# AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR

# &

# VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

**(Constituent Colleges of Vinayaka Mission's Research Foundation Deemed to be University)**

**AICTE APPROVED & NAAC Accredited**

VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

## Faculty of Engineering and Technology

## Department of Civil Engineering Programme:

## M.E – Construction Engineering and Management

## CHOICE BASED CREDIT SYSTEM (CBCS)

## Curriculum & Syllabus (Semester I to IV)

## Regulations 2021

# AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR
# &
# VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

## Department of Civil Engineering

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

| | |
|---|---|
| **PEO 1** | Graduates will perform as professional engineers in the field of Construction Engineering and Management. |
| **PEO 2** | Graduates will perform well in their specialized field and also trained in teamwork and leadership positions. |
| **PEO 3** | Graduates will pursue lifelong learning in the specialized fields of Construction Engineering and Management. |
| **PEO 4** | Graduates will exhibit entrepreneurship qualities. |
| **PEO 5** | Graduates will contribute to the development of the profession, nation andsociety |

### PROGRAM SPECIFIC OUTCOMES (PSOs)

To achieve the mission of the program, Civil Engineering graduates will be able:

| | |
|---|---|
| **PSO 1** | To work independently as well as in team to formulate, design, execute solutions for engineering problems and also analyze, synthesize technical data for application to product, process, system design & development |
| **PSO 2** | To understand & contribute towards social, environmental issues, following professional ethics and codes of conduct and embrace lifelong learning for continuous improvement |
| **PSO 3** | To develop expertise towards use of modern engineering tools, careers in industries and research and demonstrate entrepreneurial skill |

# PROGRAMME OUTCOMES

Engineering Graduates will be able to:

| | |
|---|---|
| **PO 1** | **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems |
| **PO 2** | **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **PO 3** | **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **PO 4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **PO 5** | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **PO 6** | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **PO 7** | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| **PO 8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **PO 9** | **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **PO 10** | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **PO 11** | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **PO12** | **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**VINAYAKA MISSIONS RESEARCH FOUNDATIONS**
**FACULTY OF ENGINEERING AND TECHNOLOGY**

**CREDIT STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM**
**(M.E / M.TECH –REGULAR) -2021**

| S.No | Category of courses | Type of courses | Suggested break up of credits |
|---|---|---|---|
| **1.** | A. Foundation courses | Statistical Methods and Queuing Theory | 3 |
| | | Research Methodology and IPR | 2 |
| **2.** | B. Program core courses | Core courses | 32 |
| **3.** | C. Elective courses | Program electives | 15 |
| | | Open electives (Courses on emerging areas) | 03 |
| **4.** | D. Employability Enhancement Courses and courses for presentation of Technical skills related to the specialization | Project work phase I | 6 |
| | | Project work phase II | 12 |
| | | Internship | 1 |
| | | Technical Seminar | 1 |
| **5.** | E. Audit courses | Any two courses on:<br>1. English for Research Paper Writing<br>2. Value Education<br>3. Constitution of India<br>4. Pedagogy Studies<br>5. Personality development through life enlighten skills | Zero credit |
| **Total credits to be earned for the award of M.E /M.Tech degree** | | | **75** |

**CREDIT STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM (M.E / M.TECH – REGULAR) -2021**

| S.No | Category of courses | Type of courses | Suggested break up of credits | Course Title |
|---|---|---|---|---|
| **1.** | A.Foundation courses | Mathematics/Applied Mathematics | 3 | Statistical Methods and QueuingTheory |
| | | Research Methodology and IPR | 2 | Research Methodology and IPR |
| **2.** | B.Program core courses | Core courses | 32 | 1. Construction Materials and ConcreteDesign<br>2. Project Formulation and Appraisal<br>3. Construction Planning, Schedulingand Control<br>4. Computer Applications in Construction Engineering andPlanning<br>5. Advanced Concrete Technology<br>6. Modernistic approaches inconstruction<br>7. Automation in ConstructionManagement<br>8. Advanced Project Management Concepts<br>9. Quality and safety in construction<br>10. Quantitative Techniques inConstruction Management<br>11. Quality Control and Assurance in Construction |
| **3.** | C.Elective courses | Program electives | 15 | 1. Contract Laws and Regulations<br>2. System Integration in Construction<br>3. Energy efficient buildings<br>4. Construction economics and FinancialManagement<br>5. Construction Personnel Management<br>6. Business Economics and FinanceManagement<br>7. Resource Management and Control inConstruction<br>8. Project Safety Management<br>9. Maintenance and Rehabilitation ofStructures |
| | | Open electives (Courses on emerging areas.) | 03 | 1.Management Information System 2.Waste to Energy<br>3. Biomedical Product Design and Development<br>4.Advanced Cyber Security<br>5. Bio Mems<br>6. Solar and Energy Storage Systems<br>7.Operations Research<br>8. Metal Additive Manufacturing |
| 4. | D.Employability Enhance Courses and courses for presentation of Technical skills related to the specialization ment | Project work phase I | 6 | |
| | | Project work phase II | 12 | |
| | | Internship | 1 | |
| | | Technical Seminar | 1 | |

| | | | | |
|---|---|---|---|---|
| 5. | E.Audit courses | Any two courses on:<br>1. English for Research Paper Writing<br>2. Value Education<br>3. Constitution of India<br>4. Pedagogy Studies<br>5. Personality Development Through Life Enlighten Skills | Zero credit | |
| **Total credits to be earned for the award of M.E /M.Tech degree** | | | **75** | |

| A. Foundation Courses - Credits (5) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | STATISTICAL METHODS AND QUEUINGTHEORY | MATH | FC-BS | 3 | 0 | 0 | 3 | NIL |
| 2. | | RESEARCH METHODOLOGY AND IPR | CIVIL | FC-HS | 2 | 0 | 0 | 2 | NIL |

| B. Program core courses – Credits 32 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | CONSTRUCTION MATERIALS AND CONCRETE DESIGN | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 2. | | PROJECT FORMULATION AND APPRAISAL | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 3. | | CONSTRUCTION PLANNING, SCHEDULING AND CONTROL | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 4. | | COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING | CIVIL | CC | 0 | 0 | 4 | 2 | NIL |
| 5. | | ADVANCED CONCRETE TECHNOLOGY | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 6. | | MODERNISTIC APPROACHES IN CONSTRUCTION | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 7. | | AUTOMATION IN CONSTRUCTION MANAGEMENT | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |
| 8. | | ADVANCED PROJECT MANAGEMENT CONCEPTS | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 9. | | QUALITY AND SAFETY IN CONSTRUCTION | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |
| 10. | | QUANTITATIVE TECHNIQUES IN CONSTRUCTION MANAGEMENT | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |
| 11. | | QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |

| Elective courses | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Program electives – Credits 15** | | | | | | | | | |
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | CONTRACT LAWS AND REGULATIONS | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 2. | | SYSTEM INTEGRATION IN CONSTRUCTION | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 3. | | ENERGY EFFICIENT BUILDINGS | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 4. | | CONSTRUCTION ECONOMICS AND FINANCIAL MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 5. | | CONSTRUCTION PERSONNEL MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 6. | | BUSINESS ECONOMICS AND FINANCE MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 7. | | RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 8. | | PROJECT SAFETY MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 9. | | MAINTENANCE AND REHABILITATION OF STRUCTURES | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |

| **C. ELECTIVE COURSES (EC) - Open electives (Courses on emerging areas..) – Credits 03** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | METAL ADDITIVE MANUFACTURING | MECH | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 2. | | WASTE TO ENERGY | BTE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 3. | | BIOMEDICAL PRODUCT DESIGN AND DEVELOPMENT | BME | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 4. | | ADVANCED CYBER SECURITY | CSE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 5. | | BIO MEMS | ECE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 6. | | SOLAR AND ENERGY STORAGE SYSTEMS | EEE | OE-EA | 3 | 0 | 0 | 3 | NIL |

**D. Employability Enhancement Courses and courses for presentation of technical skills related to the specialization (Credits - 21)**

| S.No | CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1. | | PROJECT WORK PHASE I | CIVIL | EE-P | 0 | 0 | 12 | 6 | NIL |
| 2. | | PROJECT WORK PHASE II | CIVIL | EE-P | 0 | 0 | 24 | 12 | NIL |
| 3. | | INTERNSHIP | CIVIL | PI-I | 3 weeks Training | | | 1 | NIL |
| 4. | | TECHNICAL SEMINAR | CIVIL | EE-S | 0 | 0 | 2 | 1 | NIL |

**E. Audit courses-Zero Credit**

| S.No | CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1. | | ENGLISH FOR RESEARCH PAPER WRITING | ENG | AC | 0 | 0 | 2 | 0 | NIL |
| 2. | | VALUE EDUCATION | HS | AC | 0 | 0 | 2 | 0 | NIL |
| 3. | | CONSTITUTION OF INDIA | LAW | AC | 0 | 0 | 2 | 0 | NIL |
| 4. | | PEDAGOGY STUDIES | HS | AC | 0 | 0 | 2 | 0 | NIL |
| 5. | | PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEN SKILLS | ENG | AC | 0 | 0 | 2 | 0 | NIL |

## IMPLEMENTATION PLAN
## PROGRAMME STRUCTURE

**Semester I**

| SL. NO | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | | Statistical Methods and Queuing Theory | MATHS | FC | 3 | 0 | 0 | 3 |
| 2. | | Construction Materials and Concrete Design | CIVIL | CC | 3 | 1 | 0 | 4 |
| 3. | | Modernistic approaches in Construction | CIVIL | CC | 3 | 1 | 0 | 4 |
| 4. | | Project Formulation and Appraisal | CIVIL | CC | 3 | 1 | 0 | 4 |
| 5. | | Quantitative Techniques in Construction Management | CIVIL | CC | 3 | 0 | 0 | 3 |
| 6. | | Program Core Elective I | CIVIL | PE | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 7. | | Computer Applications in Construction Engineering and Planning | CIVIL | CC | 0 | 0 | 4 | 2 |

**SEMESTER II**

| SL. NO. | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | | Automation in Construction Management | CIVIL | CC | 3 | 0 | 0 | 3 |
| 2. | | Advanced Project Management concepts | CIVIL | CC | 3 | 1 | 0 | 4 |
| 3. | | Quality and safety in construction | CIVIL | CC | 3 | 0 | 0 | 3 |
| 4. | | Advanced Concrete Technology | CIVIL | CC | 3 | 1 | 0 | 4 |
| 5. | | Program Core Elective II | CIVIL | PE | 3 | 0 | 0 | 3 |
| 6. | | Open Elective | | OE | 3 | 0 | 0 | 3 |
| 7. | | Technical Seminar | CIVIL | PI | 0 | 0 | 2 | 1 |
| 8. | | Audit course I | | AC | 0 | 0 | 0 | 0 |

**SEMESTER III**

| SL. NO. | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | | Program Core Elective III | CIVIL | PE | 3 | 0 | 0 | 3 |
| 2 | | Program Core Elective IV | CIVIL | PE | 3 | 0 | 0 | 3 |
| 3 | | Program Core Elective V | CIVIL | PE | 3 | 0 | 0 | 3 |
| 4 | | Project work phase I | CIVIL | PE | 0 | 0 | 12 | 6 |
| 5 | | Internship | CIVIL | PI | 3 weeks Training | | | 1 |
| 6. | | Audit course II | CIVIL | PE | 0 | 0 | 0 | 0 |

**SEMESTER IV**

| SL. NO. | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | | Project work phase II | CIVIL | PE | 0 | 0 | 24 | 12 |

**TOTAL CREDITS : 75**

| B. Program core courses – Credits 32 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | CONSTRUCTION MATERIALS AND CONCRETE DESIGN | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 2. | | PROJECT FORMULATION AND APPRAISAL | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 3. | | CONSTRUCTION PLANNING, SCHEDULING AND CONTROL | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 4. | | COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING | CIVIL | CC | 0 | 0 | 4 | 2 | NIL |
| 5. | | ADVANCED CONCRETE TECHNOLOGY | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 6. | | MODERNISTIC APPROACHES IN CONSTRUCTION | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 7. | | AUTOMATION IN CONSTRUCTION MANAGEMENT | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |
| 8. | | ADVANCED PROJECT MANAGEMENT CONCEPTS | CIVIL | CC | 3 | 1 | 0 | 4 | NIL |
| 9. | | QUALITY AND SAFETY IN CONSTRUCTION | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |
| 10. | | QUANTITATIVE TECHNIQUES IN CONSTRUCTION MANAGEMENT | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |
| 11. | | QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION | CIVIL | CC | 3 | 0 | 0 | 3 | NIL |

| Elective courses | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Program electives – Credits 15** | | | | | | | | | |
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | CONTRACT LAWS AND REGULATIONS | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 2. | | SYSTEM INTEGRATION IN CONSTRUCTION | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 3. | | ENERGY EFFICIENT BUILDINGS | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 4. | | CONSTRUCTION ECONOMICS AND FINANCIAL MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 5. | | CONSTRUCTION PERSONNEL MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 6. | | BUSINESS ECONOMICS AND FINANCE MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 7. | | RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 8. | | PROJECT SAFETY MANAGEMENT | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |
| 9. | | MAINTENANCE AND REHABILITATION OF STRUCTURES | CIVIL | EC-PS | 3 | 0 | 0 | 3 | NIL |

| **C. ELECTIVE COURSES (EC) - Open electives (Courses on emerging areas..) – Credits 03** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **CODE** | **COURSE** | **OFFERING DEPT.** | **CATEGORY** | **L** | **T** | **P** | **C** | **PREREQUISITE** |
| 1. | | METAL ADDITIVE MANUFACTURING | MECH | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 2. | | WASTE TO ENERGY | BTE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 3. | | BIOMEDICAL PRODUCT DESIGN AND DEVELOPMENT | BME | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 4. | | ADVANCED CYBER SECURITY | CSE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 5. | | BIO MEMS | ECE | OE-EA | 3 | 0 | 0 | 3 | NIL |
| 6. | | SOLAR AND ENERGY STORAGE SYSTEMS | EEE | OE-EA | 3 | 0 | 0 | 3 | NIL |

**D. Employability Enhancement Courses and courses for presentation of technical skills related to the specialization (Credits - 21)**

| S.No | CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1. | | PROJECT WORK PHASE I | CIVIL | EE-P | 0 | 0 | 12 | 6 | NIL |
| 2. | | PROJECT WORK PHASE II | CIVIL | EE-P | 0 | 0 | 24 | 12 | NIL |
| 3. | | INTERNSHIP | CIVIL | PI-I | 3 weeks Training | | | 1 | NIL |
| 4. | | TECHNICAL SEMINAR | CIVIL | EE-S | 0 | 0 | 2 | 1 | NIL |

**E. Audit courses-Zero Credit**

| S.No | CODE | COURSE | OFFERING DEPT. | CATEGORY | L | T | P | C | PREREQUISITE |
|---|---|---|---|---|---|---|---|---|---|
| 1. | | ENGLISH FOR RESEARCH PAPER WRITING | ENG | AC | 0 | 0 | 2 | 0 | NIL |
| 2. | | VALUE EDUCATION | HS | AC | 0 | 0 | 2 | 0 | NIL |
| 3. | | CONSTITUTION OF INDIA | LAW | AC | 0 | 0 | 2 | 0 | NIL |
| 4. | | PEDAGOGY STUDIES | HS | AC | 0 | 0 | 2 | 0 | NIL |
| 5. | | PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEN SKILLS | ENG | AC | 0 | 0 | 2 | 0 | NIL |

## IMPLEMENTATION PLAN
## PROGRAMME STRUCTURE

**Semester I**

| SL. NO | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | | Statistical Methods and Queuing Theory | MATHS | FC | 3 | 0 | 0 | 3 |
| 2. | | Construction Materials and Concrete Design | CIVIL | CC | 3 | 1 | 0 | 4 |
| 3. | | Modernistic approaches in Construction | CIVIL | CC | 3 | 1 | 0 | 4 |
| 4. | | Project Formulation and Appraisal | CIVIL | CC | 3 | 1 | 0 | 4 |
| 5. | | Quantitative Techniques in Construction Management | CIVIL | CC | 3 | 0 | 0 | 3 |
| 6. | | Program Core Elective I | CIVIL | PE | 3 | 0 | 0 | 3 |
| **PRACTICAL** | | | | | | | | |
| 7. | | Computer Applications in Construction Engineering and Planning | CIVIL | CC | 0 | 0 | 4 | 2 |

**SEMESTER II**

| SL. NO. | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1. | | Automation in Construction Management | CIVIL | CC | 3 | 0 | 0 | 3 |
| 2. | | Advanced Project Management concepts | CIVIL | CC | 3 | 1 | 0 | 4 |
| 3. | | Quality and safety in construction | CIVIL | CC | 3 | 0 | 0 | 3 |
| 4. | | Advanced Concrete Technology | CIVIL | CC | 3 | 1 | 0 | 4 |
| 5. | | Program Core Elective II | CIVIL | PE | 3 | 0 | 0 | 3 |
| 6. | | Open Elective | | OE | 3 | 0 | 0 | 3 |
| 7. | | Technical Seminar | CIVIL | PI | 0 | 0 | 2 | 1 |
| 8. | | Audit course I | | AC | 0 | 0 | 0 | 0 |

**SEMESTER III**

| SL. NO. | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| **THEORY** | | | | | | | | |
| 1 | | Program Core Elective III | CIVIL | PE | 3 | 0 | 0 | 3 |
| 2 | | Program Core Elective IV | CIVIL | PE | 3 | 0 | 0 | 3 |
| 3 | | Program Core Elective V | CIVIL | PE | 3 | 0 | 0 | 3 |
| 4 | | Project work phase I | CIVIL | PE | 0 | 0 | 12 | 6 |
| 5 | | Internship | CIVIL | PI | 3 weeks Training | | | 1 |
| 6. | | Audit course II | CIVIL | PE | 0 | 0 | 0 | 0 |

**SEMESTER IV**

| SL. NO. | COURSE CODE | COURSE TITLE | DEPT OFFERING THE COURSE | CATEGORY | L | T | P | C |
|---|---|---|---|---|---|---|---|---|
| 1 | | Project work phase II | CIVIL | PE | 0 | 0 | 24 | 12 |

**TOTAL CREDITS : 75**

# FOUNDATION COURSES

| | STATISTICAL METHODS AND QUEUEING THEORY | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | FC-BS | 3 | 0 | 0 | 3 |

**PREAMBLE**

This course is designed to provide the solid foundation on various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modelling. Queuing theory is the mathematical study of waiting lines and it's a primary tool for studying the problem of congestion.

**PREREQUISITE – Nil**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To get the knowledge on concepts of random variables and distributions with respect to how they are applied to statistical data. |
| 2 | To introduce the concepts of sampling distributions and the test statistics |
| 3 | To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample. |
| 4 | To train the students in design experiments and use these concepts for research |
| 5 | To study queuing models for analyzing the real world systems. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1;** Select an appropriate probability distribution to determine the probability function for solving engineering problem. | Apply |
| **CO2:** Use the appropriate and relevant estimates | Apply |
| **CO3:** Make appropriate decisions using inferential statistical tools that are central to experimental Research | Apply |
| **CO4:** Construct standard experimental designs and describe statistical models Estimated using the data. | Apply |
| **CO5:** Derive and apply main formulas for some properties (such as stationary probabilities, average waiting and system time, expected number of customers in the queue, etc.) M/M/1, M/M/C – finite and infinite capacity queueing system. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | M | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO2 | S | S | M | M | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO3 | S | S | M | M | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO4 | S | S | M | M | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |
| CO5 | S | S | M | M | -- | -- | -- | M | -- | -- | -- | M | -- | -- | -- |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**PROBABILITY AND RANDOM VARIABLES:**

Probability Concepts – Bayes Theorem –Random Variable - Discrete and continuous random variables- Probability mass function – Probability density functions - Moment generating functions and their properties– Standard distributions – Binomial, Poisson, Uniform, Exponential, Normal distribution.

**ESTIMATION THEORY**

Sampling distributions – Estimation of parameters (consistent and unbiased) – Point and interval estimates for population proportions, mean and variance - Maximum likelihood estimate method - Method of moments – Curve fitting by Principle of least squares – Regression Lines.

**TESTING OF HYPOTHESES**

Sampling distributions–Normal distribution – Area properties – Statistical hypothesis – Type I and Type II errors– Testing of hypothesis for mean, variance, and proportions for large and Small Samples (Z, t and F test) – Chi- square Tests for Goodness of fit –Independence of attributes.

**DESIGN OF EXPERIMENTS**

Analysis of variance – One-way and two-way classifications – Latin square design – $2^k$ Factorial Design -Fractional Factorial Design - Response Surface Methods – Central Composite Design

**QUEUEING MODELS**

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

**Text Book:**


1. T.Veerarajan, "Probability and Statistics, Random Processes and Queueing Theory", 4th Edition, Tata McGraw Hill, (2018).
2. Milton J. S and Arnold J.C, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition (2007).
3. Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co (2007)


**REFERENCE:**


4. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2017.
5. Kanti Swarup, P K Gupta, Man Mohan, "Operations Research", Sultan Chand &Sons (2014)


**COURSE DESIGNERS**


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| Course Code | Course Title | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| | Research Methodology and IPR | FC-HS | 2 | 0 | 0 | 2 |

Course Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information.
3. Follow research ethics.
4. Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis, the need of information about Intellectual Property Right to be promoted among students in general & Engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

**UNIT I- RESEARCH PROBLEM AND SCOPE FOR SOLUTION**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**UNIT II- FORMAT**

Effective literature studies approaches, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format ofresearch proposal, a presentation and assessment by a review committee

**UNIT III- PROCESS AND DEVELOPMENT**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, patenting under PCT.

**UNIT IV- PATENT RIGHTS**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**UNIT V- NEW DEVELOPMENTS IN IPR**

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**TEXT BOOKS**

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”Juta Publishers,1996.

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction” , Juta Publishers,2004.

3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

**REFERENCES**

1. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.

2. Mayall, “Industrial Design”, McGraw Hill, 1992.

3. Niebel, “Product Design”, McGraw Hill, 1974.

4. Asimov, “Introduction to Design”, Prentice Hall, 1962.

5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

# PROGRAM CORE COURSES

| | Construction Materials and Concrete Design | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 1 | 0 | 4 |

**PREAMBLE**

This course familiarize about the various and latest construction materials, and methodology of concrete design.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | Criteria for choice of the appropriate material and the various tests for quality control. |
| 2 | Characterization of uses and application of the different construction materials |
| 3 | Detail the manufacturing process of the construction and building materials |
| 4 | Special Materials and advanced technology in construction fabrication units. |
| 5 | Concrete design procedure for desired strength and durability. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1 - Understand the typical and potential applications of basic construction materials | Understand |
| CO2 - Compare the properties of most common and advanced building materials | Understand |
| CO3 - Understand the relation between material properties and structural Form | Understand |
| CO4 - Understand the importance of experimental verification of material properties | Understand |
| CO5 - Design an appropriate concrete as per the requirements of the project | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | - | L | - | L | - | - | - | - | - | - | | | |
| CO2 | S | S | M | L | - | - | - | - | - | - | - | - | | | |
| CO3 | S | M | S | M | - | - | - | - | - | - | - | - | | | |
| CO4 | S | M | S | M | - | L | - | - | - | - | - | - | | | |
| CO5 | S | S | L | L | - | - | - | - | - | - | - | - | | | |

**S- Strong; M-Medium; L-Low**

## SYLLABUS

**UNIT I SPECIAL CONCRETES**

Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

**UNIT II COMPOSITES**

Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers Types of FRP – FRP on different structural elements – Applications of FRP.

**UNIT III OTHER MATERIALS**

Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application.

**UNIT IV SMART AND INTELLIGENT MATERIALS**

Types & Differences between Smart and Intelligent Materials – Special features – Case studies showing the applications of smart & Intelligent Materials.

**UNIT V CONCRETE MIX DESIGN**

Mix Proportioning – Mixes incorporating Fly ash, Silica fume, GGBS – Mixes for High Performance Concrete – High strength concrete – variations in concrete strength.

**BOOKS:**


1. Ashby, M.F. and Jones.D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
2. Gambhir.M.L., Concrete Technology – Tata McGraw Hill Book Co. Ltd.,Delhi, 2004.


**REFERENCES:**


1. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
2. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.



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| | PROJECT FORMULATION AND APPRAISAL | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 1 | 0 | 4 |

**PREAMBLE**

This subject helps the students to understand the complete project formulation, appraisal process from project identification, to project clearance. It also give better exposure to the students in the area of appraisal, finance and PSP process

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

Study and understand the concepts of project formulation

Study the role and methods of project cash flows and project costing.

The students know about International Practice of appraisal.

Expose the student's knowledge of Project Financing.

Acquire the knowledge of Private Sector Participation

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| Have wide knowledge in respect of the projects particularly Project Estimates, Techno-Economic Feasibility Report, Detailed Project Report | Understand |
| Follow the methods of cash flow in the project and also have an idea of the cost of capital | Understand |
| Understand the project appraisal and implement it in every stage on ongoing work and analysis the risk | Apply |
| Know about the requirement and source of finance to carried out the project and financial Institutions | Understand |
| Develop the knowledge in respect of execution of infrastructure development and Scope of Technology Transfer | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | S | **M** | - | - | **S** | **M** | **L** | **M** | **L** | **S** | - | **L** | - | **L** | - |
| CO2 | **L** | **S** | M | - | - | **S** | **M** | **L** | **M** | **L** | **S** | - | **L** | **L** | **L** | - |
| CO3 | **M** | **S** | **M** | **L** | - | **S** | **L** | **M** | **M** | **L** | **S** | - | **L** | **S** | **L** | - |
| CO4 | **M** | **S** | **S** | **L** | - | **M** | **L** | **M** | **S** | **L** | **S** | - | **L** | **M** | **L** | - |
| CO5 | **M** | **S** | **S** | **L** | - | **M** | **L** | **M** | **M** | **L** | **S** | - | **M** | **M** | **L** | |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**PROJECT FORMULATION**: 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

**PROJECT COSTING**- Project Cash Flows – Time Value of Money – Cost of Capital

**PROJECT APPRAISAL** NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice

**PROJECT FINANCING** Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators - Ratios

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

**TEXTBOOKS**

1. Prasanna Chandra, "Project-Planning Analysis Selection Implementation & Review 6 th Edition", Tata Mc Graw Mill Publishing Co., Ltd, Newdelhi 2016.
2.Joy.P.K., Total Quality Project Management – The Indian Context, New Delhi, Macmillan India Ltd.,1992.

**REFERENCES**

1. United Nations Industrial Development Organization (UNIDO) Manual for the Preparation of Industrial feasibility Studies, (IDBI Reproduction) Bombay 1987.
2.Barcus, SW. and Willison., Handbook of Management consulting Services, McGraw Hill, New York,1986.



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| | CONSTRUCTION PLANNING, SCHEDULING AND CONTROL | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 1 | 0 | 4 |

**PREAMBLE**

Gain a thorough understanding of the finer points of construction project planning, scheduling, and control

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To familiarise them with project management concepts, from planning to execution. |
| 2 | To familiarise them with project feasibility analysis and network analysis tools for cost and time estimation. |
| 3 | To equip them with a working knowledge of contract administration, costing, and budgeting. |
| 4 | To familiarise students with quality control. |
| 5 | To gain an understanding of the various types of project information. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Recognize the characteristics of a project and its various stages. | Understand |
| **CO2.** Recognize the conceptual clarity with which projects are organised and feasibility analyses are conducted | Understand |
| **CO3.** Analyze and comprehend project planning, scheduling, and execution control techniques. | Analyze |
| **CO4** Utilize the risk management plan and conduct an analysis of the stakeholders' roles. | Apply |
| **CO5.** Contract management, project procurement, service level agreements, and productivity all require an understanding. | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **M** | **M** | **L** | M | **L** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **S** | **S** | **M** | **L** | **M** | **S** | **M** | **L** | **L** | **S** | **L** | **S** | **S** | **M** | **M** |
| CO3 | **M** | **M** | **M** | **L** | **M** | **M** | **S** | **M** | **M** | **L** | **S** | **L** | **M** | **S** | **S** |
| CO4 | **L** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **L** | **S** | **L** | **M** | **L** | **L** |
| CO5 | **M** | **M** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT – I CONSTRUCTION PLANNING**

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**

Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis, software in Construction scheduling (MSP, primavera, Construction manager).

**UNIT - III SPECIFICATION OF PROJECT BUDGET**

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 SAFETY AND QUALITY MANAGEMENT**

Safety and Quality Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical QualityControl with Sampling by Attributes - Statistical Quality Control with Sampling by Variables – Safety

**UNIT - V PROJECT INFORMATION**

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

**BOOKS:**


1. Chitkara. K.K. “Construction Project Management: Planning Scheduling and Control”, Tata McGraw Hill Publishing Company, New Delhi, 2008. .
2. Calin M. Popescu, Chotchal Charoenngam, “Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications”, Wiley, New York, 2005.


**REFERENCES:**


1. Willis, E. M., “Scheduling Construction Projects”, John Wiley & Sons, 2006.
2. Halpin, D. W. “Financial and Cost Concepts for Construction Management”, John Wiley & Sons. New York, 2005



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| | COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 0 | 0 | 4 | 2 |

**PREAMBLE**

This helps the students to utilize the optimized computer technology in the field of planning andconstruction. This subject also helps the project planning and scheduling in digitalized approach.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the introduction of system hardware. |
| 2 | To study the role and methods of optimization techniques. |
| 3 | The students know about inventory models. |
| 4 | To Expose the student's knowledge of scheduling application. |
| 5 | To learn about project planning and scheduling. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | | |
|---|---|---|
| CO:1 | To understand the about the optimization techniques and practice | Understand |
| CO:2 | To under the about the resource allocation and resource utilization | Understand |
| CO:3 | To utilize the software interface in project planning and scheduling. | Analyze |
| CO:4 | To perceive the Human Resource Management in the Construction Project | Apply |
| CO:5 | To perceive the Material Management in the Construction Project | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO 01 | PO 02 | PO 03 | PO 04 | PO 05 | PO 06 | PO 07 | PO 08 | PO 09 | PO 10 | PO 11 | PO 12 | PSO 01 | PSO 02 | PSO 03 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO:1 | **M** | **M** | **L** | M | **L** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO:2 | **S** | **S** | **M** | **L** | **M** | **S** | **M** | **L** | **L** | **S** | **L** | **S** | **S** | **M** | **M** |
| CO:3 | **M** | **M** | **M** | **L** | **M** | **M** | **S** | **M** | **M** | **L** | **S** | **L** | **M** | **S** | **S** |
| CO:4 | **L** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **L** | **S** | **L** | **M** | **L** | **L** |
| CO:5 | **M** | **M** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** |

S – STRONG, M – MEDIUM and L – LOW

**SYLLABUS**

**INTRODUCTION**

**LIST OF EXPERIMENTS**

1. Planning and Scheduling of Project using Microsoft Project
2. Project and Portfolio Management using Computer Application
3. Resources Management using Computer Application
4. Risk Management using Computer Application
5. Workflow of events and activities in Construction Project
6. Project templates and Web administration in Construction Industry
7. ERP in Construction Industry
8. Material Management in Construction industry using Computer Application

**TEXT BOOKS**

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

**REFERENCE BOOKS**

1. Feigenbaum,L., Construction Scheduling with Primavera Project PlannerPrentice HallInc., 2002
2. Ming Sun and Rob Howard, "Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, London and New York, 2004.

**COURSE DESIGNERS**

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| | ADVANCED CONCRETE TECHNOLOGY | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 1 | 0 | 4 |

**PREAMBLE**

This course explains about the materials used for various types of concrete, their behaviour and concreting methods.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the concrete ingredients. |
| 2 | To study the role of fibre reinforced concrete. |
| 3 | The students know about concrete mix design and high strength concrete. |
| 4 | To expose the students knowledge of mechanical properties of concrete. |
| 5 | To acquire the knowledge of durability of concrete. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1 - Understand the chemical and mechanical properties of cement | Understand and Apply |
| CO2 - Understand the role of different admixtures in concrete | Apply |
| CO3 - Design for various concrete grades using codal provisions | Apply |
| CO4 - Understand the concept on fresh and hardened concrete properties and its testing Procedures | Apply |
| CO5 - Describe about the special concretes | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | M | - | - | - | - | - | - | - | - | | | |
| CO2 | S | L | M | L | - | - | - | - | - | - | - | - | | | |
| CO3 | S | S | M | L | - | - | - | S | - | - | - | - | | | |
| CO4 | S | M | L | L | - | - | - | - | - | - | - | - | | | |
| CO5 | M | M | L | M | - | - | - | - | - | - | - | - | | | |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I CONCRETE INGREDIENTS**

Composition of OPC – Manufacture – Modified Portland Cements – Hydration Process of Portland Cements – Structure of Hydrated Cement Pastes

Mineral Admixtures – Slags – Pozzolanas and Fillers – Chemical Admixtures – Solutes – Retarders – Air Entraining Agents – Water Proofing Compounds – Plasticizers and Super Plasticizers

Aggregates – Properties and testing of fine and course aggregates – combining of aggregates – Substitute material for aggregates – recent advancements.

**UNIT II SPECIAL CONCRETES**

Fibre Reinforced Concrete – Self Compacting Concrete – Polymer Concrete – Sustainable Concrete – Lightweight concrete.

**UNIT – II CONCRETE MIX DESIGN**

Mix Proportioning – Mixes incorporating Fly ash, Silica fume, GGBS – Mixes for High Performance Concrete – High strength concrete – variations in concrete strength.

**UNIT IV MECHANICAL PROPERTIES OF CONCRETE**

Interfacial Transition Zone – Fracture Strength – Compressive strength – Tensile strength - Impact strength - Bond strength.

**UNIT V DURABILITY OF CONCRETE**

Factors affecting durability – Chemical Attack – Permeability – Sulphate attack - chloride penetration – water absorption – creep – Shrinkage.

**BOOKS:**


3. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi. 2007.
4. Gambhir.M.L., Concrete Technology – Tata McGraw Hill Book Co. Ltd.,Delhi, 2004.


**REFERENCES:**


1. Neville, A.M., Properties of Concrete, Longman, 1995.
2. Metha P.K. and Montreio P.J.M., Concrete Structure Properties and Materials, Prentice Hall, 1998.



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| | MODERNISTIC APPROACHES IN CONSTRUCTION | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 1 | 0 | 4 |

**PREAMBLE**

Study and comprehend the Modernized construction approaches practicing in the field of civil engineering.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the usage of different sustainable materials in construction |
| 2 | To study the concept and usage of Nano technology in the field of civil engineering |
| 3 | To study the inevitable role of biotechnology in the field of construction |
| 4 | To rendering the different automation process involved in modern day of construction |
| 5 | To acquire the role of prefab construction |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Investigate and comprehend the use of various sustainable building materials. | Understand |
| **CO2.** Analyze the concept of Nanotechnology and its application in the field of civil engineering. | Understand |
| **CO3.** To validate the basic knowledge of biotechnology in the construction industry | Analyze |
| **CO4.** To clearly elucidate about the various automation processes that are used in today's construction | Apply |
| **CO5.** To clearly explicate the equipment's and methods used in modular construction | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | **L** | **L** | M | **L** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **M** | **M** | **M** | **L** | **M** | **S** | **S** | **-** | **L** | **S** | **L** | **S** | **S** | **M** | **M** |
| CO3 | **M** | **L** | **M** | **L** | **M** | **M** | **-** | **M** | **M** | **-** | **S** | **L** | **M** | **S** | **S** |
| CO4 | **M** | **M** | **M** | **L** | **M** | **S** | **L** | **M** | **M** | **L** | **S** | **L** | **M** | **L** | **L** |
| CO5 | **L** | **L** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT - I SUSTAINABLE BUILDING MATERIALS**

Special alloys of steel and other metals- glass- polymer- fabric- Construction chemicals- Specialized equipment's-Market survey -collection of information about the materials

**UNIT - II NANO CONCRETE**

Concept of Nanotechnology- Nano Cement materials- Nanoscale Characterization -Silica Aerogels- Effect of Nano-SiO- Nano Clay- Graphene-Oxide- Electrochemical Injection- Cement Reinforcement by Nanotubes.

**UNIT - III CONSTRUCTION BIOTECHNOLOGY**

Basics of Biotechnology for Civil Engineering - Biotechnological Admixtures- Biotechnological Plastics- Bio cements- Bio coating of Surfaces- Bio grouts- Bio corrosion- Bio deterioration - Future Developments

**UNIT - IV CONSTRUCTION AUTOMATION**

Concept- Building Information Model- 3D Printing- Roles of artificial intelligence in construction engineering and management

**UNIT - V MODULAR CONSTRUCTION**

Modular construction- Types- prefabrication–Principles–Materials–Modular coordination–Standardization–Systems–Production–Transportation–Erection –Construction and erection of roof and floor slabs–Wall panels –Columns–Shear walls

**BOOKS:**


3. CBRI, Building materials and components, India, 1990
4. Nanotechnology in Construction, Konstantin Sobolev & Surendra P. Shah, Springer International Publishing, Switzerland 2015
5. Construction Biotechnology, Volodymyr & Ivanov Viktor Stabnikov, Green Energy and Technology (GREEN), 2017
6. Construction Automation. In: Castro-Lacouture D. (2009) , Springer Handbook of Automation, 2009


**REFERENCES:**


3. Henrick Nissen, "Industrial Building and Modular Design",Cement Concrete Association,
4. Roy Chudley& Roger Greeno, "Advanced Construction Techniques", Pearson Prentice Hall


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| | AUTOMATION IN CONSTRUCTION MANAGEMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 0 | 0 | 3 |

**PREAMBLE**

Having the ability to create unique insights from what is seen or observed, as well as having a strong digital footprint in the field of construction management

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To gain insight into the use of automation and robots in construction management |
| 2 | To understand the fundamentals of sensors and inspection |
| 3 | To investigate existing and prototype construction equipment. |
| 4 | Data networking for prefabrication elements will be investigated. |
| 5 | Robotic technologies for prefabrication elements will be investigated. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Understand how building management systems and automation can be used in both on-site and off-site projects. | Understand |
| **CO2.** Robotics can be used to solve construction problems. | Apply |
| **CO3.** The use of computers in construction The processing of data | Apply |
| **CO4.** Learn the fundamentals of communication and office automation. | Understand |
| **CO5.** To clearly explicate the Robotics in the Construction Industry | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | **L** | **L** | M | **L** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **M** | **M** | **M** | **L** | **M** | **S** | **S** | **-** | **L** | **S** | **L** | **S** | **S** | **M** | **M** |
| CO3 | **M** | **L** | **M** | **L** | **M** | **M** | **-** | **M** | **M** | **-** | **S** | **L** | **M** | **S** | **S** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | **M** | **M** | **M** | **L** | **M** | **S** | **L** | **M** | **M** | **L** | **S** | **L** | **M** | **L** | **L** |
| CO5 | **L** | **L** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT - I FUDAMENTAL OF BMS**

Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS- Review and analysis of state- of –art in construction automation

**UNIT-II OFF AND ON-SITE AUTOMATION IN CONSTRUCTION**

Field sensors actuators- controllers- non-destructive evaluation- data acquisition- Off site automation in construction Information processing- Materials processing - Case study - Existing and prototype equipment for construction – case study

**UNIT - III BUILDING AUTOMATION**

Introduction to building automation systems – components– Heating, ventilation, and air Conditioning (HVAC)– Lighting – Electrical systems water supply and sanitary systems– Fire Safety – security -Communication and office automation system -Water pump monitoring & Control - Control of Computerized HVAC Systems

. **UNIT - IV ROBOTICS IN CONSTRUCTION**

Automation and robotic technologies for customized component, module and building Prefabrication- Elementary technologies and single – Task construction robots - Site automation robotic on site factories

**UNIT - V DATA NETWORKING CONSTRUCTION AUTOMATION**

Data networking– IBMS system and its components – Centralized control equipment's – substation and field controllers – Gamma building control – energy-efficient building and room automation.

**BOOKS:**


7. Javad Majrouhi Sardroud, (2011),"Automated Management of Construction Projects" LAP Lambert Academic Publishing.
8. Wang Shengwei, (2010), "Intelligent Buildings and Building Automation" Taylor & Francis Group.


**REFERENCES:**


5. Majrouhi Sardroud Javad, (2014), "Automation in Construction Management" Scholars' Press
6. HongleiXu and Xiangyu Wang, (2014), "Optimization and Control Methods in Industrial Engineering and Construction (Intelligent Systems, Control and Automation: Science and Engineering)" Springer.



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| | ADVANCED PROJECT MANAGEMENT CONCEPTS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 1 | 0 | 4 |

**PREAMBLE**

In this Advanced Project Management Concepts, students delve deeper into project management concepts include task analysis, critical path method, planning, project timelines, and ongoing monitoring.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the project life cycle and types of construction. |
| 2 | To study the role of project management, owners perspective. |
| 3 | The students know about organizing for project management. |
| 4 | To expose the students knowledge of labour material and equipment utilization. |
| 5 | To Acquire the Knowledge of Cost Estimation |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Recognize and mitigate the early seeds of failure in the project life cycle | Understand and Apply |
| **CO2.** Engage and lead effective project management teams in your Organization | Apply |
| **CO3.** Understand project management design, development, and deployment | Apply |
| **CO4**. Use project management tools, techniques, and skills | Apply |
| **CO5.** Understand how to manage project cost, quality, and delivery | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | M | **L** | **-** | **-** | **-** | **M** | **L** | **L** | **M** | **-** | **M** | **L** | **L** | **L** |
| CO2 | **M** | **S** | **M** | **-** | **M** | **S** | **S** | **L** | **M** | **-** | **S** | **L** | **M** | **M** | **S** |
| CO3 | **L** | **L** | **S** | **L** | **-** | **-** | **M** | **S** | **M** | **L** | **L** | **S** | **M** | **S** | **M** |
| CO4 | **M** | **S** | **S** | **-** | **L** | **-** | **S** | **M** | **S** | **L** | **L** | **S** | **L** | **L** | **M** |
| CO5 | **M** | **M** | **L** | **L** | **M** | **S** | **M** | **S** | **M** | **L** | **M** | **M** | **M** | **M** | **S** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I THE OWNER'S PERSPECTIVE**

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**

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**

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**

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 - Choiceof Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

**UNIT V COST ESTIMATION**

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.

**BOOKS:**


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.


**REFERENCES:**


1. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
2. Choudhury, S , Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
3. George J.Ritz , Total Construction Project Management - McGraw-Hill Inc, 1994.



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| | QUALITY AND SAFETY IN CONSTRUCTION | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 0 | 0 | 3 |

**PREAMBLE**

The students will be able to gain knowledge about the importance of quality and safety in construction and will be skilled to manage both at work place.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To understand the elements of quality planning and the implication. |
| 2 | To become aware of objectives and advantage of quality assurance and management. |
| 3 | To study about safety in construction. |
| 4 | To study about various safety operations in construction. |
| 5 | To study about accidents and safety measures in construction industry. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Should be exposed to means of quality in construction. | Understand |
| **CO2.** Should be able to learn about quality management. | Understand |
| **CO3.** Should be able to taken safety measures in construction. | Understand, Apply |
| **CO4.** The concept of other various operations with safety. | Understand, Apply |
| **CO5.** Know about accidents & measures taken in construction. | Understand , Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | L | **L** | **-** | **L** | **L** | **-** | **S** | **L** | **-** | **M** | **M** | **M** | **L** | **L** |
| CO2 | **L** | **L** | **M** | **-** | **M** | **L** | **-** | **S** | **L** | **-** | **M** | **L** | **M** | **M** | **M** |
| CO3 | **M** | **M** | **M** | **L** | **M** | **L** | **M** | **M** | **M** | **-** | **L** | **M** | **M** | **S** | **S** |
| CO4 | **S** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **L** | **S** | **S** | **M** | **S** |
| CO5 | **S** | **S** | **S** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **S** | **S** | **M** | **S** |

**S-Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT – I Construction Quality**

Construction Quality, Inspection and Testing, Quality control, Quality Assurance, Quality Certification for companies and laboratories (ISO Certification, NABL certification)

**UNIT – II Construction Quality Management**

Total Quality Management, Critical factors of TQM, TQM in Projects, Benchmarking, concepts of quality policy, standards, manual - Needs Of QA/QC - Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality-Critical, Standardization.

**UNIT – III Construction Safety**

Construction Safety-meaning and scope, Safety in construction- Roles of different groups in safety - Technological aspects, organizational aspects and behavioural aspects, Safety legislation and Standards, Contract conditions on safety in Civil Engineering projects.

**UNIT – IV Safety in Various Construction Operations**

Basic terminology in safety, safety pyramid- Safety in Construction: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a)For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario - National Building Code Provisions on construction safety, Construction safety manuals. Safety in Vehicles, Cranes, Tower Cranes, Wire Ropes, Pulley blocks, Mixers. SoPs (Safe Operating Procedures) – Construction equipment, materials handling-disposal & hand tools.

**UNIT – V Accidents & Safety measures**

Types of injuries, Factors affecting safety, Strategic Planning for safety provisions. Personal & Structural safety - Recording injuries and accident indices. Theories and principles of accident –frequency – rate – serviceability rate – incident rate – activity rate, first aid. Other hazards – fire, confined spaces, electrical safety. Method statement, SOPs, PPE, Inspections, Investigations. Site safety programmes - JSA, JHA, Root cause analysis, meetings, safety policy, manuals, training & orientation. Safety legislation regard to violation.

**BOOKS:**


1. John L. Ashford, The Management of Quality in Construction, E & F.N, Spon. New York, 2009.
2. K.N.Vaid, Construction Safety Management, National Institute of Construction Management and Research, 1988
3. J.B.Fullman, Construction Safety Security & Loss Prevention , John Wiley & Sons Inc
4. Linger.L, Modern Methods of Material Handling
5. Hinze, J.W. (1997) Construction Safety, Prentice Hall.
6. MacCollum, D.V. (1995) Construction Safety Planning, John Wiley & Sons
7. Bhattacharjee, S.K. (2011) Safety Management in Construction, Khanna Publishers


**REFERENCES:**


1. David Gold Smith, "Safety Management in construction and Industry", Mc Graw Hill
2. K N Vaid, "Construction Safety Management", NICMAR, Bombay
3. D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book

House, Bangalore
4. "The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, Universal Law Publishing Co. Pvt. Ltd.
5. James, J.O Brien, Construction Inspection Handbook - Quality Assurance and Quality Control, Van Nostrand, New York, 1989. 11

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| | QUANTITATIVE TECHNIQUES IN CONSTRUCTION MANAGEMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 0 | 0 | 3 |

**PREAMBLE**

The students will be able to gain knowledge about the importance of quantitative management techniques and management of materials and human resources.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the operation research, linear programming. |
| 2 | To study the role of production management. |
| 3 | The students know about financial management and capital budgeting. |
| 4 | To expose the students knowledge of pricing techniques. |
| 5 | To acquire the knowledge of managerial economics. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Should be exposed to means of quantity computation in construction. | Understand |
| **CO2.** Should be able to learn about quantity management. | Understand |
| **CO3.** Should be able to taken measures in construction to manage resources. | Understand, Apply |
| **CO4.** The concept of other various operations with construction activities and events. | Understand, Apply |
| **CO5.** Know about measures taken in quantity accretion. | Understand , Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | L | **L** | **-** | **L** | **L** | **-** | **S** | **L** | **-** | **M** | **M** | **M** | **L** | **L** |
| CO2 | **L** | **L** | **M** | **-** | **M** | **L** | **-** | **S** | **L** | **-** | **M** | **L** | **M** | **M** | **M** |
| CO3 | **M** | **M** | **M** | **L** | **M** | **L** | **M** | **M** | **M** | **-** | **L** | **M** | **M** | **S** | **S** |
| CO4 | **S** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **M** | **M** | **L** | **S** | **S** | **M** | **S** |
| CO5 | **S** | **S** | **S** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **S** | **S** | **M** | **S** |

**S-Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I OPERATIONS RESEARCH**

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

**UNIT II PRODUCTION MANAGEMENT**

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

**UNIT III FINANCIAL MANAGEMENT**

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

**UNIT IV DECISION THEORY**

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

**UNIT V MANAGERIAL ECONOMICS**

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

**BOOKS:**


1. Vohra, N.D., Quantitative Techniques in Management, Tata McGraw-HillCompany 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.


***REFERENCES:***


1. Frank Harrison, E., The Managerial Decision Making Process, Houghton MifflinCo., Boston, 1975.
2. Hamdy A.Taha, Operations Research: An Introduction, Prentice Hall, 2002.


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| | QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | CC | 3 | 0 | 0 | 3 |

**PREAMBLE**

To study about quality management, quality planning and its improvement techniques and to study about the quality improvement techniques

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the quality management, quality plan. |
| 2 | To study the role of quality system and preparing quality system documents. |
| 3 | The students know about quality planning |
| 4 | To expose the students knowledge of quality assurance and control**.** |
| 5 | To acquire the knowledge of quality improvement techniques |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.**To Implement quality systems and standards in the preparation of documents and be aware of the different aspects of cost of quality. | Understand and Apply |
| **CO2.** To Apply relevant codes and standards, codes of quality, quality policy, methods in construction industry to attain customer satisfaction in projects. | Apply |
| **CO3..** To understand the elements of quality planning and the implication | Apply |
| **CO4.** To become aware of objectives and advantage of quality assurance | Apply |
| **CO5.** To clearly Identify and solve problems relating to quality improvement on the way and able to take early decisions to achieve the ultimate aim of the organization. | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | S | **L** | **L** | **M** | L | L | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** | **L** |
| CO2 | **L** | **L** | **S** | **M** | L | S | **S** | **L** | **M** | **L** | **S** | **S** | **S** | **S** | **S** | **S** |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | **L** | **S** | **L** | **L** | **L** | **M** | **M** | **M** | **M** | **L** | **S** | **S** | **M** | **S** | **M** | **L** |
| CO4 | **L** | **S** | **L** | **S** | **L** | **L** | **S** | **M** | **L** | **L** | **S** | **S** | **L** | **S** | **M** | **M** |
| CO5 | **L** | **L** | **M** | **M** | **M** | **S** | **S** | **L** | **M** | **M** | **M** | **M** | **M** | **S** | **S** | **L** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT - I QUALITY MANAGEMENT**

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

**UNIT II QUALITY SYSTEMS**

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**

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's conceptof 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**

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**

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.

**BOOKS:**


1. James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 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


**REFERENCES:**


1. Hutchins.G, ISO 9000, Viva Books, New Delhi, 2000
2. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill,1989.

3. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York, 1989
4. Steven McCabe, Quality Improvement Techniques in Construction, AddisonWesley Longman Ltd, England. 1998


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# ELECTIVE COURSES

| | CONTRACT LAWS AND REGULATIONS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

To study contract laws and regulations so that adequate knowledge on formulating and managing construction contracts is gained

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study the various types of construction contracts and their legal aspects and provisions. |
| 2 | To study the tenders, its formation and labour regulations. |
| 3 | To study the elements of concluding, and administering contracts. |
| 4 | To achieve awareness on arbitrations and legal procedures. |
| 5 | To study labour regulations and their impact on managing of contracts. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** To study and understand the Elements of Contracts. | Understand |
| **CO2.** To study the role of Contract Formation and Interpretation. | Understand |
| **CO3.** To learn about the roles of an arbitrator. | Apply |
| **CO4.** To interpret the student knowledge on Tax Laws. | Apply |
| **CO5.** To acquire the knowledge of Labour Regulations and Welfare Legislation. | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | - | L | - | L | L | - | - | M | S | M | L | - | M | M |
| CO2 | M | L | L | - | L | L | - | - | M | S | M | L | - | M | M |
| CO3 | M | M | - | - | M | - | - | M | L | M | M | L | L | L | L |
| CO4 | L | M | M | - | S | S | L | M | - | L | M | M | M | L | M |
| CO5 | L | M | M | - | S | S | L | S | - | L | M | M | M | L | M |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT – I CONSTRUCTION CONTRACTS**

Definition of Contract - Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents –- Legal Issues in Contract – Standard Forms of Contracts- General and Special Conditions of Contracts - Project Management Consultants and the Contractor

**UNIT – II TENDERS**

Tendering Process - Tender Documents – Requirements for Tendering –Methods of Inviting Tenders-Evaluationof Tender from Technical, Financial Aspects– Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act.

**UNIT – III ARBITRATION**

Earnest Money Deposit (EMD) – Security deposits - Arbitrator– Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Violations –

Certificates, Forms, Schedules

**UNIT – IV LEGAL REQUIREMENTS**

Insurance and Bonding – Types of Bonds - Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Fine and Liquidated Damages – Insurance Income Tax – Sales Tax – VAT– Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval

**UNIT – V LABOUR REGULATIONS**

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations- Indian Contracts Act - Labour Laws - Minimum Wages Act – Child Labour Act- Industrial Dispute Act- Maternity Benefit Act – Workmen's Compensation Act – Indian Factory Act – Tamil Nadu Factory Act.

**TEXT BOOKS:**


1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982.
2. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
3. Sharma M.R., (2013), Fundamentals of Construction Planning & Management S.K. Kataria& Sons, New Delhi.


**REFERNCES:**


1. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.
2. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.
3. Martin Brook (2016), Estimating and Tendering for Construction Work, 5th Edition, Routledge, Taylor & Francis.
4. Jimmie Hinze, (2013), Construction Contracts, 3rd Edition, McGraw Hill, New Delhi.



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| | SYSTEM INTEGRATION IN CONSTRUCTION | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

This course consolidates the fundamentals by taking a holistic approach to building technology in the design and construction of structures. The focus of the course is on understanding how systems interact with one another in the context of achieving high performance in various categories of major use. To illustrate the concept and practice, a case study approach will be used.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To research the integration of various construction systems, environmental factors, services, maintenance, and safety systems |
| 2 | To comprehend how the various systems that make up a building design are interwoven in order to achieve a high-performance structure |
| 3 | To comprehend how the various systems that make up a building design are integrated in order to achieve a high-performance structure |
| 4 | Through case studies, gain an understanding of building systems integration with a focus on sustainable design |
| 5 | Through case studies, gain an understanding of building systems integration with a focus on sustainable construction |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** To understand various structural systems requirements in construction after completing this course. | Understand |
| **CO2.** To understand various Environmental factor in construction after completing this course. | Understand |
| **CO3.** To understand various Service steps requirements in construction after completing this course. | Understand |
| **CO4.** To understand various maintenance steps requirements in construction after completing this course. | Understand |
| **CO5.** To understand various safety steps requirements in construction after completing this course. | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | **L** | **L** | M | **L** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **M** | **M** | **M** | **L** | **M** | **S** | **S** | **-** | **L** | **S** | **L** | **S** | **S** | **M** | **M** |
| CO3 | **M** | **L** | **M** | **L** | **M** | **M** | **-** | **M** | **M** | **-** | **S** | **L** | **M** | **S** | **S** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | **M** | **M** | **M** | **L** | **M** | **S** | **L** | **M** | **M** | **L** | **S** | **L** | **M** | **L** | **L** |
| CO5 | **L** | **L** | **L** | **M** | **L** | **M** | **S** | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT - I STRUCTURAL INTEGRATION**

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

**UNIT-II ENVIRONMENTAL FACTORS**

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**

Plumbing – Electricity – Vertical circulation and their interaction – HVAC

**UNIT - IV MAINTENANCE**

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**

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

**BOOKS:**


1. A.J.Elder and Martiz Vinden Barg, "Handbook of Building Enclosure", McGraw-Hill Book Company, 1983.
2. David V.Chadderton, "Building Services Engineering", Taylar and Francis, 2007.


**REFERENCES:**


1. Jane Taylor and Gordin Cooke, "The Fire Precautions" Act in Practices, 1987.
2. Peter R. Smith and Warren G. Julian, "Building Services", Applied Science Publishers Ltd., London, 1993.
3. William T. Mayer, "Energy Economics and Building Design , McGraw-Hill Book Company, 1983.


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| | ENERGY EFFICIENT BUILDINGS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

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.

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To Study about the energy requirement of the building construction |
| 2 | To Study about the key design elements for energy efficient buildings |
| 3 | To learn the green buildings concepts applicable to modern buildings. |
| 4 | Acquaint students with the principle theories, materials, and construction techniques and to create energy efficient buildings. |
| 5 | To learn energy efficiency measures on grounds of engineering and economic feasibility. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** To understand the concept effective utilization of energy in building. | **Understand** |
| **CO2.** To learn about energy efficiency through landscaping. | **Understand** |
| **CO3.** The learn the methods air regulation in buildings | **Understand** |
| **CO4.** To learn about how to develop a heat transfer mechanism in building | **Apply** |
| **CO5.** To Integrate the renewable energy systems in the buildings and passive cooling in buildings. | **Apply** |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | M | - | - | - | L | M | - | L | - | L | L | L | - | - |
| CO2 | M | M | L | - | L | - | M | L | M | L | L | L | - | L | - |
| CO3 | L | L | M | - | M | M | S | - | - | L | L | S | M | L | L |
| CO4 | S | - | M | M | S | M | S | - | M | M | M | S | M | M | M |
| CO5 | S | - | M | M | M | M | S | - | M | - | M | S | M | M | M |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I INTRODUCTION**

Conventional versus Energy Efficient buildings – Historical perspective - Water – Energy – IAQ requirement analysis – Energy required for building construction - Heat Transfer Future building design aspects.

**UNIT II LANDSCAPE AND BUILDING ENVELOPES**

Energy efficient Landscape design - Micro-climates – various methods –Building materials, Envelope heat loss and heat gain and its evaluation, paints, Insulation, Design methods and tools - Air Filtration and odor removal –Heat Recovery in large buildings

**UNIT III HEATING, VENTILATION AND AIR CONDITIONING**

Natural Ventilation, Passive cooling and heating - Application of wind, water and earth for cooling, evaporative cooling, radiant cooling – Hybrid Methods – Energy Conservation measures, Thermal Storage integration in buildings.

**UNIT IV HEAT TRANSMISSION IN BUILDINGS**

Surface co-efficient: air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; Heat transfer due to ventilation/infiltration, internal heat transfer; Sol-air temperature; Decrement factor; Phase lag. Design of day lighting; Computer packages for carrying out thermal design of buildings and predicting performance.

**UNIT V PASSIVE COOLING & RENEWABLE ENERGY IN BUILDINGS**

Passive cooling concepts: Evaporative cooling, radiative cooling; Application of wind, water and earth for cooling; Shading, paints and cavity walls for cooling; Roof radiation traps; Earth air tunnel. Introduction of renewable sources in buildings, solar water heating, small wind turbines, stand-alone PV systems, Hybrid system – Economics.

**TEXT BOOKS:**


1. Krieder J. and Rabi A., "Heating and Cooling of buildings : Design for Efficiency", Mc Graw Hill, 1994.
2. Ursala Eicker, "Solar Technologies for buildings", Wiley publications, 2003.
3. Moore, F., "Environmental Control System", McGraw Hill Inc. 2002


**REFERENCES:**


1. Brown, G.Z. and DeKay, M., "Sun, Wind and Light – Architectural Design Strategies", John Wiley and Sons Inc, 2001.
2. Chilogioji, M.H., and Oura, E.N., "Energy Conservation in Commercial and Residential Buildings" - Marcel Dekker Inc., New York and Basel, 2005.
3. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)
4. Energy Conservation Building Code, Bureau of Energy Efficiency", New Delhi,2007.


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| | CONSTRUCTION ECONOMICS AND FINANCE MANAGEMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE:**

For any construction project to be successful, it must be technically sound and the resulting benefits must exceed the cost associated with the project. This course "Construction Economics and Finance" basically aims at describing various aspects of engineering economics. The field of construction economics and finance deals with the systematic evaluation of cost and benefit associated with different projects. The topics in this course cover principles of engineering economy followed by basic methods for carrying out economic studies considering the time value of money. The other topics include the demonstration of different methods namely present, future and annual worth method, rate of return, break-even comparison, capitalized-cost and cost-benefit analysis for the comparison of alternatives

**PREREQUISITE:** NIL

**COURSE OBJECTIVES:**

To study and understand the role of civil engineering industrial development

To study the role of construction economics and transport energy.

The students know about financing instruments..

To Expose the students knowledge of Cash basis of a accounting

To acquire the knowledge of Loans to Contractors

**COURSE OUTCOMES:**

After successful completion of the course, students will be able to

| | |
|---|---|
| CO1: Understand the concept of Economy related to Engineering | Understand |
| CO2: Practice the Construction development in Housing, transport energy and other Infrastructures | Apply |
| CO3: Analyse the financial statements and Investment and financing decision | Analysing |
| CO4: Assess the Accounting for tax reporting purposes and financial reporting purposes | Analysing |
| CO5: Understand the Interim construction financing | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | M | L | - | - | - | L | L | L | M | L | M | - | - | L |
| CO2 | M | M | L | - | L | L | - | L | M | M | - | L | - | - | - |
| CO3 | L | S | L | S | S | - | - | L | - | L | - | L | M | M | - |
| CO4 | L | M | S | L | M | - | L | - | L | M | L | M | - | M | - |
| CO5 | L | L | M | - | L | M | S | S | M | L | L | M | L | - | M |

**S- Strong; M-Medium; L-Low**

**SYLLABUS:**

**UNIT I ECONOMICS:**

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 CONSTRCUTION ECONOMICS** -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** 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** -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** Loans to Contractors – Interim construction financing – Security and risk aspects.

**TEXT BOOKS:**


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.


**REFERENCES:**


1. Warneer Z Hirsch, Urban Economics, Macmillan, New York, 1993.
2. Kwaku A, Tenah and Jose M.Guevara, Fundamental of Construction
3. Management and Organisation, Prentice – Hall of India, 1995.
4. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988.



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| CONSTRUCTION PERSONNEL MANAGEMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|
| | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

To study and execute the importance of events and activities management in construction projects

**PREREQUISITE**

Construction Planning, Scheduling and Control

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study the various aspects of manpower management. |
| 2 | To study the man power planning management |
| 3 | To study the various aspects of organization management |
| 4 | To study the human relations management |
| 5 | To study the welfare and development methods in construction |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** know various processes in manpowerplanning | Understand and, Apply |
| **CO2.** handle organizational and welfare measures. | Apply |
| **CO3.** tackle problems in execution. | Apply |
| **CO4.** find the route to complete the target when difficulties arise. | Apply |
| **CO5.** to know the value of manual power | Understand and Apply |

**MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | M | **L** | **-** | **S** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **L** | **L** | **S** | **-** | **S** | **S** | **S** | **L** | **M** | **M** | **S** | **L** | **M** | **M** | **S** |
| CO3 | **M** | **L** | **S** | **L** | **L** | **-** | **M** | **M** | **M** | **L** | **L** | **S** | **M** | **S** | **M** |
| CO4 | **M** | **L** | **S** | **L** | **L** | **-** | **S** | **M** | **S** | **L** | **L** | **S** | **L** | **L** | **M** |
| CO5 | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** | **M** | **L** | **M** | **M** | **M** | **M** | **S** |

**S-Strong;M-Medium;L-Low**

**SYLLABUS**

**UNIT I MANPOWER PLANNING**

Manpower Planning process , Organising, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.

**UNIT II ORGANISATION**

Requirement of Organisation – Organisation structure – Organisation Hierarchical charts – Staffing

Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection strategies – Placement and Training.

**UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR**

Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager – al aspects of decision making – Significance of human relation and organizational – Individual in organization – Motivation – Personality and creativity – Group dynamics, Team working – Communication and negotiation skills.

**UNIT IV WELFARE MEASURES**

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

**UNIT V MANAGEMENT AND DEVELOPMENT METHODS**

Wages and Salary, Employee benefits, Employee appraisal and assessment – Employee services-Safety and Health Management – Special Human resource problems – Productivity in human resources – Innovative approach to designing and managing organization – Managing New Technologies – Total Quality Management – Concept of quality of work life – Levels of change in the organizational Development – Requirements of organizational Development – System design and methods for automation and management of operations – Developing policies, practices and establishing process pattern – Competency upgradation and their assessment – New methods of training and development – Performance Management**.**

**REEFERENCES:**


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



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| | BUSINESS ECONOMICS AND FINANCE MANAGEMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

To study about the construction economics and its role and to exposure on financial instrumentation on their cash basis of accounting

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the role of civil engineering industrial development. . |
| 2 | To study the role of construction economics and transport energy. |
| 3 | The students know about financing instruments. |
| 4 | To Expose the students knowledge of Cash basis of a accounting. |
| 5 | To acquire the knowledge of Loans to Contractors |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** To Evaluate the economic theories, cost concepts and pricing policies | Understand and Apply |
| **CO2.** To study the elements of construction economics | Apply |
| **CO3..** To study the need for financial management and means of achieving the same. | Apply |
| **CO4.** To study a few accounting methods | Apply |
| **CO5.** To study the elements of lending to the contractors | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 | PSO4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **L** | S | **L** | **L** | **L** | L | L | **L** | **L** | **M** | **L** | **M** | M | **L** | **S** | **L** |
| CO2 | **S** | **M** | **M** | **S** | L | L | **S** | **S** | **M** | **M** | **S** | **S** | **M** | **S** | **S** | **L** |
| CO3 | **L** | **L** | **L** | **L** | - | **M** | **S** | **S** | **S** | **L** | **S** | **S** | **M** | **S** | **S** | **M** |
| CO4 | **L** | **S** | **S** | **M** | **L** | **M** | **M** | **M** | **L** | **L** | **S** | **S** | **L** | **S** | **S** | **M** |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO5 | **L** | **M** | **M** | **M** | **S** | **S** | **S** | **L** | **M** | **S** | **M** | **M** | **L** | **S** | **S** | **L** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I ECONOMICS**

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 CONSTRCUTION ECONOMICS**

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**

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 financecorporations – 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**

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**

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

**BOOKS:**


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.


**REFERENCES:**


1. Warneer Z Hirsch, Urban Economics, Macmillan, New York, 1993.
2. Kwaku A, Tenah and Jose M.Guevara, Fundamental of Construction
3. Management and Organisation, Prentice – Hall of India, 1995.
4. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988



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| | RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

To study about various aspects of Resource Management and Control in Construction and to aply the techniques of recourse allocation.

**PREREQUISITE**

NIL

**COURSEOBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the resource planning and types of resources. |
| 2 | To study the role of labour management and labour schedule. |
| 3 | The students know about materials and equipment. |
| 4 | To expose the students knowledge of time management. |
| 5 | To acquire the knowledge of resource allocation and leveling |

**COURSEOUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** To be well versed in resource planning and management in construction | Understandand Apply |
| **CO2.** To clearly understand the labour costs and schedule in construction. | Apply |
| **CO3.** To be well versed to manage the materials at site | Apply |
| **CO4.** To demonstrate the time management for all kind of projects. | Apply |
| **CO5.** To incorporate the realities of construction site and respond to changes in project objectives and to track resource utilization. | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **M** | M | **L** | **M** | **S** | **S** | **S** | **M** | **L** | **M** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **M** | **L** | **S** | **M** | **S** | **M** | **M** | **L** | **M** | **M** | **S** | **L** | **M** | **M** | **S** |
| CO3 | **M** | **M** | **S** | **L** | **L** | **M** | **M** | **M** | **M** | **L** | **L** | **S** | **M** | **S** | **M** |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO4 | **L** | **L** | **S** | **L** | **L** | **-** | **S** | **M** | **M** | **L** | **L** | **M** | **L** | **L** | **M** |
| CO5 | **M** | **M** | **M** | **M** | **M** | **S** | **M** | **M** | **M** | **L** | **M** | **M** | **M** | **M** | **S** |

**S-Strong;M-Medium;L-Low**

**SYLLABUS**

**UNIT – I RESOURCE PLANNING**

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**

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**

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

**UNIT – IV TIME MANAGEMENT**

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**

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

.

**BOOKS:**

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.

**REFERENCES:**

1. Harvey, A., Levine, Project Management using Micro Computers, Obsorne
2. Glenn .A, Sea's and Reichard, Clough .H, “Construction Project Management”, John Wiley and Sons, Inc, 2009.

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| | PROJECT SAFETY MANAGEMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

**PREREQUISITE**

NIL

**COURSEOBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the construction accidents and cost of construction injuries. |
| 2 | To study the role of safety programmes and elements of effective safety programme. |
| 3 | The students know about International Practice of appraisal |
| 4 | To Expose the students knowledge of design for safety. |
| 5 | To acquire the knowledge of owners' and designers' outlook. |

**COURSEOUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** To understand the construction accidents and Legal Implications. | Understand and Apply |
| **CO2.** To clearly explain the Elements of an Effective Safety Programme | Apply |
| **CO3.** To elaborate the concept on Safety in Construction Contracts. | Apply |
| **CO4.** To clearly explain the Owners responsibility and safety and role of designers in ensuring safety | Apply |
| **CO5.** To understand the Safety Procedures and Workers Compensation | Understand and Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **M** | M | **L** | **M** | **S** | **S** | **S** | **L** | **L** | **M** | **M** | **M** | **L** | **L** | **M** |
| CO2 | **M** | **L** | **S** | **-** | **S** | **S** | **S** | **L** | **M** | **M** | **S** | **L** | **M** | **M** | **S** |
| CO3 | **M** | **S** | **S** | **L** | **L** | **L** | **M** | **M** | **M** | **M** | **L** | **M** | **M** | **S** | **M** |
| CO4 | **M** | **L** | **S** | **M** | **L** | **-** | **S** | **M** | **S** | **L** | **L** | **S** | **L** | **L** | **M** |
| CO5 | **M** | **M** | **M** | **M** | **M** | **S** | **S** | **M** | **M** | **L** | **M** | **M** | **M** | **M** | **S** |

**S-Strong;M-Medium;L-Low**

**SYLLABUS**

**UNIT – I CONSTRUCTION ACCIDENTS**

Accidents and their causes – Human factors in construction safety – costs of construction injuries- occupational and safety hazard assessment- legal implications

**UNIT – II SAFETY PROGRAMMES**

Problem areas in construction safety- Elements of an Effective Safety Programme-Job –Site safety assessment- Safety Meetings- Safety Incentives

**UNIT – III CONTRACTUAL OBLIGATIONS**

Safety in construction contracts- Substance Abuse- Safety record keeping

**UNIT – IV DESIGNING FOR SAFETY**

Forklifts 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 OWNERS' AND DESIGNERS' OUTLOOK**

Study of various case studies.

**BOOKS:**

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.

**REFERENCES:**

1. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamil nadu.

| S.No | Name of the Faculty | Designation | Name of the College | Mail ID |
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| | MAINTENANCE AND REHABILITATION OF STRUCTURES | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EC-PS | 3 | 0 | 0 | 3 |

**PREAMBLE**

To study the damages, repair and rehabilitation of structures

**PREREQUISITE**

NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To study and understand the maintenance repair and rehabilitation. |
| 2 | To study the role of serviceability and durability of concrete |
| 3 | The students know about materials and techniques for repair. |
| 4 | To Expose the students knowledge of repair to structures. |
| 5 | To acquire the knowledge of demolition of structures. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1.** Describe various phases of maintenance and be able to evaluate damaged structures | Understand |
| **CO2.** Analyze the influence of different environmental elements, fire and pollution on buildings. | Understand and apply |
| **CO3.** Identify and describe material used in repair work. | Understand and apply |
| **CO4.** Describe various procedures and techniques in strengthening measures | Understand and apply |
| **CO5.** Explain demolition techniques for existing buildings | Understand and apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | **M** | M | **L** | **-** | **S** | **L** | **S** | **L** | **M** | **-** | **M** | **M** | **L** | **L** | **L** |
| CO2 | **L** | **L** | **-** | **M** | **-** | **-** | **M** | **L** | **M** | **-** | **S** | **L** | **M** | **L** | **S** |
| CO3 | **M** | **L** | **-** | **L** | **-** | **-** | **-** | **-** | **M** | **-** | **L** | **S** | **L** | **S** | **M** |
| CO4 | **S** | **L** | **S** | **-** | **M** | **-** | **-** | **-** | **S** | **L** | **L** | **S** | **L** | **L** | **M** |
| CO5 | **M** | **S** | **M** | **-** | **M** | **-** | **-** | **-** | **M** | **L** | **M** | **M** | **S** | **L** | **L** |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**UNIT I MAINTENANCE AND REPAIR STRATEGIES**

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**

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- Impact of Pollution on Buildings.

**UNIT III MATERIALS AND TECHNIQUES FOR REPAIR**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Gunite 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**

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

**UNIT V DEMOLITION OF STRUCTURES**

Planning, Precautions and Protective Measures In Demolition Work-Sequence Of Operations Demolition Of Structural Elements. Engineered Demolition techniques for dilapidated structures - Case studies.

**BOOKS:**

Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991.

Allen R.T and Edwards S.C, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987.

**REFERENCES:**

M.S. Shetty, "Concrete Technology - Theory and Practice ", S. Chand and Company, New Delhi, 6th Edition, 2005.

N.Palaniappan, "Estate Management, Anna Institute of Management ", Chennai, 1992.

Lakshmipathy, Metal Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30th October 1999.

Raikar, R.N., “Learning from failures - Deficiencies in Design, Construction and Service” - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

Santhakumar A.R., “Concrete Technology” Oxford University Press, Printed in India by Radha Press, New Delhi, 2007.

Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications pvt. Ltd., 2001.

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# OPEN ELECTIVES ON EMERGING AREAS

| | METAL ADDITIVE MANUFACTURING | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE--EA | 3 | 0 | 0 | 3 |

**Prerequisite:-Nil**

**Course Objective**

| | |
|---|---|
| 1 | Understand the basic principles, methods, areas of usage, possibilities and limitations and the environmental effects of the metal additive manufacturing |
| 2 | Select suitable materials for development of parts using additive manufacturing with sound mechanical properties |
| 3 | Select suitable processes from various metal additive manufacturing processes as per the product requirement |
| 4 | Develop and select suitable parameter for manufacturing and post processing techniques for metal additive manufacturing parts |
| 5 | Design the parts for metal additive manufacturing |

**Course Outcomes: On the successful completion of the course, students will be able to**

| | | |
|---|---|---|
| CO1. | Understand the basic principles, applications and limitations metal additive manufacturing system | Understand |
| CO2. | Understand how to select suitable materials from the existing or develop new materials for additive manufacturing | Understand |
| CO3. | Understand the working principle of various methods in MAM and their applications and limitation | Understand |
| CO4. | Produce a defect free MAM parts with suitable material selection and post processing techniques | Apply |
| CO5. | Understand the design and optimization techniques to design and develop parts using MAM techniques | Apply |

**Mapping with Programme Outcomes and Programme Specific Outcomes**

| CO | PO1 | PO | PO | PO | PO | PO | PO | PO | PO | PO 1 | PO 1 | PO 1 | PS O | PS O | PS O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | - | - | - | M | - | M | - | - | - | - | L | L | - | - |
| CO2 | M | - | - | - | M | - | M | - | - | - | - | L | L | - | - |
| CO3 | M | - | - | - | M | - | M | - | - | - | - | L | L | - | M |
| CO4 | M | - | - | - | M | - | M | - | - | - | - | L | L | - | M |
| CO5 | M | - | - | - | M | - | M | - | - | - | - | L | L | - | M |

**S-Strong;M-Medium;L-Low**

Syllabus

| | | |
|---|---|---|
| **Module 1** | **Introduction** | 9 |
| Introduction to metal additive manufacturing – classification and challenges – applications- CAD for additive manufacturing – file formats, CAD CAM software, modelling and data processing – STL format – slicing – design consideration- machine set up | | |
| **Module 2** | **Materials and properties of AM printed parts** | 9 |
| Manufacturing of metallic materials - Conventional vs AM process - Solidification of Metals Equilibrium and Non-equilibrium phases for solidification for AM<br>Phase diagrams - Iron-Carbon - Aluminum alloy - Titanium alloy - Nickel alloy<br>Methods of Powder Particles Production and Powder Properties - Wire Properties for Direct Energy Deposition - Mechanical properties of AM printed parts | | |
| **Module 3** | **Basic processes in metal additive manufacturing** | 9 |
| Powder bed fusion – direct energy deposition – binder jetting – metal extrusion – material jetting - sheet lamination<br>Laser theory - Continuous vs pulsed laser - Laser types - Laser beam properties<br>Basics of electron beam - Electron beam powder bed fusion and mechanism<br>Powder feeders and their classification - Delivery Nozzles - Powder bed delivery and spreading system Wire Fed Systems - Positioning Devices - Print-heads | | |
| **Module 4** | **AM process parameters** | 9 |
| Beam Scanning Strategies and Parameters for PBF and DED - Powder Properties for PBF, DED, and BJ - Ambient Parameters for PBF and DED - Geometry-Specific Parameters, Support Structures (PBF)<br>Defects in AM Printed Parts - Need of Post Processing - Need for Surface Finishing<br>Common Post Processing for MAM - Potential Hazards of Additive Manufacturing – economics of MAM | | |
| **Module 5** | **Design for Additive Manufacturing** | 9 |
| Fundamentals and principle -design techniques and steps - design optimization, material selection and consideration in application field - Part decomposition and Decomposition methods<br>Topology optimization techniques - Overhangs, and Bridging and cavities in design<br>Key characteristics and considerations in topology optimization - Topology optimization under material uncertainty and manufacturability - Industry 4.0 future with AM | | |

| **Text Books** | |
|---|---|
| **1** | Milewski, J.O., 2017. Additive manufacturing of metals. Cham: Springer International Publishing. |
| **2** | Balasubramanian, K.R. and Senthilkumar, V. eds., 2020. Additive Manufacturing Applications for Metals and Composites. IGI Global. |
| **Reference Books** | |
| **1** | Leach, R. and Carmignato, S. eds., 2020. Precision Metal Additive Manufacturing. CRC Press. |
| **2** | Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003 |

| | |
|---|---|
| **3** | Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010 |
| **4** | Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006. |

**CourseDesigners**

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| | | | | |

| | WASTE TO ENERGY | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

This course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production.

**PREREQUISITE – Nil**

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To enable students to understand of the concept of Waste to Energy. |
| 2 | To link legal, technical and management principles for production of energy form waste. |
| 3 | To learn about the best available technologies for waste to energy. |
| 4 | To analyze of case studies for understanding success and failures. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **O1:** Understand the knowledge about the operations of Waste to Energy Plants. | Understand |
| **O2:** Analyse the various aspects of Waste to Energy Management Systems. | Analyze |
| **O3:** Carry out Techno-economic feasibility for Waste to Energy Plants | Apply |
| **O4:** Evaluate planning and operations of Waste to Energy plants. | Evaluate |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO1 1 | PO1 2 | PSO 1 | PS O2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | - | - | L | - | - | - | - | - | - | - | - | L | - | - |
| CO2 | M | M | L | L | - | M | - | - | - | - | - | - | L | - | - |
| CO3 | S | M | S | M | - | L | - | M | - | - | - | - | M | L | - |
| CO4 | S | M | S | - | L | - | - | - | - | - | - | - | M | L | - |
| CO5 | L | L | - | L | - | - | - | - | - | - | - | - | L | - | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**INTRODUCTION**

The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

**WASTE SOURCES & CHARACTERIZATION**

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

**TECHNOLOGIES FOR WASTE TO ENERGY**

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

**WASTE TO ENERGY OPTIONS**

Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to

fuel resources for other useful energy applications Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery. Energy Recovery from wastes and optimization of its use, benchmarking and standardization. Energy Analysis.

**CASE STUDIES - WASTE TO ENERGY PLANTS**

Success/failures of waste to energy Global Best Practices in Waste to energy production distribution and use. Indian Scenario on Waste to Energy production distribution and use in India. Success and Failures of Indian Waste to Energy plants. Role of the Government in promoting 'Waste to Energy'. Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

**EFERENCES**


1. Lee, James M., "Biochemical Engineering." PHI, 1st Edition, 1992. Yeh W.K., Yang H.C., James R.M., "Enzyme Technologies: Metagenomics, Biocatalysis and Biosynsthesis", Wiley- Blackwell, 1st Edition, 2010. Blanch H.W., Clark D. S., "Biochemical Engineering", Marcel Dekker, Inc. 2nd Edition, 1997.
2. Palmer, Trevor. "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry." 2nd Edition, East West Press, 2008.


**Course Designers**


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| | BIOMEDICAL PRODUCT DESIGN AND DEVELOPMENT | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

**PREREQUISITE** – Nil

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To understand the global trends and development methodologies of various types of products and services. |
| 2 | To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems. |
| 3 | To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification. |
| 4 | To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics. |
| 5 | To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1**. Define, formulate and analyze a problem for the product design. | Apply |
| **CO2** Obtain the domain knowledge of product development and regulatory requirements for the design of prototype. | Apply |
| **CO3**. Explain the process of manufacturing, testing and validation for scalable product development. | Apply |
| **CO4** Gain knowledge of the Innovation & Product Development process in the Business Context. | Apply |
| **CO5** Discuss the economics in product development and business strategies for turnover from commercialization. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | S | M | L | -- | -- | -- | M | -- | -- | -- | M | S | L | M |
| CO2 | S | S | M | L | -- | -- | -- | M | -- | -- | -- | M | S | L | M |
| CO3 | S | S | M | L | -- | -- | -- | M | -- | -- | -- | M | S | L | M |
| CO4 | S | S | S | L | -- | -- | -- | M | -- | -- | -- | M | S | L | M |
| CO5 | S | S | S | L | -- | -- | -- | M | -- | -- | -- | M | S | L | M |

S- Strong; M-Medium; L-Low

**SYLLABUS**

**PRODUCT DESIGN**

Definition, History and Modern Practice – Designs; Design and Product Life Cycle; Design Process; What is a medical device, Challenges in medical device, Understanding the innovation cycle, Good Design Practice.

Understanding, analyzing and validating user needs, Screening Needs, Technical Requirements, Concept Generation – Innovation Survey Questionnaire, Morphological Matrix, QFD, Concept Analysis and validation, Concept Modelling, Concept Screening & Validation.

**PRODUCT DEVELOPMENT AND REGULATORY**

Breakthrough Products, Platform Products, Front End of Innovations / Fuzzy Front End, Generic Product Development Process (Concept Development, System Design, Detailed Design, Test & Refinement, Production Ramp-up), Variants of Development Processes (Market Pull, Technology Push, Platform, Process-Intensive, Customized, High-Risk, Quick Build, Complex Systems), Good Documentation Practice, Prototyping Specifications, Prototyping, Medical Device standards, Quality management systems, Medical Device Classification, Design of Clinical Trials, Design Control & Regulatory Requirements, Documentation in Medical Devices, Regulatory pathways.

**CALABLE PRODUCT DEVELOPMENT**

Design for manufacturing, Design for assembly, Design for Serviceability, Design for usability, Medical Device Verification & Validation, Product Testing & Regulatory compliance, Clinical trial & validation, Device Certification.

**MANUFACTURING AND BUSINESS STRATEGIES**

Lean Manufacturing – Toyota Production System, Good Manufacturing Practices, Framework for Product Strategy – Core Strategic Vision (CSV), Characteristics of good CSV, Opportunity Identification Process & Generating Opportunities, Quality of Opportunities – Real-Win-Worth It (3M RWW), Product Planning Process, Technology S-Curve, Evaluating and Prioritizing Projects, Product-Process Change Matrix, Resource Planning, Total Available Market (Segmentation, Targeting & Positioning), Served Available Market, Product Platform Strategy, Market Platform Plan (Product Platform Management, Product Line Strategy).

**PRODUCT ECONOMICS AND MARKET INFUSIONS**

Economics/Finance in Product Development (Sales Forecasting – ATAR Model/ Bases Model, Pricing the product, Cash flow in Product Development, Categorizing the costs, Structuring Manufacturing Costs, Prototyping Costs, Development Costs, Cost Volume Profit Analysis, Breakeven Analysis, Common Return Metrics – Payback/ NPV/ IRR, Common Comparison Metrics – WACC/ RRR/ MARR). Business Model Canvas, Marketing Channels, Sales Models, Post Commercialization Surveillance, End of Life support.

**REFERENCES:**


1. Jones, J.C., Design Methods, John Wiley, 1981.
2. Cross, N., Engineering Design Methods, John Wiley, 1994.
3. Pahl, G., and Beitz, W., Engineering Design, Design Council, 1984.
4. Michael E. McGrath, Product Strategy for High-Technology Companies, 2nd Edition, McGraw Hill.
5. Ulrich, K.T., and Eppinger, S.D., Product Design and Development, Tata McGraw Hill, India.
6. Ehrelspiel. K, and Lindemann U Cost Efficient Design, Springer, 2007.
7. Paul H king, Richard C. Fries, Arthur T. Johnson, Design of Biomedical Devices and Systems. Third edition, ISBN 9781466569133.
8. Peter J. Ogrodnik, Medical Device Design: Innovation from Concept to Market, Academic Press Inc; Edition (2012), ISBN- 10:0123919428.
9. Stefanos Zenios, Josh Makower, Paul Yock, Todd J. Brinton, Uday N. Kumar, Lyn Denend, Thomas M. Krummel, Biodesign: the Process of Innovating Medical Technologies, Cambridbge University press; Edition (2009), ISBN- 10:0521517427.


**COURSE DESIGNERS**

| S.No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1 | Dr.L.K.Hema | Professor & Head | BME & ECE | hodbme@avit.ac.in |
| 2 | Dr.N.Babu | Professor | BME | babu@vmkvec.edu.in |
| 3 | Dr.R.Ezhilan | Assistant Professor | BME | ezhilan@vmkvec.edu.in |

| | ADVANCED CYBER SECURITY | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

To understand the need for Cyber Security in real time and to study techniques involved in it.

**PREREQUISITE :** NIL

**COURSE OBJECTIVES**

| | |
|---|---|
| **1.** | To understand the basic terminologies related to cyber security and current cyber security threat landscape. |
| **2.** | To unserstand the cyberattacks that target computers, mobiles and persons |
| **3.** | To understand the legal framework that exist in India for cyber crimes and penalties and punishments for such crimes |
| **4.** | To study the data privacy and security issues related to Social media platforms. |
| **5.** | To understand the main components of cyber security plan |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| **CO1:** able to understand the basic terminologies related to cyber security and current cybe security threat landscape. | Understand |
| **CO2:** Able to complete u n d e r s t a n d i n g of the cyberattacks that target computers, mobiles and persons | Apply |
| **CO3:** able to understand the legal framework that exist in India for cyber crimes and penalties and punishments for such crimes, It will also expose students to limitations of existing IT Act,2000 legal framework that is followed in other countries and legal and ethical aspects related to new technologies. | Apply |
| **CO4**: Able to get insight into the Data Protection Bill,2019 and data privacy and security issues related to Social media platforms. | Apply |
| ***CO5:***Able to understand the main components of cyber security plan. | Apply |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PS O1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | M | M | M | M | - | - | - | - | - | - | - | - | M | M | M |
| CO 2 | M | M | M | M | M | - | - | - | - | - | - | - | M | M | M |
| CO 3 | M | M | S | M | M | - | - | - | - | - | - | - | M | M | M |
| CO 4 | S | M | M | M | | - | - | - | - | - | - | - | M | M | S |
| CO 5 | S | M | M | M | S | - | - | - | - | - | - | - | M | M | S |

S- Strong; M-Medium; L-Low

**SYLLABUS:**

| | |
|---|---|
| Overview of Cyber security | **9 hours** |
| Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies. | |
| Cyber crimes | **9 hours** |
| Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cybersquatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake newscyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies. | |
| Cyber Law | **9 hours** |
| Cyber crime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies. | |
| Data Privacy and Data Security | **9 hours** |
| Defining data, meta-data, big data, nonpersonal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues. | |
| Cyber security M a n a g e m e n t , Compliance and Governance | **9 hours** |
| Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy. | |
| **REFERENCES** | |
| 1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.<br>2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.<br>3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.<br>4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.<br>5. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication.<br>6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning. | |

**COURSE DESIGNERS**

| S. No. | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1. | Dr.R.Jaichandran | Assistant professor G-II | CSE | rjaichandran@avit.ac.in |
| 2. | Mr. B. Sundharamurthy | Assistant Professor | CSE | sundharamurthy@vmkvec.edu.in |

| | BIO MEMS | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

The rapid development of the integrated circuit (IC) industry has led to the emergence of micro electronics process engineering as a new advanced discipline. The combination of MEMS and integrated intelligence has been put forward as a disruptive technology.Gives brief knowledge about applications of Bio-MEMS technology for therapeutics and diagnostics.

**PREREQUISITE**

Nil

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To train the students in the design aspects of Bio MEMS devices and Systems. |
| 2 | To learn the basic principles of BioMEMS/Microfluidic device manufacturing. |
| 3 | To make the students aware of applications in various medical specialists especially the Comparison of conventions methods and Bio MEMS usage. |
| 4 | To Classify the different mechanisms of micro sensors and actuators. |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Understand the Micro fluidic Principles and study its applications. | Understand |
| CO2. Explain the principles and applications of Micro Total Analysis. | Understand |
| CO3. Discuss and realize the MEMS applications in Bio Medical Engineering | Understand |
| CO4. Classifying the principles of Micro Actuators and Drug Delivery system | Apply |
| CO5.Utilizing the concept of MEMS with biological applications | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | L | L | L | L | - | - | - | - | - | - | - | - | - | - |
| CO2 | S | L | L | L | M | - | - | - | - | - | - | - | - | - | - |
| CO3 | S | L | M | L | M | - | - | - | - | - | - | - | - | L | - |
| CO4 | S | M | M | L | M | - | - | - | - | - | - | L | L | L | - |
| CO5 | S | S | M | L | M | - | - | - | - | - | - | L | L | L | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**Unit I**

Introduction-The driving force behind Biomedical Applications – Biocompatibility - Reliability Considerations-Regularity Considerations – Organizations - Education of Bio MEMS-Silicon Micro fabrication-Soft Fabrication techniques

**Unit II**

Micro fluidic Principles- Introduction-Transport Processes- Electro kinetic Phenomena-Micro valves –Micro mixers-Micro pumps.

**Unit III**

SENSOR PRINCIPLES and MICRO SENSORS: Introduction-Fabrication-Basic Sensors-Optical fibers-Piezo electricity and SAW devices-Electrochemical detection-Applications in Medicine

**Unit IV**

MICRO ACTUATORS and DRUG DELIVERY: Introduction-Activation Methods-Micro actuators for Micro fluidics-equivalent circuit representation-Drug Delivery

**Unit V**

MICRO TOTAL ANALYSIS: Lab on Chip-Capillary Electrophoresis Arrays-cell, molecule and Particle Handling-Surface Modification-Microsphere-Cell based Bioassay Systems Detection and Measurement Methods-Emerging Bio MEMS Technology-Packaging, Power, Data and RF Safety-Biocompatibility, Standards

**Text Books/ References Books :**


1. Steven S. Saliterman, Fundamentals of Bio MEMS and Medical Micro devices, Wiley Interscience, 2006.
2. Albert Folch , Introduction to Bio MEMS, CRC Press, 2012
3. Gerald A. Urban, Bio MEMS, Springer, 2006
4. Wanjun wang, steven A. Soper, Bio MEMS, 2006.
5. M. J. Madou, “Fundamentals of Micro fabrication”,2002.
6. G.T. A. Kovacs, “Micro machined Transducers Sourcebook”, 1998.

| COURSE DESIGNERS | | | | |
|---|---|---|---|---|
| **S.No** | **Name of the Faculty** | **Designation** | **Department** | **Mail ID** |
| 1 | Mrs.A.Malarvizhi | Assistant Professor | ECE | malarvizhi@vmkvec.edu.in |
| 2 | Dr.T.Muthumanickam | Professor & Head | ECE | muthumanickam@vmkvec.edu.in |

| | SOLAR AND ENERGY STORAGE SYSTEMS | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| | | OE-EA | 3 | 0 | 0 | 3 |

**PREAMBLE**

This subject deals with the general concept of Solar and Energy Storage Systems, and improvement.

**PREREQUISITE: Nil**

**COURSE OBJECTIVE**

| | |
|---|---|
| 1. | To explain basics of solar photovoltaic systems and energy storage system |
| 2. | To understand the concepts and various components of stand-alone system |
| 3. | To gain the sound knowledge about grid connected PV system |
| 4. | To know the design of various PV-interconnected systems. |
| 5. | To provide the knowledge about the various applications of solar system |

**COURSE OUTCOMES**

| | |
|---|---|
| On the successful completion of the course, students will be able to | Understand |
| CO1: Describe the basics of solar system. | Understand |
| CO2:Recognize the concepts of standalone PV system. | Analysis |
| CO3: Design the grid connected system for various applications. | Analysis |
| CO4: Select the suitable storage system for particular applications. | Analysis |
| CO5: Recognize the various applications of solar system. | Create |

Mapping with programme outcomes and programme specific outcomes

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | M | - | - | M | S | S | M | - | - | L | - | M | - | M |
| CO2 | S | S | - | - | M | S | S | M | - | - | L | - | L | - | L |
| CO3 | S | S | L | - | S | S | S | M | - | - | M | - | M | L | L |
| CO4 | S | M | L | M | S | S | M | M | - | - | M | - | M | - | - |
| CO5 | S | M | L | M | S | S | M | L | L | - | M | - | M | - | M |

S-STRONG ,M-MEDIUM,L-LOW

**Introduction**
Characteristics of sunlight: the sun and its radiation, Solar radiation, Direct and diffusion radiation, greenhouse effect, solar isolation data and estimation-semiconductors and P-N junctions: semiconductors and types, absorption of light, recombination and PN junctions –behavior of solar cells – cell properties: efficiency and losses, Top contact design, Laser grooved, Buried contact solar cell – PV cell interconnection: Module and circuit design, Environmental and thermal protection.

**Stand-alone PV System**
Solar modules – storage systems: Types, applications, requirements, efficiency, Lead acid batteries – power conditioning and regulation: Diodes, Regulators, Inverters- Balance of system components - protection – standalone PV systems design – sizing: Reliability maps, sizing for high reliability, existing methods.

**Grid Connected PV Systems**
PV systems in buildings – Utility applications for photo voltaic – design issues for central power stations – safety– Economic aspect – Efficiency and performance - International PV programs – Integration of PV and Wind –Indian Specific Standard for Integration.

**Energy Storage Systems**
Impact of intermittent generation: Wind, gas and coal integration, impacts of cycling, PSCO case studies – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage.

**Applications**
Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.1

**Total Hours = 45**

**Text book(s):**
1. Solar Energy – S.P. Sukhatme, Tata McGraw Hill, 2017.
2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2011.

**Reference(s):**
1. Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2017.
2. S. Sumathi, “Solar PV and Wind Energy Conversion Systems (Green Energy and Technology)”, L. Ashok Kumar , P. Surekha, 2015.
3 https://nptel.ac.in/courses/112/105/112105051/
4 https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf

**COURSE DESIGNERS**


| S.No | Name of the faculty | Designation | Department | Mail-id |
|---|---|---|---|---|
| 1. | Mr.A.Balamurugan | AP | EEE | balamurugan@vmkvec.edu.in |
| 2. | Mr.V.Rattan Kumar | AP(Gr-II) | EEE | rattankumar@avit.ac.in |

# Employability Enhancement Courses

| | TECHNICAL SEMINAR | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | EE-S | 0 | 0 | 2 | 1 |

**COURSE OBJECTIVES**

- To work on a specific technical topic in advanced topics in Civil Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

**COURSE OUTCOMES**

On completion of the course, the student is expected to be able to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | S | - | M | M | - | S | S | - | - | M | - | M | S | - | S |

| S- Strong | M-Medium | L-Low |
|---|---|---|

**SYLLABUS**

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to advanced topics in Civil Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and report submitted.

**TOTAL : 30 PERIODS**

## AUDIT COURSES

| | ENGLISH FOR RESEARCH PAPER WRITING | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 0 | 0 | 2 | 0 |

**PREAMBLE**

This course is designed to improve the writing skills, level of readability of the learner and skills for writing the title.

**PREREQUISITE**

Nil

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | Understand that how to improve your writing skills and level of readability |
| 2 | Learn about what to write in each section |
| 3 | Understand the skills needed when writing a Title |
| 4 | Ensure the good quality of paper at very first-time submission |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Understand how to improve your writing skills with conciseness so as to and removing redundancy | Understand |
| CO2. Classify the sections involved in research paper writing | Understand |
| CO3. Interpret the sequence of research findings with results | Apply |
| CO4. Use various paraphrasing method to provide good quality paper at very first-time submission | Apply |

| MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1 | L | M | - | - | - | - | - | - | M | - | - | M | - | - | S |
| CO2 | L | M | - | - | M | - | - | - | M | - | - | M | - | - | S |
| CO3 | L | M | - | - | M | - | - | - | M | - | - | M | - | - | S |
| CO4 | L | M | - | - | M | - | - | - | M | - | - | M | - | - | S |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**Unit I**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

**Unit II**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

**Unit III**

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check, key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

**Unit IV**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

**Unit V**

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**Text Books/ References Books :**


1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011


**COURSE DESIGNERS**


| S.No | Name of the Faculty | Designation | Department | Mail ID |
|---|---|---|---|---|
| 1. | Dr.Jennifer G Joseph | HoD-H&S | AVIT | Jennifer@avit.a.cin |
| 2. | Mr. Tyndale Cicil | Assistant Professor | AVIT | tyndale.english@avit.ac.in |

| | VALUE EDUCATION | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 0 | 0 | 2 | 0 |

**PREAMBLE**

The course highlights the importance of values and ethics for human life and organization.

**PREREQUISITE**

Nil

**COURSE OBJECTIVES**

| | |
|---|---|
| 1 | To understand value of education and self- development |
| 2 | To inculcate good values in students to make them patriotic with humanity |
| 3 | To groom the personality with positive thinking with universal brotherhood and religious tolerance. |
| 4 | To impart the value of true friendship and happiness |
| 5 | To enhance the character and competence for developing into self-control person |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

| | |
|---|---|
| CO1. Identify the value of education and self- development with work ethics | Remember |
| CO2. Interpret sense of duties with good values in students to make them patriotic with humanity | Understand |
| CO3. Explain the integration, scientific attitude, overall personality with labor dignity | Understand |
| CO4. Discuss the value of true friendship and happiness | Understand |
| CO5. Paraphrase the character and competence for developing into self-control person | Understand |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | L | - | - | - | - | - | S | - | L | - | - | - | - | - |
| CO2 | L | L | - | - | - | - | - | M | - | - | - | - | - | - | - |
| CO3 | L | L | M | - | - | - | - | M | - | - | - | L | L | L | - |
| CO4 | L | S | - | - | - | - | - | M | - | - | - | - | - | - | - |
| CO5 | L | S | M | - | - | - | - | M | - | L | - | - | L | L | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**Unit I**

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, value judgements

**Unit II**

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature, Discipline

**Unit III**

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline., Punctuality, Love and Kindness, avoid fault Thinking, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance

**Unit IV**

True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, doing best for saving nature

**Unit V**

Character and Competence –Holy books vs Blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, all religions and same message, mind your Mind, Self-control, Honesty, Studying effectively

**Text Books/ References Books :**

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford UniversityPress, New Delhi

| Course Code | Course Title | category | L | T | P | C |
|---|---|---|---|---|---|---|
| | **CONSTITUTION OF INDIA** | **AC** | 0 | 0 | 2 | 0 |

**Course Objectives:**
On completion of this course, the students will be able:

1 To understand the nature and the Philosophy of the Constitution.

2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.

3 To Analyse Panchayat Raj institutions as a tool of decentralization.

4 To Understand and analyse the three wings of the state in the contemporary scenario.

5 To Analyse Role of Adjudicatory Process.

5 To Understand and Evaluate the recent trends in the Indian Judiciary.

**Course Content**

**UNIT I**

**The Constitution - Introduction**

The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and the Basic Structure - Fundamental Rights and Fundamental Duties –Directive Principles State Policy

**UNIT II –Government of the Union**

The Union Executive-Powers and duties of President –Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha

**UNIT III –Government of the States**

The Governor –Role and Powers - Cheif Minister and Council of Ministers- State Legislature

**UNIT IV – Local Government**

The New system of Panchayats ,Municipalities and Co-Operative Societies

**UNIT V – Elections**

Powers of Legislature -Role of Chief Election Commissioner-State Election Commission

**TEXTBOOKS AND REFERENCE BOOKS:**

1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008

2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)

3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition Suggested

**Total Hours:30 hours**

**Software/Learning Websites:**

1. https://www.constitution.org/cons/india/const.html

2. http://www.legislative.gov.in/constitution-of-india

3. https://www.sci.gov.in/constitution

4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

**Alternative NPTEL/SWAYAM Course:**

| S.NO | NPTEL ID | NPTEL Course Title | Course Instructor |
|---|---|---|---|
| **1** | 12910600 | CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS | PROF. M. K. RAMESH NATIONAL LAW SCHOOL OF INDIA UNIVERSITY |

**COURSE DESIGNER**

| S.NO | NAME OF THE FACULTY | DESIGNATION | NAME OF THE INSTITUTION | MAIL ID |
|---|---|---|---|---|
| 1 | Dr.Sudheer | Principal | AV School of Law | Sudheersurya18@gmail.com |

| | PEDAGOGY STUDIES | Category | L | T | P | Credit |
|---|---|---|---|---|---|---|
| | | AC | 0 | 0 | 2 | 0 |

**PREAMBLE**

The course is designed to provide pedagogical practices towards academic, research activities and professional developments.

**PREREQUISITE**

Nil

**COURSE OBJECTIVES**

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|---|---|
| 1 | To provide theories and methodologies related to curriculum development and research framework |
| 2 | To familiarize with pedagogical practices in formaland informal classrooms in developing countries |
| 3 | To identify evidence on the effectiveness of the pedagogical practices for enhancing teaching and learning Methods |
| 4 | To understand the learning and resource barriers while handling large classes |
| 5 | To identify critical evidence gaps to guide the development |

**COURSE OUTCOMES**

On the successful completion of the course, students will be able to

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|---|---|
| CO1.Identify theories and methodologies related to curriculum development and research framework | Remember |
| CO2.Interpret pedagogical practices in formaland informal classrooms in developing countries | Understand |
| CO3.Draw a chart on the effectiveness of the pedagogical practices for enhancing teaching and learning methods | Apply |
| CO4.Explore the learning and resource barriers while handling large classes | Analyze |
| CO5.Examine critical evidence gaps to guide the development | Analyze |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES**

| COS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | L | - | - | - | - | - | - | - | L | - | - | - | - | - |
| CO2 | L | L | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO3 | L | L | M | - | - | - | - | - | - | - | - | L | L | L | - |
| CO4 | L | S | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO5 | L | S | M | - | - | - | - | - | - | L | - | - | L | L | - |

**S- Strong; M-Medium; L-Low**

**SYLLABUS**

**Unit I**

Introduction and Methodology,Aims and rationale, Policy background, Conceptual framework andterminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and searching.

**Unit II**

Thematic overview: Pedagogical practices are being used by teachers in formaland informal classrooms in developing countries, Curriculum, Teacher education.

**Unit III**

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the schoolcurriculum and guidance materials best support effective pedagogy, Theory of change, Strength and nature of the body of evidence for effective pedagogicalpractices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

**Unit IV**

Professional development: alignment with classroom practices and followupsupport, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

**Unit V**

Research gaps and future directions, Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

**Text Books/ References Books :**


1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher educationresearch project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning ofbasicmaths and reading in Africa: Does teacher preparation count? International JournalEducational Development, 33 (3): 272–282.

| Course Code | Course Title | Category | L | T | P | C |
|---|---|---|---|---|---|---|
| | **Personality Development Through Life Enlighten Skills** | **AC** | 0 | 0 | 2 | 0 |

**Course Objectives:**

1. To help the learner understand the basics of Personality and its correlation to society.
2. To understand the role of Attitude and motivation in the enhancement of personality.
3. To apply the concepts learnt in heightening the self esteem.
4. To analyse the most efficient method to develop the personality and prepare for employment.

**UNIT I- Introduction to Personality Development**

The concept of personality - Dimensions of personality – Theories of Freud & Erickson- Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles -Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

**UNIT II Attitude & Motivation**

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation

**UNIT III Self-esteem**

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

**UNIT IV Other Aspects of Personality Development**

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.**UNIT V Employability Quotient**

Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview - Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

**Total: 45 Periods**

Text Books: 1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill. 2. Stephen P.Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

| **COURSE DESIGNERS** | | | |
|---|---|---|---|
| **COURSE INSTRUCTOR** | **DESIGNATION** | **NAME OF THE INSTITUTION** | **MAIL ID** |

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|---|---|---|---|
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