

CURRICULUM & SYLLABUS (R2015)

CHOICE BASED CREDIT SYSTEM

M.Tech-CONSTRUCTION ENGINEERING MANAGEMENT

FULL TIME

I – IV SEMESTERS

| SEMESTER I | | | | | | | |
|-------------------|-----------------|-----------------|--|----------|----------|----------|----------|
| S.No | Category | Code No. | Course Title | L | T | P | C |
| Theory | | | | | | | |
| 1 | PM | MMA104 | Statistical Methods and Queuing Theory | 3 | 1 | 0 | 4 |
| 2 | PC | MCM101 | Modern Construction Materials | 3 | 0 | 0 | 3 |
| 3 | PC | MCM102 | Construction Equipment and Management | 3 | 0 | 0 | 3 |
| 4 | PC | MCM103 | Project Formulation and Appraisal | 3 | 0 | 0 | 3 |
| 5 | PE | MCM1E1 | Professional Elective I | 3 | 0 | 0 | 3 |
| 6 | PE | MCM1E2 | Professional Elective II | 3 | 0 | 0 | 3 |
| Total | | | | 18 | 1 | 0 | 19 |

| SEMESTER II | | | | | | | |
|--------------------|-----------------|-----------------|---|----------|----------|----------|----------|
| S.No | Category | Code No. | Course Title | L | T | P | C |
| Theory | | | | | | | |
| 1 | PC | MCM201 | Advanced Construction Techniques | 3 | 0 | 0 | 3 |
| 2 | PC | MCM202 | Contract Laws and Regulations | 3 | 0 | 0 | 3 |
| 3 | PC | MCM203 | Construction Planning, Scheduling and Control | 3 | 0 | 0 | 3 |
| 4 | PC | MCM204 | Safety Practices in Construction | 3 | 0 | 0 | 3 |
| 5 | PE | MCM2E3 | Professional Elective III | 3 | 0 | 0 | 3 |
| 6 | PE | MCM2E4 | Professional Elective IV | 3 | 0 | 0 | 3 |
| Practical | | | | | | | |
| 7 | PC | MCM2L1 | Advanced Construction Engineering Laboratory | 0 | 0 | 4 | 2 |
| Total | | | | 18 | 0 | 4 | 20 |

| SEMESTER III | | | | | | | |
|---------------------|-----------------|-----------------|------------------------|----------|----------|----------|----------|
| S.No | Category | Code No. | Course Title | L | T | P | C |
| 1 | PR | MCM3P1 | Project Work (Phase-1) | 0 | 0 | 12 | 6 |

| | | | | | | | |
|---|----|--------|--|----|---|----|----|
| 2 | PC | MCM301 | Computer Applications in Construction Engineering and Planning | 3 | 0 | 0 | 3 |
| 3 | PE | MCM3E5 | Professional Elective V | 3 | 0 | 0 | 3 |
| 4 | OE | MCM3E6 | Open Elective | 3 | 0 | 0 | 3 |
| | | | Total | 12 | 0 | 12 | 15 |

| SEMESTER IV | | | | | | | |
|--------------------|----------|----------|---------------------------|---|---|----|----|
| S.No | Category | Code No. | Course Title | L | T | P | C |
| 1 | PR | MCM4P1 | Project Work (Phase – II) | 0 | 0 | 24 | 12 |
| | | | Total | 0 | 0 | 24 | 12 |

Overall Credits for the Programme – 66

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

| S.No | Sub Area | Credits as per semester | | | | No. of Credit | % of credit |
|------|--|-------------------------|-----------|-----------|-----------|---------------|-------------|
| | | I | II | III | IV | | |
| 1 | Professional Mathematics (PM) | 4 | - | - | - | 4 | 6.060 |
| 1 | Professional Core (PC) | 9 | 14 | 3 | - | 26 | 39.393 |
| 2 | Professional Electives (PE) | 6 | 6 | 3 | - | 15 | 22.727 |
| 3 | Open Electives (OE) | - | - | 3 | - | 3 | 4.545 |
| 4 | Project Work, Seminar, Internship, Term Paper, etc. (PR) | - | - | 6 | 12 | 18 | 27.272 |
| | Total Credits | 19 | 20 | 15 | 12 | 66 | 100 |
| | Total Contact Hours | 18 | 22 | 24 | 24 | 88 Hrs | |

LIST OF ELECTIVES

List of Professional Elective (PE) - I

| S.No | Code No. | Course Title | L | T | P | C |
|------|----------|---|---|---|---|---|
| 1 | MCM056 | Construction Project Management | 3 | 0 | 0 | 3 |
| 2 | MCM057 | Quantitative Techniques in Management | 3 | 0 | 0 | 3 |
| 3 | MCM058 | Construction Personnel Management | 3 | 0 | 0 | 3 |
| 4 | MCM061 | Resource Management and Control in Construction | 3 | 0 | 0 | 3 |
| 5 | MCM062 | Project Safety Management | 3 | 0 | 0 | 3 |

List of Professional Elective (PE) - II

| S.No | Code No. | Course Title | L | T | P | C |
|------|----------|---|---|---|---|---|
| 1 | MCM051 | Advanced Concrete Technology | 3 | 0 | 0 | 3 |
| 2 | MCM060 | Quality Control and Assurance in Construction | 3 | 0 | 0 | 3 |
| 3 | MCM065 | Maintenance and Rehabilitation of Structures | 3 | 0 | 0 | 3 |

List of Professional Elective (PE) - III

| S.No | Code No. | Course Title | L | T | P | C |
|------|----------|------------------------------------|---|---|---|---|
| 1 | MCM053 | System Integration in Construction | 3 | 0 | 0 | 3 |
| 2 | MCM070 | Infrastructure Development | 3 | 0 | 0 | 3 |
| | | | | | | |

List of Professional Elective (PE) - IV

| S.No | Code No. | Course Title | L | T | P | C |
|------|----------|--|---|---|---|---|
| 1 | MCM052 | Construction of Pavements | 3 | 0 | 0 | 3 |
| 2 | MCM067 | Prefabrication and Construction Techniques | 3 | 0 | 0 | 3 |

List of Professional Elective (PE) - V

| S.No | Code No. | Course Title | L | T | P | C |
|------|----------|----------------------------|---|---|---|---|
| 1 | MCM064 | Energy-Efficient Buildings | 3 | 0 | 0 | 3 |
| 2 | MCM071 | Building Services | 3 | 0 | 0 | 3 |

List of Open Elective (OE)

| S.No | Code No. | Course Title | L | T | P | C |
|-------------|-----------------|---|----------|----------|----------|----------|
| 1 | MCM059 | Business Economics and Finance Management | 3 | 0 | 0 | 3 |
| 2 | MCM063 | Management Information Systems | 3 | 0 | 0 | 3 |
| 3 | MCM054 | Energy Conservation Techniques in Building Construction | 3 | 0 | 0 | 3 |
| 4 | MCM066 | Condition Assessment and Evaluation Engineering | 3 | 0 | 0 | 3 |
| 5 | MCM068 | Design of Industrial Structures | 3 | 0 | 0 | 3 |
| 6 | MCM069 | GIS in Construction Engineering & Management | 3 | 0 | 0 | 3 |
| 7 | MCM072 | Research Methodology | 3 | 0 | 0 | 3 |

SYLLABUS

| | | | | | | | | |
|--|--|-------------------------------|------------------------|----------------------------|--------------------|---|----------|----------|
| MMA 104 | STATISTICAL METHODS AND QUEUEING THEORY | | | | L | T | P | C |
| | Total Contact Hours: 60 | | | | 3 | 1 | 0 | 4 |
| | Prerequisite: Numerical Methods | | | | | | | |
| | Course Designed by : Department of civil | | | | | | | |
| <p>OBJECTIVES : To develop analytical capability and to impart knowledge in statistical methods and Queuing theory and their applications in Engineering and Technology and to apply these concepts in engineering problems they would come across.</p> | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Analyze the one dimensional random variable and their properties and functions. | | | | | | | |
| CO2 | Analyze and study about the estimation theory using various methods. | | | | | | | |
| CO3 | Analyze and test the hypotheses based on different distributions and attributes. | | | | | | | |
| CO4 | Analyze the variance and perform randomised block and latin square design. | | | | | | | |
| CO5 | Analyze and work on different queuing models. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | H | | M | L | | | |
| | CO2 | M | | H | | L | | |
| | CO3 | L | M | | | H | | |
| | CO4 | H | | M | L | | | |
| | CO5 | L | | M | | H | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) | | |
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|---|----------|---|
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 |
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UNIT I-ONE DIMENSIONAL RANDOM VARIABLE

9+3

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT II-ESTIMATION THEORY

9+3

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT III-TESTING OF HYPOTHESES

9+3

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, .2 and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT IV-DESIGN OF EXPERIMENTS

9+3

Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design.

UNIT V-QUEUING MODELS

9+3

Poisson Process – Markovian queues – Single and Multi Server Models – Little’s formula Machine Interference Model – Steady State analysis – Self Service queue.

TOTAL: 60 PERIODS

REFERENCES:

1. Jay L. Devore, Probability and Statistics and Probability for Engineers, CENGAGE Learning, Indian Edition, Singapore, 2008.
2. D. C. Montgomery, G. C. Runger, Applied Statistics and Probability for Engineers, Third Edition, John Wiley and Sons, 2007.
3. D. Gross, C. M. Harris, Fundamentals of Queuing Theory, Third Edition, John Wiley and Sons, 2002.
4. Walpole, R.E., Myer, R.H., Myer, S.L. and Ye, K., Probability and Statistics for Engineers and Scientists, 7th edition, Pearson Education, Delhi, 2002.
5. Vohra, N.D. “Quantitative Techniques in Management”, Tata McGraw – Hill Company Limited, 2007.
6. Gupta, S. C. and Kapoor, V. K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 2001.
7. Taha, H. A., Operations Research: An Introduction, Seventh Edition, Pearson Education Edition, Asia, New Delhi , 2002.

| | | | | | | | |
|--|---|---|------------------------|----------------------------|--------------------|---|----------|
| MCM 101 | MODERN CONSTRUCTION MATERIALS | | | L | T | P | C |
| | Total Contact Hours: 45 | | | 3 | 0 | 0 | 3 |
| | Prerequisite: Concrete technology | | | | | | |
| | Course Designed by : Department of civil | | | | | | |
| OBJECTIVES : To bring about an exposure to design concepts structures, the loads, systems, structural materials, design procedures, repair and rehabilitation of systems. | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | |
| CO1 | Identify the various types of concretes and their constituents and properties. | | | | | | |
| CO2 | Identify the various types of metals, their properties and applications. | | | | | | |
| CO3 | Identify the various composite materials, their properties and applications. | | | | | | |
| CO4 | Understand the concept of water-proofing and identify the purpose of flooring and facade materials. | | | | | | |
| CO5 | Design and develop smart intelligent buildings. | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | |
| L | CO1 | H | | | L | | |
| | CO2 | H | | | L | L | |
| | CO3 | H | | | L | | |
| | CO4 | M | L | | L | | |
| | CO5 | H | M | L | | | L |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) | |
| | | | √ | | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | | |

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|---|-----------|
| UNIT I-SPECIAL CONCRETES | 10 |
| Concretes, Behaviour of concretes - High Strength and High Performance Concrete – Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete. | |
| UNIT II-METALS | 10 |
| Steels - New Alloy Steels – Aluminum and its Products –Coatings to reinforcement – Applications. | |
| UNIT III-COMPOSITES | 10 |
| Plastics –Reinforced Polymers – FRP – Applications | |
| UNIT IV-OTHER MATERIALS | 10 |
| Water Proofing Compounds – Non-weathering Materials – Flooring and Façade Materials | |
| UNIT V-SMART AND INTELLIGENT MATERIALS | 5 |
| Smart and Intelligent Materials for intelligent buildings - Special features | |

TOTAL: 45 PERIODS

REFERENCES:

1. Santhakumar A.R., Concrete Technology, Oxford University press, New Delhi. 2007.
2. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
3. Ashby, M.F. and Jones.D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005.
4. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
5. Aitkens , High Performance Concrete, McGraw Hill, 1999
6. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
7. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.
8. ACI Report 440.2R-02, “Guide for the design and construction of externally bonded RP systems for strengthening concrete structures”, American Concrete Institute, 2002.

| | | | | | |
|--|---|----------|----------|----------|----------|
| MCM 102 | CONSTRUCTION EQUIPMENT AND MANAGEMENT | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Construction techniques equipment and practices | | | | |
| | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To introduce various construction equipment and study the efficient utilization of the same using scientific principles. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |

| | | | | | | |
|---|---|---|------------------------|----------------------------|--------------------|---|
| CO1 | Manage the equipment, cost control and maintenance of a project. | | | | | |
| CO2 | Identify and understand the working principle of earthwork equipments. | | | | | |
| CO3 | Identify and understand the working of various equipments for different construction process. | | | | | |
| CO4 | Identify and understand the working principle of material handling equipments. | | | | | |
| CO5 | Understand the working of aggregate production and concreting equipments. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | H | L | | M | |
| | CO2 | H | | | L | |
| | CO3 | H | L | | L | |
| | CO4 | M | L | | | |
| | CO5 | H | M | | M | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-CONSTRUCTION EQUIPMENT MANAGEMENT

10

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

UNIT II-EQUIPMENT FOR EARTHWORK

10

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

UNIT III-OTHER CONSTRUCTION EQUIPMENTS

10

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 – Equipment for Demolition.

UNIT IV-MATERIALS HANDLING EQUIPMENT 5

Forklifts and related equipment - Portable Material Bins – Conveyors – Hauling Equipment.

UNIT V-EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING 10

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

TOTAL: 45 PERIODS

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2006.
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.

| | | | | | |
|--|---|----------|----------|----------|----------|
| MCM 103 | PROJECT FORMULATIONS AND APPRAISAL | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Management concepts for civil engineers | | | | |
| | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To introduce and study formulation, costing, appraisal and finance of construction projects. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |
| CO1 | Formulate and generate the project and prepare reports for executing the work. | | | | |
| CO2 | Understand the costing and cash flows of a project. | | | | |
| CO3 | Assess various methods of project appraisal. | | | | |
| CO4 | Understand the project financing and special schemes. | | | | |
| CO5 | Know about private sector participation in Infrastructure Development Projects. | | | | |

| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | | H | M | L | L |
| | CO2 | H | L | | | |
| | CO3 | | M | | L | |
| | CO4 | M | M | | | L |
| | CO5 | M | | | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-PROJECT FORMULATION

10

Project – Concepts – Capital investments - **Generation and Screening of Project Ideas** - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required.

UNIT II-PROJECT COSTING

10

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

UNIT III-PROJECT APPRAISAL

15

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.

UNIT IV-PROJECT FINANCING

5

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios.

UNIT V-PRIVATE SECTOR PARTICIPATION

5

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - **Technology Transfer and Foreign Collaboration** - Scope of Technology Transfer.

TOTAL: 45 PERIODS

REFERENCES:

1. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation Review, Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992
3. United Nations Industrial Development 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.

| | | | | | | | | | |
|---|--|--|---|---|---|----------|----------|----------|----------|
| MCM 201 | | ADVANCED CONSTRUCTION TECHNIQUES | | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Concrete technology | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To bring about a complete understanding of advanced construction techniques in sub structure super structure and repair construction. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Understand the various processes involved in sub-structure construction. | | | | | | | | |
| CO2 | Understand the various processes involved in super-structure construction. | | | | | | | | |
| CO3 | Understand the construction process of special structures and offshore structures. | | | | | | | | |
| CO4 | Know about the rehabilitation techniques carried out for a structure. | | | | | | | | |
| CO5 | Know about the demolition techniques carried out for a structure. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | M | H | | L | L | | | |
| | CO2 | M | H | | L | L | | | |
| | CO3 | M | H | | | L | | | |
| | CO4 | M | H | | | L | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| | CO5 | | L | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | √ | | | |
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UNIT I-SUB STRUCTURE CONSTRUCTION

15

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 - well points - dewatering and stand by plant equipment for underground open excavation.

UNIT II-SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS

10

Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures.

UNIT III-CONSTRUCTION OF SPECIAL STRUCTURES

10

Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques for offshore structures – construction sequence and methods in domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

UNIT IV-REHABILITATION TECHNIQUES

6

Mud jacking grout through slab foundation - micropiling for strengthening floor and shallow profile - pipeline laying - protecting sheet piles, screw anchors - sub grade water proofing, underpinning, crack stabilization techniques.

UNIT V-DEMOLITION

4

Advanced techniques and sequence in demolition and dismantling.

TOTAL: 45 PERIODS

REFERENCES:

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 Rocketr, 1984
4. Peter.H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.

Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

| | | | | | | | | |
|---|--|--|---|---|----------|----------|----------|----------|
| MCM 202 | | CONTRACT LAWS AND REGULATIONS | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Estimation and Costing | | | | | | |
| | | Course Designed by : Department of civil | | | | | | |
| OBJECTIVES : To study contract laws and regulations so that adequate knowledge on formulating and managing construction contracts is gained. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the elements of concluding and the process of administering contracts. | | | | | | | |
| CO2 | Understand the various processes involved in tenders. | | | | | | | |
| CO3 | Achieve awareness on arbitrations and powers and duty of an arbitrator. | | | | | | | |
| CO4 | Know about the legal requirements and the corresponding government laws. | | | | | | | |
| CO5 | Know about the labour requirements and administration and the corresponding government laws. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | M | M | | | | | |
| | CO2 | H | L | | L | | | |
| | CO3 | M | | | | L | | |
| | CO4 | M | | | L | | | |
| | CO5 | M | | | L | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|--|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper/ Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-CONSTRUCTION CONTRACTS

10

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

UNIT II-TENDERS

10

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.

UNIT III-ARBITRATION

5

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs

UNIT IV-LEGAL REQUIREMENTS

10

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

UNIT V-LABOUR REGULATIONS

10

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen’s Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws

TOTAL: 45 PERIODS

REFERENCES:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982

2. Jimmie Hinze, Construction Contracts, McGraw Hill, 2001
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
4. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.
5. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.

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|---|---|--|---|---|----------|----------|----------|----------|
| MCM 203 | | CONSTRUCTION PLANNING, SCHEDULING AND CONTROL | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Management concepts for civil engineers | | | | | | |
| | | Course Designed by : Department of civil | | | | | | |
| OBJECTIVES : To study the finer aspects of planning, scheduling and controlling of construction projects. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the elements of construction planning and estimating activity durations and resource requirements. | | | | | | | |
| CO2 | Know the elements of scheduling and to apply appropriate tools and techniques like networks and coding systems. | | | | | | | |
| CO3 | Understand the monitoring and accounting of projects through cost control. | | | | | | | |
| CO4 | Know the elements of quality control and safety of construction projects. | | | | | | | |
| CO5 | Know the concept of gathering and using project information. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | H | M | | L | | | |
| | CO2 | H | M | | L | | | |
| | CO3 | H | L | | L | | | |
| | CO4 | H | M | | | | | |
| | CO5 | H | | L | | | L | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|--|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper/ Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-CONSTRUCTION PLANNING

9

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

UNIT II-SCHEDULING PROCEDURES AND TECHNIQUES

9

Construction Schedules - Critical Path Method – Scheduling Calculations - Float - Presenting Project Schedules - Scheduling for Activity-on-Arrow and with Leads, Lags, and Windows - Scheduling with Resource **Constraints and Precedences** - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Improving the Scheduling Process.

UNIT III-COST CONTROL, MONITORING AND ACCOUNTING

9

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.

UNIT IV-QUALITY CONTROL DURING CONSTRUCTION

9

Quality Concerns in Construction - Organizing for Quality - Work and Material specifications - Total Quality Control - **Quality Control by Statistical Methods** - Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables

UNIT V-ORGANIZATION AND USE OF PROJECT INFORMATION

9

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.

TOTAL: 45 PERIODS

REFERENCES:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.

2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. 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.

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| MCM 204 | SAFETY PRACTICES IN CONSTRUCTION | | | | L | T | P | C |
| | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | Prerequisite: Building Construction | | | | | | | |
| | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To study various safety practices that has to be adopted in construction and to know the finer aspects of safety programs, sampling and audit. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the safety concepts that have to be adopted in construction. | | | | | | | |
| CO2 | Understand the elements of safety programmes. | | | | | | | |
| CO3 | Know the awareness on safety practices that has to be ensured during construction. | | | | | | | |
| CO4 | Know about the accident prevention, safety sampling and audit. | | | | | | | |
| CO5 | Know the safety concepts in hand tools, grinding, lifting works and while operating fire fighting equipments. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | H | | | M | M | | |
| | CO2 | L | | | L | | | |
| | CO3 | M | L | | L | | | |
| | CO4 | H | L | | | L | | |
| | CO5 | L | M | | | L | | |

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|---|----------|---|------------------------|----------------------------|--------------------|--|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper/ Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-SAFETY CONCEPTS

9

Construction accidents - **Construction Safety Management**: Importance - causes of accident, safety measures- Environmental issues in construction-Construction industry related laws. Human factors in safety – legal and financial aspects of accidents in construction – occupational and safety hazard assessment.

UNIT II-SAFETY PROGRAMMES

9

Safety Programmes - Construction Safety - Elements of an Effective Safety Programmes - Job-site assessment - Safety Meetings - Safety Incentives. Contractual Obligations - Safety in construction contracts- Substance Abuse - **safety Record Keeping**.

UNIT III-SAFETY PRACTICES

9

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

UNIT IV-SAFETY SAMPLING AND AUDIT

9

Accident prevention-cost of accidents-Safety and productivity-safety provision in the factories act-accident reporting investigation and statistics-total loss control and damage control-Safety sampling- safety audit - critical incident technique- safety equipment - planning and site preparation- safety system of storing construction materials-Excavation - blasting- timbering-scaffolding- safe use of ladders- safety in welding.

UNIT V-SAFETY IN LIFTING AND FIRE

9

Safety in hand tools- Safety in grinding- Hoisting apparatus and conveyors- Safety in the use of mobile cranes-Manual handling- **Safety in demolition work**- Trusses, girders and beams- First-aid- Fire hazards and preventing methods-Interesting experiences at the construction site against the fire accidents.

TOTAL: 45 PERIODS

REFERENCES

1. Jimmy W. Hinze, *Construction Safety, Prentice Hall Inc., 1997*
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, *Construction Safety and Health Management, Prentice Hall Inc., 2001.*
3. Hand Book on Construction Safety Practices, SP:70, BIS, 2001.

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| MCM 2L1 | | ADVANCED CONSTRUCTION ENGINEERING LABORATORY | | | L | T | P | C |
| | | Total Contact Hours: 30 | 0 | 0 | 4 | 2 | | |
| | | Prerequisite: Construction Engineering Laboratory | | | | | | |
| | | Course Designed by : Department of civil | | | | | | |
| OBJECTIVES : To expose the students to the testing of concrete under the action of various minerals and admixtures and determination of their characteristics experimentally and also to calculate mix design and perform NDT. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the Mix design of concrete as per IS, ACI & BS methods for high performance concrete. | | | | | | | |
| CO2 | Understand the Flow Characteristics of Self Compacting concrete. | | | | | | | |
| CO3 | Know the Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability. | | | | | | | |
| CO4 | Perform NDT on hardened concrete. | | | | | | | |
| CO5 | Know the Permeability tests on hardened concrete. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | H | | | L | L | | |
| | CO2 | | | | L | | | |
| | CO3 | M | L | | L | | | |
| | CO4 | | M | | | | | |
| | CO5 | | L | | L | | | |

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|---|----------|---|------------------------|----------------------------|--------------------|---|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

LIST OF EXPERIMENTS

1. Mix design of concrete as per IS, ACI & BS methods for high performance concrete.
2. Flow Characteristics of Self Compacting concrete
3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
4. NDT on hardened concrete - UPV, Rebound hammer and core test.
5. Permeability tests on hardened concrete

TOTAL: 30 PERIODS

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| MCM 301 | COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING | | | | L | T | P | C |
| | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | Prerequisite: Building Construction | | | | | | | |
| | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To bring about an understanding of use of computers for solving scheduling and other related problems by applying critical path methods. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the system hardware and system management. | | | | | | | |
| CO2 | Understand the optimisation techniques and software problems. | | | | | | | |

| | | | | | | |
|---|--|---|------------------------|----------------------------|--------------------|---|
| CO3 | Know the Deterministic and Probabilistic Inventory Models. | | | | | |
| CO4 | Know the scheduling techniques. | | | | | |
| CO5 | Understand other concepts regarding estimation, planning, scheduling and accounting. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | M | L | | H | |
| | CO2 | L | | M | | L |
| | CO3 | | M | | L | |
| | CO4 | | M | | M | |
| | CO5 | H | | | | L |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | √ | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-INTRODUCTION

9

Introduction to System Hardware – Languages – Feasibility study and analysis – procurement, training, implementation and system management – procedural language - developing application with spread sheet -developing application with files and database software.

UNIT II-OPTIMIZATION TECHNIQUES

9

Linear, Dynamic and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications

UNIT III-INVENTORY MODELS

9

Deterministic and Probabilistic Inventory Models - Software applications

UNIT IV-SCHEDULING APPLICATION

9

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

UNIT V-OTHER PROBLEMS**9**

Estimating – project planning and scheduling- accounting and **cost engineering** – Enterprises – Introduction to ERP systems - operations simulation

TOTAL: 45 PERIODS**REFERENCES:**

1. Billy E.Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, Tata Mc Graw Hill, 1990
2. Paulson, B.R., Computer Applications in Construction, Mc Graw Hill, 1995
3. Feigenbaum,L., Construction Scheduling with Primavera Project Planner Prentice Hall Inc., 2002

Ming Sun and Rob Howard, “Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, London and New York, 2004.

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|---|---|--|---|---|---|----------|----------|----------|----------|
| MCM 051 | | ADVANCED CONCRETE TECHNOLOGY | | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Concrete Technology | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To study the properties of concrete, special types of concrete, concreting techniques and mix design procedure. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Know the concrete making materials. | | | | | | | | |
| CO2 | Understand the properties of fresh and hardened concrete. | | | | | | | | |
| CO3 | Know the Mix design adopted for casting of concrete. | | | | | | | | |
| CO4 | Know the special types of concrete. | | | | | | | | |
| CO5 | Understand the various concreting methods adopted. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | M | M | | L | | | | |
| | CO2 | L | M | | | H | | | |
| | CO3 | M | M | | L | | | | |
| | CO4 | L | M | | | | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| | CO5 | M | M | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-CONCRETE MAKING MATERIALS

9

Aggregates classification, IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates. Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements. Water Chemical admixtures, Mineral admixture.

UNIT II-CONCRETE

9

Properties of fresh concrete, **Hardened concrete**, Strength, Elastic properties, Creep and shrinkage, Variability of concrete strength, durability of concrete.

UNIT III-MIX DESIGN

9

Principles of concrete mix design, **Methods of concrete mix design**, Testing of Concrete. Statistical quality control- sampling and acceptance criteria.

UNIT IV-SPECIAL CONCRETE

9

Light weight concrete, Fly ash concrete, **Fibre reinforced concrete**, Sulphur impregnated concrete, Polymer Concrete, Super plasticised concrete, hyper plasticized concrete, Epoxy resins and screeds for rehabilitation - properties and applications - high performance concrete. High performance fiber reinforced concrete, self-compacting-concrete.

UNIT V-CONCRETING METHODS

9

Process of manufacturing of concrete, methods of transportation, placing and curing. Extreme weather concreting, special concreting methods. **Vacuum dewatering** - underwater concrete, special form work.

TOTAL: 45 PERIODS

REFERENCES:

1. Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.
2. Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2003.

3. A.R.Santhakumar ;"Concrete Technology",Oxford University Press,2007.
4. Rudhani G. Light Weight Concrete Academic Kiado, Publishing Home of Hungarian Academy of Sciences, 1963.

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| MCM 052 | | CONSTRUCTION OF PAVEMENTS | | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Transportation Engineering | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To bring about an understanding of construction of pavements and the properties of pavements. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Know the materials in pavement construction. | | | | | | | | |
| CO2 | Understand the design and properties of bituminous mixtures. | | | | | | | | |
| CO3 | Know the properties of pavement quality and the construction practice. | | | | | | | | |
| CO4 | Know the road making machineries. | | | | | | | | |
| CO5 | Be aware of the latest advancements in pavement engineering. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | M | L | | | L | | | |
| | CO2 | H | H | | M | | | | |
| | CO3 | M | | | L | | | | |
| | CO4 | H | L | M | | | | | |
| | CO5 | | M | | | | | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) | | | |
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| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 |
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UNIT I-ROAD MAKING MATERIALS FOR FLEXIBLE AND RIGID PAVEMENTS

9

Classification, testing and applications of road making aggregates – Road binders – Bitumen - Cement

UNIT II-PROPERTIES OF BITUMINOUS MIXTURES

10

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

UNIT III-PROPERTIES OF PAVEMENT QUALITY CONCRETE MIXTURES AND CONSTRUCTION PRACTICE

11

Properties of fresh and hardened concrete – laboratory tests – Design of concrete mixes for Pavement Quality Concrete. Construction of various layers in rigid and flexible pavements – Quality assurance during construction – sampling and analysis.

UNIT IV-MACHINERIES

8

Road making machineries – Road formation, bituminous constructions - Road surface evaluation

UNIT V-LATEST ADVANCEMENTS

7

Methods to improve bitumen quality – Rheological and chemical additives – Polymer modified bitumen – Super pave concepts – Recycling of bituminous courses – Smart materials for cement concrete pavement – Use of admixtures and fibres.

TOTAL: 45 PERIODS

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.

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| MCM 053 | SYSTEM INTEGRATION IN CONSTRUCTION | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |

| | | | | | | |
|---|---|---|------------------------|----------------------------|--------------------|--|
| | | Prerequisite: Maintenance and Rehabilitation of structures | | | | |
| | | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To study and understand the construction system integration, environmental factors, services, maintenance and safety systems. | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | |
| CO1 | Know about the structural integration and systems | | | | | |
| CO2 | Understand the environmental factors and its relevant structural integration. | | | | | |
| CO3 | Know the services regarding plumbing and electricity. | | | | | |
| CO4 | Know the maintenance techniques and the materials involved. | | | | | |
| CO5 | Understand the safety and preventive systems. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | M | M | | L | |
| | CO2 | | H | | | H |
| | CO3 | M | | | | L |
| | CO4 | L | | | M | |
| | CO5 | | | | | L |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper/ Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-STRUCTURAL INTEGRATION

9

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

UNIT II-ENVIRONMENTAL FACTORS**9**

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.

UNIT III-SERVICES**9**

Plumbing – Electricity – Vertical circulation and their interaction - HVAC

UNIT IV-MAINTENANCE**9**

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.

UNIT V-SAFETY**9**

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

TOTAL: 45 PERIODS**REFERENCES:**

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

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|--|--|----------|----------|----------|----------|
| MCM 054 | ENERGY CONSERVATION TECHNIQUES IN BUILDING CONSTRUCTION | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Repair and rehabilitation of structures | | | | |
| | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To bring about an exposure to different sources and production systems of energy and their effective management adopting appropriate design methodology in construction. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |

| | | | | | | |
|---|--|---|------------------------|----------------------------|--------------------|---|
| CO1 | Know the energy production systems and energy economic analysis. | | | | | |
| CO2 | Understand the environmental aspect and resource conservation. | | | | | |
| CO3 | Know the energy efficient design strategies. | | | | | |
| CO4 | Know the energy audit, energy flow diagram and energy consumption. | | | | | |
| CO5 | Understand the concepts of energy management programme. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | | H | | M | |
| | CO2 | | | | L | H |
| | CO3 | H | H | | | |
| | CO4 | | M | | L | |
| | CO5 | H | | M | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | | √ | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-INTRODUCTION

6

Fundamentals of energy- Energy Production Systems-Heating, Ventilating and air-conditioning – Solar Energy and Conservation – Energy Economic Analysis – Energy conservation and audits – Domestic energy consumption – savings - challenges – primary energy use in buildings - Residential – Commercial – Institutional and public buildings – Legal requirements for conservation of fuel and power in buildings.

UNIT II-ENVIRONMENTAL

7

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.

UNIT III-DESIGN**8**

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.

UNIT IV-SERVICES**12**

Energy in building design – Energy efficient and environment friendly building – Thermal phenomena – thermal comfort – Indoor Air quality – Climate, sun and Solar radiation, - Psychometrics – passive heating and cooling systems - Energy Analysis – Active HVAC systems - Preliminary Investigation – Goals and policies – Energy audit – Types of Energy audit – Analysis of results – Energy flow diagram – Energy consumption / Unit Production – Identification of wastage- Priority of conservative measures – Maintenance of energy management programme.

UNIT V-ENERGY MANAGEMENT**12**

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.

TOTAL: 45 PERIODS**REFERENCES:**

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

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|--|---|----------|----------|----------|----------|
| MCM 055 | SHORING, SCAFFOLDING AND FORMWORK | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Concrete Technology | | | | |
| | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To bring about an exposure to different sources and production systems of energy and their effective management adopting appropriate design methodology in construction. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |
| CO1 | Study the materials associated with formwork. | | | | |

| | | | | | | |
|---|---|---|------------------------|----------------------------|--------------------|---|
| CO2 | Study the design aspects of formwork under various requirements. | | | | | |
| CO3 | Know the design of forms and shores. | | | | | |
| CO4 | Study the planning and erection aspects of form work for buildings. | | | | | |
| CO5 | Understand few other special types of forms. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | L | | | L | |
| | CO2 | H | H | | L | |
| | CO3 | H | H | | | L |
| | CO4 | | M | | | |
| | CO5 | M | L | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-PLANNING AND SITE EQUIPMENT & PLANT FOR FORM WORK 9

At Tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms. Overall Planning – detail planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning Crane arrangements – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales and ties – scaffold frames from accessories – Vertical transport table form work.

UNIT II-FORM MATERIALS

9

Lumber – Types – Finish – Sheathing boards working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminium Form lining materials – Hardware and fasteners – Nails in Plywood Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic pressure and pressure distribution – Examples – Vertical loads - Uplift on shores – Adjustment for non standard conditions.

UNIT III-DESIGN OF FORMS AND SHORES

9

Basic simplification – Beam formulas – Allowable stresses – Deflection bending lateral stability – Shear, Bearing – Examples in wall forms – Slab forms – Beam forms – Ties, Anchors and Hangers – Column forms – Examples in each. Simple wood stresses – Slenderness ratio – Allowable load – Tubular steel shores patented shores – Site Preparation, Size and spacing – Steel Tower Frames – Safety practices – Horizontal shores shoring for multistories – More concentrated shore loads T- heads – Tow Tier wood shores – Ellis shores – Dayton sure grip and Baker Roofs shores – Safeway Symons shores – Beaver – advance shores Dead shore – Raking and Flying shores.

UNIT IV-FORMWORK FOR BUILDINGS

9

Location of job mill – Storage – Equipment – Footings – Wall footings – Column footings Sloped footing forms – Curb and gutter forms – Wall forms –Prefabricated panel systems – Giant forms curved wall forms – Column heads – Beam or girder forms – Beam pockets – Suspended forms – Concrete joint construction – Flying system forms. Causes of failures – Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping – Errors in design – Failure to follow codes – How formwork affects concretes quality – ACI – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – Advantages of reshoring.

UNIT V-FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SAFETY PRACTICES FOR SCAFFOLDS

9

Hemispherical, Parabolic, Translational typical barrel vaults, Hyperbolic Folded plates – Shell form design considerations loads – Inserts , Anchors bolts – Building the forms-Placing concrete – Form removed – Strength requirements – Tunnel forming components – Curb forms invert forms – Arch forms – Concrete placement methods – Cut and cover construction – Tolerances – Form construction – Shafts. Slip Forms -Principles – Types – advantages – Functions of various components – Planning – Desirable characteristics of concrete – Common problems faced – Safety in slip forms special structures built with slip form Technique – Codal provisions Types of scaffolds – Putlog and independent scaffold – Single pole scaffolds – Fixing ties – Spacing of ties plan – bracing – knots – safety net – General safety requirements – precautions against particular hazards – Truss suspended – Gantry and system scaffolds.

TOTAL: 45 PERIODS

REFERENCES:

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

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|----------------|--|----------|----------|----------|----------|
| MCM 056 | CONSTRUCTION PROJECT MANAGEMENT | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |

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|--|--|---|------------------------|----------------------------|--------------------|---|
| | | Prerequisite: Construction Technology | | | | |
| | | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To study the elements of construction project management; consisting of owners' perspective, organization, design and construction procedures, resource utilization and cost estimation. | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | |
| CO1 | Know the types and financing of construction and changing environment of the industry. | | | | | |
| CO2 | Understand the organisation of project management. | | | | | |
| CO3 | Know the design and construction process as an integrated system. | | | | | |
| CO4 | Know the labour, material and equipment utilisation. | | | | | |
| CO5 | Understand Cost Estimates and the Costs Associated with Construction Facilities. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | H | | | L | M |
| | CO2 | | M | | | L |
| | CO3 | | | L | | |
| | CO4 | | L | | | M |
| | CO5 | L | | | M | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-THE OWNERS' PERSPECTIVE

9

Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services -

Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers

UNIT II-ORGANIZING FOR PROJECT MANAGEMENT 9

Project Management – modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer- Constructor Sequence - Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team

UNIT III-DESIGN AND CONSTRUCTION PROCESS 9

Design and Construction as an Integrated System - Innovation and Technological Feasibility - Innovation and Economic Feasibility - Design Methodology - Functional Design - Construction Site Environment

UNIT IV-LABOUR, MATERIAL AND EQUIPMENT UTILIZATION 9

Historical Perspective - Labour Productivity - Factors Affecting Job-Site Productivity - Labour Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of Costs in Materials Management. - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

UNIT V-COST ESTIMATION 9

Costs Associated with Constructed 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 Engineer's List of Quantities - Estimation of Operating Costs.

TOTAL: 45 PERIODS

REFERENCES:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
4. Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. George J.Ritz , Total Construction Project Management - McGraw-Hill Inc, 1994.

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|----------------|--|----------|----------|----------|----------|
| MCM 057 | QUANTITATIVE TECHNIQUES IN MANAGEMENT | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |

| | | | | | | |
|---|---|---|------------------------|----------------------------|--------------------|---|
| | | Prerequisite: Principles of Management | | | | |
| | | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To bring about an understanding of quantitative techniques in management and managerial economics. | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | |
| CO1 | Know the operations research and optimality analysis. | | | | | |
| CO2 | Understand the production management. | | | | | |
| CO3 | Understand the financial management. | | | | | |
| CO4 | Know decision making under conditions of certainty, risk and uncertainty. | | | | | |
| CO5 | Understand managerial economics and game theory applications. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | | H | | L | |
| | CO2 | | L | | M | |
| | CO3 | | L | | M | |
| | CO4 | L | | | L | |
| | CO5 | M | | | | L |
| 1 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-OPERATIONS RESEARCH

12

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

UNIT II-PRODUCTION MANAGEMENT

12

Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

UNIT III-FINANCIAL MANAGEMENT 7

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

UNIT IV-DECISION THEORY 7

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

UNIT V-MANAGERIAL ECONOMICS 7

Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications.

TOTAL: 45 PERIODS

REFERENCES:

1. Vohra, N.D., Quantitative Techniques in Management, Tata McGraw-Hill Company Ltd, New Delhi, 1990.
2. Schroeder, R.G, Operations Management, McGraw Hill, USA, 1982.
3. Levin, R.I, 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. Hamdy A.Taha, Operations Research: An Introduction, Prentice Hall, 2002.

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|---|---|----------|----------|----------|----------|
| MCM 058 | CONSTRUCTION PERSONNEL MANAGEMENT | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Total Quality Management | | | | |
| | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To introduce the elements of human behaviour and their impact on construction personnel management. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |
| CO1 | Know about the Manpower Planning and Organising. | | | | |
| CO2 | Understand the Development and Operation of human resources | | | | |
| CO3 | Understand the awareness on fundamentals of human behavior under varying stress conditions. | | | | |
| CO4 | Know the welfare measures and Laws related to welfare measures. | | | | |

| | | | | | | |
|---|--|---|------------------------|----------------------------|--------------------|---|
| CO5 | Understand Management and Development Methods Productivity of Human resources. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | M | L | | L | |
| | CO2 | M | L | | L | |
| | CO3 | | | | | M |
| | CO4 | L | | | | L |
| | CO5 | L | | | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-MANPOWER PLANNING

10

Manpower Planning, Organising, Staffing, directing, and controlling – Personnel Principles

UNIT II-ORGANISATION

10

Organisation – Span of Control – Organisation Charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development.

UNIT III-HUMAN BEHAVIOUR

10

Introduction to the field of people management - basic individual psychology; motivation - ob design and performance management - Managing groups at work - self-managing work teams - intergroup behaviour and conflict in organisations – Leadership - Behavioural aspects of decision-making; and communication for people management

UNIT IV-WELFARE MEASURES

5

Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension –Laws related to welfare measures.

UNIT V-MANAGEMENT AND DEVELOPMENT METHODS**10**

Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge - Special Human resource problems, Performance appraisal. - Employee hand book and personnel manual – Job descriptions and organization structure and human relations – Productivity of Human resources.

TOTAL: 45 PERIODS**REFERENCES:**

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

| MCM 059 | BUSINESS ECONOMICS AND FINANCE MANAGEMENT | L | T | P | C |
|--|---|----------|----------|----------|----------|
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| Prerequisite: Management Concepts for civil engineers | | | | | |
| Course Designed by : Department of civil | | | | | |
| OBJECTIVES : To study the concepts of Construction Economics and Finance such as comparing alternatives proposals, evaluating alternative investments, management of funds, and management of accounting. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |
| CO1 | Know about the engineering economics and Quality Audit in economic law of returns governing production. | | | | |
| CO2 | Understand the Construction development in Housing, transport energy and other infrastructures. | | | | |
| CO3 | Know the financial control and the need of financial management. | | | | |
| CO4 | Know the Accounting for tax reporting purposes and financial reporting purposes. | | | | |
| CO5 | Understand the interim construction financing. | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | | M | | | L |
| | CO2 | M | L | | L | |
| | CO3 | M | | | M | L |
| | CO4 | L | | | | |
| | CO5 | | M | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | | √ | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-ECONOMICS

10

Role of Civil Engineering in Industrial Development – Advances in Civil Engineering - Engineering Economics – Support Matters of Economy related to Engineering – Market demand and supply – Choice of Technology – Quality Audit in economic law of returns governing production.

UNIT II-CONSTRUCTION ECONOMICS

10

Construction development in Housing, transport energy and other infrastructures – Economics of ecology, environment, energy resources – **Local material selection** – Form and functional designs – Construction workers – Urban Problems – Poverty – Migration – Unemployment – Pollution.

UNIT III-FINANCING

13

The need for financial management - Types of financing – **Financing instruments**– short term borrowing – Long term borrowing – Leasing – Equity financing – Internal generation of funds – External commercial borrowings – Assistance from government budgeting support and international finance corporations – Analysis of financial statements – Balance Sheet - Profit and Loss account – Cash flow and Fund flow analysis – Ratio analysis – Investment and financing decision – Financial Control - centralized management.

UNIT IV-ACCOUNTING METHOD

6

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 – Accounting Standards.

UNIT V-LENDING TO CONTRACTORS

6

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

TOTAL: 45 PERIODS**REFERENCES:**

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

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| MCM 060 | QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION | | | | L | T | P | C |
| | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | Prerequisite: Total Quality Management | | | | | | | |
| | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To create a complete understanding on quality planning, quality assurance, quality control and safety management. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the Quality plan and Quality Management Guidelines. | | | | | | | |
| CO2 | Understand the Quality system and standard Documents and Quality related training. | | | | | | | |
| CO3 | Know the quality planning, Contract and construction programming, Inspection procedures, Processes and products | | | | | | | |
| CO4 | Know the quality assurance, appraisals and quality control by reliability testing. | | | | | | | |
| CO5 | Understand how the quality techniques can be improved. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | M | L | | L | | | |
| | CO2 | L | | | | | M | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| | CO3 | M | | | M | |
| | CO4 | H | L | | L | M |
| | CO5 | L | M | | | L |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-QUALITY MANAGEMENT

9

Introduction – Definitions and objectives – Factor influencing construction quality - Responsibilities and authority - Quality plan - Quality Management Guidelines – Quality circles.

UNIT II-QUALITY SYSTEMS

9

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

UNIT III-QUALITY PLANNING

9

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi’s concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication.

UNIT IV-QUALITY ASSURANCE AND CONTROL

9

Objectives - Regularity agent, owner, design, contract and construction oriented objectives, methods - Techniques and needs of QA/QC - Different aspects of quality - Appraisals, Factors influencing construction quality - Critical, major failure aspects and failure mode analysis, - Stability methods and tools, optimum design - Reliability testing, reliability coefficient and reliability prediction.

UNIT V-QUALITY IMPROVEMENT TECHNIQUES

9

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.

TOTAL: 45 PERIODS

REFERENCES:

1. James, J.O’ Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 1993
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 2000
5. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York, 1989.
7. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, England. 1998.

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| MCM 061 | | RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION | | | | L | T | P | C |
| | | Total Contact Hours: 45 | 3 | 0 | 0 | 3 | | | |
| | | Prerequisite: Building construction | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To study the resources required for construction like material, equipment, labour and time and comprehend the effective management of the same towards fruitful completion of the project. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Know the Resource Planning, Procurement and Identification. | | | | | | | | |
| CO2 | Understand the Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour. | | | | | | | | |
| CO3 | Study and evaluate the resources - material, equipment, labour and time. | | | | | | | | |
| CO4 | Know to manage time on the project and forecasting the future. | | | | | | | | |
| CO5 | Understand other concepts regarding resource allocation and levelling. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | M | L | | M | L | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| | CO2 | H | M | | L | L |
| | CO3 | M | L | | M | |
| | CO4 | | M | | | L |
| | CO5 | H | M | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-RESOURCE PLANNING

10

Resource Planning, Procurement, Identification, Personnel, **Planning for material**, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time.

UNIT II-LABOUR MANAGEMENT

5

Systems approach, Characteristics of resources, **Utilization, measurement** of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour.

UNIT III-MATERIALS AND EQUIPMENT

10

Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution. Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source and handling.

UNIT IV-TIME MANAGEMENT

10

Personnel time, Management and **planning, managing time on the project**, forecasting the future, Critical path measuring the changes and their effects - Cash flow and cost control

UNIT V-RESOURCE ALLOCATION AND LEVELLING

10

Time-cost trade off, Computer application - resource leveling, resource list, resource allocation, Resource loading, **Cumulative cost** - Value Management.

TOTAL: 45 PERIODS

REFERENCES:

1. Andrew,D., Szilagg, Hand Book of Engineering Management, 1982.

2. James.A., Adrain, Quantitative Methods in Construction Management, American Elsevier Publishing Co., Inc., 1973.
3. Harvey, A., Levine, Project Management using Micro Computers, Osborne- McGraw Hill C.A.Publishing Co., Inc. 1988.
4. Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1980.

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|---|---|--|---|---|----------|----------|----------|----------|
| MCM 062 | | PROJECT SAFETY MANAGEMENT | | | L | T | P | C |
| | | Total Contact Hours: 45 | 3 | 0 | 0 | 3 | | |
| | | Prerequisite: Building construction | | | | | | |
| | | Course Designed by : Department of civil | | | | | | |
| OBJECTIVES : To study and understand the various safety concepts and requirements applied to construction projects and to study the nature of construction accidents, safety programmes, contractual obligations, and design for safety. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the nature of construction accidents and their causes. | | | | | | | |
| CO2 | Understand the Elements of an Effective Safety Programme. | | | | | | | |
| CO3 | Know the Safety in Construction Contracts, Substance Abuse and Safety Record keeping. | | | | | | | |
| CO4 | Know the Safety Culture and Project Coordination and Safety Procedures. | | | | | | | |
| CO5 | Understand other concepts regarding safety sampling and audit. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | M | H | | L | | | |
| | CO2 | | M | | | L | | |
| | CO3 | M | H | | L | | | |
| | CO4 | | M | | | L | | |
| | CO5 | M | H | | L | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-CONSTRUCTION ACCIDENTS

10

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

UNIT II-SAFETY PROGRAMMES

10

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

UNIT III-CONTRACTUAL OBLIGATIONS

5

Safety in Construction Contracts – Substance Abuse – Safety Record Keeping

UNIT IV-DESIGNING FOR SAFETY

10

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

UNIT V-SAFETY SAMPLING AND AUDIT

10

Safety sampling- safety audit - Components of safety audit – review of inspection critical incident technique- safety records, formats – implementation of a u d i t i n d i c a t i o n c h e c k l i s t – identification of unsafe acts of workers and unsafe conditions safety equipment - planning and site preparation- safety system of storing construction materials.

TOTAL: 45 PERIODS

REFERENCES:

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

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|--|---|---|------------------------|----------------------------|--------------------|---|----------|----------|----------|
| MCM 063 | | MANAGEMENT INFORMATION SYSTEM | | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Management concepts for civil engineers | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To study the various models of management information systems and their application to project management. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Know the exposure to information systems in a formal manner. | | | | | | | | |
| CO2 | Understand the development of information systems. | | | | | | | | |
| CO3 | Know the means of applying information systems models to project management. | | | | | | | | |
| CO4 | Know to assess the value and risk of Information System. | | | | | | | | |
| CO5 | Understand other concepts regarding system audit and its associated features. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | H | | | | L | | | |
| | CO2 | H | M | | L | | | | |
| | CO3 | | L | | | | | | |
| | CO4 | L | | | | M | | | |
| | CO5 | M | L | | L | | | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) | | | |
| | | | | | √ | | | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | | | | |

UNIT I-INTRODUCTION **7**
 Information Systems - Establishing the Framework - Business Models – Information System Architecture - Evolution of Information Systems.

UNIT II-SYSTEM DEVELOPMENT **8**
 Modern Information System - System Development Life Cycle - Structured Methodologies - Designing Computer Based Methods, Procedures, Control - Designing Structured Programs.

UNIT III-INFORMATION SYSTEMS **10**
 Integrated Construction Management Information System - Project Management Information System - Functional Areas, Finance, Marketing, Production, Personnel - Levels, DSS, EIS, and ES - Comparison, Concepts and Knowledge Representation - Managing International Information System.

UNIT IV-IMPLEMENTATION AND CONTROL **10**
 Control - Testing Security - Coding Techniques - Defection of Error - Validating - Cost Benefit Analysis - Assessing the value and risk of Information System.

UNIT V-SYSTEM AUDIT **10**
 Software Engineering qualities - Design, Production, Service, Software specification, Software Metrics, Software quality assurance - Systems Methodology - Objectives - Time and Logic, Knowledge and Human Dimension - Software life cycle models - Verification and Validation.

TOTAL: 45 PERIODS

REFERENCES:

1. Kenneth C Laudon and Jane Price Laudon, Management Information Systems - Organisation and Technology, Prentice Hall, 1996.
2. Gordon B. Davis, Management Information System: Conceptual Foundations, Structure and Development, McGraw Hill, 1974.
3. Joyce J Elam, Case series for Management Information Systems , Simon and Schuster, Custom Publishing, 1996.
4. Ralph H Sprague and Huge J Watson, Decision Support for Managers, Prentice Hall, 1996.
5. Michael W. Evans and John J Marciniak, Software Quality assurance and Management, John Wiley and Sons, 1987.
6. Card and Glass, Measuring Software Design quality , Prentice Hall, 1990.

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|----------------|--|----------|----------|----------|----------|
| MCM 064 | ENERGY-EFFICIENT BUILDINGS | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Environmental studies | | | | |
| | Course Designed by : Department of civil | | | | |

| | | | | | | |
|--|--|---|------------------------|----------------------------|--------------------|---|
| OBJECTIVES : To study the design of energy efficient buildings which balances all aspects of energy, lighting, space conditioning and ventilation by providing a mix of passive solar design strategies and to learn the use of materials with low embodied energy. | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | |
| CO1 | Know the energy requirement of the building construction. | | | | | |
| CO2 | Understand the key design principles for energy efficient buildings | | | | | |
| CO3 | Know the concepts of day lighting and components of daylight factor. | | | | | |
| CO4 | Know the Heat transmission, heat control and ventilation. | | | | | |
| CO5 | Know about the Energy efficient buildings for various zones. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | L | M | | L | |
| | CO2 | | M | | L | H |
| | CO3 | M | | | M | M |
| | CO4 | | L | | L | |
| | CO5 | M | M | | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-INTRODUCTION

9

Energy required for building construction - Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Green house Effect – Psychrometry Chart – Measuring latent and sensible heat. Thermal Comfort – Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Protection – Types of Shading Devices – Conservation – Heating and Cooling loads.

UNIT II-PASSIVE SOLAR HEATING AND COOLING

9

General Principles of passive Solar Heating – Key Design Elements -Direct gain – Trombe Walls, Water Walls, Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Predicting ventilation in buildings – window ventilation calculations -Radiation – Evaporation and dehumidification – Mass Effect – Load Control – Air Filtration and odor removal – Heat Recovery in large buildings.

UNIT III-DAY LIGHTING AND ELECTRICAL LIGHTING 9

Materials, components and details -Insulation – Optical materials – Radiant Barriers – Glazing materials -Daylighting – Sources and concepts – Building Design Strategies – Case Studies – Electric Lighting –Light Distribution – Electric Lighting control for daylighted buildings – Illumination requirement – Components of Daylight factor – Recommended Daylight factors – Daylighting analysis – Supplementary Artificial Lighting Design.

UNIT IV-HEAT CONTROL AND VENTILATION 9

Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings Influence of Design Parameters – Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation – Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation.

UNIT V-DESIGN FOR CLIMATIC ZONES 9

Energy efficiency – an overview of design concepts and architectural interventions – Energy efficient buildings for various zones – cold and cloudy – cold and sunny – composite – hot and dry – moderate – warm and humid – case studies of residences, office buildings and other buildings in each zones – Energy Audit – Certification.

TOTAL: 45 PERIODS

REFERENCES:

1. Moore, F., Environmental Control System, McGraw Hill Inc. 2002
2. Brown, G.Z. and DeKay, M., Sun, Wind and Light – Architectural Design Strategies, John Wiley and Sons Inc, 2001
3. Chilogioji, M.H., and Oura, E.N., Energy Conservation in Commercial and Residential Buildings -Marcel Dekker Inc., New York and Basel, 1995.
4. Cook, J., Award-winning Passive Solar Designs, McGraw Hill Book Company, 1984
5. Dubin, F.S. and Long, C.G., Energy Conservation Standards – For Building Design, Construction and Operation - McGraw Hill Book Company 1990.
6. Majumdar, M. (Ed), Energy – efficient Buildings in India, Tata Energy Research Institute, Ministry of Non Conventional Energy Sources, 2002.
7. Tyagi, A. K.(Ed), Handbook on energy audits and management Tata Energy Research Institute, 2000.

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|----------------|---|----------|----------|----------|----------|
| MCM 065 | MAINTENANCE AND REHABILITATION OF STRUCTURES | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Construction Technology | | | | |

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|---|---|---|------------------------|----------------------------|--------------------|---|
| | | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To study the damages, repair and rehabilitation of structures. | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | |
| CO1 | Know about maintenance and repair strategies. | | | | | |
| CO2 | Know about serviceability and durability of concrete. | | | | | |
| CO3 | Know the materials and techniques for repair. | | | | | |
| CO4 | Know the stabilization techniques for repair. | | | | | |
| CO5 | Understand the engineered demolition techniques for structures. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | M | | | L | L |
| | CO2 | M | | | L | L |
| | CO3 | M | | | | L |
| | CO4 | M | | | L | L |
| | CO5 | M | | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-MAINTENANCE AND REPAIR STRATEGIES

8

Maintenance, repair and rehabilitation, **Facets of Maintenance**, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.

UNIT II-SERVICEABILITY AND DURABILITY OF CONCRETE

8

Quality assurance for concrete construction **concrete properties - strength**, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking.

UNIT III-MATERIALS AND TECHNIQUES FOR REPAIR**15**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection.

UNIT IV-REPAIRS TO STRUCTURES**10**

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

UNIT V-DEMOLITION OF STRUCTURES**4**

Engineered demolition techniques for structures - case studies.

TOTAL: 45 PERIODS**REFERENCES:**

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

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|---|---|----------|----------|----------|----------|
| MCM 066 | CONDITION ASSESSMENT AND EVALUATION | L | T | P | C |
| | ENGINEERING | | | | |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Repair and rehabilitation of structures | | | | |
| Course Designed by : Department of civil | | | | | |
| OBJECTIVES : To bring about an understanding of use of methods, techniques and equipments for condition assessment and evaluation engineering. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |
| CO1 | Know the Procedure for the condition assessment of concrete structures. | | | | |
| CO2 | Understand the working of NDT equipments. | | | | |
| CO3 | Know the electro-chemical methods performed. | | | | |

| | | | | | | |
|---|--|---|------------------------|----------------------------|--------------------|---|
| CO4 | Know the chemical analysis for cement content. | | | | | |
| CO5 | Understand other concepts regarding performance and integrity tests. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | M | L | | L | |
| | CO2 | | M | | | |
| | CO3 | | M | | L | |
| | CO4 | | M | | M | |
| | CO5 | | M | | | L |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | | √ | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-CONDITION ASSESSMENT

9

Introduction – Procedure for the condition assessment of concrete structures – walk over Survey –collation information – Establishment of in-service conditions – field visits – inspection – sampling – structural capacity –load testing – condition assessment of structures and health monitoring.

UNIT II-NON-DESTRUCTIVE TESTING

9

Strength Tests - Rebound Hammer – Ultrasonic Pulse Velocity Measurement – Pull-out test – Pull-off test – Break-off test –Windsor Probe test –Core cutting.

UNIT III-ELECTRO-CHEMICAL METHODS

9

Half-Cell Potential measurements - Resistivity – Permeability – Cover survey –tests for rebar corrosion assessment – Abrasion resistance test.

UNIT IV-CHEMICAL ANALYSIS

9

Chemical analysis for cement content and type – Depth of carbonation –original water content – Chloride content –Sulphate content.

UNIT V-PERFORMANCE AND INTEGRITY TESTS**9**

Radiography – Radar – Resonant Frequency method-Acoustic Emission –Impact echo method – Dynamic Response.

TOTAL: 45 PERIODS**REFERENCES:**

1. Basheer, P. A. M., Proceedings of a Special Technical Session on —Near-surface Testing for Strength and Durability of Concrete, Fifth CANMET/ACI International Conference on Durability of Concrete, Barcelona, Spain, 4-9 June 2000.
2. R.Holland., Appraisal & Repair of Reinforced Concrete, Thomas Telford
3. Michael Stratton, Structure and Style, E& FN Spon.
4. Recommendations for inspection, maintenance and management of Car Park structure- Institution of Civil Engineers – 2202, Typeset by Gray Publishers, Thomas Telford James Douglas, Building Adaptation, Elsevier.
5. Neville, A.M., Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.

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|---|---|---|---|---|----------|----------|----------|----------|
| MCM 067 | PREFABRICATION AND CONSTRUCTION | | | | L | T | P | C |
| | TECHNIQUES | | | | | | | |
| | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | Prerequisite: Pre stressed concrete structures | | | | | | | |
| Course Designed by : Department of civil | | | | | | | | |
| OBJECTIVES : To bring about an understanding of the prefabrication and construction techniques adopted. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the standardization and tolerances-system for prefabrication. | | | | | | | |
| CO2 | Understand the Pre-casting and handling techniques. | | | | | | | |
| CO3 | Know the Curing techniques including accelerated curing. | | | | | | | |
| CO4 | Know the Pre-cast and pre-fabricating technology for low cost and mass housing schemes. | | | | | | | |
| CO5 | Understand the Repairs and economical aspects on prefabrication. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | | L | | M | | | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| | CO2 | M | L | | L | L |
| | CO3 | | M | | | |
| | CO4 | M | M | | | L |
| | CO5 | M | | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-INTRODUCTION

9

Materials - Modular co-ordination, standardization and tolerances-system for prefabrication. Pre-cast concrete manufacturing techniques, Moulds –construction design, maintenance and repair.

UNIT II-PREFABRICATED TECHNIQUES

9

Pre-casting techniques - Planning, analysis and design considerations - Handling techniques - Transportation Storage and erection of structures.

UNIT III-JOINTS IN STRUCTURAL MEMBERS

9

Joints -Curing techniques including accelerated curing such as steam curing, hot air blowing etc., -Test on precast elements - skeletal and large panel constructions - Industrial structures.

UNIT IV-APPLICATIONS ON PREFABRICATION

9

Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast products like door frames, shutters, Ferro-cement in housing - Water tank service core unit.

UNIT V-QUALITY CONTROL

9

Quality control - Repairs and economical aspects on prefabrication.

TOTAL: 45 PERIODS

REFERENCES:

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,
2. Konex.T., Handbook of Pre-cast Construction, Vol.1.2&3.
3. Richardson,J.G., Pre-cast concrete Production, Cement and Concrete Association, London, 1973.
4. Madhava Rao.A-G., Modern Trends in Housing in Developing Countries, Oxford & UBH Publishing co., 1985. -
5. Lewicki.B., Building with Large Pre-fabrications, Elsevier Publishers.
6. Large Panel Prefabricated Constructions, Proc. of Advance Course conducted by SERC, Madras.
7. Bruggeling.A.S.G., & Huyghe.G.F., Prefabrication with Concrete, A.s.A., Balkema Publishers, Netherland, 1991.

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|---|--|--|---|---|---|----------|----------|----------|----------|
| MCM 068 | | DESIGN OF INDUSTRIAL STRUCTURES | | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Industrial structures | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To bring about an understanding of the design of Industrial structures and construction techniques for Industrial Structures. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Know the Specific requirements for industries. | | | | | | | | |
| CO2 | Understand the Planning of building work of industrial structures. | | | | | | | | |
| CO3 | Know the use of modern hoisting and other construction equipments. | | | | | | | | |
| CO4 | Know the working of lifts, cranes, continuous conveyors. | | | | | | | | |
| CO5 | Understand the Functional requirements of industrial structures. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | L | M | | L | | | | |
| | CO2 | | H | | M | | | | |
| | CO3 | M | | | | L | | | |
| | CO4 | L | M | | L | | | | |
| | CO5 | M | | | L | | | | |

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|---|----------|---|------------------------|----------------------------|--------------------|--|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper/ Seminar/ Internship (PR) |
| | | | | | √ | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-GENERAL SPECIFICATIONS

9

Specific requirements for industries, like textile, sugar, cement, chemical etc., site layout and external facilities.

UNIT II-POWER PLANT STRUCTURES

9

Planning of building work-standards-structural materials including plastics, polymers, fibre glass, pressed cardboards, etc., multi-storey buildings; steel skeletal structures, reinforced concrete frames; workshops; ware houses; single storey buildings; sheds in steel and reinforced concrete; north lights; single span spherical and other special constructions; cooling towers and chimneys; bunkers and silos; prefabrication; construction.

UNIT III-FOUNDATION

9

Construction Techniques-Expansion joints-machine foundations; water proofing; roofs and roofing; roof drainage; floors and flooring joists; curtain walling; outer wall facing; sound and shock proof mountings; use of modern hoisting and other construction equipments.

UNIT IV-INDUSTRIAL BUILDINGS

9

Circulation, communication and transport; fixed points (central cores); stair cases; grid floor sections; lifts; cranes; continuous conveyors; mobile cranes; transporters; doors; sliding gates

UNIT V-PLANNING AND FUNCTIONAL REQUIREMENTS

9

Functional requirements- Lighting: natural lighting; protection from the sun-sky lights; window cleaning installations. Services: layout; wiring; fixtures, cable and pipe bridges; electrical installations; lighting substation; effluent. Ventilation and fire protection: ventilation; air conditioning; fire escapes and chutes; fire alarms; extinguishers and hydrants.

TOTAL: 45 PERIODS

REFERENCES

1. Dunham, C.W ,Planning of industrial structures-Mc Graw Hill book Co. 1948.
2. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2008.

3. Dayaratnam, P, Design of Steel Structures- Chand & Co, New Delhi, 2008.
4. SP32-1986, Handbook on Functional requirements of industrial buildings, BIS, New Delhi

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|---|--|---|---|---|----------|----------|----------|----------|
| MCM 069 | GIS IN CONSTRUCTION ENGINEERING AND MANAGEMENT | | | | L | T | P | C |
| | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | Prerequisite: Geographic and information system | | | | | | | |
| | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To introduce the elements of GIS as applied to construction management and achieve awareness on application techniques. | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | |
| CO1 | Know the characteristics of map and map projections. | | | | | | | |
| CO2 | Understand the the various types of data, data analysis methods and data quality requirements. | | | | | | | |
| CO3 | Know the concepts of raster and vector data structure and applications of DEM. | | | | | | | |
| CO4 | Know the Measurement, Buffering, Overlaying and Components of data quality. | | | | | | | |
| CO5 | Understand means of getting suitable data output and to use the data output for construction management using GIS tools. | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | |
| 2 | CO1 | M | | | L | | | |
| | CO2 | M | L | | | | | |
| | CO3 | M | | | L | L | | |
| | CO4 | M | | | L | L | | |
| | CO5 | M | H | | | | M | |

| | | | | | | |
|---|----------|---|------------------------|----------------------------|--------------------|---|
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | | √ | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-INTRODUCTION TO GIS

9

GIS - Definition - Components of GIS -Maps - Definition - Types of Maps - Characteristics of Maps - Map Projections -- Hardware, Software and Organizational Context - GIS software

UNIT II-TYPES OF DATA

9

Data Types - Spatial and Non-Spatial - Spatial Data - Points, Lines and areas- Non-spatial data - Nominal, Ordinal, Interval and Ratio - Digitizer - Scanner - Editing and Cleaning - Geo reference data

UNIT III-DATA STRUCTURE

9

Raster and Vector Data Structure - Raster data storage - Run length, Chain and Block Coding - Vector Data Storage - Topology - Topological Models - Arc Node Structure - Surface Data - DEM - Grid DEM and TIN structure- Applications of DEM

UNIT IV-DATA QUALITY

9

Reclassification - Measurement - Buffering - Overlaying - SQL for Queries - Neighbourhood and zonal operations - Data Quality - Components of data quality - Sources of errors in GIS - Meta data

UNIT V-DIFFERENT TYPES OF OUTPUT

9

Output - Maps, Graphs, Charts, Plots , Reports - Printers - Plotters - Fields of application - Natural Resource Management, construction management-Parcel based, AM/FM applications examples - Case study

TOTAL: 45 PERIODS

REFERENCES

1. Burrough P.A., Principles of GIS for Land Resources Assessment, Oxford Publication, 1998
2. Robert Laurini and Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press, 1996

3. Anji Reddy, Remote Sensing and Geographical Information Systems , BS Publications 2001
4. Srinivas M.G. (Edited by), Remote Sensing Applications, Narosa Publishing House, 2001
5. Rhind, D., Understanding of GIS, The ARC / INFO Method, ESRI Press. 1990

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|---|--|--|------------------------|----------------------------|--------------------|---|----------|----------|----------|
| MCM 070 | | INFRASTRUCTURE DEVELOPMENT | | | | L | T | P | C |
| | | Total Contact Hours: 45 | | | | 3 | 0 | 0 | 3 |
| | | Prerequisite: Building Construction | | | | | | | |
| | | Course Designed by : Department of civil | | | | | | | |
| OBJECTIVES : To bring about an understanding of the infrastructure development, status of infrastructure in India and the agencies associated with it. | | | | | | | | | |
| COURSE OUTCOMES (COs) | | | | | | | | | |
| CO1 | Know the Role of infrastructure development in employment generation. | | | | | | | | |
| CO2 | Know the Agencies associated with infrastructure development in India. | | | | | | | | |
| CO3 | Know the status of Infrastructure in India. | | | | | | | | |
| CO4 | Know the issues related to infrastructure development. | | | | | | | | |
| CO5 | Understand the funding and managing of infrastructure projects. | | | | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | | | | |
| 1 | COs/Pos | a | b | c | d | e | | | |
| 2 | CO1 | M | | | | L | | | |
| | CO2 | | L | | M | L | | | |
| | CO3 | | | | M | L | | | |
| | CO4 | | | | H | L | | | |
| | CO5 | | | | M | L | | | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) | | | |
| | | | | ✓ | | | | | |

| | | |
|---|----------|---|
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 |
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UNIT I-INTRODUCTION 9

Construction Industry – Nature, characteristics, size and structure - Role of infrastructure development in employment generation and improving of the National economy. Agencies associated with infrastructure development in India as regards various sectors.

UNIT II-SECTOR MANAGEMENT 9

Agencies associated with infrastructure development in India as regards various sectors.

UNIT III-INFRASTRUCTURE PLANNING 9

Status of Infrastructure in India- Indian government policy, Roads and buildings, communication, water supply, irrigation, power energy sectors, ports and aviation, health and educational services, rural development.

UNIT IV-PUBLIC AND PRIVATE SECTOR PARTNERSHIP 9

Issues related to infrastructure development – pre – requisites necessary to ensure success for switching over from public sector management to private sector management, issues in development.

UNIT V-FINANCING INFRASTRUCTURE PROJECTS 9

Funding and managing infrastructure projects, role, responsibility of project management consultants.

TOTAL: 45 PERIODS

REFERENCES

1. India Infrastructure Report – Rakesh Mohan
2. Infrastructure Today - Magazine
3. Document of five year plans, published by Govt. of India.

| | | | | | |
|--|--|----------|----------|----------|----------|
| MCM 071 | BUILDING SERVICES | L | T | P | C |
| | Total Contact Hours: 45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Building Construction | | | | |
| | Course Designed by : Department of civil | | | | |
| OBJECTIVES : To study the elements of building services like water supply sanitation, electrical installations air conditioning, and fire safety. | | | | | |
| COURSE OUTCOMES (COs) | | | | | |

| | | | | | | |
|---|--|---|------------------------|----------------------------|--------------------|---|
| CO1 | Know the components of water supply and sanitation arrangements in a building. | | | | | |
| CO2 | Understand the the rudiments of electrical installations in a building. | | | | | |
| CO3 | Know the ventilation and design principles of lifts and staircases for vertical mobility inside buildings. | | | | | |
| CO4 | Know the safety regulations to be adopted in the building. | | | | | |
| CO5 | Know the concepts of intelligent building. | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | L | M | | | |
| | CO2 | | H | | | L |
| | CO3 | L | H | | | |
| | CO4 | | | | H | M |
| | CO5 | H | | | L | |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | √ | | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-WATER SUPPLY SYSTEMS

9

Plumbing system for buildings-internal water supply in buildings-relevant municipal bye laws and regulations - **Rain Water Harvesting** -Sanitation in buildings-arrangement of sewerage systems in housing – pipe systems- storm water drainage from buildings -septic tank – principles of collection, conveyance and disposal of town refuse.

UNIT II-WIRING SYSTEMS

9

Types of wires , wiring systems and their choice –**planning electrical wiring for building** –main and distribution boards –transformers and switch gears –modern theory of light and colour – synthesis of light –luminous flux –candela- laws of illumination-lighting design-design for modern lighting.

UNIT III-VENTILATION AND VERTICAL MOBILITY**9**

Ventilation and its importance-natural and artificial systems-Window type and packaged air-conditioners-chilled water plant –fan coil systems-water piping –cooling load –air conditioning systems for different types of buildings –design principles of lifts and staircases for vertical mobility inside buildings.

UNIT IV-SAFETY REGULATIONS**9**

Causes of fire in buildings-safety regulations-NBC-planning considerations in buildings like Non-combustible materials, construction, staircases and electrical wiring and A.C. systems, special features required for physically handicapped and elderly in building types-heat and smoke detectors-dry and wet risers-Automatic sprinklers.

UNIT V-INTELLIGENT BUILDINGS**9**

Intelligent buildings-Building automation-Smart buildings- Building services in high rise buildings-Green buildings-Energy efficient buildings for various zones-Case studies of residence, office buildings and other buildings in each zones.

TOTAL: 45 PERIODS**REFERANCES**

1. G.M. Fair, J. C. Geyer and D. Okun, “Water and waste Engineering“, Vol.II, John Wiley &sons, Inc., New York. 2008.
2. R. G. Hopkinson and J. D. Kay, “The Lighting of buildings”, Faber and Faber, London, 2009.
3. “Hand book for Building Engineers in Metric systems”, NBC, NewDelhi, 2008..
4. “Philips Lighting in Architecture Designs”,McGraw Hill, New York,2004.
5. “Time saver Standards for Architecture Design Data”, CallendarJH,McGraw Hill, 2004.
6. William H. Severns and Julian R. Fellows, “Air conditioning and refrigeration”, John Wily and sons, London,2008.
7. E.C. Butcher and A.C. Parnell, Designing for Fire Safety, John Wiley and Sons, 1993.

| | | RESEARCH METHODOLOGY | | | |
|---|--|-----------------------------|----------|----------|----------|
| | | L | T | P | C |
| MCM 072 | Total Contact Hours:45 | 3 | 0 | 0 | 3 |
| | Prerequisite: Professional Courses | | | | |
| | Course Designed by : Department of Civil Engineering | | | | |
| | OBJECTIVES | | | | |
| <ul style="list-style-type: none"> • To Get adequate knowledge about research concepts • To describe mathematical modeling and simulation • To understand experimental modeling • To get knowledge about the interpretation of result | | | | | |
| COURSE OUTCOMES (COs) | | | | | |
| CO1 | To describe research concepts. | | | | |

| | | | | | | |
|---|---|---|------------------------|----------------------------|--------------------|---|
| | | | | | | |
| CO2 | To Get adequate knowledge about mathematical modeling | | | | | |
| CO3 | To describe experimental modeling | | | | | |
| CO4 | To understand analysis of results | | | | | |
| CO5 | To know about report writing | | | | | |
| Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low | | | | | | |
| 1 | COs/Pos | a | b | c | d | e |
| 2 | CO1 | H | M | L | M | M |
| | CO2 | H | M | L | M | M |
| | CO3 | H | M | | M | M |
| | CO4 | H | M | L | M | M |
| | CO5 | H | M | | M | M |
| 3 | Category | Professional Mathematics (PM) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project/ Term Paper Seminar/ Internship (PR) |
| | | | | | √ | |
| 4 | Approval | 37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016 | | | | |

UNIT I-RESEARCH CONCEPTS

9

Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, Applied & Experimental).

Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, Hypothetical proposals for future development and testing, selection of Research task.

UNIT II-MATHEMATICAL MODELING AND SIMULATION

9

Concepts of modeling, Classification of Mathematical Models, Modeling with Ordinary differential Equations, Difference Equations, Partial Differential equations, Graphs, Simulation, Process of formulation of Model based on Simulation.

UNIT III-EXPERIMENTAL MODELING

9

Definition of Experimental Design, Examples, and Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.

UNIT IV-ANALYSIS OF RESULT

9

Parametric and Non-parametric, descriptive and Inferential data, types of data, collection of data (normal distribution, calculation of correlation coefficient), processing, analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity and non-linearity of model.

UNIT V-REPORT WRITING

9

Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Wilkinson K. L, Bhandarkar P. L, „Formulation of Hypothesis“, Himalaya Publication.
2. Schank Fr.,”Theories of Engineering Experiments“, Tata Mc Graw Hill Publication.

REFERENCE BOOKS

1. Douglas Montgomery, “Design of Experiments“, Statistical Consulting Services, 1990.
2. Douglas H. W. Allan, “Statistical Quality Control: An Introduction for Management“, Reinhold Pub Corp, 1959.
3. Cochran and Cocks, „Experimental Design“, John Willy & Sons.
4. John W. Besr and James V. Kahn, „Research in Education“, PHI Publication.
5. Adler and Granovky, “Optimization of Engineering Experiments“, Meer Publication.
6. S. S. Rao, „Optimization Theory and Application“, Wiley Eastern Ltd., New Delhi, 1996.