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curriculum and experiential learning document

## **1.3.2**

# **COURSES THAT INCLUDE EXPERIENTIAL LEARNING THROUGH PROJECT WORK/FIELD WORK/INTERNSHIP DURING 2021-2022**



# NPR

## College of Engineering & Technology

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Natham, Dindigul - 624 401. Web: www.nprcet.org



### 1.3.2 AVERAGE PERCENTAGE OF COURSES THAT INCLUDE EXPERIENTIAL LEARNING THROUGH PROJECT WORK / FIELD WORK / INTERNSHIP DURING 2021-2022

S.NO	PROGRAMME OFFERING	NAME OF THE COURSE	COURSE CODE	PROJECT WORK / FIELD WORK / INTERNSHIP	PAGE NO
1	B.E-Civil Engineering	Strength of Materials I	CE8301	Internship	3
2	B.E-Civil Engineering	Fluid Mechanics	CE8302	Internship	6
3	B.E-Civil Engineering	Surveying	CE8351	Internship	9
4	B.E-Civil Engineering	Construction Materials	CE8391	Project work	12
5	B.E-Civil Engineering	Construction Techniques and Practices	CE8401	Project work	18
6	B.E-Civil Engineering	Concrete Technology	CE8404	Project work	24
7	B.E-Civil Engineering	Soil Mechanics	CE8491	Internship	30
8	B.E-Civil Engineering	Design of Reinforced Cement Concrete Elements	CE8501	Internship	33
9	B.E-Civil Engineering	Structural Analysis I	CE8502	Internship	36
10	B.E-Civil Engineering	Water Supply Engineering	EN8491	Project work	39
11	B.E-Civil Engineering	Foundation Engineering	CE8591	Internship	45
12	B.E-Civil Engineering	Survey Camp	CE8513	Field work	49
13	B.E-Civil Engineering	Design of Steel Structural Elements	CE8601	Internship	51
14	B.E-Civil Engineering	Structural Analysis II	CE8602	Internship	54
15	B.E-Civil Engineering	Irrigation Engineering	CE8603	Internship	57
16	B.E-Civil Engineering	Highway Engineering	CE8604	Internship	61
17	B.E-Civil Engineering	Wastewater Engineering	EN8592	Internship	64
18	B.E-Civil Engineering	Estimation, Costing and Valuation Engineering	CE8701	Internship	67
19	B.E-Civil Engineering	Railways, Airports, Docks and Harbour Engineering	CE8702	Internship	70
21	B.E-Civil Engineering	Structural Design and Drawing	CE8703	Internship	73
22	B.E-Civil Engineering	Project Work	CE8811	Project work	76



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B.E., M.Tech., Ph.D.,  
Principal  
N.P.R. College of Engineering & Technology  
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**OBJECTIVES:**

- To learn the fundamental concepts of Stress, Strain and deformation of solids.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyze plane and space trusses

**UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9**

Simple Stresses and strains – Elastic constants - Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member - Composite Bars - Thermal Stresses – State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress - Mohr's circle method.

**UNIT II TRANSFER OF LOADS AND STRESSES IN BEAMS 9**

Types of loads, supports, beams – concept of shearing force and bending moment - Relationship between intensity of load, Shear Force and Bending moment - Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force - Flitched Beams - Leaf Springs.

**UNIT III DEFLECTION OF BEAMS 9**

Elastic curve – Governing differential equation - Double integration method - Macaulay's method - Area moment method - conjugate beam method for computation of slope and deflection of determinant beams.

**UNIT IV TORSION 9**

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel – Design of buffer springs.

**UNIT V ANALYSIS OF TRUSSES 9**

Determinate and indeterminate trusses - Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient – Analysis of Space trusses by tension coefficient method.

**TOTAL :45 PERIODS****OUTCOMES:**

Students will be able to

- Understand the concepts of stress and strain, principal stresses and principal planes.
- Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
- Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
- Apply basic equation of torsion in design of circular shafts and helical springs, .
- Analyze the pin jointed plane and space trusses




**TEXTBOOKS:**

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2015.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials,Laxmi publications. New Delhi, 2015
3. Rattan . S. S, "Strength of Materials", Tata McGraw Hill Education Private Limited, NewDelhi, 2012
4. Bansal. R.K. "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 2010

**REFERENCES :**

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", Van Nos Reinhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, "Analysis of Structures", Vol I Khanna Publishers, NewDelhi,1995.
3. Junnarkar.S.B. and Shah.H.J, "Mechanics of Structures", Vol I, Charotar Publishing House,New Delhi 2016.
4. Singh. D.K., " Strength of Materials", Ane Books Pvt. Ltd., New Delhi, 2016
5. Basavarajaiah, B.S. and Mahadevappa, P., Strength of Materials, Universities Press,Hyderabad, 2010.
6. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., NewDelhi, 2009.



  
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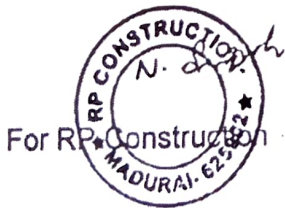
G16, Race Course Colony, New Natham Road, Madurai – 625 002.


Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that **Mr. P. Anandhan Alaguvel, Reg. No: 920820103002**, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



  
**Dr. JSUNDARAJAN,**  
B.E., M.Tech., Ph.D.,  
Principal  
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**OBJECTIVE:**

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.

**UNIT I FLUID PROPERTIES AND FLUID STATICS**

9

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

**UNIT II FLUID KINEMATICS AND DYNAMICS**

9

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line-streak line-path line- stream function - velocity potential function - flow net. Fluid dynamics - equations of motion -Euler's equation along a streamline - Bernoulli's equation – applications - venturi meter, orifice meter and Pitot tube- linear momentum equation and its application to pipe bend.

**UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES**

9

Fundamental dimensions - dimensional homogeneity - Rayleigh's method and Buckingham Pi- theorem - dimensionless parameters - similitudes and model studies - distorted models.

**UNIT IV FLOW THROUGH PIPES**

9

Reynold's experiment - laminar flow through circular pipe (Hagen poiseulle's) - hydraulic and energy gradient – flow through pipes - Darcy - Weisbach's equation - pipe roughness -friction factor- Moody's diagram- major and minor losses of flow in pipes - pipes in series and in parallel.

**UNIT V BOUNDARY LAYER**

9

Boundary layer – definition- boundary layer on a flat plate – laminar and turbulent boundary layer-displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate.


**TOTAL: 45 PERIODS****TEXT BOOKS:**

1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
2. Jain.A.K., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
3. Subramanya.K " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi, 2008.

**REFERENCES:**

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 2013.
3. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
4. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.
5. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013.



  
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**Sona Builders**  
Engineers & Contractors

Er. P. Senthilkumar

Date: 05.03.2022

**TO WHOM IT MAY CONCERN**

This is to certify that **Ms. S. Yazhini (920820103014)**, B.E. Civil Engineering from NPR College of Engineering & Technology, Natham has successfully completed her internship during the period 15.02.2022 to 05.03.2022.



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**OBJECTIVES :**

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying

**UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING**

9

Classifications and basic principles of surveying - Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass - Basic Principles- Bearing — Types - True Bearing - Magnetic Bearing - Levelling- Principles and theory of Levelling – Datum-- Bench Marks — Temporary and Permanent Adjustments- Methods of Levelling- Booking — Reduction - Sources of errors in Levelling - Curvature and refraction.

**UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING**

9

Horizontal and vertical angle measurements - Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometry surveying - Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring - Contour gradient – Uses of contour plan and map

**UNIT III CONTROL SURVEYING AND ADJUSTMENT**

9

Horizontal and vertical control – Methods – specifications – triangulation- baseline – satellite stations – reduction to centre- trigonometrical levelling – single and reciprocal observations – traversing – Gale's table. - Errors Sources- precautions and corrections – classification of errors –

true and most probable values - weighed observations – method of equal shifts – principle of leastsquares - normal equation – correlates- level nets- adjustment of simple triangulation networks.

**UNIT IV ADVANCED TOPICS IN SURVEYING**

9

Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem – Strength of fix – astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods –.Astronomical terms and definitions - Motion of sun and stars - Celestial coordinate systems - different time systems - Nautical Almanac - Apparent altitude and corrections - Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method

**UNIT V MODERN SURVEYING**

9



Total Station : Advantages - Fundamental quantities measured - Parts and accessories - working principle - On board calculations - Field procedure - Errors and Good practices in using Total Station GPS Surveying : Different segments - space, control and user segments - satellite configuration - signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - Hand Held and Geodetic receivers - data processing - Traversing and triangulation.

**TOTAL : 45 PERIODS**

#### **OUTCOMES :**

At the end of the course the student will be able understand

- The use of various surveying instruments and mapping
- Measuring Horizontal angle and vertical angle using different instruments
- Methods of Leveling and setting Levels with different instruments
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- Concept and principle of modern surveying.

#### **TEXTBOOKS :**

1. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi GrihaPrakashan, Pune, 2008
2. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, McGraw Hill, 2001.
4. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
5. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993
6. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

#### **REFERENCES :**

1. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3<sup>rd</sup> Edition, 2004.
2. Guocheng Xu, "GPS Theory , Algorithms and Applications", Springer – Berlin, 2003.
3. SatheshGopi, rasathishkumar, N. madhu, "Advanced Surveying, Total Station GPS and Remote Sensing" Pearson education, 2007
4. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. Arora K.R., "Surveying Vol I & II", Standard Book house, 10<sup>th</sup> Edition 2008



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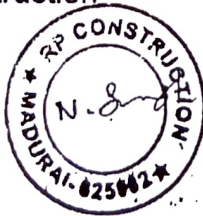
Date: 11.09.2021

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that Ms. K.Kalyani, Reg. No: 920818103003, III year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed her internship in our construction from 12.08.2021 to 11.09.2021.

During the tenure of training her conduct was found good.

For RP Construction



*(Signature)*  
**Dr. J.SUNDARARAJAN,**  
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**OBJECTIVE:**

- To introduce students to various materials commonly used in civil engineering construction and their properties.

**UNIT I STONES – BRICKS – CONCRETE BLOCKS 9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks.

**UNIT II LIME – CEMENT – AGGREGATES – MORTAR 9**

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness – Soundness and consistency – Setting time – fine aggregates – river sand – crushed stone sand – properties – coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading

**UNIT III CONCRETE 9**

Concrete – Ingredients – Manufacturing Process – Batching plants – mixing – transporting – placing – compaction of concrete – curing and finishing – Ready mix Concrete – Mix specification.

**UNIT IV TIMBER AND OTHER MATERIALS 9**

Timber – Market forms – Industrial timber – Plywood – Veneer – Thermocol – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

**UNIT V MODERN MATERIALS 9**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles – Geomembranes and Geotextiles for earth reinforcement.

**TOTAL: 45 PERIODS****OUTCOMES:**

On completion of this course the students will be able to

- Compare the properties of most common and advanced building materials.
- understand the typical and potential applications of lime, cement and aggregates
- know the production of concrete and also the method of placing and making of concrete elements.
- understand the applications of timbers and other materials
- Understand the importance of modern material for construction.


**TEXT BOOKS:**

1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015.
2. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
3. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
4. Duggal.S.K., "Building Materials", 4th Edition, New Age International, 2008.

REFERENCES:

1. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
2. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
3. IS456 - 2000: Indian Standard specification for plain and reinforced concrete, 2011
4. IS4926 - 2003: Indian Standard specification for ready-mixed concrete, 2012
5. IS383 - 1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete, 2011
6. IS1542-1992: Indian standard specification for sand for plaster, 2009
7. IS 10262-2009: Indian Standard Concrete Mix Proportioning –Guidelines, 2009



  
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**EXPERIMENTAL STUDY ON  
FLY ASH – RED MUD BASED FOAMED BRICKS  
BY USING NATURAL FOAMING AGENT**

**A PROJECT REPORT**

*Submitted by*

**REVATHY. A**

**920818103009**

**YUVASHREE. S**

**920818103011**

*In partial fulfilment for the award of the degree*

*Of*

**BACHELOR OF ENGINEERING**

**IN**

**CIVIL ENGINEERING**



**DEPARTMENT OF CIVIL ENGINEERING  
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**ANNA UNIVERSITY: CHENNAI 600 025**

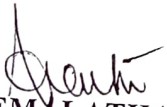
**JUNE 2022**




**ANNA UNIVERSITY: CHENNAI 600 025**


**BONAFIDE CERTIFICATE**

Certified that this project report “**EXPERIMENTAL STUDY ON FLYASH - RED MUD BASED FOAMED BRICKS BY USING NATURAL FOAMING AGENT**” is the bonafide work of **REVATHY A (920818103009)**, **YUVASHREE S (920818103011)**, who carried out the project work under my supervision.


  
**Dr. A. HEMALATHA, M.Tech., Ph.D.,**  
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**Mr. P. MANIKANDAN M.E.,**  
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Submitted for the viva-voice Examination of CE8811 project work held at NPR College of Engineering and Technology, Natham on 24.06.2022

  
**INTERNAL EXAMINER**



  
**EXTERNAL EXAMINER**

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## ABSTRACT

The project deals with experimental study on fly ash – red mud based foamed bricks using natural foaming agent. This type of foamed bricks was manufactured by using mineral admixtures such as fly ash, red mud in addition with natural foaming agent (soapnut solution). In this project, we studied the property of bricks with a partial replacement of water by soapnut solution. The replacement percentages are 0%, 6%, 12%, 18%, 24%, 30%, 36% and 42%. The size of the brick is adopted as 190 x 90 x 90 mm. Based on various literature studies, the optimum ratio of the red mud and fly ash is 45% and 55% respectively. After casting, bricks were dried and burnt under ambient temperature. The properties of bricks were tested by conducting compressive strength test, water absorption test, efflorescence test, soundness test for various mixing proportions. From the test results, optimum replacement percentage of water by soapnut (SN) solution was found. This project has revealed that the bricks manufactured using this method have good quality with acceptable strength and further, they can be manufactured in a cost effective manner.

KEYWORDS: red mud, fly ash, soapnut, ambient temperature, cost

effective.





## CHAPTER 9 CONCLUSION

### 9.1 GENERAL

In this experimental program, forty bricks were cast and tested up to failure. Out of forty, six was control specimen. Then the properties of red mud fly - ash bricks were studied.

Based on the test result it has been inferred that red mud, fly ash and soapnut solution can be utilized as an effective in structural constructions.

According to Indian standard 1077:1992 class designation 3.5, the average compressive strength should not be less than  $3.5 \text{ N/mm}^2$  and the received results shows by the addition of 36% soapnut solution (S36) to brick gives  $8.48 \text{ N/mm}^2$  compressive strength which gives 31.01% increase in compressive strength when compared to control specimen (S0). Beyond the addition of soapnut solution above 36% shows decrease in compressive strength.

According to IS 1077:1992, water absorption should not be more than 20% by weight, and the received results on bricks is 14.70%. There is no efflorescence in the bricks that we produced.

The bricks we produced are economic as compared to normal bricks.

### 9.2 SCOPE FOR FUTURE WORK

The utilization of SCMs in the construction industry has increased tremendously. There is a lot of potential for usage of fly ash, rice husk ash in bricks. Based on the experimental investigation the following conclusions were made : further investigation can be done by adding artificial foaming agent in red mud brick and that results can be compared with test results obtained while adding natural foaming agent in red mud fly – ash brick.



**OBJECTIVE:**

- The main objective of this course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities. At the end of this course the student shall have a reasonable knowledge about the various construction procedures for sub to super structure and also the equipment needed for construction of various types of structures from foundation to super structure.

**UNIT I CONSTRUCTION TECHNIQUES**

9

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism — floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials — responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones-Case studies of residential, office buildings and other buildings in each zones.

**UNIT II CONSTRUCTION PRACTICES**

9

Specifications, details and sequence of activities and construction co-ordination - Site Clearance - Marking - Earthwork - masonry - stone masonry - Bond in masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - frames - braced domes - laying brick - weather and water proof - roof finishes - acoustic and fire protection.

**UNIT III SUB STRUCTURE CONSTRUCTION**

9

Techniques of Box jacking - Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques - Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation.

**UNIT IV SUPER STRUCTURE CONSTRUCTION**

9

Launching girders, bridge decks, off shore platforms — special forms for shells - techniques for heavy decks - in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.

**UNIT V CONSTRUCTION EQUIPMENT**

9

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end loaders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching, mixing



and concreting - Equipment for material handling and erection of structures — types of cranes - Equipment for dredging, trenching, tunneling,

**TOTAL: 45 PERIODS**

**OUTCOMES:**

On successful completion of this course, students will be able to:

- know the different construction techniques and structural systems
- Understand various techniques and practices on masonry construction, flooring, and roofing.
- Plan the requirements for substructure construction.
- Know the methods and techniques involved in the construction of various types of superstructures
- Select, maintain and operate hand and power tools and equipment used in the building construction sites.

**TEXTBOOKS :**

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5<sup>th</sup> Edition, McGraw Hill, Singapore, 1995.
2. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.
3. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

**REFERENCES:**

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.
2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers New Delhi, 2002.
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 2012.
4. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi, 1983.



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Vellore, Tamil Nadu, India

**EXPERIMENTAL INVESTIGATION ON  
MECHANICAL BEHAVIOUR OF FIBRE  
REINFORCED CONCRETE**

**A PROJECT REPORT**

*Submitted by*

**J. NAVEEN - 920818103007**

**A.VETRI VEL - 920818103302**

**K.RAJA - 920818103502**

*In partial fulfillment for the award of the degree*

*Of*

**BACHELOR OF ENGINEERING**

**IN**

**CIVIL ENGINEERING**



**NPR COLLEGE OF ENGINEERING AND TECHNOLOGY**

**NATHAM – 624 401**

**ANNA UNIVERSITY: CHENNAI 600 025**

**JUNE 2022**



# ANNA UNIVERSITY: CHENNAI-600 025



## BONAFIDE CERTIFICATE

Certified that this project report “**EXPERIMENTAL INVESTIGATION ON MECHANICAL BEHAVIOUR OF FIBRE REINFORCED CONCRETE**” is the bonafide work of **J.NAVEEN (920818103007), A.VETRIVEL (920818103302), K.RAJA (920818103502)** who carried out the project work under my supervision.

  
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EXTERNAL EXAMINER

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## ABSTRACT

Reinforced Concrete is the mostly commonly used in construction, for gaining more strength and durability of the structure. Researchers are coming to find out addition of material using composite material, so as to increase the life time of the structure. Now-a-days natural fibers are becoming good choice as they are cheap, light weight, good strength, and high stiffness properties, safe to manufacture, recyclable, bio-degradable and eco-friendly. Even though the natural fiber composite preparation is a time-consuming process it is preferred as it is available enormously with low cost. Many research work which are carried out recently shows their wide usage in replacing the conventional materials. In this project work, 10mm, 6mm TMT rods are wined with glass fiber with epoxy resin and the hybrid TMT rod composite are fabricated using hand lay-up method and this TMT rod is casted with beam to determine the flexural strength and deflection of the specimen.



## CHAPTER 10 CONCLUSION

The CFFRC has shown gradual increase when compared to Reinforced Concrete, 10% of increase is shown in CFFRC. Load attained from CFFRC has more strength than RC. Flexural Strength of CFFRC beam has shown valuable increase in strength. The deflection occurred from CFFRC beam has an increase of 2.5% more than RC beam. From, this durability of the structure varies from RC structure.

- ❖ In compressive strength and split tensile strength, the addition of coconut fiber the strength is increasing linearly up to 0.5%, 1%, and then it is decreasing 1.5%.
- ❖ It is concluded that the strength is increasing while increasing the percentage of Coconut fiber up to 0.5%, 1%. After 1% the strength is reducing.
- ❖ Finally concluded that Coconut fiber can be added upto 1%.



**OBJECTIVE:**

- To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes.

**UNIT I      CONSTITUENT MATERIALS      9**

Cement - Different types - Chemical composition and Properties – Hydration of cement - Tests on cement - IS Specifications - Aggregates – Classification - Mechanical properties and tests as per BIS - Grading requirements – Water - Quality of water for use in concrete.

**UNIT II      CHEMICAL AND MINERAL ADMIXTURES      9**

Accelerators – Retarders - Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Effects on concrete properties.

**UNIT III      PROPORTIONING OF CONCRETE MIX      9**

Principles of Mix Proportioning - Properties of concrete related to Mix Design - Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples

**UNIT IV      FRESH AND HARDENED PROPERTIES OF CONCRETE      9**

Workability - Tests for workability of concrete - Segregation and Bleeding - Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength - Flexural strength - Stress-strain curve for concrete - Modulus of elasticity – durability of concrete – water absorption – permeability – corrosion test – acid resistance.

**UNIT V      SPECIAL CONCRETES      9**

Light weight concretes - foam concrete- self compacting concrete – vacuum concrete - High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON - Shotcrete – Polymer concrete - High performance concrete - Geopolymer Concrete

**TOTAL: 45 PERIODS**



## OUTCOMES:

Students will be able to understand

- The various requirements of cement, aggregates and water for making concrete
- The effect of admixtures on properties of concrete
- The concept and procedure of mix design as per IS method
- The properties of concrete at fresh and hardened state
- The importance and application of special concretes.

## TEXTBOOKS:

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
3. Bhavikatti.S.S, “ Concrete Technology”, I.K.International Publishing House Pvt. Ltd., NewDelhi, 2015
4. Santhakumar. A.R., “Concrete Technology”, Oxford University Press India, 2006.

## REFERENCES:

1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995
2. Gambhir, M.L; "Concrete Technology", 3<sup>rd</sup> Edition, Tata McGraw Hill Publishing Co Ltd,New Delhi, 2007
3. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of IndianStandards, New Delhi, 1998.
4. Job Thomas, “Concrete Technology”, Cengage Learning India Pvt. Ltd., Delhi, 2015
5. Kumar P Mehta., Paulo J M Monterio., “Concrete - Microstructure, Properties andMaterials”, McGraw Hill Education (India) Private Limited, New Delhi, 2016



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EXPERIMENTAL STUDY ON  
FLY ASH – RED MUD BASED FOAMED BRICKS  
BY USING NATURAL FOAMING AGENT

A PROJECT REPORT

*Submitted by*

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YUVASHREE. S                                    920818103011

*In partial fulfilment for the award of the degree*

*Of*

BACHELOR OF ENGINEERING

IN

CIVIL ENGINEERING



DEPARTMENT OF CIVIL ENGINEERING  
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JUNE 2022

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## ABSTRACT

The project deals with experimental study on fly ash – red mud based foamed bricks using natural foaming agent. This type of foamed bricks was manufactured by using mineral admixtures such as fly ash, red mud in addition with natural foaming agent (soapnut solution). In this project, we studied the property of bricks with a partial replacement of water by soapnut solution. The replacement percentages are 0%, 6%, 12%, 18%, 24%, 30%, 36% and 42%. The size of the brick is adopted as 190 x 90 x 90 mm. Based on various literature studies, the optimum ratio of the red mud and fly ash is 45% and 55% respectively. After casting, bricks were dried and burnt under ambient temperature. The properties of bricks were tested by conducting compressive strength test, water absorption test, efflorescence test, soundness test for various mixing proportions. From the test results, optimum replacement percentage of water by soapnut (SN) solution was found. This project has revealed that the bricks manufactured using this method have good quality with acceptable strength and further, they can be manufactured in a cost effective manner.

KEYWORDS: red mud, fly ash, soapnut, ambient temperature, cost effective.



## CHAPTER 9

### CONCLUSION

#### 9.1 GENERAL

In this experimental program, forty bricks were cast and tested up to failure. Out of forty, six was control specimen. Then the properties of red mud fly - ash bricks were studied.

Based on the test result it has been inferred that red mud, fly ash and soapnut solution can be utilized as an effective in structural constructions.

According to Indian standard 1077:1992 class designation 3.5, the average compressive strength should not be less than  $3.5 \text{ N/mm}^2$  and the received results shows by the addition of 36% soapnut solution (S36) to brick gives  $8.48 \text{ N/mm}^2$  compressive strength which gives 31.01% increase in compressive strength when compared to control specimen (S0). Beyond the addition of soapnut solution above 36% shows decrease in compressive strength.

According to IS 1077:1992, water absorption should not be more than 20% by weight, and the received results on bricks is 14.70%. There is no efflorescence in the bricks that we produced.

The bricks we produced are economic as compared to normal bricks.

#### 9.2 SCOPE FOR FUTURE WORK

The utilization of SCMs in the construction industry has increased tremendously. There is a lot of potential for usage of fly ash, rice husk ash in bricks. Based on the experimental investigation the following conclusions were made : further investigation can be done by adding artificial foaming agent in red mud brick and that results can be compared with test results obtained while adding natural foaming agent in red mud fly - ash brick.

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**OBJECTIVE:**

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

**UNIT I SOIL CLASSIFICATION AND COMPACTION**

9

History – formation and types of soil – composition - Index properties – clay mineralogy structural arrangement of grains – description – Classification – BIS – US – phase relationship – Compaction theory – laboratory and field technology – field Compaction method – factors influencing compaction.

**UNIT II EFFECTIVE STRESS AND PERMEABILITY**

9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena— Permeability – Darcy's law – Determination of Permeability – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace's equation – Introduction to flow nets – Simple problems Sheet pile and wier.

**UNIT III STRESS DISTRIBUTION AND SETTLEMENT**

9

Stress distribution in homogeneous and isotropic medium – Boussines of theory – (Point load, Line load and udl) Use of Newmarks influence chart – Components of settlement – Immediate and consolidation settlement – Factors influencing settlement – Terzaghi's one dimensional consolidation theory – Computation of rate of settlement. –  $\sqrt{t}$  and  $\log t$  methods.  $e$ - $\log p$  relationship consolidation settlement N-C clays – O.C clays – Computation.

**UNIT IV SHEAR STRENGTH**

9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Factors influences shear strength of soil.

**UNIT V SLOPE STABILITY**

9

Infinite slopes and finite slopes — Friction circle method – Use of stability number – Guidelines for location of critical slope surface in cohesive and c - soil – Slope protection measures.

**TOTAL: 45 PERIODS****OUTCOMES:**

Students will be able to

- classify the soil and assess the engineering properties, based on index properties.
- Understand the stress concepts in soils



- Understand and identify the settlement in soils.
- Determine the shear strength of soil
- Analyze both finite and infinite slopes.


**TEXTBOOKS:**

1. Murthy, V.N.S., “Text book of Soil Mechanics and Foundation Engineering”, CBS Publishers Distribution Ltd., New Delhi. 2014
2. Arora, K.R., “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 7<sup>th</sup> Edition, 2017 (Reprint).
3. Gopal Ranjan, A S R Rao, “Basic and Applied Soil Mechanics” New Age International Publication, 3<sup>rd</sup> Edition, 2016.
4. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd. New Delhi, 16<sup>th</sup> Edition, 2017.

**REFERENCES:**

1. McCarthy, D.F., “Essentials of Soil Mechanics and Foundations: Basic Geotechnics”. Prentice-Hall, 2006.
2. Coduto, D.P., “Geotechnical Engineering – Principles and Practices”, Prentice Hall of India Pvt. Ltd. New Delhi, 2010.
3. Braja M Das, “Principles of Geotechnical Engineering”, Cengage Learning India Private Limited, 8<sup>th</sup> Edition, 2014.
4. Palanikumar.M., “Soil Mechanics”, Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2013.
5. Craig.R.F., “Soil Mechanics”, E & FN Spon, London and New York, 2012.
6. Purushothama Raj. P., “Soil Mechanics and Foundations Engineering”, 2<sup>nd</sup> Edition, Pearson Education, 2013.
7. Venkatramaiah.C., “Geotechnical Engineering”, New Age International Pvt. Ltd., New Delhi, 2017



  
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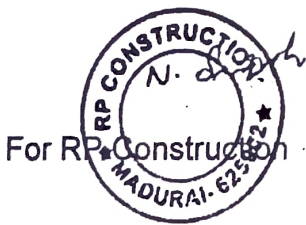
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Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**


This is to certify that **Ms. K. Alagar, Reg. No: 920820103001**, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



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**OBJECTIVES:**

To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

**UNIT I INTRODUCTION**

9+6

Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC –Properties of Concrete and Reinforcing Steel - Analysis and Design of Singly reinforced Rectangular beams by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method.

**UNIT II DESIGN OF BEAMS**

9+6

Analysis and design of Flanged beams for – Use of design aids for Flexure - Behaviour of RC members in Shear, Bond and Anchorage - Design requirements as per current code - Behaviour of rectangular RC beams in shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

**UNIT III DESIGN OF SLABS AND STAIRCASE**

9+6

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two way slab- Design of simply supported and continuous slabs using IS code coefficients- Types of Staircases – Design of dog-legged Staircase.

**UNIT IV DESIGN OF COLUMNS**

9+6

Types of columns –Axially Loaded columns – Design of short Rectangular Square and circular columns –Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves

**UNIT V DESIGN OF FOOTINGS**

9+6

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings – Design of Combined Rectangular footing for two columns only.

TOTAL: 75 PERIODS

**OUTCOMES:**

Students will be able to

- Understand the various design methodologies for the design of RC elements.
- Know the analysis and design of flanged beams by limit state method and sign of beams for shear, bond and torsion.
- design the various types of slabs and staircase by limit state method.



- Design columns for axial, uniaxial and biaxial eccentric loadings.
- Design of footing by limit state method.


**TEXT BOOKS:**

1. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt.Ltd., New Delhi, 2002.
2. Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Subramanian,N., "Design of Reinforced Concrete Structures", Oxford University Press, NewDelhi, 2013.
4. Krishnaraju.N " Design of Reinforced Concrete Structures ", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
5. Ramachandra, "Limit state Design of Concrete Structures" Standard Book House, New Delhi

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1. Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee, 1998
2. Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd.,New Delhi, 2002
3. Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., 2009
4. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2007.
5. Bandyopadhyay. J.N., "Design of Concrete Structures", Prentice Hall of India Pvt. Ltd.,New Delhi, 2008.
6. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
7. SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards,New Delhi, 1999
8. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publications, Pune, 2013



  
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Date: 04.03.2022

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During the tenure of training his conduct was found good.



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**OBJECTIVE:**

- To introduce the students to basic theory and concepts of classical methods of structural analysis

**UNIT I STRAIN ENERGY METHOD** 9

Determination of Static and Kinematic Indeterminacies — Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy).

**UNIT II SLOPE DEFLECTION METHOD** 9

Slope deflection equations — Equilibrium conditions - Analysis of continuous beams and rigid frames — Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

**UNIT III MOMENT DISTRIBUTION METHOD** 9

Stiffness and carry over factors — Distribution and carryover of moments - Analysis of continuous Beams - Plane rigid frames with and without sway — Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

**UNIT IV FLEXIBILITY METHOD** 9

Primary structures - Compatibility conditions — Formation flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

**UNIT V STIFFNESS METHOD** 9

Restrained structure – Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

**TOTAL: 45 PERIODS****OUTCOMES:**

Students will be able to

- Analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames by strain energy method
- Analyse the continuous beams and rigid frames by slope deflection method.
- Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
- Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
- Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

**TEXTBOOKS:**

1. Bhavikatti, S.S, Structural Analysis, Vol.1, & 2, Vikas Publishing House Pvt.Ltd., New Delhi-4, 2014.
2. Bhavikatti, S.S, Matrix Method of Structural Analysis, I. K. International




- Publishing House Pvt. Ltd., New Delhi-4, 2014.
3. Vazrani.V.N And Ratwani, M.M, Analysis of Structures, Vol.II, Khanna Publishers, 2015.
  4. Pandit G.S.and Gupta S.P., Structural Analysis–A Matrix Approach, Tata McGraw Hill Publishing Company Ltd., 2006

**REFERENCES:**

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, Theory of structures, Laxmi Publications, New Delhi, 2004.
2. William Weaver, Jrand James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Delhi, 1995
3. Hibbeler, R.C., Structural Analysis, VII Edition, Prentice Hall, 2012.
4. Reddy.C.S, “Basic Structural Analysis”, Tata McGraw Hill Publishing Company, 2005.
5. Rajasekaran. S, & G. Sankarasubramanian., “Computational Structural Mechanics”, PHI Learning Pvt. Ltd, 2015
6. Negi L.S.and Jangid R.S., Structural Analysis, Tata McGraw Hill Publishing Co.Ltd. 2004.



  
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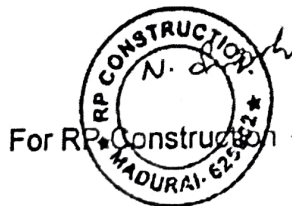
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**OBJECTIVE:**

- To equip the students with the principles and design of water treatment units and distribution system.

**UNIT I SOURCES OF WATER** 9

Public water supply system – Planning, Objectives, Design period, Population forecasting; Water demand – Sources of water and their characteristics, Surface and Groundwater – Impounding Reservoir – Development and selection of source – Source Water quality – Characterization – Significance – Drinking Water quality standards.

**UNIT II CONVEYANCE FROM THE SOURCE** 9

Water supply – intake structures – Functions; Pipes and conduits for water – Pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – appurtenances – Types and capacity of pumps – Selection of pumps and pipe materials.

**UNIT III WATER TREATMENT** 9

Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clarifloccuator-Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - Residue Management – Construction, Operation and Maintenance aspects.

**UNIT IV ADVANCED WATER TREATMENT** 9

Water softening – Desalination- R.O. Plant – demineralization – Adsorption - Ion exchange– Membrane Systems – RO Reject Management - Iron and Manganese removal - Defluoridation - Construction and Operation & Maintenance aspects – Recent advances - MBR process

**UNIT V WATER DISTRIBUTION AND SUPPLY** 9

Requirements of water distribution – Components – Selection of pipe material – Service reservoirs– Functions – Network design – Economics – Analysis of distribution networks -Computerapplications – Appurtenances – Leak detection.Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing.

**TOTAL: 45 PERIODS****OUTCOMES:**

The students completing the course will have

- an insight into the structure of drinking water supply systems, including water transport, treatment and distribution
- the knowledge in various unit operations and processes in water treatment
- an ability to design the various functional units in water treatment
- an understanding of water quality criteria and standards, and their relation to public health
- the ability to design and evaluate water supply project alternatives on basis of chosen



criteria.


**TEXTBOOKS:**

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3. Punmia, B.C., Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2014.

**REFERENCES:**

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.



  
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# COMPARATIVE CHARACTERISTICS STUDY ON DRINKING WATER QUALITY IN NATHAM BLOCK

A PROJECT REPORT

*Submitted by*

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<b>T.MANOBHARATHI</b>	<b>920818103006</b>
<b>M.RAMALAKSHMI</b>	<b>920818103008</b>

*In partial fulfillment for the award of the degree of*

**BACHELOR OF ENGINEERING**

**IN**

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**ANNA UNIVERSITY: CHENNAI 600 025**

**JUNE 2022**

**ANNA UNIVERSITY: CHENNAI 600 025**

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Certified that this project report "COMPARATIVE CHARACTERISTICS STUDY ON DRINKING WATER QUALITY IN NATHAM BLOCK" is the bonafide work of **K.KALYANI (920818103003), T.MANOBHARATHI (920818103006) and M.RAMALAKSHMI (920818103008)** who carried out the project work under my supervision.

  
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## ABSTRACT

Water is the most important commodity and mainly most misused one. Groundwater is the main principal source for drinking water and other activities in Natham, Tamilnadu.

This paper is about analysis of drinking water quality in different places of Natham Taluk. This attempts is to bring the significance quality of ground water at the location. Total 8 ground water samples were collected, around Natham following standard methods and procedures of sampling from the various locations to analyze various physical and chemical parameters. The results were compared with Indian standards and WHO. This study revealed that water of the area is much polluted and quality management is urgently needed. Titrimetric measurements for total hardness, total dissolved solids, alkalinity, chloride, dissolved oxygen have been made. Conductivity and pH measurements have also been carried out. Total dissolved solids measured gravimetrically.

The results were compared with the standards prescribed by World Health Organization (WHO) and Bureau of Indian Standards (BIS) for drinking water. This chapter presents aspects of providing safe drinking water - background information, quality of water and safety of public, in the sustainable Public water supply system in Natham Block. The characteristic studies of drinking water from different villages are studied in this experiment.



## CHAPTER - 12

### CONCLUSION

From the above results we have concluded that due to increase in industrialization, water quality of drinking water get decreases, and hence there is a need of proper and prior treatment. Present study leads to following conclusions:

The ground water quality in Natham taluk, Dindugul district, Tamilnadu India is suitable for domestic and agricultural purpose.

Sirugudi, Natham and Velayuthanpatti are well within the permissible limit of WHO and BIS.

Ullupagudi, Manakaatur, Sendhurai and Kuttupatti shows slightly changes in Total Dissolved Solids , Hardness and Dissolved Oxygen.

Mulaiyur exceeds from all the given permissible limit so it should be properly treated.



**OBJECTIVE:**

To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.

**UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9**

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotarydrilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters - Bore log reportand Selection of foundation.

**UNIT II SHALLOW FOUNDATION 9**

Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation onhomogeneous deposits – Terzaghi's formula and BIS formula – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codalprovision – Methods of minimizing total and differential settlements.

**UNIT III FOOTINGS AND RAFTS 9**

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum thickness for rigid behaviour – Applications – Compensated foundation – Codal provision

**UNIT IV PILE FOUNDATION 9**

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering newsand Hileys) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – Uplift capacity-Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Cohesive – expansive – non expansive – Cohesionless soils – Codal provisions.

**UNIT V RETAINING WALLS 9**

Plastic equilibrium in soils – Active and passive states – Rankine's theory – Cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure onretaining walls of simple configurations – Culmann's Graphical method – Pressure on the wall due to line load – Stability analysis of



retaining walls Codal provisions.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

Students will be able to

- Understand the site investigation, methods and sampling.
- Get knowledge on bearing capacity and testing methods.
- Design shallow footings.
- Determine the load carrying capacity, settlement of pile foundation.
- Determine the earth pressure on retaining walls and analysis for stability.

**TEXTBOOKS:**

1. Murthy, V.N.S., “Text book of Soil Mechanics and Foundation Engineering”, CBS Publishers Distribution Ltd., New Delhi. 2014.
2. Arora, K.R., “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 7<sup>th</sup> Edition, 2017 (Reprint).
3. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd. New Delhi, 16<sup>th</sup> Edition 2017.


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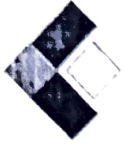
1. Braja M Das, “Principles of Foundation Engineering” (Eighth edition), Cengage Learning 2014.
2. Kaniraj, S.R. “Design aids in Soil Mechanics and Foundation Engineering”, Tata McGrawHill publishing company Ltd., New Delhi, 2014.
3. Joseph E bowles, “Foundation Analysis and design”, McGraw Hill Education, 5<sup>th</sup> Edition, 28<sup>th</sup> August 2015.
4. IS Code 6403 : 1981 (Reaffirmed 1997) “Bearing capacity of shallow foundation”, Bureau of Indian Standards, New Delhi.
5. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) “Shallow foundations subjected to symmetrical static vertical loads”, Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 2):1980 (Reaffirmed 1995) “Deep foundations subjected to symmetrical static vertical loading”, Bureau of Indian Standards, New Delhi.
7. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) “Concrete Piles” Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) “Timber Piles”, Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) “Under Reamed Piles”, Bureau of Indian Standards, New Delhi.
10. IS Code 2911 (Part 4) : 1979 (Reaffirmed 1997) “Load Test on Piles”, Bureau of Indian Standards, New Delhi.
11. IS Code 1904: 1986 (Reaffirmed 1995) “Design and Construction of Foundations in Soils”, Bureau of Indian Standards, New Delhi.
12. IS Code 2131: 1981 (Reaffirmed 1997) “Method for Standard Penetration test for Soils”, Bureau of Indian Standards, New Delhi.
13. IS Code 2132: 1986 (Reaffirmed 1997) “Code of Practice for thin – walled tube sampling for soils”, Bureau of Indian Standards, New Delhi.



14. IS Code 1892 (1979): Code of Practice for subsurface Investigation for Foundations. Bureau of Indian Standards, New Delhi.
15. IS Code 14458 (Part 1) : 1998 “Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall” , Bureau of Indian Standards, New Delhi.
16. IS Code 14458 (Part 2) : 1998 “Retaining Wall for Hill Area – Guidelines, Design of Retaining/Breast Walls” , Bureau of Indian Standards, New Delhi.
17. IS Code 14458 (Part 3) : 1998 “Retaining Wall for Hill Area – Guidelines, Construction Of Dry Stone Walls” , Bureau of Indian Standards, New Delhi.



  
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## WALLS INFRA Constructions

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### TO WHOMSOEVER IT MAY CONCERN

This is to certify that Mr. N.Ajaykannan , III year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in site maintenance and site execution during the period 13/08/2021 to 10/09/2021.

Date: 10/09/2021



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The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. **Traverse - using Total station**
2. Contouring
  - (i). **Radial tachometric contouring** - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
  - (ii). Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval
  - (iii). **L.S & C.S** - Road and canal alignment for a Length of not less than 1 Kilo Meter atleast L.S at Every 30M and C.S at every 90 M
3. **Offset of Buildings and Plotting the Location.**
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. **Curve setting by deflection angle**

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.



  
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**caaliber**  
CONSTRUCTION  
Degree of Excellence

Er.S.Senthil Kumar, DCE.,B.E.(Civil)  
Proprietor  
Registered Engineer- Madurai Corporation  
Mobile: +91-98439 73537

Date: 07.09.2021

**TO WHOMSOEVER IT MAY CONCERN**

This to certify that **Ms. K. Lakshmidevi** student from Third year B.E., Civil Engineering, NPR College of Engineering & Technology has successfully completed her Internship in Madurai site. During the period of training from 09.08.2021 to 07.09.2021, her conduct was good.

*S. Senthil Kumar*  
**Er. S. SENTHILKUMAR, DCE., B.E.(Civil)**  
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*J. Sundararajan*  
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**OBJECTIVE:**

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. Design of structural systems such as roof trusses, gantry girders as per provisions of current code (IS 800 - 2007) of practice for working stress and Limit state Method.

**UNIT I INTRODUCTION AND ALLOWABLE STRESS DESIGN****9+6**

Structural steel types — Mechanical Properties of structural steel- Indian structural steel products- Steps involved in the Design Process -Steel Structural systems and their Elements- -Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel structures-Relative advantages and Limitations-Strengths and Serviceability Limit states.

Allowable stresses as per IS 800 section 11 -Concepts of Allowable stress design for bending and Shear –Check for Elastic deflection-Calculation of moment carrying capacity –Design of Laterally supported Solid Hot Rolled section beams-Allowable stress design of Angle Tension and Compression Members and estimation of axial load carrying capacity.

**UNIT II CONNECTIONS IN STEEL STRUCTURES****9+6**

Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts –Prying forces and Hanger connection–Design of Slip critical connections with High strength Friction Grip bolts.- Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and butt Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.

**UNIT III TENSION MEMBERS****9+6**

Tension Members - Types of Tension members and sections –Behaviour of Tension Members- modes of failure-Slenderness ratio- Net area – Net effective sections for Plates, Angles and Tee in tension –Concepts of Shear Lag- Design of plate and angle tension members-design of built up tension Members-Connections in tension members – Use of lug angles – Design of tension splice.

**UNIT IV COMPRESSION MEMBERS****9+6**

Types of compression members and sections–Behaviour and types of failures-Short and slender columns- Current code provisions for compression members- Effective Length, Slenderness ratio –Column formula and column curves- Design of single section and compound Angles-Axially Loaded solid section Columns- Design of Built up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns- Splices for columns.



## UNIT V DESIGN OF FLEXURAL MEMBERS

9+6

Types of steel Beam sections- Behaviour of Beams in flexure- Codal Provisions – Classification of cross sections- Flexural Strength and Lateral stability of Beams –Shear Strength-Web Buckling, Crippling and deflection of Beams- Design of laterally supported Beams- Design of solid rolled section Beams- Design of Plated beams with cover plates - Design Strength of Laterally unsupported Beams — Design of laterally unsupported rolled section Beams- Purlin in RoofTrusses-Design of Channel and I section Purlins.

**TOTAL: 75 PERIODS**

### OUTCOMES:

Students will be able to

- Understand the concepts of various design philosophies
- Design common bolted and welded connections for steel structures
- Design tension members and understand the effect of shear lag.
- Understand the design concept of axially loaded columns and column base connections.
- Understand specific problems related to the design of laterally restrained and unrestrained steel beams.

### TEXTBOOKS:

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
3. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005

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1. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002
2. Sai Ram. K.S. "Design of Steel Structures" Dorling Kindersley (India) Pvt. Ltd., New Delhi, 2nd Edition, 2015, [www.pearsoned.co.in/kssairam](http://www.pearsoned.co.in/kssairam)
3. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2<sup>nd</sup> Edition, 2013
4. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800– 2007, IK International Publishing House Pvt. Ltd., 2009
5. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800– 2007, Structures Publications, 2009.
6. IS800 :2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
7. SP 6(1) Hand book on structural Steel Sections



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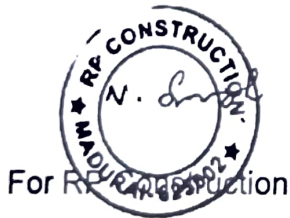
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Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that **Ms. G. Mohanraj**, Reg. No: 920820103006, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



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**OBJECTIVES :**

- To learn the method of drawing influence lines and its uses in various applications like beams and plane trusses.
- To analyse the arches, suspension bridges and space trusses.
- Also to learn Plastic analysis of beams and rigid frames.

**UNIT I INFLUENCE LINES FOR DETERMINATE BEAMS** 9

Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment – Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.

**UNIT II INFLUENCE LINES FOR INDETERMINATE BEAMS** 9

Muller Breslau's principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams.

**UNIT III ARCHES** 9

Arches - Types of arches – Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches – Settlement and temperature effects.

**UNIT IV CABLES AND SUSPENSION BRIDGES** 9

Equilibrium of cable – length of cable - anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

**UNIT V PLASTIC ANALYSIS** 9

Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods – Upper and lower bound theorems - Plastic analysis of indeterminate beams and frames.

**TOTAL:45 PERIODS****OUTCOMES:**

Students will be able to

- Draw influence lines for statically determinate structures and calculate critical stress resultants.
- Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
- Analyse of three hinged, two hinged and fixed arches.
- Analyse the suspension bridges with stiffening girders
- Understand the concept of Plastic analysis and the method of analyzing beams and rigid frames.

**TEXTBOOKS:**

1. Bhavikatti, S.S, Structural Analysis, Vol.1 & 2, Vikas Publishing House Pvt.Ltd.,



- NewDelhi-4,2014.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi,Publications,2004.
  3. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.

**REFERENCES:**

1. Negi.L.S and Jangid R.S., Structural Analysis, Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co.Ltd.2002.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHIL earning Pvt.Ltd.,2011.
4. Prakash Rao D.S., Structural Analysis, Universities Press,1996.



  
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Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**


This is to certify that **Mr.M.HARISH, Reg. No: 920820103005**, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



For RP Construction



  
**Dr. JSUNDARAJAN.**  
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**OBJECTIVE:**

- The student is exposed to different phases in irrigation practices and Planning and management of irrigation. Further they will be imparted required knowledge on Irrigation storage and distribution canal system and Irrigation management.

**UNIT I CROP WATER REQUIREMENT 9**

Need and classification of irrigation- historical development and merits and demerits of irrigation- types of crops-crop season-duty, delta and base period- consumptive use of crops- **estimation of Evapotranspiration using experimental and theoretical methods**

**UNIT II IRRIGATION METHODS 9**

**Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation – design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Waterdistribution system- Irrigation efficiencies.**

**UNIT III DIVERSION AND IMPOUNDING STRUCTURES 9**

Types of Impounding structures - Gravity dam – Forces on a dam **-Design of Gravity dams; Earthdams, Arch dams- Diversion Head works - Weirs and Barrages-**

**UNIT IV CANAL IRRIGATION 9**

Canal regulations – direct sluice - Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining - Kennedy's and Lacey's Regime theory-Design of unlined canal

**UNIT V WATER MANAGEMENT IN IRRIGATION 9**

**Modernization techniques- Rehabilitation – Optimization of water use-Minimizing water losses- On form development works-Participatory irrigation management- Water resources associations- Changing paradigms in water management-Performance evaluation-Economic aspects of irrigation**

**TOTAL :45 PERIODS****OUTCOMES:**

Students will be able to

- Have knowledge and skills on crop water requirements.
- Understand the methods and management of irrigation.
- Gain knowledge on types of Impounding structures
- Understand methods of irrigation including canal irrigation.
- Get knowledge on water management on optimization of water use.

**TEXTBOOKS:**

1. Dilip Kumar Majumdar, "Irrigation Water Management", Prentice-Hall of India, New Delhi, 2008.
2. Punmia B.C., et. al; Irrigation and water power Engineering, Laxmi Publications, 16<sup>th</sup> Edition, New Delhi, 2009
3. Garg S. K., "Irrigation Engineering and Hydraulic structures", Khanna Publishers, 23<sup>rd</sup> Revised Edition, New Delhi, 2009

**REFERENCES:**


1. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age



International Publishers, 2005

2. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000
3. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1997.



  
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4. Sharma R.K.. "Irrigation Engineering", S.Chand & Co. 2007.
5. Michael A.M., Irrigation Theory and Practice, 2nd Edition, Vikas Publishing House Pvt. Ltd.,Noida, Up, 2008
6. Asawa, G.L., "Irrigation Engineering", NewAge International Publishers, New Delhi, 2000.
7. Basak, N.N, "Irrigation Engineering", Tata McGraw Hill Publishing Co. New Delhi,1999



  
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**Sona Builders**  
Engineers & Contractors

Er. P. Senthilkumar

Date: 11.09.2021


**TO WHOM IT MAY CONCERN**

This is to certify that **Ms. M. Ramalakshmi (920818103008)**,  
B.E. Civil Engineering from NPR College of Engineering & Technology,  
Natham has successfully completed her internship during the period  
09.08.2021 to 10.09.2021.



For Sona Builders Engineers & Contractors

  
Er. P. Senthilkumar  
Proprietor

  
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**OBJECTIVE:**

- To give an overview about the highway engineering with respect to, planning, design, construction and maintenance of highways as per IRC standards, specifications and methods.

**UNIT I HIGHWAY PLANNING AND ALIGNMENT 9**

Significance of highway planning – Modal limitations towards sustainability - History of road development in India – factors influencing highway alignment – Soil suitability analysis - Road ecology - **Engineering surveys for alignment, objectives, conventional and modern methods** - Classification of highways – Locations and functions – Typical cross sections of Urban and Ruralroads

**UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9**

Cross sectional elements - Sight distances – **Horizontal curves, Super elevation, transition curves, widening at curves** – Vertical curves - Gradients, Special consideration for hill roads - Hairpin bends – Lateral and vertical clearance at underpasses.

**UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9**

Pavement components and their role - Design principles **-Design practice for flexible and rigid Pavements (IRC methods only)** – Embankments- Problems in Flexible pavement design.

**UNIT IV HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE 9**

**Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Test on Bituminous mixes-Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures - Highway drainage – Construction machineries.**

**UNIT V EVALUATION AND MAINTENANCE OF PAVEMENTS 9**

Pavement distress in flexible and rigid pavements – Types of maintenance – Pavement Management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements – Strengthening of pavements –Highway Project formulation.

**TOTAL: 45 PERIODS****OUTCOMES:**

Students will be able to

- Get knowledge on planning and aligning of highway.
- Geometric design of highways
- Design flexible and rigid pavements.
- Gain knowledge on Highway construction materials, properties, testing methods
- Understand the concept of pavement management system, evaluation of distress and maintenance of pavements.




### TEXTBOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", NemchandPublishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", ScitechPublications (India), Chennai, 2010
3. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna TechnicalPublications, 8th edition Delhi, 2013.

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1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, ( ThirdRevision), IRC: 37-2012
2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavementsfor Highways, ( Third Revision), IRC: 58-2012
3. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, NinethImpression, South Asia, 2012
4. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, IstEdition, USA, 2011
5. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of HighwayEngineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011
6. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning,New Delhi, 2010
7. O'Flaherty.C.A "Highways, Butterworth – Heinemann, Oxford, 2006
8. IRC-37–2012,The Indian roads Congress, Guidelines for the Design of Flexible Pavements, New Delhi
9. IRC 58-2012. The Indian Road Congress, Guideline for the Design of Rigid Pavementsfor Highways, New Delhi



  
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Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that **Ms. B.Sundaraprakadeeswaran, Reg. No: 920820103010**, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



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**OBJECTIVE:**

- The objectives of this course is to help students develop the ability to apply basic understanding of physical, chemical, and biological phenomena for successful design, operation and maintenance of sewage treatment plants.

**UNIT I PLANNING AND DESIGN OF SEWERAGE SYSTEM**

9

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design – Storm drainage-Storm runoff estimation – sewer appurtenances – corrosion in sewers – prevention and control – sewage pumping-drainage in buildings-plumbing systems for drainage - Rain Water ting.

**UNIT II PRIMARY TREATMENT OF SEWAGE**

9

Objectives – Unit Operations and Processes – Selection of treatment processes – Onsite sanitation - Septic tank- Grey water harvesting – Primary treatment – Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks – Construction, Operation and Maintenance aspects.

**UNIT III SECONDARY TREATMENT OF SEWAGE**

9

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor(SBR) – Membrane Bioreactor - UASB – Waste Stabilization Ponds – - Other treatment methods -Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction, Operation and Maintenance aspects.

**UNIT IV DISPOSAL OF SEWAGE**

9

Standards for– Disposal - Methods – dilution – Mass balance principle - Self purification of river- Oxygen sag curve – deoxygenation and reaeration - Streeter–Phelps model - Land disposal – Sewage farming – sodium hazards - Soil dispersion system.

**UNIT V SLUDGE TREATMENT AND DISPOSAL**

9

Objectives - Sludge characterization – Thickening - Design of gravity thickener- Sludge digestion Standard rate and High rate digester design- Biogas recovery – Sludge Conditioning and Dewatering – Sludge drying beds- ultimate residue disposal – recent advances.

**TOTAL: 45 PERIODS****OUTCOMES:**

The students completing the course will have

- An ability to estimate sewage generation and design sewer system including sewage pumping stations





- The required understanding on the characteristics and composition of sewage, self-purification of streams
- An ability to perform basic design of the unit operations and processes that are used in sewage treatment
- Understand the standard methods for disposal of sewage.
- Gain knowledge on sludge treatment and disposal.

**TEXTBOOKS:**

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2015.
2. Duggal K.N., “Elements of Environmental Engineering” S.Chand and Co. Ltd., New Delhi, 2014.
- 3, Punmia, B.C., Jain, A.K., and Jain.A.K., Environmental Engineering, Vol.II, Laxmi Publications, 2010.

**REFERENCES:**

1. Manual on Sewerage and Sewage Treatment Systems Part A,B and C, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
2. Metcalf and Eddy- Wastewater Engineering–Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2010.
3. Syed R. Qasim “Wastewater Treatment Plants”, CRC Press, Washington D.C., 2010
4. Gray N.F, “Water Technology”, Elsevier India Pvt. Ltd., New Delhi, 2006.



  
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G16, Race Course Colony, New Natham Road, Madurai – 625 002.

Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that **Mr. M. Alexpandi, Reg. No: 920820103302**, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



**Dr. JSUNDARAJAN,**  
B.E., M.Tech., Ph.D.  
Principal  
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**OBJECTIVE:**

- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

**UNIT I QUANTITY ESTIMATION 9**

Philosophy – Purpose – Methods of estimation – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – culverts (additional practice in class room using computer softwares)

**UNIT II RATE ANALYSIS AND COSTING 9**

Standard Data – Observed Data – Schedule of rates – Market rates – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads– Cost Estimates (additional practice in class room using Computer softwares) - (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

**UNIT III SPECIFICATIONS, REPORTS AND TENDERS 9**

Specifications – Detailed and general specifications – Constructions – Sources – Types of specifications – Principles for report preparation – report on estimate of residential building – Culvert – Roads – TTT Act 2000 – Tender notices – types – tender procedures – Drafting model tenders , E-tendering-Digital signature certificates- Encrypting -Decrypting – Reverse auctions.

**UNIT IV CONTRACTS 9**

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD / MORTH Standard bidding documents – Construction contracts – Contract problems – Arbitration and legal requirements.

**UNIT V VALUATION 9**

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent – Mortgage – Lease

**TOTAL: 45 PERIODS****OUTCOMES:**

The student will be able to

- Estimate the quantities for buildings,
- Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
- Understand types of specifications, principles for report preparation, tender notices types.
- Gain knowledge on types of contracts
- Evaluate valuation for building and land.

**TEXTBOOKS:**


1. B.N Dutta 'Estimating and Costing in Civil Engineering', UBS Publishers & Distributors (P) Ltd, 2010.
2. B.S.Patil, 'Civil Engineering Contracts and Estimates', University Press, 2006
3. D.N. Banerjee, 'Principles and Practices of Valuation', V Edition, Eastern Law House, 1998

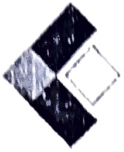


**REFERENCES:**

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD
2. Tamil Nadu Transparencies in Tenders Act, 1998
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Good or Works, The World Bank, April 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2003



  
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## WALLS-INFRA Constructions

42B. Renga Residency, 1<sup>st</sup> Street,  
Ranakrishna Layout, TVS Nagar,  
Edayarpalayam, Coimbatore - 641025

Mail: vimal@wallsinfra.com

Mobile: +91-9585712310

### TO WHOMSOEVER IT MAY CONCERN

This is to certify that Mr. T. Deepan pandi, III year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in site maintenance and site execution during the period 13/08/2021 to 10/09/2021

Date: 10/09/2021



**Dr. J.SUNDARARAJAN,**  
B.E., M.Tech., Ph.D.,  
Principal

N.P.R. College of Engineering & Technology  
Natham, Dindigul (Dt) - 624 401.

**OBJECTIVE:**

- To introduce the students about Railways planning, design, construction and maintenance and planning design principles of airport and harbour

<b>UNIT I</b>	<b>RAILWAY PLANNING AND CONSTRUCTION</b>	<b>10</b>
Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods-- <b>Geometric design of railway, gradient, super elevation, widening of gauge on curves- Level Crossings.</b>		
<b>UNIT II</b>	<b>RAILWAY CONSTRUCTION AND MAINTENANCE</b>	<b>8</b>
<b>Earthwork</b> – Stabilization of track on poor soil - Track drainage – <b>Calculation of Materials required for track laying</b> - Construction and maintenance of tracks – Railway Station and yards and passenger amenities-Signalling		
<b>UNIT III</b>	<b>AIRPORT PLANNING</b>	<b>7</b>
<b>Air transport characteristics - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area</b>		
<b>UNIT IV</b>	<b>AIRPORT DESIGN</b>	<b>10</b>
<b>Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.</b>		
<b>UNIT V</b>	<b>HARBOUR ENGINEERING</b>	<b>10</b>
Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Coastal Regulation Zone, 2011		
		<b>TOTAL: 45 PERIODS</b>

**OUTCOMES:**

Students who successfully complete this course will be able to:

- Understand the methods of route alignment and design elements in Railway Planning and Constructions.
- Understand the Construction techniques and Maintenance of Track laying and Railway stations.
- Gain an insight on the planning and site selection of Airport Planning and design.
- Analyze and design the elements for orientation of runways and passenger facility systems.
- Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.




### TEXTBOOKS:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, V ScitechPublications (India), Chennai, 2010
2. Saxena Subhash, C.and Satyapal Arora, A Course in Railway Engineering, Dhanapat Raiand Sons, Delhi, 1998
3. Khanna.S.K. Arora.M.G and Jain.S.S, Airport Planning and Design, Nemachand and Bros,Roorkee, 1994

### REFERENCES:

1. Venkatramaiah. C., Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels.,Universities Press (India) Private Limited, Hyderabad,2015.
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education ( India) Private Ltd, New Delhi, 2013



  
Dr. J.SUNDARARAJAN,  
B.E., M.Tech., Ph.D.,  
Principal  
N.P.R. College of Engineering & Technology  
Natham, Dindigul (Dt) - 624 401.



**Sona Builders**  
Engineers & Contractors

Er. P. Senthilkumar

**Date: 05.03.2022**

**TO WHOM IT MAY CONCERN**

This is to certify that **Ms. S. Srilakshmi (920820103312)**, B.E. Civil Engineering from NPR College of Engineering & Technology, Natham has successfully completed her internship during the period 15.02.2022 to 05.03.2022.



**Dr. J.SUNDARARAJAN,**  
B.E., M.Tech., Ph.D.,  
Principal  
N.P.R. College of Engineering & Techno  
Natham, Dindigul (Dt) - 624 401.

For Sona Builders Engineers & Contractors

  
Er. P. Senthilkumar  
Proprietor

2/408/2, F - Block, MVM Nagar Extn., Dindigul - 624 003.  
Ph:0451 2424346, Cell: 96984 46611, E-mail: sonasenthil123@yahoo.co.in

Tin No.33675340834



**OBJECTIVE:**

- This course aims at providing students with a solid background on the principles of structural engineering design. Students will be acquire the knowledge of liquid retaining structures, bridges components, retaining wall and industrial structures.

<b>UNIT I</b>	<b>RETAINING WALLS</b>	<b>9+6</b>
Reinforced concrete Cantilever and Counter fort Retaining Walls-Horizontal Backfill with Surcharge-Design of Shear Key-Design and Drawing.		
<b>UNIT II</b>	<b>FLAT SLAB and BRIDGES</b>	<b>9+6</b>
Design of Flat Slabs with and without drops by Direct Design Method of IS code- Design and Drawing - IRC Specifications and Loading - RC Solid Slab Bridge - Steel Foot-over Bridge- Design and Drawing.		
<b>UNIT III</b>	<b>LIQUID STORAGE STRUCTURES</b>	<b>9+6</b>
RCC Water Tanks - On ground, Elevated Circular, underground Rectangular Tanks- Hemispherical Bottomed Steel Water Tank -Design and Drawing		
<b>UNIT IV</b>	<b>INDUSTRIAL STRUCTURES</b>	<b>9+6</b>
Structural steel Framing - Steel Roof Trusses - Roofing Elements - Beam columns - Codal provisions - Design and Drawing.		
<b>UNIT V</b>	<b>GIRDERS AND CONNECTIONS</b>	<b>9+6</b>
Plate Girders - Behaviour of Components-Deign of Welded Plate Girder-Design of Industrial Gantry Girders - Design of Eccentric Shear and Moment Resisting connections.		

**TOTAL: 75 PERIODS****Design and Drawing Exercises for practical component****Part A - RCC Structures**

1. Rectangular Column and Footing
2. Combined footing with Two columns
3. RCC one way & Two way Slab and beam system
4. Cantilever Retaining wall
5. RCC T beam bridge deck
6. Underground Rectangular Water Tank
7. Elevated circular water Tank

**Part B- Steel Structures**

1. Built up column, column base and Foundation
2. Simple Steel Roof Trusses
3. Industrial building Elements
4. Plate Girder (welded)
5. Framed Connections and Detailing
6. Gantry girder
7. Steel water Tank



STRUCTURAL DESIGN AND DRAWING	Theory Examination		Practicals	
	Question paper Pattern	Marks to awarded	Question paper Pattern	Marks to awarded
This paper is a theory cum practical course weightage for theory 80% and for practical 20%	Five Either/Or type questions 5 x20 = 100 marks : covering all the five units Total Duration of Examination will be 3 hours  Each Question include Design - 12 Marks Free hand Drawing (Not to scale) - 8 marks	Theoretical component Marks will carry 80% weightage. End Semester Examination will be conducted by COE	2 Questions, one from Part A - RCC Structures & one from Part B- Steel Structures	Practical component Marks will carry 20% weightage. Practical Examination will be conducted by the respective institution as internal mode.

### OUTCOMES:

At the end of the course the student will be able to

- Design and draw reinforced concrete Cantilever and Counterfort Retaining Walls
- Design and draw flat slab as per code provisions
- Design and draw reinforced concrete and steel bridges
- Design and draw reinforced concrete and steel water tanks
- Design and detail the various steel trusses and cantry girders

### TEXTBOOKS:

1. Krishnaraju N, Structural Design and Drawing, Universities Press, 2009.
2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, Comprehensive Design of Steel Structures, Laxmi Publications Pvt. Ltd., 2003.

### REFERENCES:

1. Krishnamurthy D, Structural Design and Drawing Voll, IlandIII, CBS Publishers, 2010.
2. Shah V L and Veena Gore, Limit State Design of Steel Structures
3. IS800-2007, Structures Publications, 2009.
4. IS 456(2000) Indian Standard Plain and Reinforced Concrete-Code of Practice, Bureau of Indian Standards, New Delhi.



  
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Date: 04.03.2022

**TO WHOMSOEVER IT MAY CONCERN**

This is to certify that **Mr.R.VIDESHWARAN**, Reg. No: **920820103315**, II year, B.E., Civil Engineering, NPR College of Engineering & Technology, Natham, has completed his internship in our construction from 16.02.2022 to 04.03.2022.

During the tenure of training his conduct was found good.



  
**Dr. JSUNDABARAJAN,**  
B.E., M.Tech., Ph.D.  
Principal  
N.P.R. College of Engineering & Technology  
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**OBJECTIVE:**


- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

**STRATEGY:**

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

**TOTAL: 300 PERIODS****OUTCOME:**

- On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.



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**EXPERIMENTAL INVESTIGATION ON PARTIAL  
REPLACEMENT OF BINDING MATERIALS IN MORTAR  
BY COW DUNG ASH (CDA) FOR PLASTERING WORK.**

**A PROJECT REPORT**

*Submitted by*

**S. HARINI - 920818103002**

**K. LAKSHMI DEVI - 920818103005**

*In partial fulfillment for the award of the degree*

*Of*

**BACHELOR OF ENGINEERING**

**IN**

**CIVIL ENGINEERING**

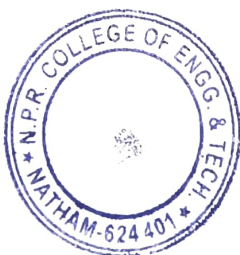
**NPR COLLEGE OF ENGINEERING AND TECHNOLOGY**



**NATHAM - 624401**

**ANNA UNIVERSITY: CHENNAI 600 025**

**JUNE 2022**



**ANNA UNIVERSITY: CHENNAI 600 025**

**BONAFIDE CERTIFICATE**

Certified that this project report "EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF BINDING MATERIALS IN MORTAR (CEMENT) BY COWDUNG ASH (CDA) FOR PLASTERING WORK" is the bonafide work of HARINI. S (920818103002), LAKSHMI DEVI. K (920818103005) who carried out the project work under my supervision.

  
SIGNATURE

**Dr. A. HEMALATHA, M.TECH, Ph.D..**

Head of the department

NPR College of Engineering and  
Technology

Natham - 624401

  
SIGNATURE

**Mr. K. SELVAM, M.E.,**

Assistant professor,


NPR College of Engineering and  
Technology

Natham - 624401

Submitted for the viva voice examination held at NPR College of Engineering and Technology, Natham on 24/6/2022

  
INTERNAL EXAMINER



  
EXTERNAL EXAMINER

**Dr. J.SUNDARARAJAN,**  
B.E., M.Tech., Ph.D.,  
Principal

N.P.R. College of Engineering & Technology  
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## ABSTRACT

The construction industry has recently seen a considerable shift towards use of sustainable and green materials due to rise in pollution and waste which is created by some of most basic ingredients during its production which releases harmful gases like carbon-di-oxide leading to global greenhouse effects and hence results in global warming various governmental and international organizations and individuals alike have started working on products that can be used as replacement materials to the ingredients of concrete and mortar such that the uses of such materials will increase the strength of the resulting product as well as will be cost effective at the same time. The needs of an ever-growing global population lead to ever increasing demand for building, houses and various other facilities and hence the faster we move towards sustainability and green construction practices the better our future will be for us and as well as the environment. In this project we have tried using cow dung ash (CDA) as a replacement material for cement that is one of the expensive materials among major ingredients of mortar. Cow dung ash is obtained from cow then later it is dried for 12 days and heated around 420-550° c and its cooled and crushed into powder form and sieved under IS 400 microns sieve. Cow dung ash as a byproduct is readily available at cattle farms with negligible prices and sometimes is almost free of cost.



## CHAPTER – 8

### CONCLUSION

Experimental investigations carried out study the cow dung ash on strength of concrete. Cement was partially replaced with four percentage (5%, 10%, 15%, 20%, 25%, 30%, 35%) of cow dung ash by weight. The compressive strength of the concrete specimens was determined at 7, 14 and 28 days respectively.

Test results indicated that the consistency limits increased up to an optimum content and decreased further with the increase in the % of CDA in cement.

The compressive strength is increased when the cement was replaced by 25% of CDA and decreased with increase in the cow dung ash content. Hence, it is concluded that the 25% cement can be replaced with CDA in cement mortar Based on test results we conclude the partial replacement of cement with 25% of cow dung ash increase the compressive strength of the mortar So, it can be used in construction of any structure.

