

Curriculum and Syllabi

PG Diploma Programme

CONSTRUCTION MANAGEMENT

(with effect from Academic Year 2007-2008)

DEPARTMENT OF CIVIL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY

CALICUTI

Department of Civil Engineering
NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

**Proposed Curriculum for PG Diploma Programme in
CIVIL ENGINEERING—CONSTRUCTION MANAGEMENT (CEM)**

S1

S2

	Code	Title	L/T	P/S	Cr		Code	Title	L/T	P/S	Cr
1	CEM601	Quantitative Techniques in Management	3		3	1	CEM611	Project Formulation and Appraisal for Construction	3		3
2	CEM602	Project Planning and Control	3		3	2	CEM612	Management Information Systems	3		3
3	CEM603	Project Safety Management	3		3	3	CEM691	Computational Laboratory for Construction Management	0	3	2
4	CEM604	Construction Equipment and Materials Management	3		3	4	CEM699	Seminar	0	3	2
						5		Elective	3		3

Total credits = 12 (Core)

Total credits = 10 (Core)+ 3 (Elective)

S3

	Code	Title	L/T	P/S	Cr
1	CEM799	Project			8

Total credits = 8 (Core)

Stipulations:

- 1 A minimum of 33 credits have to be earned for the award of PG Diploma in this programme.
- 2 Project is to be carried out in industry with relevance on application and will be guided jointly by a faculty member of NITC and a personnel from industry.

S2

List of Electives (CEM)

CEM651	Shoring, Scaffolding and Formwork
CEM652	Management Principles and Risk Analysis
CEM653	Maintenance and Rehabilitation of Structures
CEM654	Construction of Pavements
CEM655	Building Information Management
CEM656	Overview of Surveying Techniques
CEA625	Bridge Engineering
CEA627	Forensic Engineering and Rehabilitation of Structures
CEB625	Geographic Information System and Applications
CEB653	Pavement Maintenance And Management
* Any other subject offered in the Institute with approval from the Programme Coordinator/Faculty Advisor	

Detailed Syllabus for PG Diploma in Construction Management

Semester I

CEM 601 QUANTITATIVE TECHNIQUES IN MANAGEMENT

L	T	P	Cr
3	0	0	3

Module 1:

Operations research

12 hr

Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems

Module 2:

Production management

10 hr

Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory, Risk modelling and, Simulation Models

Module 3:

Financial management

7 hr

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting

Managerial economics

3 hr

Cost Concepts – Break-even analysis – Pricing Techniques

Module 4:

Decision theory

10 hr

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory

REFERENCES

1. Vohra, N.D. Quantitative Techniques in Management, Tata McGraw-Hill Company Ltd, New Delhi, 1990.
2. Sehroeder, R.G, Operations Management, McGraw-Hill, USA, 1982.
3. Levin, R.I, Rubin, 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. Varshney, R.L. and Maheswari, K.L., Managerial Economics, Sultan Chand, 1975

CEM602 PROJECT PLANNING AND CONTROL

L	T	P	Cr
3	0	0	3

Module 1:**Construction planning**

10 hr

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

Module 2:**Scheduling procedures and techniques**

11 hr

Relevance of Construction Schedules - The Critical Path Method - Calculations for Critical Path Scheduling - Activity Float and Schedules - Presenting Project Schedules - Critical Path Scheduling for Activity-on-Arrow and with Leads, Lags, - Calculations for Scheduling with Leads, Lags – LOB and LSM - Resource Oriented Scheduling - Scheduling with Resource Constraints and Precedence - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Scheduling in Poorly Structured Problems - Improving the Scheduling Process.

Module 3:**Cost control, monitoring and accounting**

10 hr

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.

Module 4:**Organization and use of project information**

11 hr

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. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
2. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
3. Moder, J., C. Phillips and E. Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Company, Third Edition, 1983.
4. Willis, 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

CEM603 PROJECT SAFETY MANAGEMENT

L	T	P	Cr
3	0	0	3

Module 1:

Construction accidents

Accidents and their Causes – Human Factors in Construction Safety - Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications

10 hr

Module 2:

Safety programmes

Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives

11 hr

Module 3:

Contractual obligations

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping

10 hr

Module 4:

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 – Subcontractual Obligation – Project Coordination and Safety Procedures – Workers Compensation

11 hr

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

**CEM 604 CONSTRUCTION EQUIPMENT AND MATERIALS
MANAGEMENT**

L	T	P	Cr
3	0	0	3

Module 1;

Construction equipment management

Identification – Planning - Equipment Management in Projects - Maintenance Management – Replacement – Unit Operating Cost - Cost Control of Equipment - Depreciation Analysis – Safety Management

10 hr

Module 2;

Equipment for earthwork

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers

10 hr

Module 3;

Equipment for production of aggregate and concreting

Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters

11 hr

Module 4;

Other construction equipment

Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment, Forklifts and related equipment - Portable Material Bins – Conveyors - Hauling Equipment

11 hr

REFERENCES

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, 6th Edition, Tata McGraw-Hill, New Delhi, 2003
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988.
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
4. Dr.Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi. 1983.

CEM611 PROJECT FORMULATION AND APPRAISAL FOR CONSTRUCTION

L	T	P	Cr
3	0	0	3

Module 1:

Project formulation

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

11 hr

Module 2:

Project costing

Project Cash Flows – Time Value of Money – Cost of Capital

10 hr

Module 3:

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

11 hr

Module 4:

Project financing

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators - Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

10 hr

REFERENCES

1. Prasanna Chandra, Projects – Planning Analysis Selection Implementation & Review Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi., 1995
2. Joy P.K., Total Project Management - The Indian Context (Chapters 3 - 7), New Delhi, Macmillan India Ltd., 1992

CEM612 MANAGEMENT INFORMATION SYSTEMS

L	T	P	Cr
3	0	0	3

Module 1:

Introduction

Information Systems - Establishing the Framework - Business Models - Information System Architecture - Evolution of Information Systems.

10 hr

Module 2:

System development

Modern Information System - System Development Life Cycle - Structured Methodologies - Designing Computer Based Methods, Procedures, Control - Designing Structured Programs.

12 hr

Module 3:

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.

10 hr

Module 4:

Implementation and control

Control - Testing Security - Coding Techniques - Defection of Error - Validating - Cost Benefit Analysis - Assessing the value and risk of Information System.

10 hr

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.

**CEM691 COMPUTATIONAL LABORATORY FOR CONSTRUCTION
MANAGEMENT**

L	T	P	Cr
0	0	3	2

Hands on training will be imparted and students are expected to acquire working knowledge on the following category of computer applications

Drafting and 3D Modelling (such as Auto Revit, AutoCAD)

Estimation tools (such as BID Master, 2000 Estimator)

Scheduling tools (such as Primavera, MS Project)

CEM699 SEMINAR

L	T	P	Cr
0	0	3	2

Each Student shall prepare a Paper and present a Seminar on any topic related to the branch of specialisation under the guidance of a staff member. The student shall submit typed copy of the paper to the Department. Grades will be awarded on the basis of contents of the paper and the presentation.

Electives

CEM 651 SHORING, SCAFFOLDING AND FORMWORK

L	T	P	Cr
3	0	0	3

Module 1:

Planning, site equipment and plant for form work

10 hr

Overall Planning – Detailed Planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning 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.

Crane arrangement – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales – Scaffold frames - Form accessories – Vertical transport table form work.

Module 2:

Form materials and pressures on formwork

10 hr

Lumber – Types – Finish – Sheathing boards - 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 – Bolts lag screw and connectors – Bolt loads.

Pressures on Formwork - Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic Adjustment for non standard condition.

Module 3:

Shores and form design

10 hr

Simple wood stresses – Slenderness ratio – Allowable loads – Tubular steel shores - Patented shores – Site Preparation - Size and spacing – Steel Tower Frames – Safety practices – Horizontal shoring for multi-levels – More concentrated shore loads - T-heads – Two tier wood shores – Ellis shores – Dayton sure grip and Baker Roos shores – Safway Symons shores – Beaver Advance shores - Dead shores – Raking and Flying shores

Basic simplification – Beam formulas – Allowable stresses – Deflection bending lateral stability – Shear, Bearing – Examples in wall forms – Slab forms – Beam form – Ties, Anchors and Hangers – Column forms – Examples in each.

Module 4:

Dome forms, tunnel forms, slipforms and safety practices for scaffolds

12 hr

Shells of translation and revolution - Hemispherical – Parabolic - Barrel vaults – Hypar Shells – Conoidal Shells - Folded plates – Shell form design – Building the form – Placing concrete – Strength requirements – Tunnel forming components – Curb and Invert forms – Arch and Wall forms - Telescopic forms – Concrete placement methods – Cut and Cover construction – Continuous Advancing slope method - Bulk head method – General design considerations influence of placing equipment – Tolerances – Form construction for Shafts.

Slipforms – Principles – Types – Advantage – Functions of various components – Planning of Slipform operations – Desirable characteristics of concrete – Common problems faced – Safety in slip forms - Special structures built with Slipform Technique – Codal provisions – Types of scaffolds – Putlog and Independent scaffold – Single pole scaffolds – Fixing ties – Spacing of ties - Plan Bracing – Knots – Safety nets – 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”, Third Edition McGraw-Hill, 1996.
2. Hurd, M.K., “Formwork for Concrete”, Special Publication No. 4 Sixth Edition, American Concrete Institute, Detroit, 1995.
3. Michael P. Hurst, “Formwork”, Construction Press, London and New York, 1997.
4. Austin, C.K., “Formwork for Concrete”, Cleaver – Hume Press Ltd., London 1996.
5. Tudor Dinescu and Constantin Radulescu, “Slipform Techniques”, Abacus Press, Turn Bridge Wells, Kent, 1992.
6. “Guide for Concrete Formwork”, American Concrete Institute Detroit, Michigan, 1996.
7. “Safety Requirements for Scaffolding”, American National Standards Institute, New York, 1994.

CEM652 MANAGEMENT PRINCIPLES AND RISK ANALYSIS

L	T	P	Cr
3	0	0	3

Module 1:

Introduction to Risk Management

15 hr

Definitions - The Development of Risk Management - Principles of Risk Management - The hazard and risk – knowledge of the contents the reasons for managing risk in the public and private sectors – Risk estimation – types of risk and classifications - benefits of having a risk management programme responsibilities of those involved in the risk management - Outline the elements of the various risk management standards,

Module 2:

Risk Assessment, Analysis and Evaluation

10 hr

Risk Management Documentation - Risk Culture - Risk Identification - – life cycle risk management – multi dimensional analysis – risk ranking – event incident scenario – uncertainties and consequences – risk estimation – assessment – quantitative techniques – human factors – decision making under uncertainty

Module 3:

Risk Control and Treatment

10 hr

Risk Reduction - Transfer and Sharing of Risk - Elimination and Retention of Risk - Entrepreneurial risks - Pure risks - Internal risks Retaining insurable risks – Insurance - Self-insurance - Contractual Transfer of Risk – Captives - Responsibilities of Those Involved in Risk Transfer -- Factors Affecting Insurance as a Financing Tool -

Module 4:

Risk Management and Internal Control

7 hr

How the Internal Audit Function Works - Control Systems - Auditing Risk Management - Setting up an Internal Audit Function

REFERENCES

1. Ian Cameron , Raghu Raman Process Systems Risk Management Elsevier Academic Press (2005)
2. Sadgrove, Kit, Complete guide to business risk management, Jaico Publication (1997)
3. Marrison, Chris, Fundamentals of risk measurements, Tata Mc Graw Hill, Delhi, (2002)
4. Hans Buhlmann, Mathematical Methods in Risk Theory, Springer – Verlag Berlin Heidelberg (1970)

CEM653 MAINTENANCE AND REHABILITATION OF STRUCTURES

L	T	P	Cr
3	0	0	3

Module 1:

Influence on serviceability and durability

10 hr

Quality assurance for concrete construction as built concrete properties strength, permeability, thermal properties and cracking, Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

Module 2:

Special materials for repair

10 hr

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete. Rust eliminators and polymers coating for Rebars, foamed concrete

Module 3:

Maintenance and repair strategies

12 hr

Definitions : Maintenance, repair and rehabilitation, Facets of Maintenance importance of Maintenance Preventive measures on various aspects Inspection, Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques,

Module 4:

Techniques for repair

10 hr

Mortar and dry pack, vacuum concrete, Guniting and Shotcrete Epoxy injection, Mortar repair for cracks, shoring and underpinning, Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering wear, fire, leakage, marine exposure, Engineered demolition techniques - case studies

REFERENCES

1. Denison Campbell, Allen and Harold Roper, "Concrete Structures", Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.
3. M.S.Shetty, "Concrete Technology - Theory and Practice", S.Chand and Company, New Delhi, 1992.
4. Santhakumar, A.R., "Training Course notes on Damage Assessment and repair in Low Cost Housing", "RHDC-NBO" Anna University, July, 1992.
5. Raikar, R.N., "Learning from failures - Deficiencies in Design", Construction and Service - R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987

CEM654 CONSTRUCTION OF PAVEMENTS

L	T	P	Cr
3	0	0	3

Module 1:

Road making materials

classification, testing and applications of road making aggregates – road binders – rheology of bituminous binders – special binders – emulsion, cut back. Cement

14 hr

Properties of bituminous mixtures

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

Module 2:

Flexible pavements

Base courses – bituminous macadam – dense bituminous macadam – bituminous concrete – semi dense bituminous concrete – construction methods – Marshall method of mix design for dense bituminous courses – surface courses – surface dressing, premix carpet, mix seal surfacing – mastic asphalt - construction methods – quality control measures – sampling and analysis of bituminous binders and mixtures.

10 hr

Module 3:

Rigid pavements

Introduction – construction practices – concrete mix design – formwork – dewatering – joints - maintenance

8 hr

Module 4:

Machineries and Latest advancements

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.

10 hr

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

CEM655 BUILDING INFORMATION MANAGEMENT

L	T	P	Cr
3	0	0	3

Module 1:

Structural

Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.

9 hr

Module 2:

Environmental aspects and services

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 systems, Plumbing – Electricity – Vertical circulation and their interaction.

14 hr

Module 3:

Maintenance and Safety

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, Ability of systems to protect fire – preventive systems – fire escape system design – planning for pollution free construction environmental – Hazard free Construction execution.

14 hr

Module 4:

Virtual Reality and Modelling

2D and 3D modelling, Simulation Models, introduction to 4D and 5D tools

5 hr

REFERENCES

1. E.C. Butcher and A.C. Parnell, Designing for Fire Safety, John Wiley and Sons, 1993.
2. William T. Mayer, Energy Economics and Build Design, McGraw-Hill Book Company, 1983.
3. Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd., London.
4. A.J.Elder and Martiz Vinden Barg, Handbook of Building Enclosure, McGraw-Hill Book Company, 1983.
5. Jane Taylor and Gordin Cooke, The Fire Precautions Act in Practices, 1987.