

Sustainable Construction Technology

COURSE OBJECTIVE:

This course introduces the concepts of sustainability in civil engineering and role construction materials play in developing green infrastructure.

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Sustainable Construction Technology	MECTM-2221	3	-	-

Unit 1.

Introduction to Sustainability: Definition of Sustainability, Resources and Reserves in Construction Materials, Greenhouse Effect and Global Warming, Carbon Footprint of Materials and Calculations.

Unit 2.

Embodied Energy of Materials and Calculations: Life Cycle Assessment and Cost Analysis, Sustainability Rating Systems.

Unit 3.

Sustainability Implications in Construction Materials: Sustainability Issues in Cement and Concrete Materials, Sustainability Issues in Asphalt Materials.

Unit 4.

Sustainability Issues in Metals: Sustainability Issues in Wood, Sustainability Issues in Glass, Sustainability Issues in Masonry.

Unit 5.

Sustainability in Alternate Construction Materials: C& D Waste Management Practices, Case Studies and Student Presentations.

COURSE OUTCOMES:

After completion of this course, the student will be able to:

1. Understand the limitations of construction techniques and energy efficient construction.
2. Analyze productivity and economics in construction techniques.
3. Understand reliable proportioning concepts in construction techniques.
4. Implement modular construction practices and sustainable material.

Reference Books:

1. Design and Control of Concrete Mixtures, Kosmatka, S.H. and Wilson, M.L., 16th Edition, Portland Cement Association, 2015
2. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.
3. Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press Inc., New York, 1998.
4. Matlack, A. S. Introduction to Green Chemistry Marcel Dekker: New York, NY, 2001

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Construction Costing and Financial Management

COURSE OBJECTIVE:

To develop a clear understanding regarding estimation & costing of construction industry works including material management and fundamentals of the financial management.

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Construction Costing and Financial Management	MECTM-2222	3	-	-

Unit 1.

Construction Costing:

Costing of construction Works; different methods of costing, cost elements in a project; analysis of rates; non-scheduled items of work; cost estimation for a small construction job; purpose, methods and stages of cost control; cost monitoring; cost forecasting methods; variations in individual items of work and their effect on total contract price; valuation of variations. Methods of measurement of earthwork, RCC, Brickwork, Woodwork joinery, steel and iron work plastering/ painting and white/colour washing & painting

Unit 2.

Cash Flow:

Determining the funds required for a construction job; preparing cash flow statements; cash inflow and outflow during contract period; project expectations.

Unit 3.

Cash and Payment of Works:

Precautions in custody of cash, imprest account and temporary advance; maintenance of temporary advance; and advance account; different types of payment, first, running, advance and final payments.

Unit 4.

Material Management:

Objectives and scope of material management classification, codification, ABC analysis, standardization and substitution; introduction to inventory control; stores management; organization and lay out; receipt, inspection and issue; care and safety; store records and store accounting.

Unit 5.

Financial Management

Meaning and scope; financial statement analysis; funds flow analysis; capital budgeting; cost- benefit analysis.

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COURSE OUTCOMES:

After completion of this course, the student will be able to:

1. Learn basics of construction costing, cash flow analysis along with their practical applications.
2. Acquire good knowledge of the management of various materials at the site.
3. Learn capital budgeting, cost benefit analysis, financial management along with their field applications

Reference Books:

1. Mueller, F.W. Integrated cost and schedule control for construction projects.
2. Gbourne: Cost control in the construction industry.
3. Schedule of rates, specification manuals etc. from PWD
4. Chris Hendrickson and Tung Au: Project Management for Construction
5. Datta: Material Management Procedures, Text and Cases, 2e Prentice Hall
6. Gopalakrishnan, P, Sundaresan, M: Material Management - an Integrated Approach, Prentice Hall.
7. Dobbler and Bart: Purchasing and Supplies Management, Text and Cases, 6e
8. Chitkara, K.K.: Construction Project Management; Tata-McGraw Hill

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Appropriate Technology & Energy Conservation

COURSE OBJECTIVES:

To Understand the fundamental of planning of rural housings their water supply systems and waste disposal methods. Acquire engineering knowledge of Socio-economic aspects of rural road network. Acquire scientific and engineering knowledge on the renewable energy aspects and associated current environment issues.

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Appropriate Technology & Energy Conservation	MECTM-2223	3	-	-

Unit 1.

Appropriate technology - concept and its role in the present circumstances.

Unit 2.

Rural Housing & Rural Environmental Technologies - Planning, use of locally available materials, construction techniques. Concept and scope in rural areas planning of water supply schemes in rural areas, development of preferred sources of water, springs, wells, infiltration wells infiltration galleries, collection of rain water, specific problems and methods in rural water supply and treatment. Treatment and disposal of waste water, community and sanitary latrines. Compact and simple waste water disposal systems, biogas plants.

Unit 3.

Rural roads - Planning of rural roads, Socio-economic aspects, materials for rural roads, design aspects, drainage problems, and maintenance of rural roads.

Unit 4.

Energy Conservation: -

Energy production, distribution and utilization, a review of global situation. Energy Trends, renewable and nonrenewable sources, research reviews. Building designs and energy factors affecting energy budget in buildings and settlements, Design of buildings for minimizing energy. Solar, Wind and Tidal energies, a review and their adoptability.

Unit 5.

Low energy materials, construction techniques and environmental control.

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COURSE OUTCOMES:

After completion of this course, students will be able to:

1. Understand the fundamental of planning of rural housings their water supply systems and waste disposal methods.
2. Acquire engineering knowledge of Socio-economic aspects of rural road network.
3. Acquire scientific and engineering knowledge on the renewable energy aspects and associated current environment issues.
4. Evaluate the broad spectrum of environmental impact of renewable energy technologies.
5. Evaluate the potential of renewable energy sources such as solar, wind Analyze the techno-economical feasibilities and technical viabilities of renewable energy sources

Reference Books:

1. Rural Development in India: Past, Present and Future : a Challenge in the Crisis Desai, Vasant Himalaya Publishing House, Delhi ISBN 8183181929 ISBN 9788183181921
2. Rural Development Strategy Rastogi, A.K. Wide Vision, Jaipur ISBN -81-8068-000-2
3. Rural Development Principles, Policies and Management Singh, Katar Sage Publications India Pvt Ltd ISBN- 978-81-7829-926-6 (PB) 1
4. Document Published by Ministry of Rural development Govt, of India Ministry of Rural development,
5. S.P. Sukhatme, Solar Energy - Principles of thermal collection and storage, second edition, Tata McGraw-Hil, New Delhi, 1996
6. M. S. Sodha, N. K. Bansal, P. K. Bansal, A. Kumar and M. A. S. Malik, Solar Passive Building: science and design, Pergamon Press, New York, 1986
7. Non-conventional Energy Resources – By D S Chauhan and S K Sreevasthava – New Age International Publishers

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Parvina

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ELECTIVE – II (A)

Advanced Construction Equipment

COURSE OBJECTIVES:

This course introduces students to advanced construction equipments and selected construction methods. This includes economy, selection, productivity of common construction equipment, and construction procedures for industrial, heavy civil, and commercial construction projects.

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Advanced Construction Equipment	MECTM-2224(A)	3	-	-

Unit 1:

Introduction

Construction Equipment Economics, Factors affecting the selection of construction equipment; Construction Equipment Process and its Safety, Basic Operation and Utilization of equipment on site, Construction equipments and machinery related, Owning and operating cost of equipment.

Unit 2:

Construction Equipment Management

Equipment Management- Introduction, Differences between men and manpower, Extent of Mechanization, Equipment planning, Selection of equipment, Forward planning, Purchase of Equipment, Specifications for ordering equipment. Maintenance Management – Introduction, Objectives, Functions, Maintenance planning, Maintenance control, Types of maintenance. Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.

Unit 3:

Earthwork Equipments

Crawler and wheel tractors, bull dozers and their use; tractor pulled scrapers, effect of grade and rolling resistance on the output of tractor pulled scrapers; earth loaders; placing and compacting earth fills. Skid steer loader, Backhoe loader, Trenchers, Power shovels - functions, selection, sizes, Draglines – functions and types.

Unit 4:

Hauling, Drilling, Blasting, Tunneling and Piling Equipments

Cranes-Mobile cranes and fixed cranes, Trucks-Dump trucks and hauling trucks, capacities of trucks, balancing the capacities of hauling units with the size of excavator, Definition of terms-bits, jackhammers, drifters, wagon drills, churn drills, piston drills, blast hole drills, shot drills, diamond drills; Tunneling equipment-Tunnel Boring Machine

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(TBM), Horizontal Directional Drilling Machine (HDD), Immersed Tube (IT), selecting the drilling method and equipment, Sheet Pile hammer Hydraulic Sheet Pile Driver, selecting a pile hammer loss of energy due to impact, energy losses due to causes other than impact. Equipment for bored and cast in-situ piles

Unit 5:

Pumping Equipment and Compaction Equipments

Pumping equipment in construction, Classification of pumps; Selection of pumps –Air operated centrifugal type sump pumps; performance of centrifugal pumps, well point system, and Compaction Equipment- Roller class: sheep's foot rollers, pneumatic tyre rollers, steel wheel rollers, vibrating rollers, grid type rollers-their applications.

COURSE OUTCOMES:

After completion of this course, the students will be able to:

1. Understand terminology and units of measurements related to construction equipments
2. Understand standard designations, sizes, and gradations of construction equipment and its management
3. Perform comparative cost analysis for owning and operating heavy equipment
4. Perform the proper selection, application, utilization, and productivity of advanced heavy equipments on construction sites

Reference Books:

1. Dr. Mahesh Varma, "Construction Equipment and its planning and Application", Metropolitan Book Company, New Delhi. 1983.
2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi, 1988.
3. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", McGraw Hill, Singapore, 2006.
4. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
5. Jagman Singh : Heavy construction Planning ,Equipment and Methods, Oxford and IBH
6. Frank Harris, Modern Construction Equipment and Methods, , John Wiley and Sons.

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ELECTIVE – II (B)
Green Buildings and Services

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Green Buildings and Services	MECTM-2224(B)	3	-	-

Unit 1.

Introduction to Green Buildings

Definition of Green Building, Benefits of Green Building, Components/features of Green Building – Site selection, Energy Efficiency, Water Efficiency, Material Efficiency, Indoor Air Quality.

Unit 2.

Design Features for Green Building Construction

Site selection strategies, landscaping, building form, orientation, building envelope and fenestration – material and construction techniques, roofs, walls, fenestration and shaded finishes, advanced passive heating and cooling techniques, Waste reduction during construction.

Unit 3.

Water and Waste Water Management

Compliance, fixtures, rainwater harvesting and techniques, water and waste water management, solid waste management.

Unit 4.

Energy Management

Appliances, compliance energy performance, solar water heating system, use of renewable energy options. High performance glass, other energy saving options, provisions of ECBC, insulator materials.

Unit 5.

Eco-friendly Materials

Various types of eco-friendly materials, use of recycled materials like: fly ash bricks, recycled ceramic tiles, recycled glass tiles, porcelain tiles, natural terracotta tile, wood, steel, aluminum and renewable materials, agrifibre, linoleum, salvaged material – properties and applications.

Reference Books

1. Pradeep Kumar and Amit Kumar Tyagi; Managing Energy Efficiently in Hotels and Commercial Buildings, TERI Publications.
2. M K Halpeth, T Senthil Kumar and G Harikumar; Light Right – A Practising Engineer's Manual on Energy Efficient Lighting, TERI Publications
3. R K Pachauri and Shyamala Abeyratne; From Sunlight to Electricity – Solar Photovoltaic Applications, TERI Publications.

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ELECTIVE – II (C)
Bridge Engineering

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Bridge Engineering	MECTM-2224(C)	3	-	-

Unit 1.

Introduction

Definition; components of a bridge; classification; importance of bridges.

Unit 2.

Standard Specifications for Road Bridges:

Indian Roads Congress Bridge Code; width of carriageway; clearances; loads to be considered; dead load; I.R.C. standard live load; impact effect; application of live load on decks; wind load; longitudinal forces; centrifugal forces; horizontal forces due to water current; Buoyancy effect; earth pressure; temperature effects; seismic force.

Unit 3.

Reinforced concrete Bridges: General arrangement and suitability: T-beam bridges; Balanced cantilever bridges; Continuous girder bridges; Rigid frame bridges; Arch bridges; Steel bridges (Familiarization with MOST specifications and drawings) Design of piers and abutments (Masonry & R.C.C).

Unit 4.

Foundations: Types of foundations; Open; Piled and Well foundations; including construction details. Pile Foundations: Suitable Pile types for bridges, Pile Installation, Carrying capacity of bored and cast- in-situ pile (No numerical) Well Foundations in Components and brief description, Well Cap, Stability of a single well.

Unit 5.

Bearings, Joints, and Handrails: Different types of bearings, joints and handrails.

Construction and Maintenance of Bridges.

Quality Assurance, Construction Method (brief) Steel bridges, long span concrete bridge, Traditional method, Incremental Push launching method, Cantilever method, Maintenance, Maintenance of Bearings, Expansion Joints.

Reference Books

1. Victor Johnson; Essentials of Bridge Engineering, Oxford & IBH Publishing Co, New Delhi.,2007
2. Khadiilkar; C.H., A text book of Bridge Construction, Allied Publisher, New Delhi.
3. Rangwala; Bridge Engg
4. Rowe, R.E., Concrete Bridge Design, John Wiley & Sons, Inc. New York
5. Raina, V.K., Concrete Bridges Practice Book, Tata McGraw Hill, New Delhi
6. Jagadeesh, Jayaram: Design of Bridge Structures, Prentice Hall.
7. Raina, V.K. Concrete Bridges Handbook, Galgotia Publications (P) Ltd, New Delhi
8. IRC.78.200
9. IS 5050
10. IS 3955

ELECTIVE – III (A)

Steel Construction Technology

COURSE OBJECTIVES:

1. To teach students loading and load combinations for the design of steel structures.
2. To make the students familiar with the concepts of steel design starting with riveted, welded and bolted connections and eccentric connections based on IS:800-1984 and IS:800-2007.
3. To teach the students design of tension, compression members and flexural members based on IS: 800-2007.

4. Course Content

5.

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Steel Construction Technology	MECTM-2225(A)	3	-	-

Unit 1.

Materials, classification and properties, Structural steel sections and data

Behaviour of steel structures:

Steel water tanks, Chimneys and Stacks, Bridge Structures, Building Frames, Steel Space grids.

Unit 2.

Structural Steel Detailing:

Symbols, layout drawings, shop detail drawings, assembly marking.

Structural steel fabrication:

Methods, tools, equipment and practices, Punching, Reaming and drilling, cutting operations, fittings, fasteners, bolting, riveting and welding, Assembly, inspection, cleaning, sand blasting and painting: Transportation of fabricated components, Storage and handling.

Unit 3.

Erection of steel structures Erection equipment, erection tools, methods of erection, section sequence field connections, detailing to facilitate erection.

Unit 4..

Specifications, Estimating and costing steel work.

Unit 5.

Fire protection of steel construction, Maintenance and repair of steel structures

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COURSE OUTCOMES:

After completion of this course, the students will be able to:

1. Calculate load required on structure for the design of steel structure members.
2. Design different type of joints and connections.
3. Design of tension, compression and flexural members of the steel structures.
4. Design beam-columns as a whole for different steel structural frame.

Reference Books:

1. Ramachandra, 'Design of steel structures', Standard Book House, New Delhi
2. Bryan E.R., 'The stressed skin design of steel buildings'
3. Malhotra M.M. 'Design of Steel Structures'
4. Bresker Boro, 'Design of steel Structures'
5. Dayaratnam, 'Design of Steel Structures.
6. Vajrani V. N., Ratwani M. M. and Mehra H. Design and Analysis of Steel Structures, Oscar Publications.
7. Syal I. C. Design of Steel Structures, Standard Publishers Distributors, New Delhi
Ramchandra, Non-Linear Analysis of Steel Structures, Standard Publishers Distributors.
8. IS: 800-2007 & Steel Table.

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ELECTIVE – III (B)
Design and Construction Of Hydraulic Structures

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Design And Construction of Hydraulic Structures	MECTM-2225(B)	3	-	-

Unit 1.

Elements of Dam Engineering.:

Embankment dam types and characteristics, concrete dam types and characteristics spillway types, site selection for dams.

Coffer Dams:

Types of coffer dams, suitability criteria, design considerations, and construction of different types of cofferdams.

Unit 2.

Concrete Dams:

Gravity dams, loading and forces on gravity dams, Considerations and design aspects of basic profile of gravity dam, stability criteria, galleries in dams, instrumentation in dams, temperature control, control of cracking, raising and strengthening of existing dams.

Mass Concreting of Dams:

Concrete mixes, ad-mixtures, batching, mixing, transportation and placing and compaction and curing of concrete, heights of lifts, Joints and tests on concrete.

Unit 3.

Earth Dams:

Factors influencing design, criteria for safety, design aspects of earth dams, seepage control, methods of construction of earth dams, clearing, removal of vegetable matter, bonding dam to foundation, building embankment, compaction protection of u/s slope, top and d/s slope, rip rap and concrete lining of slopes.

Rockfill Dams:

Design consideration and various forces in rock fill dam, rubble backing of impervious face, impervious u/s facing, settlement and sluicing.

Unit 4.

Lining of Irrigation Channels:

Advantages and suitability, types of lining, design considerations of concrete lining for channels, concrete lining, shotcrete lining, brick lining, tiles, asphaltic lining, stone and concrete block lining, lining of earth materials, comparative water tightness of different types of lining, use of Geo-textiles in canal works. Provision of filters for canals in areas having high sub surface water level.

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Unit 5.

Well Design and Construction:

Material selection, design of well & selection of site, drilling methods, methods of sampling, selection and lowering of well assembly, plumbness and alignment, methods of gravel packing, placing cement seal and grout, well development methods and pump selection.

Reference Books:

1. Barrows H.K., Water Power Engg. Tata McGraw Hill.
2. Punmia B.C., Irrigation and water Power Engg. Standard Publishing distributors.
3. P.Novak, A.I.B Maffat & C.Nalluri, Hydraulic Structures, Unwin Hyman.
4. Campbell Lehr, Water Well Technology, Tata McGraw Hill.
5. Davis Handbook of Applied Hydraulics, Tata McGraw Hill.
6. Bharat Singh, Engineering for Embankment Dams Oxford & IBH.

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- Middle left: P. Saxena
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- Bottom center: Son
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ELECTIVE – III (C)
Ground Water Engineering

Course Content

Branch	Subject Title	Subject Code	Credit allotted subject wise		
			L	T	P
M.E.(CTM)	Ground Water Engineering	MECTM-2225(C)	3	-	-

Unit 1.

Ground Water in Hydrologic Cycle

Hydrological properties of water bearing strata-confined aquifers, transmissibility, storage coefficient, Safe Yield, Optimal yield concept.

Unit 2.

Flow in to Wells

General flow equations, ground water flow lines, flow in relation of ground water contours, water table maps. Steady and unsteady radial flow to a well, well in a uniform flow; steady flow with uniform recharge, non-equilibrium equation for pumping test data, Multiple well systems, partially-penetrating well, well-losses. Leaky aquifers.

Unit 3.

Design of Wells

Design Particular for surface casing, Pump Chamber, Screen Assembly Gravel packing, reduces, overlaps seals and Grouts Trmie pipe centering guides, foundation requirement for installation of wells.

Unit 4.

Construction of wells

Site selection, shallow wells-dug, bored, driven and jetted wells, well-point system for dewatering of Excavations. Deep wells-cable tool, hydraulic rotary and reverse rotary methods. Well completion-well screens, gravel-packs, development, Testing for yield and efficiency. Sanitary protection, protection against corrosion, incrustation. Maintenance of wells-well failures and their remedies.

Unit 5.

Replenishment of Ground Water

Requisites of artificial recharge, Artificial recharge by surface spreading and by injection, Roof top water harvesting.

Investigations of Ground Water:

Surface investigations Electrical resistivity method. Surface investigations – Test drilling, Well logs

Practicals / Field work:

- (i) Field visit to well drilling sites
- (ii) Use of logger and its interpretation for installation of well-screens
- (iii) Resistivity study

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- (iv) Testing of gravel for gravel packing of well
- (v) Report on well Pumping Tests.

Reference Books:

1. Mickael AM, Khepar SD, Water Well and Pump Engineering, Tata McGraw-Hill Publishing Co. New Delhi.
2. Camp bell M.D. Jay A, Lehr Water Well Technology, McGraw Hill Book Co. New Delhi.
3. Chugh C.P. Manual of drilling Technology Oxford Press Pvt. Ltd. New Delhi
4. Praveen Kumar, Ground Water and Well Drilling, Nitasha Publishers, N.Delhi.
5. Handa O.P. Ground Water Drilling Oxford & IBH Publishing Co. New Delhi
6. Raghunath M.M. Ground Water, Wiley Eastern Ltd. New Delhi.

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