



MOHAMED SATHAK A J COLLEGE OF ENGINEERING

Sponsored by Mohamed Sathak Trust

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

Siruseri IT Park, Egattur, Chennai 603 103

BE-CIVIL ENGINEERING

S.No	Name of the course that include experiential learning through Project work/ Internship (2020 – 2021)
1	CE8604 - Highway Engineering
2	CE8404 - Concrete Technology
3	CE8391 - Construction Materials
4	EN8491 - Water Supply Engineering
5	GE8291 - Environmental Science and Engineering
6	CE8501 - Design of Reinforced Cement Concrete Elements
7	CE8401 - Construction Techniques and Practices
8	CE8020 - Maintenance, Repair and Rehabilitation of Structures


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OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**14**

Definition, scope and importance of environment - need for public awareness - concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem - ecological succession - food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) - Introduction to biodiversity definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels - India as a mega-diversity nation - hot-spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems - pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION**8**

Definition - causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards - solid waste management: causes, effects and control measures of municipal solid wastes - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site - Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES**10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people - Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies - Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources - Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets - river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT**7**

From unsustainable to sustainable development - urban problems related to energy - water conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - role of non-governmental organization- environmental ethics: Issues and possible solutions - climate change, global

warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. - wasteland reclamation - consumerism and waste products - environment production act - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forest conservation act - enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations - population explosion - family welfare programme - environment and human health - human rights - value education - HIV / AIDS - women and child welfare - role of information technology in environment and human health - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXTBOOKS:

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hyderabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.



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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 design 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:

- Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, Pvt. Ltd. New Delhi, 2002.
- Gambhir. M.L., "Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
- Subramanian, N., "Design of Reinforced Concrete Structures", Oxford University Press, New Delhi, 2013.



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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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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

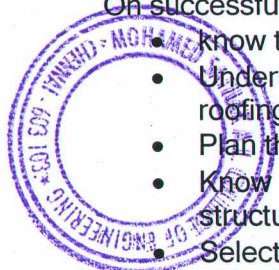
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Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end loaders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching, mixing 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 super structures
- 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", 5th 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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OBJECTIVE:

- To acquire the knowledge on Quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATEGIES

9

Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE

9

Quality assurance for concrete-Strength, Durability- Cracks, different types, causes-Effects due to climate, temperature, Sustained elevated temperature, Corrosion

UNIT III SPECIAL CONCRETES

9

Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS

9

Non-destructive Testing Techniques, Load Test for Stability-Epoxy injection, Shoring, Underpinning, Corrosion protection techniques-Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES

9

Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake-Transportation of Structures from one place to other -Structural Health Monitoring- demolition techniques-Engineered demolition methods-Case studies

TOTAL: 45 PERIODS**OUTCOMES:**

Students will be able to understand

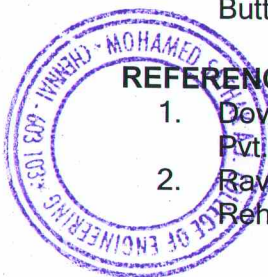
- the importance of maintenance and assessment method of distressed structures.
- the strength and durability properties, their effects due to climate and temperature.
- recent development in concrete
- the techniques for repair and protection methods
- repair, rehabilitation and retrofitting of structures and demolition methods.

TEXT BOOKS:

- Shetty.M.S.Concrete Technology-Theory and Practice,S.Chand and Company, 2008.
- Vidivelli.B Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.
- Varghese.P.C Maintenance Repair, and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.
- Dodge Woodson.R Concrete Structures, Protection, Repair and Rehabilitation, Butterworth- Heinemann,Elsevier,New Delhi 2012

REFERENCES:

- DovKominetzky.M.S.,-Design and Construction Failures, Galgotia, Publications Pvt.Ltd.,2001
- Ravishankar.K. Krishnamoorthy.T.S, Structural Health Monitoring, Repair And Rehabilitation of Concrete Structures, Allied Publishers, 2004.



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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 Rural roads

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.

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TEXTBOOKS:

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

REFERENCES:

1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC: 37-2012
2. Indian Road Congress (IRC), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, (Third Revision), IRC: 58-2012
3. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Ninth Impression, South Asia, 2012
4. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011
5. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering 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 Pavements for Highways, New Delhi



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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.

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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., New Delhi, 2015
4. Santhakumar. A.R., "Concrete Technology", Oxford University Press India, 2006.

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1. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995
2. Gambhir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
3. IS10262-2009 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, 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 and Materials", McGraw Hill Education (India) Private Limited, New Delhi, 2016



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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:45PERIODS**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.

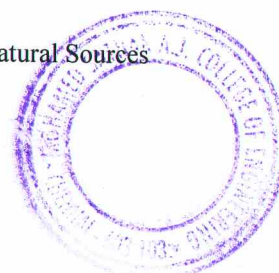
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- Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015.
- Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
- Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
- Duggal.S.K.,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

REFERENCES:

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

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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 – Clariflocculator-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 – Computer applications – 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:

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



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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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BONAFIDE CERTIFICATE

Certified that this project report **"EXPERIMENTAL STUDY ON RIGID PAVEMENT USING WASTE PLASTIC"** is the bonafide work of **MOHAMED SHAHEEM S B (311817103015) NAINA MOHAMED BASITH D (311817103701)** who carried out the project work under my supervision.

M.B.  07/11/2021
SIGNATURE

Mr. M. B. SHANMUHARAJAN, ME., (PhD).,
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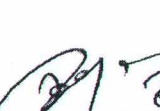


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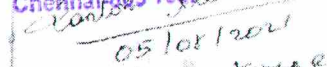
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Project Viva-Voce held on

05/08/2021

M.B.  05/08/2021
INTERNAL EXAMINER



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EXTERNAL EXAMINER

ABSTRACT

Plastic are typically organic polymers of high molecular mass and often derived from petro-chemicals and becoming a major problem in causing environmental pollution when it burns. They were widely used because of their ease in manufacturing, low cost, and versatility. Utilization of these waste material like plastic bags, bottles, et c by partial replacement of concrete in concrete mixes to improve the properties of mix in addition to solving disposal problems. The waste plastic like bottles, plastic glasses were used are cleaned and cut into pieces of size ranges from 2.36mm to 75 microns and sieved.0020The resultant mix was used in the rigid road construction. It also increases the road life and also as well as help in decrease of pollution to the Environment. Plastic roads are very useful in the hot climatic areas. By using of this type of waste plastic in the construction of pavement can increase the strength, durability by which the rigid pavements are failing. Rigid pavement is a composite material mostly used in construction projects like road surfacing, parking lots.

Key Words- Waste plastic, Environmental pollution, Partial replacement



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CHAPTER 7

CONCLUSION

As per the above discussion of pavements by many test some conclusions:

1. Rigid pavement carries higher flexural strength than flexible pavement i.e. it carries bending and deformation without rupture under wheel axial load.
2. In flexible pavement load is transferred from grain to grain and because of that many failures occurs such as fatigue cracking, rutting and thermal cracking. But in rigid pavement no such phenomenon of grain to grain load transfer exists, hence there is fewer amounts of failure.
3. Life span of rigid pavement is more than the flexible pavement with low maintenance cost. Life cycle cost of flexible pavement will be about 19 % higher than the rigid pavement after 20 years.
4. Initial cost of rigid pavement is higher but when comparing total cost of pavement through life span rigid pavement is more economical than flexible pavement.
5. Initial cost of concrete pavement is reduces by replacing cement by fly ash at some percent or by using other alternatives.



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ABSTRACT

In this research ,presence of basalt fibers with super plasticizers improves the physical properties as well as it act as crack arrester. How the impact of basalt fibers in the properties of M25 grade concrete with super plasticizer. Basalt fiber has increased the popularity in reinforcing application of concrete due to its excellent mechanical properties and environmental friendly manufacturing process. Basalt fibers used here is 12mm long and 13micron in diameter. Concrete specimens have casted with BF in cubes, cylinders & beams. Finally Results were compared and analyzed with conventional concrete, and suggest that by using the different proportions of basalt fibers, with super plasticizer (AURAMIX 400) how it improves the compressive, split tensile and flexural strength of the concrete.



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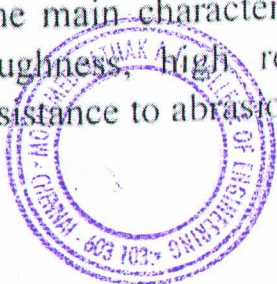
CHAPTER 10

FUTURE SCOPE

- In today's world for the purpose of construction, concrete is the most commonly material.
- The fibers are used in the concrete to enhance its physical, mechanical and chemical properties.
- The compressive, split tensile and flexural strength are gradually increased by using the basalt fiber.
- Basalt fibers are non-corrosive and highly stable in the strong alkali environment.
-
- These fibers enhances the structural integrity of the structure. Also the basalt fibers led to decrease the crack propagation in the concrete phenomena called crack arresting.
- Fiber reinforced concrete can also replace the steel reinforcement and these fibers lead to reduction in corrosion as compare to steel reinforcement.
- The fiber reinforced concrete are also used in the application of building structures like bridges etc.
- These fibers provide excellent resistance to accidental impact due to its high impact resistance and toughness.
- The fiber reinforced concrete are also used in payment slabs and repair. These material has a very high strain capacity, toughness and controlled crack propagation.
- The main characteristics of fiber reinforced concrete are high strength, toughness, high resistance to corrosion and chemical attack, high resistance to abrasion and fatigue.



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Certified that this project report **"EXPERIMENTAL INVESTIGATION OF PAVER BLOCKS MADE WITH DIFFERENT WASTE MATERIALS"** is the bonafide work of **"KISHORE KUMAR S (311817103010), MOHAMED TAJAMMUL (311817103016), MOHAMED UMAR (311817103017)"** who carried out the project work under my supervision.

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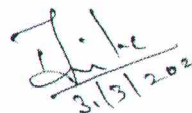
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EXTERNAL EXAMINER

Abstract

India produces 26,000 tonnes of waste every day and about 9.4 million tonnes a year, according to the Central Pollution Control Board. From this only 5.6 million tons of waste is recycled per year. While the remaining 3.8 million tons remain unattended in landfills. This is a serious environmental problem as some waste can't easily be decomposed. So, making of low-cost tiles with such waste will help a lot in decreasing the environmental pollution. To solve this, the waste is separated into different grades. Then the waste is mixed with various proportion of sand and other recyclable materials for ore forming of the right composition and placed into the mould for making blocks. Then, the Mechanical performance of these blocks are experimentally investigated to figure out the best additive and optimal composition



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Chapter 9

Conclusion and Future Scope

9. Conclusion

- Coconut shell can be used as an alternate for the conventional coarse aggregate in the production of paver blocks also.
- It seems that the Compressive Strength goes on increasing with the increase in Fly Ash but after the replacement of 20% the strength goes on decreasing.
- The paver block made with coarse aggregate has settled with fine shape and good strength when compared to paver block made with sea shell.
- The paver block made with cashew nut shell obtained weaker strength and shape when compared to the block made with coconut shell.
- The paver blocks made with sea shells has the least water absorption and so would have high water resistivity



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ABSTRACT

Plastic are typically organic polymers of high molecular mass and often derived from petro-chemicals and becoming a major problem in causing environmental pollution when it burns. They were widely used because of their ease in manufacturing, low cost, and versatility. Utilization of these waste material like plastic bags, bottles, et c by partial replacement of bitumen in bituminous mixes to improve the properties of mix in addition to solving disposal problems. The waste plastic like bottles, plastic glasses were used are cleaned and cut into pieces of size ranges from 2.36mm to 75 microns and sieved. These pieces were added evenly around the hot aggregates and heated up to 160°C and heating the bitumen up to 130°C. The resultant mix was used in the flexible road construction.

It also increases the road life and also as well as help in decrease of pollution to the Environment. Plastic roads are very useful in the hot climatic areas. By using of this type of waste plastic in the construction of pavement can increase the strength, durability by which the bituminous pavements are failing. Bituminous mix is a composite material mostly used in construction projects like road surfacing, parking lots.

Key Words- Waste plastic, Environmental pollution, Partial replacement, Bituminous mix, Bituminous pavements

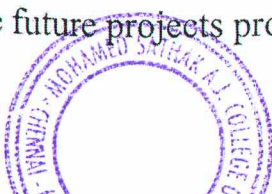


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CHAPTER 7

CONCLUSION

Bituminous plastic is used for the better performance of roads. This helps to have a better binding of bitumen waste plastic and aggregate due to increased bonding and increased area of contact between polymers and bitumen. The Plastic mix also reduces the voids. This prevents the moisture absorption and oxidation of bitumen by entrapped air. Results reducing rutting, Traveling and there is no pothole formation. The roads can withstand heavy traffic and show better durability. Here we conclude that the innovative concept of using a plastic bitumen mix road in a place which does not carry heavy traffic is quite economical. The project becomes effective in not only the economical perspective of the development of the country but also the environmental preservation. The technology implemented does not only give a low cost benefit but also give a maintenance benefit. This technology becomes a boon to the environment as we are using a lot of garbage which used to be dumped or burned leading to air, land and water pollution. This technology without affecting the aesthetics traditions and equipment requirement serves a better road for the people in the vicinity. The equipment requirement of this road is similar to that of the ordinary road and hence no further costs are incorporated. Thus in order to construct the road no further training of the labours for the handling of new product is required. The project shows the innovative vision towards the infrastructure development of the country and hence is sure to be widely accepted in the near future. Being in the experimental stage it has shown excellent results and hence is ought to be accepted for the future projects too. Thus here we conclude that the road will serve the tenure of its construction for the betterment of the people residing in the vicinity of the road. And serve a good property value for the future projects proposed by the construction agencies sharing the route.



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Certified that this project report **EXPERIMENTAL STUDY ON REPLACEMENT OF SAND BY M-SAND AND PLASTIC PELLETS IN CONCRETE** is the bonafide work of M.ARUN (311817103003), P.M.IJAZ AHMED (311817103006), M.A.JAFFER ABBAS (311817103008) who carried out the project work under my supervision.

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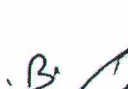
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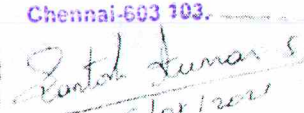
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ABSTRACT

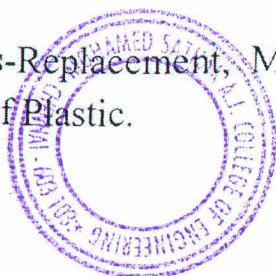
In construction materials, concrete is the largest production of all other materials. The increase in demand for the ingredients of concrete is met by partial replacement of materials by the plastic wastes. Plastic being the major threat of the Indian Subcontinent, huge amount of plastic wastes are produced day by day, 53.04 lakhs tonnes of plastic wastes are produced in Tamilnadu per annum they pollute environment in all possible ways. These wastes are disposed in the form of landfills causes an enormous amount of land pollution. So for the increasing demand to protect the normal environment, especially in buildup areas, the needs to use these wastes are very important. Therefore, replacing all or some portion of natural aggregates with high density polyethylene would lead to considerable environmental benefits. The utilization of waste materials from the industries has been continuously emphasized in the research work. The present work is to use high density polyethylene as replacement for fine aggregate. The M25 concrete with high volume steel slag replacement for fine aggregate are examined in the present study. In previous studies, there was a strength reduction in the concrete as the addition of plastic refuse increases. The addition of plastic refuse in the form of pellets has increased the strength of concrete as plastic pellets are having more density than raw plastic refuse. The replacement is done in 0, 2, 4, 6, 8 and 10 percent in 1:1.44:3.33 mix with water/cement ratio 0.5. The addition of plastic pellets of 4% has achieved a maximum compressive strength, tensile strength and flexural strength of 28 N/mm², 1.96 N/mm² and 2.75 N/mm² respectively at the end of 28 days curing

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Keywords-Replacement, Manufacturing Sand, Plastic, Minimum percentage, Disposal of Plastic.



CHAPTER 6

CONCLUSION

Based on the experimental investigation the following conclusions are:

- It is observed that M-Sand and HDPE based concrete have achieved— an increase in strength for 4% replacement of fine aggregate at the age of 7, 14 and 28 days.
- The replacement of fine aggregate by M-Sand— & HDPE not only increases the compressive strength but also reduces cost of the concrete and provides an environment value to it.
- As far as cost is concerned, cost of it is cheap as waste—& availability of HDPE is abundant in the environment which provides source for HDPE for replacement.

Replaced concrete which yields some good amount of strength as conventional concrete it can be used in construction purposes and structures made up of concrete. The addition of plastic pellets of 4% has achieved a maximum compressive strength, tensile strength and flexural strength of 28 N/mm², 1.96 N/mm² and 2.75 N/mm² respectively at the end of 28 days curing. It also helps us in protecting environment by preventing the dumping of plastic waste as landfill etc. This replacement concrete will bring wide changes in the field of Civil Engineering.

Therefore, partial replacement of sand by the mixture of M-Sand and plastic pellets as fine aggregate, is not only economical but also facilitates environmental friendly disposal of the waste plastic into a useful product. This replaced concrete is as efficient as conventional concrete



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BONAFIDE CERTIFICATE

Certified that this project report **"EXPERIMENTAL ANALYSIS AND COMPARISON OF GROUND WATER IN NEELANKARAI"** is the bonafide work of **ANTONY. A (311817103002)** who carried out the project work under my supervision.

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ABSTRACT

The good quality of groundwater is important for future planning and management. The present study has been undertaken to provide an overview on the status of groundwater quality through physico-chemical parameters namely pH, alkalinity, total hardness, total dissolved solids, chloride, fluoride, nitrate, phosphate and iron through laboratory analysis. Samples have been collected from 15 BORE WELLS in Neelankarai. Neelankarai is a small coastal town located to the south of Chennai, Tamil Nadu, near the highway 49. The population of the town is about 16,000 people. The town has a few districts including residential area, a small industrial center, a business district, and a coastal resort area. The latitude of Neelankarai, Chennai, Tamil Nadu, India is 12.949282, and the longitude is 80.255013. Neelankarai, Chennai, Tamil Nadu, India is located at India country in the Companies place category with the gps coordinates of 12° 56' 57.4152" N and 80° 15' 18.0468" E.

Key Words: Groundwater quality, Neelankarai, Parameters, Water.




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CHAPTER 7

CONCLUSION

As the groundwater in Neelankarai satisfies most of the required parameters as per IS 10500:2012, we can say that this water is usable for domestic purposes and it also means that the amount of salt water intrusion is almost non-existent and the water is usable for some industrial purposes too. The groundwater quality was assessed in Neelankarai, Chennai, Tamil Nadu, India. In order to find out the suitability of groundwaters for drinking purpose, compared the value of selected parameters pH, electrical conductivity (EC), total dissolved solids (TDS), total hardness (TH), chloride (Cl), turbidity, taste with the value of selected parameters from IS 10500:2012 drinking water quality standard. The physicochemical study of the groundwater systems of selected in Neelankarai showed that groundwater is nearly perfect and the groundwater is fit for drinking purpose the slight variation is mainly due to the dissolved constituents, which exists as ions, molecules or solid particles, these constituents not only undergo chemical and physical reactions but also redistribution take place among the various ionic species this can also take place between the liquid and solid phases.

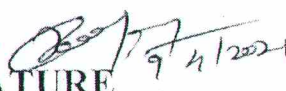


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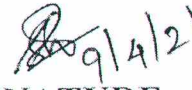
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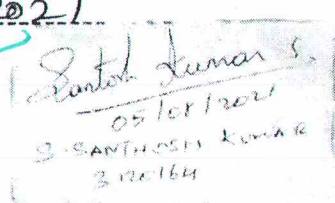
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ABSTRACT

In this research ,presence of basalt fibers with super plasticizers improves the physical properties as well as it act as crack arrester. How the impact of basalt fibers in the properties of M25 grade concrete with super plasticizer. Basalt fiber has increased the popularity in reinforcing application of concrete due to its excellent mechanical properties and environmental friendly manufacturing process. Basalt fibers used here is 12mm long and 13micron in diameter. Concrete specimens have casted with BF in cubes, cylinders & beams. Finally Results were compared and analyzed with conventional concrete, and suggest that by using the different proportions of basalt fibers, with super plasticizer (AURAMIX 400) how it improves the compressive, split tensile and flexural strength of the concrete.



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CHAPTER 9

CONCLUSION

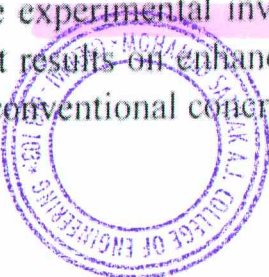
- From the research it was proposed that, the usage of Basalt fibers in low cost composites for civil infrastructure applications gives good mechanical properties like strength and lower cost predicted for basalt fibers. Basalt fiber has used as a cost effectively replace to fiber glass, steel fiber, polypropylene, polyethylene, polyester, aramid and carbon fiber products in many applications.
- When in contact with other chemical they produce no chemical reaction that may damage health or environment.
- So it is ecological friendly material. Basalt rock fibers have new range of materials in building constructions, road construction, concrete industry and agriculture field.
- Basalt is well known as a rock found in virtually every country around the world.
- The benefits of using basalt fiber is that it is non corrosive, having high stability in strong alkali environments and inherits good chemical resistance.
- The basalt fiber enhances the compressive strength of concrete by 10-15% as compare to plain/control concrete.
- From the research its concluded that the compressive, split tensile and flexural strength of basalt fiber concrete is higher to conventional concrete.
- The experimental investigation shows that 12mm basalt fibers gives the best results on enhancing mechanical properties of concrete as compared to conventional concrete

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Certified that this project report **"FEASIBILITY STUDY ON NATURAL FILTER MEDIA FOR WATER PURIFICATION USING DUAL FILTRATION METHOD"** is the bonafide work of **S.FAREED AHAMED (311817103005), A.MOHAMED SAMEEM MOHIDEEN (311817103014), S.MOHAMMED ISMAIL (311817103019)** who carried out the project work under my supervision.


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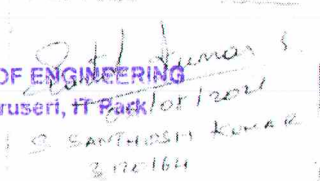

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EXTERNAL EXAMINER

ABSTRACT

In this project, we have done purification of lake water using double filter media. The type of filter media which we used is coconut shell charcoal, fine sand and membrane. We prepared neem extract by using copper nanoparticles. We made membrane by using fine sand, saw dust, clay and neem water extract. We passed lake water in our filter media and it got filtered, then we tested the filtered water. The following tests were done in the lake water sample: Conductivity, Total dissolved solids (TDS), Dissolved oxygen (DO), Biochemical oxygen demand (BOD) and PH. From the test, we got to know that the water gets purified by our setup. We decided to do this project because alternative purification methods are comparatively costly. Our method is more feasible and easier to setup.




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CHAPTER 7

RESULT AND CONCLUSION

7.1 RESULT

The following tests were done in the lake water sample: Conductivity, Total dissolved solids(TDS), Dissolved oxygen(DO), Biochemical oxygen demand(BOD) and PH. On comparing the initial sample of water collected from a lake to the final sample of water purified by our setup we concluded that the double filtration process of water purification is feasible. We came to the above conclusion because the purified sample had permissible value of conductivity, low BOD and TDS. We plan to obtain potable water in the near future by further improving our method of purification.

We collected many impure water samples and tested multiple properties related to purity and recorded it. We fabricated a double filtration method of water purifier and purified the impure water samples with the help of it. On testing the purified water sample we came to know that it was more clean and dirtless compared to the initial sample of water. Hence we can deduce that our filtration method using a dual membrane is very successful and feasible.



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7.2 CONCLUSION

After completing the experiment we can conclude that the proposed dual filtration method is very effective, cost saving and less time consuming. The main objective of the project is to check the feasibility of the proposed filtration process and it is successfully done.

After loads of research and testing we came to know that it is feasible.

The project we have done can be further upgraded with multiple updates to more efficiently purify impure water and make it potable. Our project is a significant milestone in purification technology because it has more advantages than the other conventional methods. In the future we plan to build a business and make sure that our technology is available all over the world. Safe, pure and potable water has a very huge demand because obviously people cant survive without it. We plan to ease the process of water purification and make it cost effective.




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