



Chaudhary Devi Lal University
Sirsa, Haryana, Pin- 125055, (India)

Paper Assessment Scheme

For

**Post Graduate Course,
For 2 Year(s) Master Degree Program in**

Faculty of Physical Science

**Master of Technology (with Credits)(M.Tech.)
(Credits System)**

(w.e.f. 2017-18-Regular)

Civil Engineering(Construction Technology & Management)

Course Code: -

Papers

Teaching And Assessment Scheme

Abbreviations : TLM - Teaching Learning Method, AM - Assessment Method, AT - Assessment Type, EA - External Assessment, IA - Internal Assessment, Hrs - Contact Hours per Week, MS - Marks System, GS - Grade System, Min - Minimum Marks, Max - Maximum Marks, DG - Direct Grading, IG - Indirect Grading

Course Part: F.Y.M.Tech. Separate Passing Head: No, Min: 0, Max: 1000, Total Credits: 44.00

Term: Sem-I Separate Passing Head: No, Min Papers: 5, Max Papers: 5, Min: 0, Max: 500, Total Credits: 22.00

The papers under Sem-I are as follows:

Paper Name: Project Planning and Control									
Paper Code: MCM-101 Min: 0 Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Lectures	4	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Civil Engg. Materials									
Paper Code: MCM-102 Min: 0 Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Lectures	4	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Quantitative Methods in Construction Management									
Paper Code: MCM-103 Min: 0 Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Lectures	4	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Construction Engineering Practices									
Paper Code: MCM-111 Min: 0 Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Lectures	4	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Construction and Contract Management									
Paper Code: MCM-112 Min: 0 Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Lectures	4	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Computational Laboratory for Construction Management									
Paper Code: MCP-104 Min: 0 Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Lab	4	2.00	Practical	40	100	EA	28	70	Marks System
						IA	-	30	Marks System

Term: Sem II Separate Passing Head: No, Min Papers: 5, Max Papers: 5, Min: 0, Max: 500, Total Credits: 22.00

The papers under Sem II are as follows:

Paper Name: Construction Methods and Equipments									
Paper Code: MCM-201 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Management of Quality and Safety in Construction									
Paper Code: MCM-202 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Building Services and Maintenance Management									
Paper Code: MCM-203 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: GIS in Construction Engineering and Management Reliability									
Paper Code: MCM-211 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Reliability Analysis in Construction Management									
Paper Code: MCM-212 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Quality Control in Construction Lab									
Paper Code: MCP-204 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lab	4	2.00	Practical	40	100	EA	28	70	Marks System
						IA	-	30	Marks System

Course Part: S.Y.M.Tech Separate Passing Head: No, Min: 0, Max: 600, Total Credits: 30.00

Term: Sem III Separate Passing Head: No, Min Papers: 3, Max Papers: 3, Min: 0, Max: 300, Total Credits: 15.00

The papers under Sem III are as follows:

Paper Name: Dissertation Part-I with Seminar									
Paper Code: MCD-301 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Dissertation	5	5.00	Dissertation	-	100	IA	40	100	Marks System
Paper Name: Construction Economics and Finance									
Paper Code: MCM-301 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System
Paper Name: Recent Advances in Construction Materials									
Paper Code: MCM-312 Min: -- Max: 100									
TLM	Hrs	Credits	AM	Min	Max	AT	Min	Max	Evaluation System
Lectures	5	5.00	Theory	40	100	EA	28	70	Marks System
						IA	-	30	Marks System

Term: Sem-IV Separate Passing Head: No, Min Papers: 1, Max Papers: 1, Min: 0, Max: 0, Total Credits:

The papers under Sem-IV are as follows:

Paper Name: Dissertation Part II With Seminar and Viva Voce									
Paper Code: MCD-401 Min: -- Max: 100									
<i>TLM</i>	<i>Hrs</i>	<i>Credits</i>	<i>AM</i>	<i>Min</i>	<i>Max</i>	<i>AT</i>	<i>Min</i>	<i>Max</i>	<i>Evaluation System</i>
Practical	0	11.00	Practical	-	100	EA	100	100	GS(IG - Ten Point Grading System)

Appendix Grade Templates

1.Template Name : CBCS Grading Template

Template Description :CBCS Grading Template

Grade System Type :Indirect Grading

Indirect Grading System Type :Absolute

Grade Scale :Ten Point Grading System

No of Intervals :8

Sr.No.	Grade Abbreviation	From(%)	To(%)	Status	Grade Point	Description
1.	O	84.50	100.00	Pass	10.00	Outstanding
2.	A+	74.50	84.49	Pass	9.00	Excellent
3.	A	64.50	74.49	Pass	8.00	Very Good
4.	B+	54.50	64.49	Pass	7.00	Good
5.	B	49.50	54.49	Pass	6.00	Above Average
6.	C	41.00	49.49	Pass	5.00	Average
7.	P	40.00	40.99	Pass	4.00	Pass
8.	F	0.00	39.99	Fail	0.00	Fail

M.Tech Civil (Construction Technology and Management), First Semester
MCM- 101 Project Planning & Control

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Work-study, work breakdown structure, Time estimates, Applications of CPM/PERT, statical concepts, Man-Material-Machinery-Money optimization, scheduling, monitoring, updating. Cost functions, time-cost trade off, resource planning-leveling and allocation. Resources - based networks, crashing, master networks, interface activities and dependencies, line of balancing techniques, application of digital computers. Material management-purchases management and inventory control, ABC analysis. Human Resource Management.

Reference Books:

- 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) Moder, J. C. Phillips and E. Davis, Project Management with CPM, PERT and Precedence Diagramming, Van Nostrand Reinhold Company, Third 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

NOTE: The examiner is required to set eight questions in all and the candidates are required to attempt any five questions.

M.Tech Civil (Construction Technology and Management), First Semester
MCM-102 Civil Engineering Materials

L	T	P/D	Total
4	1	-	5

Max Marks : 100
Theory : 70 Marks
Sessional : 30 Marks
Duration : 3 Hours

Cement selection for civil works. Concrete making materials. Fresh concrete and its theology properties. Mechanical, deformational behavior and microstructure of hardened concrete. Creep and shrinkage. Laboratory testing of concrete. Durability of plain and reinforced concrete, Structural steels including alloyed and cold-worked steels.

Reference Books:

- 1) Metha P.K and Monteiro.P.J.M, " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006
- 2) Shetty .M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., New Delhi,2006
- 3) Neville. A.M. , " Properties of Concrete", 4th Edition Longman,1995
- 4) Mindass and Young, " Concrete", Prentice Hall.1998

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M.Tech Civil (Construction Technology and Management), First Semester
MCM-103 Quantitative Methods in Construction Management

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Introduction and concepts of probability and statistics. Linear programming, Transportation and assignment problems. Dynamic programming, Queuing theory, Decision theory, Games theory simulations applied to construction, Modifications and improvement on CPM/PERT techniques.

Reference Books:

- 1) Gupta, S.C., and Kapoor, V.K., Fundamentals of mathematical statistics, Sultan Chand and sons, Reprint 2003
- 2) Gupta, S.C., and Kapoor, V.K., Fundamentals of Applied statistics, Sultan Chand and sons, 2003
- 3) Veerarajan, T., Probability Statistics and Random processes, TMH, First reprint, 2004
- 4) Vohra, N.D. " Quantitative Techniques in Management ", Tata McGraw Hill Co., Ltd, New Delhi, 1990
- 5) Seehroeder, R.G., " Operations Management ", McGraw Hill, USA, 1982
- 6) Levin, R.I, Rubin, D.S., and Stinsonm J., " Quantitative Approaches to Management" McGraw Hill Book Co., 1988
- 7) Frank Harrison, E., " The Managerial Decision Making Process ", Houghton Mifflin Co. Boston, 1975
- 8) Varshney. R.L. and Maheswari, K.L., " Managerial Economics ", Sultan Chand, 1975

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Departmental Electives

M.Tech Civil (Construction Technology and Management)
MCM-III Construction Engineering Practices

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Concrete Construction methods: form work design and scaffolding, slip form and other moving forms, pumping of concrete and grouting mass concreting (roller compacted concrete), ready mixed concrete, various methods of placing and handling concrete, Accelerated curing, Hot and cold weather concreting, Under water concreting, Pre-stressing.

Reference Books:

- 1) Robert Wade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995
- 2) Patrick Powers .J, Construction Dewatering: New Methods and Applications John Wiley & Sons, 1992
- 3) Jerry Irvine. Advanced Construction Techniques CA Rockers, 1984
- 4) Peurifoy, R.L., Ledbetter, W.B. and Schexnayder. C, Construction Planning Equipment and Methods, McGraw Hill. Singapore 1995
- 5) Sharma S.C. Construction Equipment and Management, Khanna Publishers, Delhi, 1988
- 6) Deodhar, S.V. Construction Equipment and Job Planning Khanna Publishers Delhi, 1988
- 7) Dr. Mahesh Varma, Construction Equipment and its planning and application, Metropolitan Book Company, New Delhi 1983

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M.Tech Civil (Construction Technology and Management), First Semester
MCM-104 Computational Laboratory for Construction Management (Lab-I)

L	T	P/D	Total
-	-	2	2

Max Marks	: 100
Practical	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

List of Experiments:

PRIMAVERA

1. Planning and Scheduling of Multi storied building
2. Planning and scheduling of Road Project
3. Prepare the resource sheet, assign and level the resource
4. Preparing different reports available in Primavera
5. Plot the variance graphs for the given Project

M.Tech Civil (Construction Technology and Management), Second Semester
MCM- 201 Construction Methods & Equipments

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Factors affecting selection of equipment - technical and economic, construction engineering fundamentals, Analysis of production outputs and costs, Characteristics and performances of equipment for Earth moving, Erection, Material transport, Pile driving, Dewatering, Concrete construction (including batching, mixing, transport, and placement) and Tunneling.

Reference Books:

1. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995
2. Patrick Powers .J, Construction Dewatering: New Methods and Applications John Wiley & Sons. 1992
3. Jerry Irvine, Advanced Construction Techniques CA Rockers, 1984
4. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder.C, Construction Planning Equipment and Methods, McGraw Hill. Singapore 1995
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers, Delhi, 1988
6. Deodhar, S.V. Construction Equipment and Job Planning Khanna Publishers Delhi, 1988
7. Dr. Mahesh Varna, Construction Equipment and its planning and application, Metropolitan Book Company, New Delhi 1983

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M.Tech Civil (Construction Technology and Management), Second Semester
MCM-202 Management of Quality & Safety in Construction

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Introduction to quality. Planning and control of quality during design of structures. Quantitative techniques in quality control. Quality assurance during construction. Inspection of materials and machinery. In process inspection and test. Preparation of quality manuals, check-list and inspection report. Establishing quality assurance system. Quality standards/codes in design and construction. Concept and philosophy of total quality management (TQM). Training in quality and quality management systems (ISO-9000).

Concept of safety. Factors affecting safety: Physiological, Psychological and Technological. Planning for safety provisions. Structural safety. Safety consideration during construction, demolition and during use of equipment. Management of accidents/injuries and provision of first aid. Provisional aspect of safety. Site management with regard to safety recommendations. Training for safety awareness and implementation. Formulation of safety manuals. Safety legislation, standards/codes with regard to construction. Quality vs. Safety. Case Studies.

Reference Books:

1. Richard J. Coble, Theo C. Haupt, Jimmie Hinze, "The Management of Construction Safety and Health", Taylor & Francis, 2000, 905809328X, 9789058093288
2. Abdul Pazzak Rumane, "Quality Management in Construction Projects", Taylor & Francis, 2010, ISBN 1439838712, 9781439838716
3. Tim Howarth, Paul Watson, "Construction Safety Management", John Wiley & Sons, 2008, ISBN 1405186607, 9781405186605
4. Phil Hughes, Ed Ferrett, "Introduction to Health and Safety in Construction: The Handbook for Construction Professionals and Students on Neboosh and Other Construction Courses", Edition 3, Publisher Routledge, 2008, ISBN 1856175219, 9781856175210

NOTE: The examiner is required to set eight questions in all and the candidates are required to attempt any five questions.

M.Tech Civil (Construction Technology and Management), Second Semester
MCM-203 Building Services & Maintenance Management

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Components of urban forms and their planning. Concepts of neighborhood unit. Street system and layout in a neighborhood. Functional planning of buildings, optimization of space: Spatial Synthesis graphical techniques, heuristic procedures, formulation of linear and non-linear optimization problem. Space requirements and relationships for typical buildings, like residential offices, hospitals, etc.

Standard fire, fire list. fire resistance, classification of buildings, means of escape, alarms, etc. Engineering services in a building as a systems. Lifts, escalators, cold and hot water systems, waster water systems, and electrical systems.

Building Maintenance: Scheduled and contingency maintenance planning. M.I.S. for building maintenance. Maintenance standards. Economic maintenance decisions.

Reference Books:

- 1) G. M. Fair, J. C. Geyer and D. Okun, Water and waste Engineering, Vol.II, John Wiley & sons, Inc., New York. 1968
- 2) R. G. Hopkinson and J. D. Kay , The Lighting of buildings ,Faber and Faber, London, 1969
- 3) Hand book for Building Engineers in Metric systems, NBC, New Delhi, 1968
- 4) Philips Lighting in Architecture Designs. McGraw Hill, New York, 1964
- 5) Time saver Standards for Architecture Design Data , Callendar JH ,McGraw Hill, 1974
- 6) William H. Sevens and Julian R. Fellows, Air conditioning and refrigeration ,John Wily and sons,

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M.Tech Civil (Construction Technology and Management)
MCM- 212 Reliability Analysis in Construction Management

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Probability Theory: Mutually exclusive events, set theory, sample points and sample space, laws of probability, total probability theorem, Baye's rule, random variables-discrete and continuous, jointly distributed discrete variables, marginal distribution, conditional distribution, jointly distribution continuous variables, functions of random variables, moments and expectations, common probability distribution normal. Lognormal, Gamma and Beta distribution, external distribution. Resistance Distribution and Parameters: Statistics of properties of concrete and steel, Statistics of strength of bricks and mortar, Characterization of variables, allowable stresses based on specified reliability. Monte Carlo Study of Reliability: Monte Carlo Method Inverse transformation technique. Application to columns beams and frames. Level 2 Reliability Methods: Basic variables and failure surface, first order second moment methods, Hooper and Lind's method, Non-normal distributions; determination of reliability index B of structural elements. Reliability Based Design: Determination of partial safety checking formats. Development of reliability based criteria, optimal safety factors, and calibration of IS 456 and IS 800. Reliability of Structural Systems: System reliability, modeling of structural systems, bounds on system reliability, automatic generation of a mechanism, generation of dominant mechanism, reliability analysis of R.C.C. and steel frames.

Reference Books:

1. Ranganathan, R. (1990) 'Reliability Analysis and Design of Structures' Tata McGraw Hill Delhi.
2. Rao, S.S. 'Reliability based Design' Tata McGraw Hill Delhi.
3. Ghosh, D.I. (1989) 'A Primer of Reliability Theory', John Wiley, New York.
4. Lewis, E.E. (1987) 'Introduction to Reliability Engineering' John Wiley, New York.

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M.Tech Civil (Construction Technology and Management), Second Semester
MCM-204 Quality Control in Construction Lab

L	T	P/D	Total
-	-	2	2

Max Marks	: 100
Practical	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

List of Experiments:

1. Mix Design of Concrete
2. Tests on fresh concrete
3. Tests on hardened concrete
4. In-situ Strength determination by Rebound Hammer.
5. Measurement of Moisture content in aggregates, soil and hardened concrete surface using NDT techniques.
6. Pull-Out Tests on concrete
7. Effect of Chemical admixtures on fresh and harden properties of concrete
8. Effect of mineral admixtures on fresh and harden properties of concrete
9. Tests on Bitumen materials
10. Tests on Course aggregates for road construction

Reference Books:

- 1) Metha P.K and Monteiro. P. J. M. " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006
- 2) Shetty .M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., New Delhi,2006
- 3) Neville. A.M. , " Properties of Concrete", 4th Edition Longman,1995
- 4) Mindass and Young, " Concrete", Prentice Hall.1998

M.Tech Civil (Construction Technology and Management), Third Semester
MCM- 301 Construction Economics & Finance

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Construction accounting, Income statement, Depreciation and amortization, Engineering economics, Time value of money, discounted cash flow, NPV, ROR, PI, Bases of comparison, Incremental rate of return, Benefit-cost analysis, Replacement analysis, Break even analysis, Risks and uncertainties and management decision in capital budgeting, Taxation and inflation, Work pricing, cost elements of contract, bidding and award, revision due to unforeseen causes, escalation, Turnkey activities, Project appraisal and project yield, Working capital management, financial plan and multiple source of finance, International finance, Budgeting and budgetary control, Performance budgeting, appraisal through financial statements, Practical problems and case studies.

Reference Books:

- 1) Eugene F. Brigham, Michael C. Ehrhardt, "Financial Management Theory and Practice", Cengage Learning, 2010
- 2) Simon A. Burtonshaw-Gunn, "Risk and Financial Management in Construction", Gower Publishing, Ltd., 2009
- 3) Warner Z. Hirsch, Urban Economics, Macmillan, New York, 1993

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M. Tech Civil (Construction Technology and Management)
MCM-312 Recent Advances in Construction Materials

L	T	P/D	Total
4	1	-	5

Max Marks	: 100
Theory	: 70 Marks
Sessional	: 30 Marks
Duration	: 3 Hours

Foams and light weight materials, fibre reinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete. Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concrete at high temperature. 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, material and properties. Polymers in Civil Engineering Polymers, fibres and composites, Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composites. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

Reference Books:

1. Metha P.K and Monteiro. P.J.M, " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006
2. Shetty .M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., New Delhi,2006
3. Neville. A.M. , " Properties of Concrete", 4th Edition Longman,1995
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