

M. Tech – Construction Technology and Management

CE	APPLIED STATISTICS AND QUEUING THEORY	3	1	0	4
1.	Basic Concepts of Queuing Theory : Probability – Random Variables – Moments – Moment Generating Functions – Standard Distributions – Functions of Random Variables – Two Dimensional Random Variables – Correlation and Regression.				12 0 0
2.	Estimation Theory : Principles of Least Squares – Multiple and Partial Correlation – Regression – Estimation of Parameters – Maximum likelihood Estimates – Method of Moments.				12 0 0
3.	Testing of Hypothesis : Sampling of Distributions-Test based on Normal, t, Chi-square and F Distributions - Analysis of Variance - One way and Two way Classifications.				12 0 0
4.	Design of Experiments : Completely Randomised Design - Randomised Block Design - Latin Square Design - 2 Square Factorial Design.				12 0 0
5.	Queuing Theory : Single and Multiple Server Markovian Queuing Models - Customer Impatience - M/G/1 Queuing System - Queuing Applications.				12 0 0
					Total 60 hrs

References :

1. Taha, H.A., " Operations Research - An Introduction ", Prentice - Hall of India, 6th Edition, New Delhi, 1997.
2. Freund, J.E. and Miller, I.R., " Probability and Statistics for Engineers ", Prentice Hall of India, 5th Edition, New Delhi, 1994.
3. Gupta, S.C. and Kapur, V.K., " Fundamentals of Mathematical Statistics ", Sultan Chand & Sons, New Delhi, 1999
4. Goel .B.S, and Mittal .S.K, " Operations Research ", Pragati Prakashan, Meerut, 2000.

CE	CONSTRUCTION METHODS AND EQUIPMENT	3	0	0	3
1.	Construction Equipment Management : Identification - Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment - Depreciation Analysis - Safety Management.				12 0 0
2.	Equipment of Earthquake : Fundamentals of Earthwork Operations - Earth Moving Operations - Types of Earthwork Equipment - Tractors, Motor Graders, Scrapers, Front End Waders, Earth Movers.				12 0 0
3.	Other Construction Equipment : Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for compaction – Erection Equipment - Types of pumps used in construction - Equipment for De-watering and Grouting - Foundation and Pile Driving Equipment..				12 0 0
4.	Materials Handling Equipment : Forklifts and Related Equipment-Portable Material Bins – Conveyors - Hauling Equipment..				12 0 0
5.	Equipment for Production of Aggregate and Concreting : Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters.				12 0 0
					Total 60 hrs

References :

1. Taha .H.A, "Operations Research - An Introduction", PHI, 6th Edition, New Delhi, 1997.
2. Peurifoy .R.L, Ledbetter .W.B and Schexnayder .C, "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.
3. Sharma S.C. " Construction Equipment and Management ", Khanna Publishers New Delhi, 1988.
4. Deodhar .S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
5. Dr. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi-, 1983.

CE	SMART MATERIALS FOR CONSTRUCTION	3	0	0	3
1.	Concretes : High Strength and High Performance Concrete - Fiber Reinforced Concrete.				12 0 0
2.	Metals : New Alloy steels - Aluminium and its Products - Other Alloys.				12 0 0

3. **Composites** : Plastics - Reinforced Polymers – FRP - Cellular Cores. 12 0 0
 4. **Other Materials** : Water Proofing Compounds - Non-weathering Materials - Flooring and Facade Materials. 12 0 0
 5. **Smart and Intelligent Materials** : Brief Outline and Uses. 12 0 0
- Total 60 hrs**

References :

1. Shan Somayaji, "Civil Engineering Materials", 2nd Edition, Prentice Hall Inc., 2001.
2. Mamlouk, M.S. and Zaniewski, J.P., "Materials for Civil and Construction Engineers", Prentice Hall Inc., 1999.
3. Derucher, K.Korfiatis. G. and Ezeldin, S., "Materials for Civil and Highway Engineers", 4th Edition, Prentice Hall Inc., 1999.
4. Aitkens, " High Performance Concrete", McGraw Hill, 1999.

CE	PROJECT FORMULATION AND APPRAISAL	3	1	0	4
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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. 9 3 0
 2. **Project Costing** : Project Cash Flows - Time value of Money - Cost of Capital. 9 3 0
 3. **Project Appraisal** : NPV - BCR - IRR – ARR – Urgency - Payback 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. 9 3 0
 4. **Project Financing** : Project Financing - Means of Finance - Financial Institutions - Special Schemes - Key Financial Indicators. 9 3 0
 5. **Private Sector Participation** : Private Sector Participation in Infrastructure Development Projects - BOT. BOL T, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer. 9 3 0
- Total 60 hrs**

References :

1. Prasanna Chandra, "Projects - Planning Analysis Selection Implementation & Review", 4th Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi., 1995.
2. Joy .P.K, "Total Project Management - The Indian Context (Chapters 3-7)", New Delhi, Macmillan India Ltd., 1992.
3. United Nations Industrial Development Organisation (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.

CE	CONSTRUCTION LAWS AND REGULATIONS	4	0	0	4
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1. **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. 12 0 0
2. **Tenders** : Pre-qualification - 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. 12 0 0
3. **Arbitration** : Comparison of Actions and Laws - Agreements, Subject Matter – Violations - Appointment of Arbitrators - Conditions of Arbitration’s - Powers and Duties of Arbitrator - Rules of Evidence - Enforcement of Award – Costs. 12 0 0
4. **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 customs duties and their influence on construction costs - Legal requirements for planning-Property Law-Agency Law-Local Government Laws for Approval - Statutory Regulations. 12 0 0
5. **Labour Regulation** : Social Security - Welfare Legislation - Laws relating to wages, Bonus and Industrial

Disputes, Labour Administration-Insurance and Safety Regulations - Workmen's Compensation Act - Other Labour laws.

12 0 0
Total 60 hrs

References :

1. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M. Tripathi Private Ltd., Bombay, 1982.
2. Tamilnadu PWD Code, 1986.
3. Jimmie Hinze, "Construction Contracts", 2nd Edition, McGraw Hill, 2001.
4. Joseph T. Bockrath, "Contracts and the Legal Environment for Engineers and Architects", 6th Edition, McGraw Hill, 2000.

PR	EMERGING ENGINEERING TECHNOLOGIES	3	0	0	3
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1. **Engineering Technologies & Systems and Critical Technologies** : Overview - Micro and Nanotechnologies, MEMS, MOEMS. 12 0 0
2. **Interdisciplinary Approach** : Engineering, Biology & Medical Technologies - Engineering disciplines & Applications - Biological disciplines & Applications - Medical disciplines & Applications. 12 0 0
3. **Genomics** : Biotechnologies, DNA, Protein, Tissue Engineering, Bioinformatics. 8 0 0
4. **Cognitive Engineering** : Nanotechnologies, Nanotubes, Molecular Manufacturing - Molecular Nanotechnology - I.T. - Artificial Intelligence, Robotics, Informatics, Human - Computer interaction, Neural Networks - Smart Materials - Microfabrication – Sensors. 15 0 0
5. **Role of Emerging Technologies and its Applications** : Energy & Environmental - Defence & Aerospace - Construction & Infrastructure - Information & Electronic Industry - Pharmaceuticals & Medicine - Food & Agricultural Sector. 15 0 0

Total 60 hrs

References :

1. Nadim Maluf, "An Introduction to Microelectromechanical Systems Engineering", (Artech House MEMS Library) Artech House; ISBN : 0890065810; (December 1999).
2. Sergey Edward Lyshevski, "Nano and Microelectromechanical Systems ; Fundamentals of Nano and Microengineering", CRC Press; ISBN : 0849309166; (September 25, 2000)
3. "Report on Critical Technologies – Overview", NDRF Publication, 2002.

CE	ADVANCED CONSTRUCTION TECHNIQUES	4	0	0	4
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1. **Sub Structure Construction** : 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 - Laying Operations for built up Offshore System - Shoring for Deep Cutting - Large Reservoir Construction with Membranes and Earth System - Well Points - Dewatering and Stand by Plant Equipment for Underground Open Excavation. 12 0 0
2. **Super Structure Construction** : Vacuum Dewatering of Concrete Flooring - Concrete Paving Technology - Techniques of Construction for Continuous Concreting Operation in Tall Buildings of various Shapes and varying Sections. 12 0 0
3. **Launching Techniques** : Suspended from Work - Erection Techniques of Tall Structures. Large Span Structures - Launching Techniques for Heavy Decks - Insitu Pre-stressing in High Rise Structures, Aerial Transporting Handling Erecting Light Weight Components on Tall Structures - Erection Office Tower as and Rigging of Transmission Line Structures - Construction sequences in Cooling Towers, Silos Chimney, Sky Scrapers, Bow String Bridges. Cable Stayed Bridges - Launching and Pushing of Box Decks. 12 0 0
4. **Advanced Construction Techniques in Offshore Construction Practice** : Construction Sequence and Methods in Domes and Pre-Stress Domes - Support Structure for Heavy Equipment and Conveyor and Machinery in Heavy Industries - Erection of Articulated Structures, Braced Domes and Space Decks. 12 0 0
5. **Repair Construction** : Mud jacking Grout through Slab Foundation - Micropiling for Strengthening Floor and

Shallow Profile - Pipeline Laying - Protecting Sheet Piles, Screw Anchors - Sub Grade Water Proofing under Pining Advanced Techniques and Sequence in Demolition and Dismantling.

12 0 0

Total 60 hrs

References :

1. Nadim Maluf, "An Introduction to Microelectromechanical Systems Engineering", (Artech House MEMS Library) Artech House; ISBN : 0890065810; (December 1999).
2. Robertwade Brown, "Practical Foundation Engineering Hand Book", McGraw Hill Publications, 1995.
3. Patrick Powers. J., "Construction Dewatering : New Methods and Applications", John Wiley and Sons, 1992.
4. Jerry Irvine, "Advanced Construction Techniques", CA Rocketr, 1984.

CE	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING	3	1	0	4
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1. **Introduction** : Introduction to System Hardware – Languages - Database Management - Spread Sheets - Applications. 12 0 0
 2. **Optimization Techniques** : Linear, Dynamic and Integer Programming - Branch and Bound Techniques - Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems - Software Development. 12 0 0
 3. **Inventory Problems** : Deterministic and Probabilistic Inventory Models - Software Development. 12 0 0
 4. **Scheduling Applications** : PERT and CPM - Software Development - Use of PRIMAVERA. 12 0 0
 5. **Other Problems** : Decision Making - Bayes Theory - Simulation – Models. 12 0 0
- Total 60 hrs**

References :

1. Bily E. Gillet, "Introduction to Operation Research - A Computer Oriented Algorithmic Approach", Tata McGraw Hill, 1990.
2. Paulson .B.R, "Computer Applications in Construction", McGraw Hill, 1995.
3. Feigenbaum .L, "Construction Scheduling with Primevera Project Planner", Prentice Hall Inc., 1999.

CE	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	3	1	0	4
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1. **Construction Planning** : Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Definition - Defining Precedence Relationships Among Activities - Estimating Activity Duration's - Estimating Resource Requirements for work activities - coding systems. 9 3 0
2. **Scheduling Procedures and Techniques** : 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-node and with Leads, Lags and Windows - Calculations for Scheduling with Leads, Lags and Windows - Resource Oriented Scheduling - Scheduling with Resource Constraints and Precedence - Use of Advanced Scheduling Techniques Scheduling with uncertain duration's - Calculations for Monte Carlo Schedule Simulations - Crashing and Time/Cost Trade Off - Scheduling in Poorly Structured Problems - Improving the Scheduling Process. 9 3 0
3. **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. 9 3 0
4. **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 by Sampling and Variables - Safety. 9 3 0
5. **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 Data Bases - Other Conceptual Models of Databases - Centralized Databases Management Systems - Databases and Application Programs - Information Transfer and Flow. 9 3 0

References :

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoengnam, "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 – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Moder. J., C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., 3rd Edition, 1983.
5. Willis., E.M., "Scheduling Construction Projects", John Wiley & Sons, 1986.
6. Halpin, D.W., "Financial and Cost Concepts for Construction Management", John Wiley & Sons, New York, 1985.

CE	CONSTRUCTION PROJECT MANAGEMENT	3	1	0	4
1.	The Owner's Perspective : Introduction - The Project Life Cycle - Major Types of Construction - Selection of Professional Services Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - The Changing Environment of the Construction Industry - The Role Project Managers.	9	3	0	
2.	Organizing for Project Management : What is Project Management? - Trends in Modern Management - Strategic Planning and Project Programming 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 - Interpersonal behaviour in Project Organization - Perceptions of Owners and Contractors.	9	3	0	
3.	The Design and Construction Process : Design and Construction as an Integrated System -Innovation and Technological Feasibility - Innovation and Technological Feasibility - Design Methodology -Functional Design - Physical Structures - Geo-technical Engineering Investigation - Construction Site Environment - Value Engineering - Construction Planning Industrialized Construction and Prefabrication -Computer - Aided Engineering.	9	3	0	
4.	Labour, Material and Equipment Utilization : Historical Perspective - Labour Productivity - Factors Affecting Job - Site Productivity - Labor Relations in Construction - Problems in Collective Bargaining -Materials Management - Materials Procurement and Delivery Inventory Control - Tradeoffs of Cost in Material Management - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks.	9	3	0	
5.	Cost Estimation : Costs Associated with Construction Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost - Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate based on Engineers List of Quantities - Allocation of Construction Costs Over Time - Computer Aided Cost Estimation - Estimation of Operating Costs.	9	3	0	
		Total 60 hrs			

References :

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.
2. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.
3. Chitkara, K.K. "Construction Project Management Planning, Scheduling and Control", Tata McGraw Hill Publishing Co., New Delhi, 1998.
4. Frederick E.Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
5. Choudhury, S., "Project Management", Tata McGraw Hill Publishing Co., New Delhi, 1988.
6. Ernest E. Ludwig, "Applied Project Engineering and Management", Gulf Publishing Co., Houston, Texas, 1988.
7. Harold Kerzner, "Project Mangement - A systems Approach to Planning", Scheduling and Controlling, CBS

Publishers & Distributors, Delhi, 1988.

8. Joy P.K., "Total Project Management", The Indian Context, Macmillan, India Ltd., New Delhi, 1992.

ELECTIVES

CE	MAINTENANCE AND REHABILITATION OF STRUCTURES	3	0	0	3
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1. **General** : Quality Assurance for Concrete Construction as Built Concrete Properties Strength. Permeability, Thermal Properties and Cracking. 12 0 0
2. **Influence on Serviceability and Durability** : 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. 12 0 0
3. **Maintenance and Repair Strategies** : 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. 12 0 0
4. **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, Fibre Reinforced Concrete. Rust Eliminators and Polymers Coating for Re-bars during Repair Foamed Concrete, Mortar and Dry Pack, Vacuum Concrete, Guniting and Shotcrete Epoxy Injection, Mortar Repair for Cracks, Shoring and Underpinning. 12 0 0
5. **Examples of Repair to Structures** : Repairs to Overcome Low Member Strength Deflection, Cracking, Chemical Disruption, Weathering Wear, Fire, Leakage, Marine Exposure - Engineered Demolition Techniques for Dilapidated Structures - Case Studies. 12 0 0

Total 60 hrs

References :

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw Hill Publishing Co., New Delhi, 1998.
2. Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
3. R.T.Allen and S.C.Edwards, "Repair of Concrete Structures", Blakie and Sons, UK, 1987.
4. M.S.Shetty, " Concrete Technology - Theory and Practice ", S. Chand and Company, New Delhi, 1992.
5. Santhakumar, A.R., "Training Course Notes on Damage Assessment and Repair in Low Cost Housing", "RHDC-NBO", Anna University, July, 1992.
6. Raikar, R.N., "Learning From Failures - Deficiencies In Design", Construction and Service - R & D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

CE	CONSTRUCTION ECONOMICS AND FINANCE MANAGEMENT	3	0	0	4
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1. **Economics** : Role of Civil Engineering in Industrial Development - Advances in Civil Engineering and Engineering Economics - Support Matters of Economy as related Top Engineering - Market Demand and Supply - Choice of Technology - Quality Control and Quality Production - Audit in Economic Law of Returns Governing Production. 12 0 0
2. **Construction Economics** : Construction Development in Housing, Transport and other Infrastructures - Economics of Ecology, Environment, Energy Resources - Local Material Selection - Form and Functional Designs - Construction Workers - Urban Problems - Poverty - Migration - Unemployment - Pollution. 12 0 0
3. **Financing** : The need for Financial Management - Types of Financing - 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 - Job Control and Centralized Management 12 0 0
4. **Accounting Method** : General Overview - Cash basis of a Accounting - Accrual basis of Accounting - Percentage Completion Method - Completed Contract Method - Accounting for Tax Reporting Purposes and Financial Reporting Purposes. 12 0 0

5. **Lending to Contractors** : Loans to Contractors - Interim Construction Financing - Security and Risk Aspects. **12 0 0**

Total 60 hrs

References :

1. Warneer Z Hirsch, "Urban Economics", Mac Milan, NewYork, 1993.
2. Prasanna Chandra, "Projects - Planning Analysis Selection Implementation & Review", 4th Edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 1995.
3. Kwaku A., Tenah and Jose M. Guevera, "Fundamental of Construction Management and Organization", Prentice Hall of India, 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.

CE	MANAGEMENT OF QUALITY AND SAFETY IN CONSTRUCTION	3	0	0	4
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1. **Construction Accidents** : Accidents and their Causes - Human Factors in Construction safety - Cost of Construction Injuries - Occupational and Safety Hazard Assessment - Legal Implications. **12 0 0**
2. **Safety Programmes** : Problem Areas in Construction safety - Elements of an Effective an safety Programme - Job Site Safety Assessment Safety Meetings - Safety Incentives. **12 0 0**
3. **Contractual Obligations** : Safety in Construction Contracts - Substance Abuse - Safety Record Keeping. **12 0 0**
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 - Sub-contractual Obligation - Project Coordination and Safety Procedures - Workers Compensation. **12 0 0**
5. **Quality in Construction** : Quality Policy, Objectives and Methods in Construction Industry - Consumer 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. **12 0 0**

Total 60 hrs

References:

1. James, J.O Brian, "Construction Inspection Handbook - Quality Assurance and Quality Control", Van Nostrand, New York. 1989.
2. Jimmy W.Hinze, "Construction Safety", Prentice Hall Inc., 1997.
3. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, "Construction Safety and Health Management", Prentice Hall Inc., 2001
4. Clarkson H. Oglesby, "Productivity Improvement in Construction", McGraw Hill 1989.
5. John L. Ashford, "The Management of Quality in Construction", E & F.N Span, New York, 1989.

CT	ENVIRONMENTAL IMPACT ASSESSMENT	3	0	0	3
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1. **Introduction** : Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) - Environmental Risk Assesment (ERA) - Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of Reference in EIA- Issues in EIA - National - Cross Sectoral - Social and Cultural. **12 0 0**
2. **Components and Methods** : Components - Screening - Setting - Analysis - Prediction of Impacts - Mitigation. Matrices - Networks - Checklists. Importance Assessment Techniques - Cost Benefit Analysis - Analysis of Alternatives - Methods for Prediction and Assessment of Impacts - Air - Water - Soil - Noise - Biological - Cultural - Social - Economic Environments. Standards and Guidelines for Evaluation. Public Participation in Environmental Decision Making. **12 0 0**
3. **Quality Control** : Trends in EIA Practice and Evaluation Criteria - Capacity Building for Quality Assurance. Expert System in EIA - Use of Regulations and AQM. **12 0 0**
4. **Documentation and Monitoring** : Document Planning - Collection and Organization of Relevant Information - Use of Visual Display Materials – Team Writing - Reminder Checklists. Environmental Monitoring - Guidelines - Policies - Planning of Monitoring Programmes. Environmental Management Plan. Post Project Audit. **12 0 0**
5. **Case Studies** : Case Studies of EIA of Developmental Projects. **12 0 0**

Total 60 hrs

References :

1. Canter, L.W., " Environmental Impact Assessment ", McGraw Hill, New York, 1996.
2. Petts, J., " Handbook of Environmental Impact Assessment Vol. I and II ", Blackwell Science, London, 1999.
3. The World Bank Group, " Environmental Assessment Sourcebook Vol. I, II and III ", The World Bank, Washington, 1991.

CE	ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION	3	0	0	4
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1. **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. 12 0 0
2. **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. 12 0 0
3. **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. 12 0 0
4. **Services** : Energy in Building Design - Energy Efficient and Environmental Friendly Building - Thermal Phenomena - Thermal Comfort - Indoor Air Quality - Climate, Sun and Solar Radiation – Psychometrics - Passive Heating and Cooling Systems - Energy Analysis - Active HV AC Systems - Preliminary Investigations - 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. 12 0 0
5. **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 - Steam Plants and Distribution Systems - Improvement of Boiler Efficiency - Frequency of Blow Down – Steam Leakage - Steam Flash and Condense Return. 12 0 0

Total 60 hrs

References:

1. MooreF., "Environmental Control Systems", McGraw Hill, Inc., 1994.
2. Brown, G.Z, Sun, "Wind and Light - Architectural Design Strategies", John Wiley & Sons., 1985.
3. Cook, J, "Award - Winning Passive Solar Design", McGraw Hill, 1984.

CE	QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION	3	0	0	4
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1. **Construction Organization** : Types of Organization - Inspection, Control and Enforcement - Quality Management Systems and Method Responsibilities and Authorities in Quality Assurance and Quality Control - Architects, Engineers, Contractors, and Consultants, Quality Circle.
2. **Quality Assurance and Control** : Objectives - Regularity Agent - Owner, Design, Contract and Construction Oriented Objectives, Methods - Techniques and Needs of QNQC - 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 - 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. 12 0 0

Total 60 hrs

References:

1. James, J.O Brian, "Construction Inspection Handbook - Quality Assurance and Quality Control", Van

Nostrand,
New York. 1989.

2. Kwaku A., Tenah and Jose M. Guevera, " Fundamental of Construction Management and Organization ", Prentice Hall o/India, 1995.
3. Juran Frank, J.M. and Gryna, F.M. "Quality planning and Analysis", Tata McGraw Hill, 1982.
4. Hutchins. G.. " ISO 9000 If, Viva Books, New Delhi, 1993.
5. Steven McCabe, "Quality Improvement Techniques in Construction", Addison Wesley Longman Ltd., England, 1998.

	KNOWLEDGE MANAGEMENT	3	0	0	3
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1. **Introduction** : Knowledge Management (KM) – Overview – Definition and Scope. Knowledge Model : Components - Construction – Benefits from KM – Human Learning – Organisational Learning. **12 0 0**
 2. **Elements of KM System** : KM and New Product Development – KM Strategy – KM in Professional Service Firms – Strategic Planning for Organisational KMS – Building and Implementing a KMS. **12 0 0**
 3. **KM System** : Network of Practice – Communities of Practice – Expertise Knowledge Portals, Bringing about Organisational Change – Group Decision Support Systems – KMS Project Review – Organising around Knowledge – Knowledge Architecture. **12 0 0**
 4. **Knowledge Engineering** : Introduction, Knowledge representation using Frames, Rules and Semantic Nets – Search Algorithms. **12 0 0**
 5. **Knowledge Base Management** : Interface to Information System – Retrieval – Reasoning – Logic Programming – Natural Language Processing – Applications – Case Studies. **12 0 0**
- Total 60 hrs**

References :

1. Guus Schreiber, et. al, "Knowledge Engineering and Management", University Press(I) Ltd., 2001.
2. Ganesh Natarajan & Sandhya Sekar, " KM – Enabling Business Growth", TMH(CI), 2000.

PR	STRATEGIC MANAGEMENT	3	0	0	3
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1. **Introduction** : The Strategic Management Process, Mission and Goals; Corporate Governance and Social Responsibility. **9 0 0**
 2. **Competitive Advantage** : External Environment, Porter's Five Forces Model, Strategic Groups Competitive Changes During Industry Evolution, Globalisation and Industry Structure, National Context and Competitive Advantage Resources, Capabilities and Competencies, Low Cost and Differentiation Generic Building Blocks of Competitive Advantage, Distinctive Competencies, Resources and Capabilities, Durability of Competitive Advantage, Avoiding Failures and Sustaining Competitive Advantage. **15 0 0**
 3. **Strategies** : Building Competitive Advantage through Functional Level Strategies, Business Level Strategy, Strategy in the Global Environment, Vertical Integration, Diversification and Strategic Alliances, Building and Restructuring the Corporation. **12 0 0**
 4. **Implementation** : Designing Organisational Structure, Designing Strategic Control Systems, Matching Structure and Control to Strategy, Implementing Strategic Change; Politics, Power and Conflict. **12 0 0**
 5. **Other Strategic Issues** : Managing Technology and Innovation, Entrepreneurial Ventures and Small Business, Non-profit Organisations, Cases in Strategic Management. **12 0 0**
- Total 60 hrs**

References :

1. L. Azlar Kazmi, "Business Policy", Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 2nd Edition 1998.
2. Thomas L. Wheelen, J. David Hunger - Strategic Management, Management and Business Policy", Entering 21st Century Global Society, Addison Wesley, 6th Edition, 1998.
3. Charles W.L. Hill & Gareth .R Jones, "Strategic Management Theory; An Integrated Approach", Houghton Mifflin Company, Pinceton New Jersey - (First Indian Edition: 1998 - All India Publisher and Distributors, Chennai)

4. Howard Business Review - Business Policy - Part I & II, Harvard Business School.

PR	ERP, LOGISTICS AND SUPPLY CHAIN MANAGEMENT	3	0	0	3
1.	Introduction : Logistics- Concepts, Definitions, Approaches, Factors Affecting Logistics. Supply Chain - Basic Tasks of the Supply Chain - The New Corporate Model. Basic Concepts and Definition of ERP, Evolution of ERP, Business Transformation through ERP, ERP – Organisation, Modelling Process Implementation Issues in ERP. 12 0 0				
2.	Supply Chain Management : The New Paradigm, The Modular Company, The Network Relations, Supply Process, Procurement Process - Distribution Management. 12 0 0				
3.	Evolution of Supply Chain Models : Strategy and Structure - Factors of Supply Chain - Manufacturing Strategy Stages, Supply Chain Progress - Model for Competing through Supply Chain Management - PLC Grid, Supply Chain Redesign - Linking Supply Chain with Customer. 12 0 0				
4.	SCM Activity Systems, Organisation and Information System : Structuring the SC, SC and New Products, Functional Roles in SC, SC Design Frame Work, Collaborative Product Commerce (CPC). The Management Task, Logistics Organisation, The Logistics Information Systems- Topology of SC Application - MRP, ERP, Warehouse Management System, Product Data Management- Cases. 12 0 0				
5.	International Logistics and Decision Models : Ocean Carrier Management, Import - Export Logistic Management. Decision Support Models of Supply Chain Management. 12 0 0				
					Total 60 hrs

References :

1. Sadagopan .S, "ERP - A Managerial Perspective", TMH, New Delhi, 1999.
2. Christopher, "Logistics and Supply Management", Richard Irwin, 1994.
3. Ayers .J.B, Hand Book of "Supply Chain Management", The St. Lencie Press, 2000.
4. Steudel .H.J, and Desruelle .P, "Manufacturing in The Ninteens - How to Become a Mean, Lean and World Class Competitor", Van Nostrand Reinhold, New York, 1992.
5. Nicolas .J.N, "Competitive Manufacturing Management - Continuous Improvement, Lean Production, Customer Focused Quality, McGraw-Hill, New York, 1998.
6. Scharj .P.B, Lasen .T.S, "Managing the Global Supply Chain", Viva Books, New Delhi, 2000.

PR	ENVIRONMENTAL MANAGEMENT SYSTEM	3	0	0	3
1.	Introduction : The Greening of Business – Need of the Hour – Awareness - Commercial Aspects of Green Competitiveness Environment Review - Physical Environment of Business: Resources, Effluents, Waste. 12 0 0				
2.	Environmental Concerns : Science/Technology/Academia, Media, Environmental Groups, Local Communities, Green Bench in India - International Agencies, Political Area - Government Regulation - National - International - ISO 14000 Series. 12 0 0				
3.	Environmental Review & Audit : Environmental Impact Assessment (EIA) - Environmental Survey - Eco Auditing – Eco Labeling - Supplier Audit - Local Authorities - External Audit. 12 0 0				
4.	Life Cycle Analysis & Assessments : Concepts and Methods 12 0 0				
5.	Waste Minimisation : R&D and Investment in Cleaner Technologies - Control of Energy Costs - Cost of Waste - Package & Recycling. Issues in Green Marketing and Management. 12 0 0				
					Total 60 hrs

References:

1. Linda .J, Speeding, "Environmental Management for Business", John Wiley & Sons, England, 1996.
2. Forest .L Reinhard & Richard .H.K Viator, "Business Management and The Natural Environment", South Western College Publishing, Ohio, USA, 1996.
3. Suzanne Pollack, "Improving Environmental Performance", Routledge London, 1995.
4. Gray, "Accounting for The Environment", The Chartered Association of Certified Accountants, London, 1993.
5. John .F Wasik, "Green Marketing & Management", Black Well, Cambridge, USA, 1996.
6. George Winter – "Blue Print for Green Management", McGraw Hill, England, 1995.

PR	TECHNICAL ENTERPRENURSHIP	3	0	0	3
1.	Introduction : Entrepreneur - Entrepreneurship Concept - Entrepreneurship as a Career.				5 0 0
2.	Entrepreneurial Competence : Personality Characteristics of Successful – Entrepreneur - Knowledge and Skills Required for an Entrepreneur.				10 0 0
3.	Entrepreneurial Environment : Business Environment - Role of Family and Society - Entrepreneurship Development, Training and Other Support Organisational Services - Central and State Government - Industrial policies and Regulations - International Business.				15 0 0
4.	Business Plan Preparation : Sources of Product for Business - Pre-feasibility Study - Criteria for Selection of Product Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.				15 0 0
5.	Launching and Development Small Business : Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching - Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units.				15 0 0
					Total 60 hrs

Reference :

1. Faculty of EDI and External Experts, "A Hand Book for New Entrepreneurs", Entrepreneurship Development Institute of India, Ahmedabad, 1986.
2. Staff College for Technical Education, Manila and Centre for Research and Industrial Staff Performance, Bhopal, Entrepreneurship Development, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998.
3. Prasama Chandra, "Projects - Planning, Analysis Selection, Implementation and Reviews", Tata McGraw Hill Publishing Company Limited, 1995.
4. P. Saravanavel, "Entrepreneurial Development", Ess Pee kay Publishing House, Chennai, 1997.

ME	TOTAL QUALITY MANAGEMENT	3	0	0	3
1.	Concepts of TQM : Philosophy of TQM, Customer Focus, Organisation, Top Management Commitment, Teamwork, Quality Philosophies of Deming, Crosby and Muller.				12 0 0
2.	TQM Process : QC Tools, Problem Solving Methodologies, New Management Tools, Work Habits, Quality Circles, Bench Marking, Strategic Quality Planning.				12 0 0
3.	TQM Systems : Quality Policy Deployment, Quality Function Deployment, Standardisation, Designing for Quality, Manufacturing for Quality.				12 0 0
4.	Quality System : Need for ISO 9000 System, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality Costs, Quality Auditing, Case Studies, ISO 9001:2000 Quality Management System (QMS) – Manual – Implementation – IQA Certification Processes.				12 0 0
5.	Implementation of TQM : Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi Methods, Case Studies. Total Productive Maintenance (TPM) : Philosophy and Implementation – Benchmarking – Type - Applications				12 0 0
					Total 60 hrs

References :

1. John Bank, "The Essence of Total Quality Management", PHI, 1993.
2. Rose, J.E, "Total Quality Management", Kogan Page Ltd. 1993.
3. Greg Bounds, Lyle Yorks et al, "Beyond Total Quality Management", McGraw Hill, 1994.
4. Takashi Osada, "The 5S", The Asian Productivity Organisation, 1991.
5. Masaki Imami, "KAIZEN", McGraw Hill, 1986.
6. Seiichi Nakagima, "Introduction to Total Productive Maintenance", Productivity Press (India) Pvt. Ltd., 1993.

	RESEARCH METHODOLOGY	3	0	0	3
1.	Concepts and Importance of Research Methodology : Meaning of Research – Objectives – Types and Importance of Research – Research Process for Applied and Basic Research.				12 0 0
2.	Research Design : Need – Concepts related to Research Design – Different Research Designs – Meaning – Importance and Scale Construction Techniques.				12 0 0

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| 3. Sample Design and Data Collection : Criteria for Selecting a Good Sample Design – Random Sample – Sampling Techniques – Probabilistic and Non-probabilistic Samples – Sample Size – Collection of Data – Primary and Secondary Sources – Selection of Appropriate Methods – Guidelines for Questionnaire Design and Successful Interviewing. | 12 0 0 |
| 4. Processing and Analysis of Data : Process Operations – Problems in Processing – Types of Analysis – Measures of Relationship – Factor –Cluster – Discriminate Analysis. | 12 0 0 |
| 5. Hypothesis Testing and Research Report : Basic Concepts and Procedure – Report Writing – The Role of Computers in Research – Use of Internet. | 12 0 0 |
| | Total 60 hrs |

References :

1. Kothari C.R, "Research Methodology – Methods & Techniques", Wishwa Prakashan, A Division of New Age International Pvt. Ltd.
2. Donald R. Cooper and Ramela S. Schindler, "Business Research Methods", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2000.
3. Uma Sekaran, "Research Methods for Business", John Wiley & Sons Inc., New York, 2000.
4. Donald H. McBurney, "Research Methods", Thomson Asia Pvt. Ltd., Singapore.
5. Ranjit Kumar, "Research Methodology", Sage Publications, London, New Delhi, 1999.
6. Chandan J.S, Statistics for Business and Economics", Vikas Publishing House Pvt. Ltd., 1998.