedestrian traffic, Govt. of India, Ministry of Railways,

ECO-FRIENDLY CONSTRUCTIONS			
Course Code	20CEM331	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module - 1			
Eco-friendly Planning: -Energy Efficient Shelters, Housing Options Today, Site Planning and Use of On-Site Resources, Smaller Houses that Utilize Space and Materials More Efficiently, Working With Nature, Better Window Planning, Balancing Energy and Aesthetic Needs.			
Module - 2			
Eco-friendly Materials: Construction materials –locally available building materials- Soil, Fly ash, Ferrocement, Lime, Fibres, Stone Dust, Red mud, Gypsum,Alternate Wood, Polymer-ADOBE,Cob Rammed Earth, Light Clay,			
Module - 3			
Eco-friendly Materials: Straw-Bale, Bamboo, Agro-Industrial Waste, Innovative Materials Developed by CBRI, SERC, Structural Properties Of Alternate Building Materials, Earthen Finishes , Earth Plasters, Earth Floors.			
Module - 4			
Cost Effective Construction Techniques: Construction Techniques-Innovative Techniques developed by CBRI, SERC for foundation, superstructure, roofing, pre-fabricated construction techniques, advantage of pre-fabrication areas where pre-fabrication can be introduced, modular contained earth, earth bag construction			
Module - 5			
Cost Effective Construction Equipments Brick moulding machine, Stabilized soil block making machine and plants for the manufacturing of concrete blocks, M.C.R. tile making machine, Ferrocement wall panel & Roofing channel making machine, R.C.C. Chaukhat making machine.			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills for eco friendly construction. • Understand the principles of eco friendly construction planning. • Develop analytical skills for cost effective construction techniques. Summarize the solution of eco friendly construction and management techniques.			
Question paper pattern:			
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. The students will have to answer five full questions, selecting one full question from each module. ■			
Textbooks and References:			
<ol style="list-style-type: none"> 1. Givoni, “Man, Climate, Architecture”, Van Nostrand, New York, 1976. 2. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, John Wiley & Sons, 2005 3. Lynne Elizabeth, Cassandra Adams “Alternative Construction : Contemporary Natural Building Methods ”, Softcover, Wiley & Sons Australia, Limited, John, Rajeeva S J, 2005 4. Eugene Eccli- “Low Cost, Energy efficient shelter for owner & builder”, Rodale Press, 1976 			

INFRASTRUCTURE DEVELOPMENT			
Course Code	20CEM332	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module-1			
Construction Industry -Nature, characteristics, size and structure, Role of infrastructure development in employment generation and improving of the National economy			
Module-2			
Infrastructure Policies and Agencies -Indian government policy, Five year plan of government, Various Agencies associated with infrastructure development in India as regards various sectors.			
Module-3			
Status of Infrastructure in India -Roads and buildings, communication, water supply, irrigation, power energy sectors, ports and aviation, health and educational services, rural development			
Module-4			
Infrastructure development -Issues related with infrastructure development, Government sector management, public sector management, private sector management			
Module-5			
Funding and Consultant -Funding and managing infrastructure projects, role, and responsibility of project management consultants.			
Project Development -BOT projects, PPP projects, related to role of government, concern Construction Company, benefits and limitations			
Course outcomes: At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills for infrastructure development. • Understand the principles of infrastructure development. • Develop analytical skills for infrastructure development. • Summarize the solution for problems in infrastructure development 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.			
<ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			
Textbooks and References: India Infrastructure Report – Rakesh Mohan			
<ul style="list-style-type: none"> • □Infrastructure Today - Magazine • □Document of five year plans, published by Govt. of India • CE & CR Magazine. • Construction World Magazine. 			

HIGHWAY INFRASTRUCTURE			
Course Code	20CEM333	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module-1			
Introduction and planning			
Roll of transport in modern society and in countries economy, modes of transport and their characteristics, need for transport planning, goals and objectives, transportation planning process - stages in transport planning - inventories, trip generation, trip distribution, modal split, and traffic assignment. Scope of highway infrastructure, Road development plans, Recent developments – NHAI,NHDP,PMGSY,MSRDC, Highway finance –BOT,BOT, Annuity, PPP, DBFO.			
Module-2			
Highway project preparation			
Importance of surveys and investigation, types, traffic surveys-classified volume count, traffic growth rate, axle load surveys, speed and delays surveys, origin and destination surveys, Conventional ground surveys, alignment and root locations, drainage studies, soil and pavement design investigations			
Module-3			
Traffic Engineering and Highway Geometric Design			
Traffic characteristics, traffic studies and analysis, traffic control devices, road marking, traffic sign, traffic signal, intersections, Terrain classification, Highway Alignment-Definition, requirements, factors controlling alignment, alignment of hill roads. Cross sectional elements, sight distances, concept of level of service, PCU, parking studies, accident studies and highway safety. Highway Drainage: Necessity, surface and subsurface drainage, maintenance and repairs			
Module-4			
Reinforced earth Structures			
Reinforced earth structures to improve bearing capacity and stability of embankment slopes, Types and applications of geosynthetic reinforcements, Bearing, Internal and external stability of reinforced earth structures, Reinforcing of earth using geosynthetics, soil nailing (SNART) to protect land sliding, Waste utilization with reinforcements in road and rail trackembankment fill			
Module-5			
Highway economics and finance			
Methods of highway finance, economical and financial evaluation of project, distinction between economic and financial analysis, commonly used terms in economic and financial analysis, total transportation cost, shadow pricing, treatment of inflation, methods of economic evaluation. Net present value (NPV), internal rate of return method, benefit cost ratio method, stages in economic evaluation, P P P Model Highway Project			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Achieve Knowledge of problem solving skills for Highway infrastructure development. • Understand the principles of highway infrastructure development. • Develop analytical skills for highway infrastructure development. • Summarize the solution for problems in highway infrastructure development 			

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each

Textbooks and References:

- Khanna S.K. and C.E.G. Justo (2000): Highway Engineering, Nem Chand & Bros., Roorkee.
- □ Partha Chakroborty and Animesh Das (2003): Principles of Transportation Engineering, Prentice-Hall India, New Delhi.
- □ Drew D.R. (1968): Traffic Flow Theory and Control, McGraw-Hill, New York.
- □ Hutchinson B.G. (1974): Principles of Urban Transport Systems Planning. McGraw-Hill Book Co., New York.
- Yang H. Huang (1993): Pavement Analysis and Design, PrenticeHall.
- L. R. Kadiyali “Traffic Engineering and transport planning”, Khanna Publishers.
- □ Annual on Economic Evaluation of Highway Projects in India.
- Foundation Engineering by P.C. Varghese, Prentice Hall of India.
- □ Foundation Analysis and Design by L.F. Bowles, Mc Graw Hill

SUSTAINABLE DEVELOPMENT AND URBAN PLANNING			
Course Code	20CEM334	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03
Module-1			
Introduction To Sustainable Development Definitions and principles of Sustainable Development - History and emergence of the concept of Sustainable Development - Environment and Development linkages- Globalization and environment – Millennium Development Goals: Status (global and Indian) - Impacts on approach to development policy and practice in India, future directions.			
Module-2			
Environmental Sustainability Land, Water and Food production - Moving towards sustainability: Energy powering Sustainable Development - Financing the environment and Sustainable Development.			
Module-3			
Empowerment Empowerment Of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business And Industry - Sustainability Indicators – Hurdles To Sustainability-Operational Guidelines-Interconnected Prerequisites For Sustainable Development - Science And Technology For Sustainable Development - Performance Indicators Of Sustainability And Assessment Mechanism – Constraints And Barriers For Sustainable Development.			
Module-4			
Urban Planning And Environment Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development			
Module-5			
The Built In Environment Urban Form, Land Use, Compact Development, Principles of street design- complete streets, Transport Integrated Urban land use Planning, , Guidelines for Environmentally sound Transportation			
Course outcomes: At the end of the course the student will be able to: <ul style="list-style-type: none"> • Describe the concept and socio-economic policies of Sustainable Development • Identify the strategies for implementing eco development programmes • Identify different approaches for resource conservation and management • Suggest action plans for implementation of sustainable development • Explain Urban Planning and Environment 			
Question paper pattern: The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60. <ul style="list-style-type: none"> • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. 			

Textbooks and References:

1. Gilg A W and Yarwood R, "Rural Change and Sustainability - Agriculture, the Environment and Communities", CABI Edited by S J Essex, September 2005.
2. Ganesha Somayaji and Sakarama Somayaji, "Environmental Concerns and Sustainable development: Some perspectives from India", Editors:, publisher TERI Press, ISBN 8179932249.
3. James H. Weaver, Michael T. Rock, Kenneth Kustere, "Achieving Broad-Based Sustainable Development: Governance, Environment, and Growth with Equity", Kumarian Press, West Hartford, CT. Publication Year, 1997.
4. Kirkby, J, O'Keefe P. and Timberlake, "Sustainable development" Earth Scan Publication, London, 1996.
5. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher: Belhaven Press, ISBN: 1852930039.
6. Munier N, "Introduction to Sustainability", Springer 2005

PROJECT WORK PHASE – 1			
Course Code	20CEM34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--
<p>Course objectives:</p> <ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. • Instil responsibilities to oneself and others. • Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. • ■ 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p>			
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation, and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. • Demonstrate the knowledge, skills and attitudes of a professional engineer. 			
<p>Continuous Internal Evaluation</p> <p>CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.</p>			

MINI PROJECT			
Course Code	20 CEM35	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	02	Exam Hours/Batch	03
<p>Course objectives:</p> <ul style="list-style-type: none"> • To support independent learning and innovative attitude. • To guide to select and utilize adequate information from varied resources upholding ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
<p>Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.</p>			
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Present the mini-project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills. • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. • Work in a team to achieve common goal. • Learn on their own, reflect on their learning and take appropriate actions to improve it. 			
<p>CIE procedure for Mini - Project:</p> <p>The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25. The marks awarded for Mini - Project report shall be the same for all the batch mates.</p> <p>Semester End Examination</p> <p>SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.</p>			

INTERNSHIP / PROFESSIONAL PRACTICE			
Course Code	20 CEM I36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03
<p>Course objectives: Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further, To put theory into practice. To expand thinking and broaden the knowledge and skills acquired through course work in the field. To relate to, interact with, and learn from current professionals in the field. To gain a greater understanding of the duties and responsibilities of a professional. To understand and adhere to professional standards in the field. To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality. To identify personal strengths and weaknesses. To develop the initiative and motivation to be a self-starter and work independently. ■</p>			
<p>Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship. Seminar: Each student, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. • The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. ■ 			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. • Identify areas for future knowledge and skill development. • Expand intellectual capacity, credibility, judgment, intuition. • Acquire the knowledge of administration, marketing, finance and economics. ■ 			

Continuous Internal Evaluation

CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson. ■

Semester End Examination

SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■

PROJECT WORK PHASE -2			
Course Code	20 CEM 41	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03
Course objectives:			
<ul style="list-style-type: none"> • To support independent learning. • To guide to select and utilize adequate information from varied resources maintaining ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. ■ 			
Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism. ■			
Course outcomes:			
At the end of the course the student will be able to:			
<ul style="list-style-type: none"> • Present the project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. • Work in a team to achieve common goal. • Learn on their own, reflect on their learning and take appropriate actions to improve it. ■ 			
Continuous Internal Evaluation:			
Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.			
Project Presentation: 10 marks. The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.			
Question and Answer: 10 marks. The student shall be evaluated based on the ability in the Question and Answer session for 10 marks.			
Semester End Examination SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■			

