# Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Civil Engineering

## BCE071 Shoring Scaffolding and Formwork

**Sixth Semester, 2016-17 (Even Semester)**

**Course (catalog) description**

Practice by studying the materials, planning and design aspects and erection procedures. To bring about a thorough exposure to shoring, scaffolding and formwork procedures in construction.

**Compulsory/Elective course :** Elective for Civil students

Credit/ contact hours : 3 credits / 45 hours

Course Coordinator : Mr.T. P.Meikandan, Assistant Professor

**Instructors :**

| Name of the instructor | Class handling | Office location | Office phone | Email (domain:@ bharathuniv.ac.in | Consultation |
|---|---|---|---|---|---|
| Mr.T. P.Meikandan | Third year Civil | Civil Block | | | 9.00 - 9.50 AM |
| Ms.K.Anitha | Third year Civil | Civil Block | | | 12.45 - 1.15 PM |

### Relationship to other courses:

Pre –requisites : Building Construction technology

Assumed knowledge : Basic knowledge in Building construction

Following courses : BECE051 Concrete Technology

### Syllabus Contents

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

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

**UNIT II FORM MATERIALS 9 Hours**

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

**UNIT III DESIGN OF FORMS AND SHORES** **9 Hours**

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

**UNIT IV FORMWORK FOR BUILDINGS** **9 Hours**

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

**UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SAFETY PRACTICES FOR SCAFFOLDS** **9 Hours**

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

## References


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


**Computer usage:** Nil

**Professional component**

| | | |
|---|---|---|
| General | - | 0% |
| Basic Sciences | - | 0% |
| Engineering sciences & Technical arts | - | 0% |
| Professional subject | - | 100% |

**Broad area :** Building Construction

## Test Schedule

| S. No. | Test | Tentative Date | Portions | Duration |
|---|---|---|---|---|
| 1 | Cycle Test-1 | February 1st week | Session 1 to 14 | 2 Periods |
| 2 | Cycle Test-2 | March 2nd week | Session 15 to 28 | 2 Periods |
| 3 | Model Test | April 2nd week | Session 1 to 45 | 3 Hrs |
| 4 | University Examination | TBA | All sessions / Units | 3 Hrs. |

## Mapping of Instructional Objectives with Program Outcome

| Practice by studying the materials, planning and design aspects and erection procedures. To bring about a thorough exposure to shoring, scaffolding and formwork procedures in construction.. | Correlates to program outcome | | |
|---|---|---|---|
| | **H** | **M** | **L** |
| 1. Study the materials associated with formwork. | e | c,f | |
| 2. Study the design aspects of formwork under various requirements. | e | c,f | h |
| 3. Know the design of forms and shores | e | c,f | |
| 4. Study the planning and erection aspects of form work for buildings. | e | c,f | |
| 5. Understand few other special types of forms. | e | c,f | |

**Draft Lecture Schedule**

| Session | Topics | Problem solving (Yes/No) | Text / Chapter |
|---|---|---|---|
| **UNIT I PLANNING AND SITE EQUIPMENT & PLANT FOR FORM WORK** | | | |
| 1. | At Tender stage – Development of basic system | No | R1 |
| 2. | Planning for maximum reuse | No | |
| 3. | Economical form construction Planning examples | No | |
| 4. | Crane size, effective scheduling estimate | No | |
| 5. | Recheck plan details Detailing the forms | No | |
| 6. | Overall Planning detail planning ,Standard units Corner units | No | |
| 7. | Schedule for column formwork, Formwork elements Planning Crane arrangements | No | |
| 8. | Site layout plan Transporting plant Formwork beams Formwork ties | No | |
| 9. | Wales and ties scaffold frames from accessories Vertical transport table form work. | No | |
| **UNIT II FORM MATERIALS** | | | |
| 10. | Lumber Types Finish Sheathing boards working stresses | No | |
| 11. | Repetitive member stress Plywood | No | |
| 12. | Types and grades Textured surfaces and strength Reconstituted wood | No | |

| | | | |
|---|---|---|---|
| 13. | Steel Aluminium Form lining materials | No | R1 |
| 14. | Hardware and fasteners Nails in Plywood Concrete density | No | |
| 15. | Height of discharge Temperature | No | |
| 16. | Rates of Placing Consistency of concrete Live loads and wind pressure | No | |
| 17. | Vibration Hydrostatic pressure and pressure distribution | No | |
| 18. | Examples Vertical loads Uplift on shores Adjustment for non standard conditions. | No | |
| **UNIT III DESIGN OF FORMS AND SHORES** | | | |
| 19. | Basic simplification – Beam formulas – Allowable stresses | No | R1 |
| 20. | Deflection bending lateral stability – Shear, Bearing | No | |
| 21. | Examples in wall forms – Slab forms – Beam forms Ties, Anchors and Hangers | No | |
| 22. | Column forms – Examples in each. Simple wood stresses | No | |
| 23. | Slenderness ratio – Allowable load – Tubular steel | No | |
| 24. | shores patented shores – Site Preparation | No | |
| 25. | Size and spacing – Steel Tower Frames Safety practices | No | |
| 26. | Horizontal shores shoring for multistories – More concentrated shore loads T- heads – Tow Tier wood shores | No | |
| 27. | Ellis shores – Dayton sure grip and Baker Roofs shores – Safeway Symons shores – Beaver advance shores Dead shore – Raking and Flying shores. | No | |
| **UNIT IV REHABILITATION TECHNIQUES** | | | |
| 28. | Location of job mill Storage Equipment Footings Wall footings | No | R1 |
| 29. | Column footings Sloped footing forms Curb and gutter forms | No | |
| 30. | Wall forms Prefabricated panel systems Giant forms | No | |
| 31. | curved wall forms Column heads Beam or girder forms | No | |
| 32. | Beam pockets Suspended forms Concrete joint | No | |
| 33. | construction Flying system forms Causes of failures | No | |
| 34. | Inadequate shoring inadequate bracing of members improper vibration Premature stripping | No | |
| 35. | Errors in design Failure to follow codes How formwork affects concretes quality ACI | No | |
| 36. | Case studies Finish of exposed concrete design deficiencies Safety factors Prevention of rotation Stripping sequence Advantages of reshoring. | No | |
| **UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SAFETY PRACTICES FOR SCAFFOLDS** | | | |
| 37. | Hemispherical, Parabolic, Translational typical barrel vaults, Hyperbolic Folded plates | No | R1 |
| 38. | Shell form design considerations loads Inserts , Anchors bolts Building the forms Placing concrete Form removed | No | |
| 39. | Strength requirements – Tunnel forming components Curb forms invert forms | No | |
| 40. | Arch forms Concrete placement methods Cut and cover construction | No | |
| 41. | Tolerances Form construction Shafts | | |
| 42. | Slip Forms Principles Types advantages Functions of various components Planning Desirable characteristics of concrete Common problems faced | | |
| 43. | Safety in slip forms special structures built with slip form Technique Codal provisions Types of scaffolds Putlog and independent scaffold | | |
| 44. | Single pole scaffolds Fixing ties Spacing of ties plan bracing knots safety net | | |
| 45. | General safety requirements precautions against particular hazards Truss suspended Gantry and system scaffolds | | |

## Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.

**Evaluation Strategies**

| | | |
|---|---|---|
| Cycle Test – I | - | 5% |
| Cycle Test – II | - | 5% |
| Model Test | - | 5% |
| Assignment | - | 5% |
| Attendance | - | 10% |
| Final exam | - | 70% |

**Prepared by**: Mr.S.Vinothkumar Assistant Professor , Department of Civil **Dated :**

**Addendum**

**ABET Outcomes expected of graduates of B.Tech / Civil / program by the time that they graduate:**

a. An ability to apply knowledge of mathematics, science, and engineering
b. An ability to design and conduct experiments, as well as to analyze and interpret data
c. An ability to design a hardware and software system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
d. An ability to function on multidisciplinary teams
e. An ability to identify, formulate, and solve engineering problems
f. An understanding of professional and ethical responsibility
g. An ability to communicate effectively
h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
i. A recognition of the need for, and an ability to engage in life-long learning
j. A knowledge of contemporary issues
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

**Program Educational Objectives**

**PEO1: PREPARATION**

Civil Engineering graduates will have knowledge to apply the fundamental principles for a successful profession and/or for higher education in Civil Engineering based on mathematical, scientific and engineering principles, to solve realistic and field problems that arise in engineering and non engineering sectors

**PEO2: CORE COMPETENCE**

Civil Engineering graduates will adapt to the modern engineering tools and construction methods for planning, design, execution and maintenance of works with sustainable development in their profession.

**PEO3: PROFESSIONALISM**

Civil Engineering Graduates will exhibit professionalism, ethical attitude, communication and managerial skills, successful team work in various private and government organizations both at the national and international level in their profession and adapt to current trends with lifelong learning.

**PEO4: SKILL**

Civil Engineering graduates will be trained for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

**PEO5: ETHICS**

Civil Engineering graduates will be installed with ethical feeling, encouraged to make decisions that are safe and environmentally-responsible and also innovative for societal improvement.

| Course Teacher | Signature |
|---|---|
| Mr.T. P.Meikandan | |
| Ms.K.Anitha | |

**Course Coordinator**

**HOD/Civil**