DEPARTMENT OF CIVIL ENGINEERING

KALASALINGAM UNIVERSITY

(Kalasalingam Academy of Research and Education)

Anand Nagar, Krishnankoil – 626 126.

M.Tech. in CONSTRUCTION ENGINEERING AND MANAGEMENT

M.TECH CONSTRUCTION ENGINEERING AND MANAGEMENT

SEMESTER I

CODE NO.	COURSE TITLE	L	T	P	C
MAT 5008	Statistics and Computational Methods	3	1	0	4
CIV 5101	Smart Construction materials	3	0	0	3
CIV 5102	Construction Techniques and Equipments	3	0	0	3
CIV 5103	Project Formulation and Appraisal	3	0	0	3
CIV 5104	Quality Control and Assurance in Construction	3	0	0	3
CIV xxxx	Elective-I	3	0	0	3
				Total credits	**19**

SEMESTER II

CODE NO.	COURSE TITLE	L	T	P	C
CIV 5105	Contract Laws and Regulations	3	0	0	3
CIV 5106	Construction Planning, Scheduling and Control	3	0	0	3
CIV 5107	Project Safety Management	3	0	0	3
CIV 5108	Computer Applications in Construction Engineering and Planning	3	0	0	3
CIV 5181	Construction Practices & Planning Laboratory	0	0	3	1
CIV xxxx	Elective-II	3	0	0	3
CIV xxxx	Elective-III	3	0	0	3
				Total credits	**19**

SEMESTERIII

CODE NO.	COURSE TITLE	L	T	P	C
CIV 5182	Practical Training	0	0	9	3
CIV xxxx	Elective-IV	3	0	0	3
CIV xxxx	Elective-V	3	0	0	3
CIV xxxx	Elective-VI	3	0	0	3
CIV 6198	Project Work Phase-I	0	0	18	6
				Total credits	**18**

SEMESTERIV

CODE NO.	COURSE TITLE	L	T	P	C
CIV 6199	Project Work Phase-II	0	0	36	12
				Total credits	**12**

LIST OF ELECTIVE COURSES

CODE NO.	COURSE TITLE	L	T	P	C
CIV 5111	Shoring, Scaffolding and Formwork	3	0	0	3
CIV 5112	Automation and Integration in Construction	3	0	0	3
CIV 5113	Energy Conservation Techniques in Building Construction	3	0	0	3
CIV 5114	Construction of Infrastructure	3	0	0	3
CIV 5115	Construction Project Management	3	0	0	3
CIV 5116	Quantitative Techniques in Management	3	0	0	3
CIV 5117	Construction Personnel Management	3	0	0	3
CIV 5118	Business Economics and Finance Management	3	0	0	3
CIV 5119	Resource Management and Control in Construction	3	0	0	3
CIV 5120	Management Information System	3	0	0	3
CIV 5121	Maintenance and Rehabilitation of Structures	3	0	0	3
CIV 5122	Structural Design for Concrete and Steel Structures	3	0	0	3
CIV 6101	Advanced concrete technology	3	0	0	3
CIV 6102	Cement and concrete composites	3	0	0	3
CIV 6103	Disaster resistant structures	3	0	0	3
CIV 6104	Experimental techniques	3	0	0	3
CIV 6105	Explosion effects and structural design for blast loading	3	0	0	3
CIV 6106	High performance concrete	3	0	0	3
CIV 6107	Measurement and instrumentation	3	0	0	3
CIV 6108	Recent advances in construction materials	3	0	0	3
CIV 6109	Self compacting concrete	3	0	0	3
CIV 6110	Coastal engineering and offshore structures	3	0	0	3
CIV 6111	Disaster management and mitigation	3	0	0	3
CIV 6112	Tsunami resistant structures	3	0	0	3

CIV 5101	SMART CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to
CO1 : Understand the structural, physical and long term performance of building materials used in construction.
CO2 : Understand mechanical and non mechanical behaviour of smart materials
CO3: Understand the use of advanced materials in construction projects.

CO4: Identify crucial problem areas in manufacture and applications of building materials.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2					H	L					M	L
CO3	L		M								H	
CO4			H								M	

Introduction

Introduction to Smart Materials and Structures - intelligent materials for intelligent buildings – Special features Instrumented structures functions and response - Sensing systems - Self diagnosis - Signal processing consideration - Actuation systems and effects.

Measuring techniques and control systems

Strain Measuring Techniques using Electrical strain gauges, Types - Resistance - Capacitance - Inductance - Wheatstone bridges - Pressure transducers - Load cells - Temperature Compensation - Strain Rosettes. Data Acquisition and Processing - Signal Processing and Control for Smart Structures - Sensors as Geometrical Processors - Signal Processing - Control System - Linear and Non-Linear.

Sensors and actuators

Sensing Technology - Types of Sensors - Physical Measurement using Piezo Electric Strain measurement - Inductively Read Transducers - The LVOT - Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment - Absorptive chemical sensors - Spectroscopes - Fibre Optic Chemical Sensing Systems and Distributed measurement. - Actuator Techniques - Actuator and actuator materials - Piezoelectric and Electrostrictive

Material - Magneto structure Material - Shape Memory Alloys - Electro orheological Fluids - Electro magnetic actuation - Role of actuators and Actuator Materials.

Special concretes

High strength and high performance concrete – Fibre reinforced concrete, Self compacting concrete, Alternate materials to concrete - Steel – New alloy steels – Aluminium and its products – Applications - Corrosion - Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection.

Composites and other materials

Plastics – Reinforced polymers – FRP – Applications- Water proofing compounds – Non-weathering materials – Flooring and façade materials.

REFERENCES

1. Brain Culshaw - Smart Structure and Materials Artech House - Borton. London-1996.
2. Srinath, L. S., Experimental Stress Analysis, Tata McGraw-Hill, 1998.
3. Dally, J. W., Riley, W.F., Experimental Stress Analysis, Tata McGraw-Hill, 1998.
4. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001.
5. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
6. Aitkens, High Performance Concrete, McGraw Hill, 1999.
7. Ashby, M.F. and Jones. D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005.

CIV 5102	CONSTRUCTION TECHNIQUES AND EQUIPMENTS	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Select construction equipment appropriate to tasks.

CO2 : Estimate equipment ownership and operating costs

CO3: Estimate and schedule activities using equipment productivity and cost data..

CO4: Understand contemporary issues pertaining to construction methods, equipment usage and management.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1			M		H					L		M
CO2					H	L					M	L
CO3	L		M								H	
CO4			H								M	

Construction practices

Specifications, details and sequence of activities and construction co-ordination - Site Clearance - Marking - Earthwork - masonry - stone masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering sheet piles - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - frames - braced domes - laying brick - weather and water proof - roof finishes - air conditioning - acoustic and fire protection.

Sub structure construction

Techniques of Box jacking - Pipe Jacking -under water construction of diaphragm walls and basement -Tunneling techniques - Piling techniques- driving well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting- Large reservoir construction with membranes and Earth system- well points - Dewatering and stand by Plant equipment for underground open excavation.

Super structure construction

Launching girders, bridge decks, off shore platforms - special forms for shells - techniques for heavy decks - in-situ pre-stressing in high rise structures, aerial transporting handling - erecting light weight components on tall structures -erection of transmission towers - Construction sequences in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges -Support structure for heavy Equipment and conveyors -Erection of articulated structures, braced domes and space decks

Construction equipment

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling, drilling, blasting - dewatering and pumping equipment - Transporters.

Rehabilitation techniques

Mud jacking grout through slab foundation – Micro-piling for strengthening floor and shallow profile – Pipeline laying – Protecting sheet piles, screw anchors – Sub grade water

proofing, underpinning, crack stabilization techniques. Advanced techniques and sequence in demolition and dismantling

REFERENCES

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 5th Edition, 1995.
2. Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, Dhanpat Rai and Sons, New Delhi 1997.
3. Jha, J and Sinha, S.K., Construction and Foundation Engineering, Khanna Publishers, New Delhi, 2004.
4. Sharma S.C. Construction Equipment and Management, Khanna Publishers New Delhi, 1988.
5. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
6. Mahesh Varma, Construction Equipment and its Planning and Application, Metropolitan Book Company, New Delhi, 1983.

CIV 5103	PROJECT FORMULATION AND APPRAISAL	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Prepare work break down plan and estimate resources requirements.

CO2 : Solve problems of resource allocation and levelling using network diagrams

CO3: Plan and develop management solutions to construction projects

CO4: Understand the principles of project management, resource management and inventory.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M				H			L		M		
CO2			H			L			L			M
CO3				M			L				H	
CO4					H				M			

Project formulation

Project – Concepts – Capital investments – Generation and screening of project ideas – Project identification – Preliminary analysis, market, technical, financial, economic and ecological – Pre-Feasibility report and its clearance, project estimates and techno-economic feasibility report, detailed project report – Different project clearances required.

Project costing

Project cash flows – Time value of money – Cost of capital.

Project Appraisal

NPV – BCR – IRR – ARR – Urgency – Pay back period – Assessment of various methods – Indian practice of investment appraisal – International practice of appraisal – Analysis of risk – Different methods – Selection of a project and risk analysis in practice.

Project Financing

Project financing – Means of finance – Financial institutions – Special schemes – Key financial indicators – Ratios.

Private Sector Participation

Private sector participation in infrastructure development projects – BOT, BOLT, BOOT – Technology transfer and foreign collaboration – Scope of technology transfer.

REFERENCES

1. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation & Review, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
2. Joy P.K., Total Project Management – The Indian Context, New Delhi, Macmillan India Ltd., 1992.
3. United Nations Industrial Development Organization (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987.
4. Barcus, S.W. and Wilkinson. J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.

CIV 5104	QUALITY CONTROL AND ASSURANCE IN	L	T	P	C

	CONSTRUCTION	3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Formulate and solve deterministic optimization problems..

CO2 : Model risk and uncertainty in construction industry

CO3: Apply stochastic optimization techniques for decision making under uncertainty

CO4: Plan and manage activities using simulation, queuing and game theory

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M					H			L		M
CO2		L			H				M			L
CO3	L					M		H				
CO4				H								M

Quality Management

Introduction – Definitions and objectives – Factor influencing construction quality – Responsibilities and authority – Quality plan – Quality management guidelines – Quality circles.

Quality Systems

Introduction – Quality system standard – ISO 9000 family of standards – Requirements – Preparing quality system documents – Quality related training – Implementing a quality system – Third party Certification.

Quality Planning

Quality policy, objectives and methods in construction industry – Consumers satisfaction, Ergonomics – Time of completion – Statistical tolerance – Taguchi's concept of quality – Codes and standards – Documents – Contract and construction programming – Inspection procedures – Processes and products – Total QA/QC programme and cost implication.

Quality Assurance and Control

Objectives – Regularity agent, owner, design, contract and construction oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals, factors influencing construction quality – Critical, major failure aspects and failure mode

analysis – Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction.

Quality Improvement Techniques

Selection of new materials – Influence of drawings, detailing, specification, standardization – Bid preparation – Construction activity, environmental safety, social and environmental factors – Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis.

REFERENCES

1. James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tena, 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, 1993.
4. Hutchins. G., ISO 9000, Viva Books, New Delhi, 2000.
5. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. John L. Ashford, The Management of Quality in Construction, E & F. N. Spon, New York, 1989.
7. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, England 1998.

CIV 5105	CONTRACT LAWS AND REGULATIONS	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Prepare contract schedules, notice inviting tender and contract documents

CO2 : Understand laws of construction contract

CO3: Implement dispute resolution.

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CO4: Prepare contract management plan as per standards

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M

CO2					H	L					M	L
CO3	L		M								H	
CO4			H								M	

Construction Contracts

Indian Contracts Act – Elements of contracts – Types of contracts – Features – Suitability Design of contract documents – International contract document – Standard contract document – Law of torts.

Tenders

Prequalification – Bidding – Accepting – Evaluation of tender from technical, contractual and commercial points of view – Contract formation and interpretation – Potential contractual problems – World bank procedures and guidelines – Tamilnadu transparency in tenders act.

Arbitration

Comparison of actions and laws – Agreements – Subject matter – Violations – Appointment of arbitrators – Conditions of arbitration – Powers and duties of arbitrator – Rules of evidence – Enforcement of award – Costs.

Legal Requirements

Insurance and bonding – Laws governing sale, purchase and use of urban and rural Land – Land revenue codes – Tax laws – Income tax, sales tax, excise and custom duties and their influence on construction costs – Legal requirements for planning – Property law – Agency law – Local government laws for approval – Statutory regulations.

Labour Regulations

Social security – Welfare legislation – Laws relating to wages, bonus and industrial disputes, labour administration – Insurance and safety regulations – Workmen’s compensation act – Indian factory act – Tamilnadu factory act – Child labour act – Other labour laws.

REFERENCES

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Kwaku. A., Tenah. P.E. Jose M. Guevara, P.E., Fundamentals of Construction Management and Organization, Printice Hall, 1985.

CIV 5106	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Prepare work break down plan and estimate resources requirements

CO2 : Solve problems of resource allocation and levelling using network diagrams

CO3: Plan and develop management solutions to construction projects.

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CO4: Understand the principles of project management, resource management and inventory.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2					H	L					M	L
CO3			H				L				M	
CO4			M								M	

Construction Planning

Basic concepts in the development of construction plans – Choice of technology and construction method – Defining work tasks – Defining precedence relationships among activities – Estimating activity durations – Estimating resource requirements for work activities – Coding systems.

Scheduling Procedures and Techniques

Construction schedules – Critical path method – Scheduling calculations – Float – Presenting project schedules – Scheduling for activity-on-node and with leads, lags and windows – Scheduling with resource constraints and precedences – Use of advanced scheduling techniques – Scheduling with uncertain durations – Calculations for Monte Carlo schedule simulation – Crashing and time/cost tradeoffs – Improving the scheduling process.

Cost Control, Monitoring and Accounting

The Cost control problem – The project budget – Forecasting for activity cost control – Financial accounting Systems and cost accounts – Control of project cash flows – Schedule control – Schedule and budget updates – Relating cost and schedule information.

Quality Control and Safety During Construction

Quality and safety concerns in construction – Organizing for quality and safety – Work and material specifications – Total quality control – Quality control by statistical methods – Statistical quality control with sampling by attributes – Statistical quality control with sampling by variables – Safety.

Organization and Use of Project Information

Types of project information – Accuracy and use of information – Computerized organization and use of information – Organizing information in databases –Relational model of databases – Other conceptual models of databases – Centralized database management systems – Databases and applications programs – Information transfer and flow.

REFERENCES

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Wills, E.M., Scheduling Construction Projects, John Wiley & Sons, 1986.
5. Halpin, D.W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

CIV 5107	**PROJECT SAFETY MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Outcomes:

At the end of the course, students would be able to

CO1 : Understand different aspects of quality and related tools.

CO2 : Apply techniques of total quality assurance and quality control programme and cost implication

CO3: Understand importance of various aspects of safety during construction activity.

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CO4: Apply principles of environmental safety to construction projects.

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			L		M					L		M

CO2					L	H					M	L
CO3			M				L				M	
CO4			H								M	

Construction Accidents

Accidents and their causes – Human factors in construction safety – Costs of construction Injuries – Occupational and safety hazard assessment – Legal implications.

Safety Programmes

Problem areas in construction safety – Elements of an effective safety programme – Job-Site safety assessment – Safety meetings – Safety incentives.

Contractual Obligations

Safety in construction contracts – Substance abuse – Safety record keeping.

Designing for Safety

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.

Owners' and Designers' Outlook

Owner's and designer's outlook about safety and project safety management

REFERENCES

1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc. 1997.
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.
3. Tamilnadu Factory Act.

CIV 5108	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Prepare work break down plan and estimate resources required in a construction project.

CO2 : Prepare precedence diagram and network diagrams.
CO3: Implement resource allocation and levelling using MSP

CO4: Apply Build architectural plan and material take-off.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2					M	L					H	L
CO3			M				L				M	
CO4			M								H	

Introduction

Introduction to system hardware – Languages – Data base management – Spread sheets - Applications.

Optimization Techniques

Linear, dynamic and integer pProgramming – Branch and bound techniques – Application to production scheduling, equipment replacement, material transportation and work assignment problems – Software applications.

Inventory Models

Deterministic and probabilistic inventory models – Software applications.

Scheduling Applications

PERT and CPM – Advanced planning and scheduling concepts – Computer applications – Case study.

Operations Simulation:

Basic concepts of simulation software – Working with simulation programs – Advanced simulation modeling concepts and features – Applications and limitations – Examples.

REFERENCES

1. Billy E. Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, Tata Mc Graw Hill, 1990.
2. Paulson, B.R., Computer Applications in Construction, Mc Graw Hill, 1995.

3. Feigenbaum, L., Construction Scheduling with Primavera Project Planner Prentice Hall Inc., 2002.
4. Ming Sun and Rob Howard, "Understanding I.T. in construction, Spon Press, Taylor and Francis Group, (2004) London and New York.

CIV 5181	CONSTRUCTION PRACTICES & PLANNING LABORATORY	L	T	P	C
		0	0	3	1

Course Outcomes:

At the end of the course, students would be able to

CO1 Prepare contract drawings and estimates for highway, building and bridge Projects
CO2 : Prepare detailed item wise specification
of the project .
CO3: Identify and estimate resources for the items of the project and prepare detailed project schedule.
CO4: Prepare notice inviting tender and contract document
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2					H	M					H	L
CO3			L			M					H	
CO4			L								H	

1. Site visit to study construction techniques and use of major construction equipment associated with on going major construction works – Submission of visit report.
2. Site visit to study the feasibility aspects, tendering procedures accounting systems, funds rising and other financial management aspects, billing procedures etc. associated with ongoing major construction works – Submission of visit report.
3. Collection of techno commercial information regarding new construction materials equipments and methods.
4. Collection and study of tender notices, tender documents, contract documents, valuation certification etc.
5. Preparation crashing and updating of precedence – network – Resource leveling, cash flow analysis for major construction work.
6. Review & detailing of reinforcement, bar bending schedule for major construction works.
7. Standard testing of construction materials and quality audit.

8. Use of drawing and 3D modeling (such as Revit Architecture Autocadd software)
9. Use of estimation software
10. Use of Scheduling tools (Primavera, M.S. Project).

CIV 5182	PRACTICAL TRAINING	L	T	P	C
		0	0	9	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Understand the various aspects of construction such as construction materials, techniques etc

CO2 : Understand the quality control and assurance, testing at site, etc. in major construction companies..

CO3 : Learn the various technologies in a practical manner.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		M			H			L				M
CO2					H	L	L					M
CO3	M								L			H

Every student is expected to undergo practical training on various aspects of construction such as construction materials, techniques, formworks, reinforcement fabrication, placing, bar bending schedule, measurements, billing, estimation, project management, cost control, quality control and assurance, testing at site, etc. in major construction companies. The duration of training is a minimum of two weeks after the completion of second semester.

Performance of the student will be evaluated based on the report submitted by the client from whom the training is acquired. Also, the student has to present the report in the form of two seminars during third semester.

Credits will be assigned based on the performance of student in training as per the report submitted and in seminar.

CIV 6198	Project Work Phase-I	L	T	P	C
		0	0	18	6

Course Outcomes:

At the end of the course, students would be able to

CO1: Define Research Problem Statement.

CO2 : Critically evaluate literature in chosen area of research & establish scope of work

CO3: Develop study /experimental methodology.

CO4: Carryout pilot theoretical study/experiment

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M	M	M	H	H	H	H		L		M
CO2	M	M	M	M	H	M	H	H			H	L
CO3			M			M					H	
CO4			M								H	

CIV 6199	**Project Work Phase-II**	**L**	**T**	**P**	**C**
		0	**0**	**18**	**6**

Course Outcomes:

At the end of the course, students would be able to

CO1: Expand on the defined research problem in Project Work Phase- I.

CO2 : Critically evaluate literature in the well defined research & clearly establish scope of work

CO3: Conduct Laboratory studies

CO4: Analyse data, develop models and offer solutions.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	M		M	H	H	H	H		L		M

CO2						M	H	H			H	L
CO3	M				H	H					H	
CO4	M	M				M					H	

ELECTIVES

CIV 5111	SHORING, SCAFFOLDING AND FORMWORK	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 :Understand problems in site preparation, drainage and shoring during excavation.

CO2 :Understand Implementation of underwater construction.

CO3 :Apply underwater tunnelling techniques.

CO4 :Design of underwater foundation for structures.

CO5 : Understand the safety steps involved in the design of form work

CO6 :Select a right material for manufacturing false work and form work suiting specific requirements.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M

CO2					H	L					M	L
CO3	L		M								H	
CO4			H								M	
CO5	M						M					H
CO6			L		L			M			M	H

Planning and Site Equipment & Plant for Form Work

At tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms.

Overall planning – Detail planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning crane arrangements – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales and ties – Scaffold frames from accessories – Vertical transport table form work.

Form Materials

Lumber – Types – Finish – Sheathing board working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminum Form lining materials – Hardware and fasteners – Nails in Plywood.

Concrete density – Height of discharge – Temperature – Rates of placing – Consistency of concrete – Live loads and wind pressure – Vibration hydrostatic pressure and pressure distribution – Examples – Vertical loads – Uplift on shores – Adjustment for non standard conditions.

Design of Forms and Shores

Basic simplification – Beam formulas – Allowable stress – Deflection bending lateral stability – Shear, bearing – Examples in wall forms – Slab forms – Beam forms – Ties, Anchors and hangers – Column forms – Examples in each.

Simple wood stresses – Slenderness ratio – Allowable load – Tubular steel shores patented shores – Site preparation, size and spacing – Steel tower frames – Safety practices – Horizontal shores shoring for multistories – More concentrated shore loads T-heads – Tow

tier wood shores – Ellis shores – Dayton sure grip and Baker roofs shores – Safeway symons shores – Beaver – Advance shores dead Shore – Raking and flying shores.

Form Work for Buildings

Location of job mill – Storage – Equipment – Footings – Wall footings – Column footings sloped footing forms – Curb and gutter forms – Wall forms – Prefabricated panel systems – Giant forms curved wall forms – Column heads – Beam or girder forms – Beam pockets – Suspended forms – Concrete joint construction – Flying system forms.

Causes of failures – Inadequate shoring inadequate bracing of members – Improper vibration – Premature stripping – Errors in design – Failure to follow codes – Effect of formwork on concrete quality – ACI – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – Advantages of reshoring.

Forms for Domes and Tunnels, Slip Forms and Safety Practices for Scaffolds

Hemispherical, parabolic, translational typical barrel vaults, hyperbolic folded plates – Shell form design considerations loads – Inserts, anchors bolts – Building the forms – Placing concrete – Form removed – Strength requirements – Tunnel forming components – Curb forms invert forms – Arch forms – Concrete placement methods – Cut and cover construction – Tolerances – Form construction – Shafts.

Slip Forms – Principles – Types – Advantages – Functions of various components – Planning – Desirable characteristics of concrete – Common problems faced – Safety in slip form technique - Special structures built with slip form technique – Codal provisions – Types of scaffolds – Putlog and independent scaffold – Single pole scaffolds – Fixing ties – Spacing of ties plan – Bracing – Knots – Safety net – General safety requirements – Precautions against particular hazards – Truss suspended – Gantry and system scaffolds.

REFERENCES

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork for Concrete Structures, McGraw – Hill, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996.
3. Michael.P. Hurst, Construction Press, London & New York, 2003.
4. Austin, C.K., Formwork for Concrete, Cleaver – Hume Press Ltd., London, 1996.

CIV 5112	AUTOMATION AND INTEGRATION IN CONSTRUCTION	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Understand the qualities of enclosure necessary to maintain a specified level of interior environmental quality..

CO2 : Plan Plumbing and Vertial circulation and their interaction.

CO3: Plan Systems for least maintenance materials and construction.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M			H			L					M
CO2				H		L			L			M
CO3		M					L					H

Structural Integration

Structural system - Systems for enclosing buildings - Functional aesthetic system - Materials selection and specification

Environmental Factors

Qualities of enclosure necessary to maintain a specified level of interior environmental quality – Weather resistance – Thermal infiltration – Acoustic control – Transmission reduction – Air quality – Illumination – Relevant systems integration with structural system.

Services

Plumbing – Electricity – Vertial circulation and their interaction – Heating, ventilation and air conditioning (HVAC).

Maintenance

Component longevity in terms of operation performance and resistance to deleterious forces – Planning systems for least maintenance materials and construction – Access for maintenance – Feasibility for replacement of damaged components – Equal life elemental design – Maintenance free exposed and finished surfaces.

Safety

Ability of systems to protect fire – Preventive systems – Fire escape system design – Planning for pollution free construction environmental – Hazard free construction execution.

REFERENCES

1. William. T. Mayer, Energy Economics and Building Design, McGraw Hill Book Company, 1983.

2. Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd., London, 1993.
3. A.J. Elder and Martiz Vinden Barg, Handbook of Building Enclosure, McGraw-Hill Book Company, 1983.
4. Jane Taylor and Gordin Cooke, The Fire Precautions Act in Practices, 1987.
5. David V. Chadderton, Building Services Engineering, Taylar and Francis, 2007.

CIV 5113	ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION	L	T	P	C
		3	0	0	3

Course outcomes

At the end of the course, students would be able to

CO1: To understand the important issues associated with energy performance of buildings.

CO2: Describe the important issues and considerations of building energy performance.

CO3: Explain the technologies, codes and policies for energy conservation in buildings

CO4: Develop the skills for theoretical analysis and practical study of building energy performance.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L										M
CO2					L						M	
CO3							M					
CO4		M										M

Introduction

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 – Challenges – Primary energy use in buildings – Residential – Commercial – Institutional and public buildings – Legal requirements for conservation of fuel and power in buildings.

Environmental

Energy and resource conservation – Design of green buildings – Evaluation tools for building energy – Embodied and operating energy – Peak demand – Comfort and indoor air quality –

Visual and acoustical quality – Land, water and materials – Airborne emissions and waste management.

Design

Natural building design consideration – Energy efficient design strategies – Contextual factors – Longevity and process assessment – Renewable energy sources and design – Advanced building technologies – Smart buildings – Economies and cost analysis.

Services

Energy in building design – Energy efficient and environment friendly building – Thermal phenomena – Thermal comfort – Indoor air quality – Climate, sun and solar radiation, - Psychometrics – Passive heating and cooling systems – Energy Analysis – Active HVAC systems – Preliminary investigation – Goals and policies – 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.

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 operation and maintenance – Facility modifications – Energy recovery dehumidifier – Waster heat recovery – Stream plants and distribution systems – Improvement of boiler efficiency – Frequency of blow down – Steam leakage – steam flash and condense return.

REFERENCES

1. Moore F., Environmental Control System, McGraw Hill, Inc. 1994.
2. Brown, GZ, Sun, Wind and light: Architectural design strategies, John Wiley & Sons., 1985.
3. Cook, J., Award – Winning passive Solar Design, Mc Graw Hill, 1984.
4. J.R. Waters, Energy conservations in Buildings: A Guide to part L of the Building Regulatons, Blackwell Publishing, 2003.

CIV 5114	CONSTRUCTION OF INFRASTRUCTURE	L	T	P	C
		3	0	0	3

Course outcomes

At the end of the course, students would be able to

CO1: Develop and apply high performance structural materials and systems

CO2: Develop performance-based earthquake engineering as a new paradigm for analysis and design of disaster-resistant infrastructure

CO3: Create new engineering materials to improve the performance of infrastructure

CO4: Improve fundamental knowledge of the inter-relationships between the built environment and natural systems

CO5: Develop the technological innovations needed to safeguard, improve, and economize infrastructure and society

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L					M					M
CO2					M						M	
CO3							M					
CO4		M				L			L			M
CO5	L			M						M		

Flexible and Rigid Pavements

Classifications, testing and applications of road making aggregates – Road binders – Bitumen - Resistance of bituminous mixtures to permanent deformation – Flexibility and brittleness – Common mechanical tests – Permeability characteristics – Weathering of bituminous road surfacing – Adhesion of bituminous binders to road aggregates – Effect of aggregate size in bituminous courses – Temperature susceptibility of bituminous courses – Design of bituminous mixes.

Pavement Construction

Construction of various layers in rigid and flexible pavements – Quality assurance during construction – Sampling and analysis. Road making machineries – Road formation, bituminous constructions – Road surface evaluation. Methods to improve bitumen quality – Rheological and chemical additives – Polymer modified bitumen – Super pave concepts – Recycling of bituminous courses – Smart materials for cement concrete pavement – Use of admixtures and fibres.

Offshore structures

Types of offshore structures and conceptual development - Analytical models for jacket structures - Materials and their behaviour under static and dynamic loads – Statutory regulations - Allowable stresses - Various design methods and Code Provisions – Design specification of API, DNV, Lloyd's and other classification societies - Construction of jacket and gravity platforms

Sky Scrappers

Introduction- History of sky scrappers – Business cycle- Safety norms – Lessons from past

Railways & bridges

Modern methods for construction of railway tracks – Design of ROB, tunnel, subway.

REFERENCES

1. Mix Design Methods for Asphalt Concrete and other hot mix types MS 2, Sixth Edition, The Asphalt Institute, 1997.
2. Edwin J. Barth, Asphalt Science and Technology, Gordon and Breach Science Publishers, New York, 1984.
3. Bituminous materials in road construction, The English Language Book Society and Her Majesty's Stationery Office, 1966.

CIV 5115	CONSTRUCTION PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO 1 :Ability to manage planning and time on a project.

CO 2 :Understand basic cost flows and project budget.

CO 3 :Understand principles of effective leadership.

CO 4 :Ability to read and interpret construction documents and specifications.

CO 5 :Understand ethics of project management.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M

CO2					H	L					M	L
CO3	L		M								H	
CO4			H								M	
CO5		H				M			L			H

The Owner's Perspective

Introduction – Project life cycle – Types of construction – Selection of professional services – Construction contractors – Financing of constructed facilities – Legal and regulatory requirements – Changing environment of the construction industry – Role of project managers.

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.

Design and Construction Process

Design and construction as an integrated system – Innovation and technological feasibility – Innovation and economic feasibility – Design methodology – Functional design – Construction site environment.

Labour, Material and Equipment Utilization

Historical perspective – Labor productivity – Factors affecting job – Site productivity – Labor relations in construction – Problems in collective bargaining – Materials management – Material procurement and delivery – Inventory control – Tradeoffs of costs in materials management – Construction equipment – Choice of equipment and standard production rates – Construction processes queues and resource bottlenecks.

Cost Estimation

Cost associated with constructed facilities – Approaches to cost estimation – Types 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 of estimating – Estimate based on Engineer's list of quantities – Estimation of operating costs.

REFERENCES

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.

2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
4. Choudhury, S. Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
5. George J. Ritz (1994), Total Construction Project Management – McGraw-Hill inc, 1994.

CIV 5116	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 Formulate and solve deterministic optimization problems.

CO2 Model risk and uncertainty in construction industry.

CO3 Apply stochastic optimization techniques for decision making under uncertainty.

CO4 Plan and manage activities using simulation, queuing and game theory

.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L											M
CO2					M							L
CO3	L								L			
CO4		H		H								H

Operations Research

Introduction to operations research – Linear programming – Graphical and simplex methods, duality and post – Optimality analysis – Transportation and assignment problems.

Production Management

Inventory control – EOQ – Quantity discounts – Safety stock – Replacement theory – PERT and CPM – Simulation models – Quality control.

Financial Management

Working capital management – Compound interest and present value methods – Discounted cash flow techniques – Capital budgeting.

Decision Theory

Decision theory – Decision rules – Decision making under conditions of certainty, risk and uncertainty – Decision tress – Utility theory.

Managerial Economics

Cost concepts – Break-even analysis – Pricing techniques – Game theory applications.

REFERENCES

1. Vohra, N.D., Quantitative Techniques in Management, Tata McGraw-Hill Company Ltd, New Delhi, 1990.
2. Schroeder, R.G., Operations Management, McGraw Hill, USA, 1982.
3. Levin, R.I., Rubbin, D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill Book Co., 1988.
4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Mifflin Co., Boston, 1975.
5. Hamdy. A. Taha, Operations Research: An Introduction, Prentice Hall, 2002.

CIV 5117	CONSTRUCTION PERSONNEL MANAGEMENT	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO 1 : Students will be able to determining and managing wages

CO2 :Students will develop skills on the various aspects of Construction Management

CO3 :Students will know various processes in manpower planning, organizational and welfare measures.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H				H			L			M
CO2			M				L					H
CO3	L				H				M			

Manpower Planning

Manpower planning, organising, staffing, directing and controlling – Personnel principles.

Organization

Organization – Span of control – Organization charts – Staffing plan – Development and operation of human resources – Managerial staffing – Recruitment – Selection – Placement, training and development

Human Behaviour

Introduction to the field of people management – Basic individual psychology; motivation – Job design and performance management – Managing groups at work – Self managing work teams – Intergroup behaviour and conflict in organizations – Leadership – Behavioural aspects of decision-making; and communication for people management.

Welfare Measures

Compensation – Safety and health – GPF – EPF – Group insurance – Housing – Pension – Laws related to welfare measures

Management and Development Methods

Compensation – Wages and salary, employee benefits, employee appraisal and assessment – Employee services – Safety and health – Discipline and discharge – Special human resource problems, performance appraisal – Employee hand book and personnel manual – Job descriptions and organization structure and human relations – Productivity of human resources.

REFERENCES

1. Carleton Counter II and Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria, C.B., Personnel Management, Himalaya Publishing Co., 1997.
3. Josy.J. Familarao, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1987.
4. Charles D Pringle, Justin Gooderi Longencter, Management, CE Merril Publishing Co. 1981.
5. R.S. Dwivedi, Human Relations and Organisationl Behaviour, Macmillian India Ltd., 2005.

CIV 5118	BUSINESS ECONOMICS AND FINANCE MANAGEMENT	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 Formulate and solve deterministic optimization problems.

CO2 Model risk and uncertainty in construction industry.

CO3 Apply stochastic optimization techniques for decision making under uncertainty.

CO4 Plan and manage activities using simulation, queuing and game theory.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	L								M			M
CO2					M		M					L
CO3			M						L			
CO4	L	H				H						H

Economics

Role of civil engineering in industrial development – Advances in civil engineering – Engineering economics – Support matters of economy related to engineering – Market demand and supply – Choice of technology – Quality audit in economic law of returns governing production.

Construction Economics

Construction development in housing, transport energy and other infrastructures – Economics of ecology, environment, energy resources – Local material selection – Form and functional Designs – Construction workers – Urban problems – Poverty – Migration – Unemployment – Pollution.

Financing

The need for financial management – Types of financing – Financing instruments – Short term borrowing – Long term borrowing – Leasing – Equity financing – Internal generation of funds – External commercial borrowings – Assistance from government budgeting support and international finance corporations – Analysis of financial statements – Balance Sheet – Profit and loss account – Cash flow and fund flow analysis – Ratio analysis – Investment and financing decision – Financial control – Centralized management.

Accounting Method

General overview – Cash basis of accounting – Accrual basis of accounting – Percentage completion method – Completed contract method – Accounting for tax reporting purposes and financial reporting purposes – Accounting standards.

Lending to Contractors

Loans to contractors – Interim construction financing – Security and risk aspects.

REFERENCES

1. Warneer Z Hirsch, Urban Economics, Macmillan, New York, 1993.
2. Prasanna Chandra, Project Selection, Planning, Analysis, Implementation and Review, Tata McGraw Hill Publishing Company, 1995.
3. Kwaku A, Tenah and Jose M. Guevara, Fundamental of Construction Management and Organisation, Prentice – Hall of Inida, 1995.
4. Halpin, D.W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.
5. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988.

CIV 5119	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Students will be able to know resource planning, management, allocation and resource levelling in construction

CO 2 : Students will be able to understand how to control project schedule, cost, quality, and risk.

CO 3: Students will how to apply the efficient ,effective deployment and allocation of an resources in Constructions.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H							M			M
CO2					L		M					H
CO3	H		M						L			

Resource Planning

Resource planning, procurement, identification, personnel, planning for material, labour, time schedule and cost control, types of resources, manpower, equipment, material, money, time.

Labour Management

Systems approach, characteristics of resources, utilization, measurement of actual resources required, tools for measurement of resources, labour, classes of labour, cost of labour, labour schedule, optimum use labour.

Materials and Equipment

Material: Time of purchase, quantity of material, sources, transportation, delivery and distribution.

Equipment: Planning and selecting by optimistic choice with respect to cost, time, source and handling.

Time Management

Personnel time, management and planning, managing time on the project, forecasting the future, critical path measuring the changes and their effects – Cash flow and cost control.

Resource Allocation and Leveling

Time-cost trade off, computer application – Resource leveling, resource list, resource allocation, resource loading, cumulative cost – Value management.

REFERENCES

1. Andrew, D., Szilagg, Hand Book of Engineering Management, 1982.
2. Harvey, A., Levine, Project Management using Micro Computers, Obsorne-McGraw Hill C.A. Publishing Co., Inc. 1988.
3. James. A., Adrain, Quantitative Methods in Construction Management, American Elsevier Publishing Co., Inc., 1973.
4. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1980.

CIV 5120	MANAGEMENT INFORMATION SYSTEM	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Identify resource dependencies in the project network.

CO2 : Understand importance of search for an optimum solution.

CO3: Provide buffers for efficient project management.

CO4: Monitor project progress by considering the consumption rate of the buffers

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2			L			L		M				L
CO3	M				H						H	
CO4			H								H	

Introduction

Information systems – Establishing the framework – Business models – Information system architecture – Evolution of information systems.

System Development

Modern information system – System development life cycle – Structured methodologies – Designing computer based methods, procedures, control – Designing structured programs.

Information Systems

Integrated construction management information system – Project management information system – Functional areas, finance, marketing, production, personnel – Levels, DSS, EIS, ES – Comparison, concepts and knowledge representation – Managing international information system.

Implementation and Control

Control – Testing security – Coding techniques – Defection of error – Validating – Cost benefit analysis – Assessing the value and risk of information system.

System Audit

Software engineering qualities – Design, production, service, software specification, software metrics, software quality assurance – Systems methodology – Objectives – Time and logic, knowledge and human dimension – Software life cycle models – Verification and validation.

REFERENCES

1. Kenneth C. Laudon and Jane Price Laudon, Management Information Systems – Organisation and Technology, Prentice Hall, 1996.
2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
3. Joyce J Elam, Case Series for Management Information Systems, Simon and Schuster, Custom Publishing, 1996.

4. Ralph H Sprague and Huge J Waston, Decision Support for Managers, Prentice Hall, 1996.
5. Michael W. Evans and John J Marciniah, Software Quality Assurance and Management, John Wiley and Sons, 1987.
6. Card and Glass, Measuring Software Design quality, Prentice Hall, 1990

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CIV 5121	MAINTENANCE AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Estimate causes for distress and deterioration of structures
CO2 : Understand NDT techniques for condition assessment of structures for identifying damages in structures.
CO3: Select repair material and retrofitting strategy suitable for distress.
CO4: Formulate guidelines for repair management of deteriorated structures.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2	M				M						M	
CO3			L			M				M		L
CO4			H								M	

Maintenance and Repair Strategies

Maintenance, repair and rehabilitation – Facets of maintenance – Importance of maintenance – Various aspects of inspection – Assessment procedure for evaluating a damaged structure – Causes of deterioration.

Serviceability and Durability of Concrete

Quality assurance for concrete construction concrete properties – Strength, permeability, thermal properties and cracking – Effects due to climate, temperature, chemicals, corrosion – Design and construction errors – Effects of cover thickness and cracking.

Materials and Techniques for Repair

Special concretes and mortar – Concrete chemicals – Special elements for accelerated strength gain – Expansive cement – Polymer concrete – Sulphur infiltrated concrete –Ferro cement – Polymers – Coating for rebars – Vacuum concrete – Gunite and Shotcrete – Expoxy

injection – Mortar repair for cracks, shoring and underpinning – Methods of corrosion protection – Corrosion inhibitors, corrosion resistant steels and cathodic protection.

Repairs to Structures

Repair of structures distressed due to earthquake – Strengthening using FRP – Strengthening and stabilization techniques for repair.

Demolition of Structures

Engineered demolition techniques for structures – Case studies.

REFERENCES

1. Dension Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2. Allen R.T and Edwards S.C., "Repair of Concrete Structures", Blakie and Sons, UK, 1987.
3. Raikar, R.N., "Learning from failures – Deficiencies in Design, Construction and Service" – R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. Santhakumar A.R., "Concrete Technology" Oxford University Press, 2007 Printed in India by Radha Press, New Delhi, 110 031.
5. Peter H. Emmons, "Concrete Repair and Maintenance Illustrated", Galgotia Publications Pvt. Ltd., 2001.

CIV 5122	STRUCTURAL DESIGN FOR CONCRETE AND STEEL STRUCTURES	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1: Understand behavior of concrete & steel structures under gravity and lateral loads

CO2 : Design concrete&steel structures for gravity, wind and seismic loads.

CO3: Design concrete &steel as shear walls for lateral action.

CO4: Apply strengthening techniques for repair and rehabilitation of masonry structures.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2					H	M					H	L

CO3			L			M				H	
CO4			L							H	

Structural Design Concepts

Classification of structures – Function, material and shape – Different structural systems -

Requirements of structures- basic structural requirements – Stability, strength and stiffness – design process – Code of practice – Limit state method of design - Probabilistic approach to design – load and resistance – Design for strength, stiffness and stability considerations

Design of Concrete Structural members

Strength and ductility of concrete frames – Analysis of shear walls – Distribution of lateral loads in uncoupled shear walls – Equivalent stiffness method – shear wall frame interactions – Behavior and design of special R.C.C members – Design of concrete corbels – Deep beams, ribbed, hollow block or voided slab – RCC walls.

Design of Steel Structural members

Design of members subjected to lateral and axial loads – Principles of analysis and design of industrial buildings and bends – crane gantry girders and crane columns – Analysis and design of steel towers – Design of industrial stacks – self supporting and guyed stacks lined and unlined.

Steel and Concrete Composite Structures

Introduction – Basic design considerations – Design of Composite beams, floors & Columns.

Pre-Engineered Buildings

Introduction – Production, transportation and erection – shuttering and mould design – dimensional tolerances - Erection of R.C structures, total prefabricated buildings, design and detailing of prefabricated building units for 1) industrial structures 2) multi-storey buildings and 3) water tanks, silos, bunkers etc.

TEXT BOOKS

1. Arthur. H. Nelson, David Darwin and Charles. W Dolan, Design of Concrete Structures, Tata McGraw Hill, 2004.
2. Gaylord, Design of Steel Structures, Mc Graw Hill, New York.

REFERENCE BOOK

1. Park R and Paulay T, Reinforced Concrete Structures, John Wiley & Sons, New York.

CIV 6101	ADVANCED CONCRETE TECHNOLOGY	L	T	P	C

		3	**0**	**0**	**3**

Course Outcomes:

At the end of the course, students would be able to

CO1: students will able to understand advanced concrete terminology.
CO2: students will able to understand design requirements for advanced concrete.
CO3: students will able to understand construction and inspection requirements the buildings
CO4: students will able to understand of safety analysis
.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					M		M
CO2					H	M					H	L
CO3			H			M					H	
CO4			H								H	

Production of fresh concrete

Proportioning of concrete, operations involved in concrete production, Workability, Factors Affecting workability, Measurement of workability – Problem of Segregation and bleeding and Laitance – Properties of Hardened Concrete – Strength and durability, Factors affecting strength and durability, Factors affecting strength and durability of concrete

Concrete mix design

Principles and Methods, Statistical Quality control, Concrete Rheology, Maturity concept, Concrete mixes for different strength as per IS:456 – 2000, Factors causing variations, field control, statistical quality Control, quality measurement in concrete construction

Mechanical properties of hardened concrete

Characteristic strength, compressive, tensile and flexure of concrete, tests on concrete, modulus of elasticity, effect of w/c ratio and admixture on strength properties of concrete

Durability of concrete

Flexural Strength Creep and shrinkage of concrete, significance, types of shrinkage and their control, factors affecting creep. Desired properties of concrete, strength, durability & impermeability. Minimum & Maximum cement content, strength & Durability relationship, volume change in concrete, impact of w/c ratio on Durability, permeability, Exposure to

different conditions, factors contributing to Cracks in concrete, Sulphate attack, Alkali aggregate reaction, chloride attack, corrosion of steel (chloride induced).

Special types of concrete

Light weight concrete, self compacting concrete, Gap graded concrete, Fibre reinforced composites, no fines concrete, plum concrete, high strength and high performance concrete

TEXT BOOK

1. Gambhir, Concrete Technology, Tata McGraw- Hill, 3rd Edition, 2005.

REFERENCES

1. M.S.Shetty, Concrete Technology, S.Chand and Company, new Delhi , 2000
2. A.M.Neveille, Propetties, and concrete, Longman publication's 4th Edition, 1995.
3. Orchard, Concrete Technology, Tata McGraw-Hill, 2002.

CIV 6102	CEMENT AND CONCRETE COMPOSITES	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1: Understand the structural, physical and long-term performance of building materials used in construction.

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CO2: Understand mechanical and non-mechanical behaviour of cement- materials

CO3: Understand the use of advanced materials in construction projects.

CO4: Identify crucial problem areas in manufacture and applications of building materials

.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		M					M		M
CO2					M	H					H	L
CO3			H			H					H	
CO4			H								H	

Cementations and Admixtures

Types of Cementations materials, Types and properties of Chemical admixtures, Compatibility with Cement, Natural and Artificial sand.

Properties of concrete

Fresh concrete – Rheology Workability Cohesiveness Segregation Temperature Air content Hardened Concrete. Factors affecting properties of concrete - Strength, Elasticity, Shrinkage, Creep and Durability of concrete, testing of concrete.

Concrete Mix Proportions and Quality control

Methods of concrete mix proportioning IS 10262, ACI method, British method and their relative merits and demerits. Quality control of concrete – Statistical aspects.

High Performance Concrete

High performance concrete – Materials properties – Mix proportioning – Ready Mix concrete.

Concrete Composites

Concrete Composite various types of Fibers used in concrete, Law of Mixtures, Behavior of Fiber Reinforced Concrete (FRC) in Tension – Compression, Flexure shear, Fatigue and Impact; Durability aspects of FRC

TEXT BOOK

1. A.M.Neveille, Properties and Concrete, Pitman Publications, 1999.

REFERENCS

1. M.S.Shetty, Concrete Technology, S.Chand and Company, New Delhi, 2000.
2. Metha P.Kand Montreio P.J.M., Concrete Structure Propertises and Materials, 2nd edition, Prentice Hall,1998
3. Mindass and young, Concrete Technology; Prentice Hall, 1998.

CIV 6103	DISASTER RESISTANT STRUCTURES	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1:The course on Introduction to Earthquake Engineering provides the fundamental concepts, principles and application of earthquake engineering in seismic analysis and design of structures.

CO2:The course begins with the Seismology explaining the causes of occurrence of earthquake and its characterization.

CO3:The seismic analysis of the structures under earthquake excitation is developed. The structural system modeled as discrete and continuous system.

CO4:The concept of response spectrum analysis procedure to determine structure response and design earthquake forces is explained. The codal provisions for earthquake resistant design of structures as per Indian Standards are explained.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		M					M		M
CO2	H				H	H					H	L
CO3			M		M	M					H	
CO4	H		M								H	

Introduction

Factors affecting design against dynamic loads – Behavior of concrete, steel, masonry and soil under impact and cyclic loads – Recap of Structural dynamics with reference to SDOF, MDOF and continuum systems, - Ductility and its importance – Cyclic load behaviour of RC, Steel elements – Design spectrum – Principles of capacity design.

Design against earthquakes

Structural Dynamics in Building Codes Development of building codes – Philosophy of seismic design – IS code provisions – Base shear – Storey shears and equivalent static forces – Ductility in reinforced concrete members – Designing for ductility – IS code provisions – Earthquake dynamics of Base – Isolated Buildings – Soil – structure interaction – Isolation systems – Base isolated multistory buildings – Application of base isolation – Design of damper – isolation systems.

Design against blast and impact

Characteristics of internal and external blast – Impact and impulse loads – Pressure distribution on buildings above ground due to external blast – Underground explosion – Design of buildings for blast and impact as per BIS codes of practice.

Design against wind

Characteristics of wind – Basic and Design wind speeds – Effect of permeability of the structure – Pressure coefficient – Aero elastic and Aerodynamic effects – Design as per BIS code of practice including Gust Factor approach – Tall buildings, stacks and chimneys.

Special considerations

Energy absorption capacity – Ductility of the material and the structure – Detailing for ductility – Passive and active control of vibration – New and favorable materials.

TEXT BOOK

1. Paulay, T.and Priestly,M.N.J., "Aseismic Design of Reinforced Concrete and Masonry building", John Wiley and Sons, 1991.

REFERENCES

1. Clough, R.W.and Perzien, J.,"Dynamics of Structure", Tata McGraw-Hill, Inc, 1993.
2. Dowling, C.H., "Blast vibration – Monitoring and control", Prentice Hall Inc., Englewood cliffs, 1985.
3. David key, "Earthquake design practice for buildings", Thomas Telfor, London.
4. IS 1893 (Part I) – 2002 "Criteria for Earthquake Resistant Design of structures, 'BIS, New Delhi.
5. IS 13920-1993 "Ductility detailing of reinforced concrete structures subjected to seismic forces" BIS New Delhi.

CIV 6104	EXPERIMENTAL TECHNIQUES	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1 : Students are able to understand the basic concepts of measurements of displacement, strain, pressure, force etc.,

CO2 : Students acquire knowledge about indicating and recording devices and their applications.

CO3: Students acquire knowledge in the field of Mechanical strain gauges Electrical resistance strain gauges, Foil strain gauges and Rosette analysis

.

CO4: Students will come to know about various testing techniques and their usages in the current scenarious.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1			M		H					L		M
CO2					H	L					M	L
CO3	L		M								H	
CO4			H								M	

Concept of measurement and Strain Gauges

Basic concepts of measurement –measurement of displacement, strain, pressure, force, torque etc.-types of strain gauges, Mechanical strain gauges – Electrical resistance strain gauges – Foil strain gauges – Rosette analysis

Strain gauge applications

Strain gauge circuit – Electrical resistance strain gauges gauge construction, adhesive and mounting methods – gauge factor – environmental effects. Strain gauge circuits – the potentiometer and the Wheatstone bridge – effects of lead wires, switches etc. use of electrical resistance strain gauges in transducer application.

Indicating and recording devices

Indicating and recording devices – static and dynamic data recording – data (digital and analogue) acquisition and processing systems – elementary systems. Strain analysis methods – Rosette analysis.

Testing techniques

Static and dynamic testing techniques equipment for loading, non-destructive testing techniques. Dynamics strain measurement – model analysis.

TEXT BOOK

1. Srinath L S et al, Experimental Stress Analysis, Tata Mc Graw-Hill Publising Co., Ltd., NewDelhi.1984

REFERENCS

1. Dally J W and Riley W.F, Experimental stress Analysis, McGraw –Hill, International, New York, 1991.
2. Rangam C S et al., Instrumentation – Device and Systems, Tata McGraw – Hill Publishing Co.Ltd., New Delhi, 1983.
3. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi. 1996.

CIV 6105	EXPLOSION EFFECTS AND STRUCTURAL DESIGN FOR BLAST LOADING	L	T	P	C
		3	0	0	3

Course Outcomes:

At the end of the course, students would be able to

CO1: Estimate causes for distress and deterioration of structures

CO2 : Understand NDT techniques for condition assessment of structures for identifying damages in structures

.

CO3: Select repair material and retrofitting strategy suitable for distress

CO4: Formulate guidelines for repair management of deteriorated structures

.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M		H					L		M
CO2					H	M					H	L
CO3			L			M					H	
CO4			L								H	

Explosion effects

Blast Wave Phenomena – Explosive Types – Cube Root Scaling – Cratering/Truck – Bombs – Blast/Barrier Walls – Loads on structures – CONWEP Software – Internal Explosions – Blast X Software.

Behavior of structural elements

Material Properties – Resistance Functions – Flexural Resistance – Shear Resistance – Tensile and Compressive Membrane Resistance – Failure Criteria – Simplified Analysis Models – Elastic Analysis/Dynamic Load Factor – Elasto – Plastic Analysis – Response Charts.

Approximate design methods

Idealized Systems – Transformation Factors – Dynamic Reactions – Limiting cases of Impulse and Peak Pressure sensitive Systems – Span W – WAC – PSADS – Dynamic Reactions – P – I Diagrams

Structural fire engineering design

Design fire severity – Heat transfer to the structure – Structural design methods.

Spalling

Factors that influence spalling – Factors to prevent or reduce the effects of spalling – A risk – based approach to spalling

TEXT BOOK

1. Donald O. Dusenberry, "Handbook For Blast Resistant Design Of Buildings", John Wiley & Sons, Jan 2010.

REFERENCES

1. Committee for Oversight and Assessment of Blast Effects and Related Research, Board on Infrastructure and the Constructed Environment, national research Council.
2. Blast Mitigation for Structures; 1999 Status Report on the DTRA/TSWG Program – http:// books.nap.edu/catalog.php?record-id=9861, National Academic press, 2000.

CIV 6106	HIGH PERFORMANCE CONCRETE	L	T	P	C
		3	0	0	3

Course outcome

At the end of the course, students would be able to

CO1: Identify the functional role of ingredients of high performance concrete and apply this knowledge to mix design philosophy

CO2: Acquire and apply fundamental knowledge in the fresh and hardened properties of concrete

CO3: Evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure

CO4: Develop an awareness of the utilization of waste materials as novel innovative materials for use in high performance concrete

CO5: Design a high performance concrete mix which fulfills the required properties for fresh and hardened concrete

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L							H			M

CO2	M				L						M	
CO3							M					
CO4		M								M		
CO5						M						M

Introduction

High Performance Concrete (HPC)-Origin-Development-Methods for achieving HPC-Advantages- Classification of materials for HPC-Properties and characteristics of HPC – Type of HPC – powder Reactive Concrete, - Selection of the type of HPC.

Mix design

Basics of Proportioning – Mix Design Principles-Methods-Empirical methods-particle Packing Method-Statistical Method.

Fresh and mechanical properties of HPC

Fresh properties Test methods-Filling ability test-passing Ability Test-Segregation test-mechanical Properties-Compressive strength-Flexural strength test-Fracture behaviour-Deformability of Hardened HPC-Creep and Shrinkage of HPC.

Durability characteristics of HPC

Durability test on HPC-Transport Properties in HPC and relation with Durability-Permeability and Diffusivity of HPC-Chloride Penetration test-Frost action with Deicing Salts-Spalling tests on HPC-Reactive Powder Concrete Exposed to Fire-Frost resistance.

Special HPC

Steel fibre reinforced concrete-Design and application-Reactive Powder Concrete-Mix design and Mechanical properties-Reactive Powder Concrete Composites.

TEXT BOOK

1. High Performance Concrete: From Materials to structure by Yues Malier Published 1992 Taylor & Francis.

REFERENCES

1. High Performance Concrete by Pierre – Claude Aitcin Published 1998 Taylor & Francis
2. Perspectives in Civil Engineering by Jeffrey S. Russel, American Society of Civil Engineers
3. High Performance Fibre Reinforced Cement Composites 2 by Hans Wolfgang Reinhardt, Antoine E Naaman.

CIV 6107	MEASUREMENT AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

Course outcomes

At the end of the course, students would be able to

CO1: Understand and respond to the need for rigorous and formal metrology concepts in designing and using measurement systems.

CO2: Recognize the limits on data imposed by measurement and analyse uncertainty in an appropriate manner.

CO3: Use basic statistical methods to aid data evaluation and decision making.

CO4: Appreciate how to identify and specify sensors (or complete instruments) for controlling machines and processes.

CO5: Understand the operating principles of a range of widely used instrumentation techniques and appreciate how to use them in the design of measurement systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H								H			M
CO2					L						M	
CO3							M					
CO4	M				M					M		
CO5		M										H

Introduction

Functional elements of an instrument – Static and dynamic characteristics – Response of first and second order instruments to step, ramp and sinusoidal inputs – Uncertainty in measurement – Systematic and random errors – Error propagation – Significant figures.

Temperature measurement

Filled in and bimetallic thermometers – RTD, thermistor, thermocouple and associated circuitry – Radiation and optical pyrometry – Digital IC thermometers – Accuracy, errors and compensation.

Pressure measurement

Low and high-pressure measurement – Differential pressure measurement – Force balance types – Displacement, diaphragm and piezoelectric types – Pressure standards and calibration.

Flow measurement

Flow velocity (insertion-type) measurement – Pitot tube, hot wire and hot film anemometers – Drag force and turbine flow meters – Flow rates by pressure variation measurement – Venturi, flow nozzle and orifice meters – Ultrasonic and cross correlation flow meters.

Miscellaneous measurements

Level, density, viscosity and PH measurement – Displacement, velocity and acceleration measurements – Force and torque measurements – Testing and calibrating of various measuring instruments.

TEXT BOOK

1. James. W. Dally, "Instrumentation for Engineering Measurement", John Wiley & Sons, Inc. 1993.

REFERENCES

1. Patranabis. D., "Principles of Industrial Instrumentation, "McGraw-Hill Publising Company, 1984.
2. Eckman D.P. "Industrial Instrumentation", Wiley Eastern Publishers, 1998.
3. Ernest, O.E. Doebelin, "Measuremnt Systems", McGraw-Hill publishing Company, 1990.

CIV 6108	RECENT ADVANCES IN CONSTRUCTION MATERIALS	L	T	P	C
		3	0	0	3

Course outcomes

At the end of the course, students would be able to

CO1: Understand the structural, physical and long term performance of building materials used in construction**.**

CO2: Understand mechanical and non mechanical behaviour of advanced materials in buildings.

CO3: Understand the use of advanced materials in construction.

CO4: Identify crucial problem areas in manufacture and applications of advance materials in construction.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		L							H			M

CO2	M				L						M	M
CO3							M					
CO4		M			M					M		H

Fibre Reinforced Concrete

Foams and light weight materials, fibreinforced concrete Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete.

Industrial Waste materials in Concrete

Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concrete at high temperature.

Corrosion of concrete and reinforcing steel

High strength concrete. Changes in concrete with time, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Electro-chemical process, measures of protection.

Ferro – Cement, Fibres and Composites

Ferro-cement, material and properties. Polymers, Fibers and composites. Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composites. Adhesives and sealants.

Polymers in buildings

Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in building Physics, Polymer concrete composites, ceramics, fly ash quarry dust.

TEXT BOOK

1. Shan Somayaji, Civil Engineering Materials, 2nd Edition, Prentice Hall Inc., 2001.

REFERENCES

1. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
2. Derucher, K. Korfiatis. G and Ezeldin S. Materials for Civil and Highway Engineers, 4th Edition, Prentice Hall Inc. 1999.
3. Aitkens, High Performance Concrete, McGraw-Hill, 1999.

CIV 6109	SELF COMPACTING CONCRETE	L	T	P	C
		3	0	0	3

Course outcomes

At the end of the course, students would be able to

CO1: Identify the functional role of ingredients of concrete and apply this knowledge to mix design philosophy

CO2: Acquire and apply fundamental knowledge in the fresh and hardened properties of self compacting concrete

CO3: Evaluate the effect of the environment on service life performance, properties and failure modes of structural concrete and demonstrate techniques of measuring the Non Destructive Testing of concrete structure

CO4: Develop an awareness of the utilization of waste materials as novel innovative materials for use in self compacting concrete

CO5: Design a concrete mix which fulfills the required properties for fresh and hardened concrete

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	L						H			M
CO2	M				L						M	
CO3							M					
CO4					M					M		
CO5			L									M

Introduction

Self Compacting Concrete (SCC)-Origin-Development-Methods for achieving SCC-Advantages-Classification of materials for SCC-Properties and characteristics of SCC-Powder Type SCC-Viscosity agent type SCC-Selection of the type of SCC.

Mix design

Basics of Proportioning-Mix Design Principles-Methods-Empirical methods-Particle Packing Method-Statistical Method.

Fresh and mechanical properties of SCC

Fresh PROPERTIES Test methods-Filling ability test-Passing Ability Test-Segregation test-Mechanical Properties – Compressive strength-Flexural strength test-Fracture behaviour - Deformability of Hardened SCC-Creep and Shrinkage of SCC-Robustness of SCC.

Durability characteristics of SCC

Durability test on SCC-Transport Properties in SCC and relation with Durability-Permeability and Diffusivity of SCC-Chloride Penetration test-Frost action with Deicing Salts-Spalling tests on SCC-Self Consolidating Concrete Exposed to Fire-Frost resistance.

Special SCC

Self Compacting steel fibre reinforced concrete-Design and application-Self compacting Hybrid fibre concrete-Mix design and Mechanical properties-self compacting concrete Composites.

TEXT BOOK

1. Self Compacting Concrete-Geert De Schutter Peter J.M. Bartos, Peter Domone and John Gibs., Whittles publishing company, Scotland, UK 2006..

REFERENCES

1. Self Compacting Concrete-Ake Skarendahl, Orjan Peterson., RILEM Publications-2003.
2. Self Compacting Concrete-Okamura H. Ouchi. M., and Ozawa.K
3. Design Performance and Use of Self consolidating concrete-Zhiwu Yu.

CIV 6110	COASTAL ENGINEERING AND OFFSHORE STRUCTURES	L	T	P	C
		3	0	0	3

Course outcomes

At the end of the course, students would be able to

CO1: Identify the significant coastal hydrodynamic processes that need to be considered in coastal engineering design projects

CO2: Overview the various types of coastal structures, their functionality, tools to determine the wave-induced loads, and their calculation and construction

CO3: Determine the hydrodynamic design conditions in coastal waters based on the evaluation of appropriate theories and data analysis techniques;

CO4: Generate the loads from wind, wave, current, earthquake, ice and snow, temperature, sea bed movement, marine growth and tide for the various types of structures

CO5: Understand the basic uses and design considerations of coastal structures

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	L						H			M

CO2					L						M	
CO3			M					L				H
CO4		M			M					M		
CO5			M			M		L				M

Theories of periodic wave motion

Small amplitude wave theory - Basic equations of hydrodynamics - Integration of equations of motion - Mathematical formulation of wave problem - Characteristics of small amplitude waves - Deep and shallow water waves - Wave energy - Group velocity of wave trains - Transformation of small amplitude waves - Reflection - Reflection and deflection of waves breaking of wave and its importance.

Forces due to ocean waves on structures

Finite amplitude wave theories - Wave forces on a vertical, inclined, circular cylinder - Coefficient of drag and inertia - Wave forces on breakwaters and sea walls due to non - Breaking and broken waves - Wave forces on piles.

Offshore soil and structure modeling

Different types of offshore structures, foundation modeling, structural modeling - Sea walls and bulkheads - Groins - Offshore breakwaters - Artificial nourishment - Functional aspects of break waters - Design of breakwaters.

Analysis of offshore structures

Static method of analysis, foundation analysis and dynamics of offshore structures.

Design of offshore structures

General - Functional aspects - Design of wharves, piers and quay walls - Functional aspects and design of Graving dry docks - Floating dry docks - Dolphines - Fenders - Offshore mooring buoys - Offshore marine platform - Design of platforms, helipads, Jacket tower and mooring cables and pipe lines.

TEXT BOOK

1. Thomas H. Dawson, "Offshore Structural Engineering", Prentice Hall Inc. Englewood Cliffs, N.J.1983.

REFERENCES

1. Keddy, D.V. and Arockiasamy, M., "Offshore Structures, Vol. I" Krieger Publishing Company, Malabar, Florida, 1991.
2. Chakrabarti, S.K., "Hydrodynamics of Offshore Structures", Computational Mechanics Publications, 1987.
3. Wiegel, R.L., "Oceanographical Engineering", Prentice Hall Inc, Englewood Cliffs, N.J.1964.
4. Brebia, C.A., Walker, S., "Dynamic Analysis of Offshore structures, New-nes Butterworths, U.K.1979.

CIV 6111	DISASTER MANAGEMENT AND MITIGATION	L	T	P	C
		3	0	0	3

Course outcome

At the end of the course, students would be able to

CO1: Capacity to integrate knowledge and to analyse, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available

CO2: Capacity to manage the Public Health aspects of the disasters.

CO3: Capacity to describe, analyse and evaluate the environmental, social, cultural, economic, legal and organisational aspects influencing vulnerabilities and capacities to face disasters.

CO4: Capacity to analyse and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L	L						H			M
CO2	M				L						M	
CO3							M					H
CO4		M				L				M		

Introduction to disaster management

Definition, nature, types and classification of disasters, risk analysis - Disasters - Causes and effects - Factors affecting damage - Type, scale, population density, socio-economic status of population, habitation pattern, physiology and climate - Factors affecting mitigation measures - Concepts of Disaster Management, Models for Disaster Management, Types of Disaster Management, Vulnerability and Capacity Assessments.

Hazard types and mitigation measures

Characteristics of Particular Hazards and Disasters and mitigation measures of Earthquakes, Tsunamis, Tropical Cyclones, Floods, Droughts, Environmental Pollution, Deforestation, Desertification, Epidemics, Chemical and Industrial Accidents.

Methods and techniques of disaster management

Disaster Mapping - Predictability, Forecasting and warning - Disaster preparedness plan - Land use zoning using Remote Sensing and Geographic Information Systems (GIS) - Preparing Community through Information, Education and Communication (IEC) – Mitigation.

Relief measures and role of monitoring

Damage Assessment - Rescue and evaluation - Shelter for victims - Control of fire - Clearance of debits, Health & Casualty Management - Reconstruction and Rehabilitation - Monitoring methodology - Techniques and problems. **Awareness and agencies in disaster management**

Human Behaviour and Response of Individual, Community, Institutional - Community participation and Awareness - Public awareness programme - Iinformation organization and dissemination - Role of various agencies in Disaster Management - District administration - Ministries and Departments of Centre and state levels - Military and Para-military forces – NGOs - International Agencies – Media.

TEXT BOOK

1. Damon coppola, “Introduction to International Disaster Management”, Bullock & Haddow press, Elsevier.

REFERENCES

1. Ramesh R. Rao, Jon Eisenberg, and Ted Schmitt, “Improving Disaster Management”, Committee on Using Information Technology to Enhance Disaster Management, National Research Council.
2. Teaching resource material on “Natural hazards and disaster management” by Central Board of Education, New Delhi.

CIV 6112	TSUNAMI RESISTANT STRUCTURES	L	T	P	C

		3	**0**	**0**	**3**

Course outcomes

At the end of the course, students would be able to

CO1: Learn how tsunamis are generated and understand where tsunami hot spots are located worldwide

CO2: Gain an understanding of how tsunamis are quantified and their range of damaging effects on buildings and coastal infrastructure

CO3: Learn how the Indian Ocean 2004 and Japan 2011 tsunamis have changed the way in which engineers are designing buildings in tsunami inundation hazard zones

CO4: Understand the link between co-existing earthquake and tsunami damage effects

CO5: Develop an ability to quantify building vulnerability to tsunami loadings, along with the associated damage and insured losses.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L										M
CO2					L						M	
CO3							L					
CO4		M			M					M		M
CO5			L					M				

Introduction

Hazards – Classification of hazards – coastal hazards - Cyclones - Cyclones in the Indian Seas - Destruction caused by Cyclones - Surge prone coasts of India - Cyclone Accounts - Cyclone Operation in India - Disaster Prevention and Preparedness - Tsunami – Causes – Case studies of tsunami affected areas.

Tsunami loads and their effects

Hydraulic jumps – Classification of jumps – Energy dissipation - Surges - Surge through channel transitions - Tsunami load determination on offshore structures - Near- and Onshore-Tsunami Effects – Tsunami models.

Design for wind, cyclone and flood resistance structures

Wind pressures on buildings – Types of damages during cyclone – Planning aspects – Site selection, orientation, wall openings and foundations – Design procedure for wind resistance buildings – Determine the wind forces, design the elements and connections, framed buildings– Flood resistance buildings – Flood zoning – Causes of floods - Flood intensity – Protection of existing houses from flood flow damage.

Design for tsunami resistant structures

Introduction - Tsunami run up behavior - Empirical data - Current design code loads - Design code equations - Factors to consider when designing a tsunami shelter - Housing unit, land-use standards, road access, physical infrastructure, natural light & ventilation - Settlements in Disaster Prone Areas - Typical conceptual architectural designs for housing of fishing settlements – Tsunami warning systems.

Reconstruction of houses affected by tsunami

Introduction - Siting of Building - Planning aspects - Soil Investigation - Construction of Dwelling units – Foundation, Walling, Roofing, Openings, Flooring, Drainage - Quality control - Measuring Materials, Mixing materials, Formwork, Placing of Reinforcement, Casting - Compacting Concrete - Curing of Concrete - Erection of Temporary Shelters.

TEXT BOOK

1. Dr. N. M. Bhandiri and Dr. Prem krishna “Improving guidelines for wind / cyclone and flood resistance structures”, University of Roorkee.

REFERENCES

1. Guidelines for “Reconstruction of houses affected by tsunami in Tamil Nadu”, Public Works Department, Tamil Nadu.
2. Tsunco Okada and Tadashi Sugano et al: Tsunami loads and structural design of tsunami refuge buildings. Journal of building centre of Japan, 2005.
3. P. Lukkunaprasit and A. Ruangrassamee: Learning from the 2004 Indian Ocean tsunami-buildings damage and clues for tsunami resistant design: Manila, Ph