



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 (2019 - 2020)
1	CE6002 - Concrete Technology
2	CE6504 - Highway Engineering
3	CE6402 - Strength of Materials
4	CE6401 - Construction Materials
5	CE6505 - Design of Reinforced Concrete Elements
6	CE6021 - Repair and Rehabilitation of Structures
7	CE6502 - Foundation Engineering
8	CE6506 - Construction Techniques, Equipment and Practice
9	GE6351 - Environmental Science and Engineering
10	EN6501 - Municipal Solid Waste Management

PRINCIPAL
MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
1	CE6002	Concrete technology	Cement properties, test on cement, aggregates, test as per BIS grading requirements, ground granulated blast furnace slag, properties of concrete related to mix design, IS method of mix design, workability, test for workability of concrete, slump test and compaction factor test, determination of compressive and flexural strength as per BIS, determination of compressive and flexural strength as per BIS, stress strain curve of concrete, determination of young's modulus, light weight concrete, fibre reinforced concrete

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OBJECTIVES:

- 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 -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- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their 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-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress-strain curve for concrete-Determination of Young's Modulus.

UNIT V SPECIAL CONCRETES

9

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

TOTAL : 45 PERIODS**OUTCOMES:**

- The student will possess the knowledge on properties of materials required for concrete tests on those materials and design procedures for making conventional and special concretes.

TEXTBOOKS:

- Gupta,B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
- Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003

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REFERENCES:

- Santhakumar,A.R; "Concrete Technology", Oxford University Press, New Delhi, 2007
- Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London,1995
- Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
- IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998





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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
2	CE6504	Highway engineering	Test on aggregate, concrete road construction, plastics, structural evaluation, strengthening of pavements

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OBJECTIVES:

- 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**8**

Significance of highway planning – Modal limitations towards sustainability - History of road development in India – Classification of highways – Locations and functions – Factors influencing highway alignment – Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT II GEOMETRIC DESIGN OF HIGHWAYS**12**

Typical cross sections of Urban and Rural roads — 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**

Design principles – pavement components and their role - Design practice for flexible and rigid Pavements (IRC methods only) - Embankments .

UNIT IV HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE**8**

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – 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**8**

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

TOTAL: 45 PERIODS**OUTCOMES:**

- The students completing this course would have acquired knowledge on planning, design, construction and maintenance of highways as per IRC standards and other methods.

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. Indian Road Congress (IRC), Guidelines and Special Publications of Planning and Design.

REFERENCES:

1. Kadiyali.L.R. "Principles and Practice of Highway Engineering", Khanna Technical Publications, 8th edition Delhi, 2013.
2. Yang H. Huang, "Pavement Analysis and Design", Pearson Education Inc, Ninth Impression, South Asia, 2012
3. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, 1st Edition, USA, 2011
4. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011
5. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
6. O'Flaherty C.A "Highways, Butterworth – Heinemann, Oxford, 2006



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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
3	CE6402	Strength of materials	State of stress in three dimension, load carrying capacity

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OBJECTIVES:

- To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing indeterminate beam
- To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

UNIT I ENERGY PRINCIPLES

9

Strain energy and strain energy density – strain energy due to axial load, shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorems - Principle of virtual work – application of energy theorems for computing deflections in beams and trusses - Williot Mohr's Diagram.

UNIT II INDETERMINATE BEAMS

9

Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III COLUMNS AND CYLINDER

9

Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section – Thick cylinders – Compound cylinders.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS

9

Determination of principal stresses and principal planes – Volumetric strain – Theories of failure – Principal stress - Principal strain – shear stress – Strain energy and distortion energy theories – application in analysis of stress, load carrying capacity.

UNIT V ADVANCED TOPICS IN BENDING OF BEAMS

9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre - curved beams – Winkler Bach formula.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

- students will have through knowledge in analysis of indeterminate beams and use of energy method for estimating the slope and deflections of beams and trusses.
- they will be in a position to assess the behaviour of columns, beams and failure of materials.

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2010.
2. Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003
2. William A .Nash, "Theory and Problems of Strength of Materials", Schaum's Outline Series, Tata McGraw Hill Publishing company, 2007.
3. Punmia B.C."Theory of Structures" (SMTS) Vol 1&II, Laxmi Publishing Pvt Ltd, New Delhi 2004.
4. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011





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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
4	CE6401	Construction materials	Fineness of cement, setting time of cement, aggregates, durability of concrete, steel, aluminum, fibre glass reinforced plastic, clay products.

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OBJECTIVES:

- 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 – Cement, Concrete blocks – Light weight 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 – Industrial byproducts – Fly ash – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading – Sand Bulking.

UNIT III CONCRETE

9

Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

UNIT IV TIMBER AND OTHER MATERIALS

9

Timber – Market forms – Industrial timber – Plywood – Veneer – Thermacole – Panels of laminates – Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Uses – 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 these materials
- understand the relationship between material properties and structural form
- understand the importance of experimental verification of material properties.

TEXT BOOKS:

- Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012.
- Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
- Shetty.M.S., "Concrete Technology (Theory and Practice)", 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





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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
9	GE6351	Environmental science and engineering	Environmental pollution, control measures, air pollution, chemicals, noise pollution, over exploitation, sustainable development.

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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**12**

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – 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.

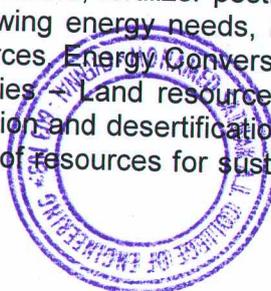
UNIT II ENVIRONMENTAL POLLUTION**10**

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission; Control of SO₂, NO_x, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies –

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 overutilization of surface and ground 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 Energy Conversion processes – Biogas – production and uses, anaerobic digestion; 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. Introduction to Environmental Biochemistry: Proteins –



Biochemical degradation of pollutants, Bioconversion of pollutants.
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 – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides.
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 –Environmental impact analysis (EIA)- -GIS-remote sensing-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. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw Hill, New Delhi, 2006.

REFERENCES :

1. Trivedi R.K. 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham W.P.Cooper., T.H. Gorbani, 'Environmental Encyclopedia', Jaico Publishing House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan R, 'Environmental Studies - From Crisis to Cure', Oxford University Press, 2005





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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
7	CE6502	Foundation engineering	Bearing capacity and its evaluation, carrying capacity of single pile in granular and cohesive soil


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OBJECTIVES:

- To impart knowledge on common method of sub soil investigation and design of foundation. At the end of this course student acquires the capacity to investigate the soil condition and to select and design a suitable foundation.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration – auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – Sampling techniques – Representative and undisturbed sampling – methods - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Penetration tests (SPT and SCPT) - Bore log report – Data interpretation - strength parameters and Liquefaction potential - Selection of foundation based on soil condition.

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems – 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 – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFTS 9

Types of footings – Contact pressure distribution: Isolated footing – Combined footings – Types and proportioning – Mat foundation – Types and applications – Proportioning – Floating foundation – Seismic force consideration – Codal Provision.

UNIT IV PILE FOUNDATION 9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formulae (Engineering news and 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.

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 on retaining walls of simple configurations – Culmann Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls.

TOTAL : 45 PERIODS**OUTCOMES:**

- Students will have the ability to select type of foundation required for the soil at a place and able to design shallow, foundation, deep foundation and retaining structures.

TEXTBOOKS:

- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2007.
- Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International Pvt. Ltd, New Delhi, 2005.
- Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013
- Varghese, P.C., "Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.



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REFERENCES:

1. Das, B.M. "Principles of Foundation Engineering" 5th edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
2. Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata McGrawHill Publishing company Ltd., New Delhi, 2002.
3. Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt.Ltd., New Delhi, 2005
4. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2007 (Reprint)
5. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2005.
6. IS 6403 : 1981 (Reaffirmed 1997) "Breaking capacity of shallow foundation", Bureau of Indian Standards, New Delhi, 1998
7. IS8009 (Part1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi, 1999
8. IS8009 (Part2):1980 (Reaffirmed 1995) "Deep foundations subjected to symmetrical static vertical loading", Bureau of Indian Standards, New Delhi, 1992
9. IS2911(Part1):1979 (Reaffirmed 1997) "Concrete Piles" Bureau of Indian Standards, New Delhi, 1994
10. IS2911(Part2):1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi, 2007
11. IS2911(Part 3) :1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi, 1998
12. IS2911 (Part 4) :1979 (Reaffirmed 1997) "Load Test on Piles", Bureau of Indian Standards, New Delhi, 1997



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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
5	CE6505	Design of reinforced concrete elements	Design codes and specification

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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 METHODS OF DESIGN OF CONCRETE STRUCTURES 9**
Concept of Elastic method, ultimate load method and limit state method – Advantages of Limit State Method over other methods – Design codes and specification – Limit State philosophy as detailed in IS code – Design of beams and slabs by working stress method.
- UNIT II LIMIT STATE DESIGN FOR FLEXURE 9**
Analysis and design of singly and doubly reinforced rectangular and flanged beams - Analysis and design of one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions.
- UNIT III LIMIT STATE DESIGN FOR BOND, ANCHORAGE SHEAR & TORSION 9**
Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending shear and torsion.
- UNIT IV LIMIT STATE DESIGN OF COLUMNS 9**
Types of columns – Braced and unbraced columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.
- UNIT V LIMIT STATE DESIGN OF FOOTING 9**
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

TOTAL: 45 PERIODS**OUTCOMES:**

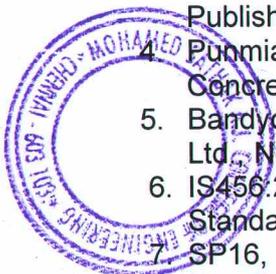
- The student shall be in a position to design the basic elements of reinforced concrete structures.

TEXTBOOKS:

- 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.

REFERENCES:

- Jain, A.K., "Limit State Design of RC Structures", Nemchand Publications, Roorkee, 1998
- Sinha, S.N., "Reinforced Concrete Design", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2002
- Unnikrishna Pillai, S., Devdas Menon, "Reinforced Concrete Design" Tata McGraw Hill Publishing Company Ltd., 2009
- Punmia.B.C., Ashok Kumar Jain, Arun Kumar Jain, "Limit State Design of Reinforced Concrete", Laxmi Publication Pvt. Ltd., New Delhi, 2007.
- Bandyopadhyay. J.N., "Design of Concrete Structures", Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
- IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000
- SP16, IS456:1978 "Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999



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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
8	CE6506	Construction techniques, equipment and practice	Construction techniques, quality of concrete, construction coordination

PRINCIPAL

MOHAMED SATHAK A.J.COLLEGE OF ENGINEERING
34, Rajiv Gandhi Road (OMR), Siruseri, IT Park
Chennai-603 103.

OBJECTIVES:

- 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 CONCRETE TECHNOLOGY

9

Cements – Grade of cements - concrete chemicals and Applications – Grade of concrete - manufacturing of concrete – Batching – mixing – transporting – placing – compaction of concrete – curing and finishing - Testing of fresh and hardened concrete – quality of concrete – Extreme Weather Concreting - Ready Mix Concrete - Non-destructive testing.

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 and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling,

TOTAL: 45 PERIODS**OUTCOMES:**

- Students completing the course will have understanding of different construction techniques, practices and equipments. They will be able to plan the requirements for substructure and superstructure a construction.

TEXTBOOKS :

- Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.
- Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.
- Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.
- Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.

REFERENCES:

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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. Dr. Mahesh Varma, "Construction Equipment and its Planning and Application", Metropolitan Book Company, New Delhi, 1983.
5. Gambhir, M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004



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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
10	EN6501	Municipal solid waste management	Land disposal, sanitary landfill,

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Chennai-603 103.

OBJECTIVES:

- To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

UNIT I SOURCES AND TYPES

8

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste (M&H) rules – integrated management-Public awareness; Role of NGO's.

UNIT II ON-SITE STORAGE AND PROCESSING

8

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III COLLECTION AND TRANSFER

8

Methods of Residential and commercial waste collection – Collection vehicles – Manpower– Collection routes – Analysis of collection systems; Transfer stations – Selection of location, operation & maintenance; options under Indian conditions – Field problems- solving.

UNIT IV OFF-SITE PROCESSING

12

Objectives of waste processing – Physical Processing techniques and Equipments; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT V DISPOSAL

9

Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills – Landfill liners – Management of leachate and landfill gas- Landfill bioreactor– Dumpsite Rehabilitation

TOTAL: 45 PERIODS**OUTCOMES:**

The students completing the course will have

- an understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management
- ability to plan waste minimisation and design storage, collection, transport, processing and disposal of municipal solid waste

TEXTBOOKS:

- Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw-Hill, New York, 1993.
- Vesilind, P.A. and Rimer, A.E., "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981
- Paul T Williams, "Waste Treatment and Disposal", John Wiley and Sons, 2000

REFERENCES:

- Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2000.
- Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
- Manser A.G.R. and Keeling A.A., " Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996



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S.No.	Subject Code	Subject Name	Content that include experimental learning through project work
6	CE6021	Repair and rehabilitation of structures	Maintenance, strength, durability and thermal properties, effects due to climate, temperature, corrosion, corrosion inhibitors

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OBJECTIVES:

- To make the students to gain 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 a damaged structure, causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion - Effects of cover thickness.

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, 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 – DEMOLITION TECHNIQUES - Engineered demolition methods - Case studies.

TOTAL: 45 PERIODS**OUTCOMES:**

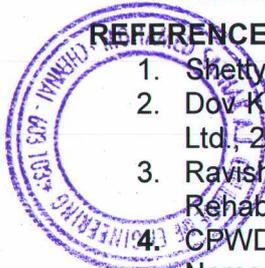
- Students must gained knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

TEXTBOOKS:

- Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991
- Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987

REFERENCES:

- Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2008.
- Dov Kominetzky.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.
- CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
- Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013



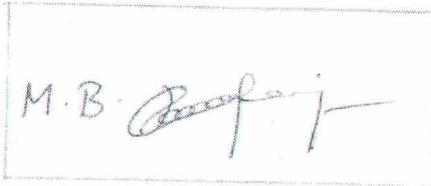
Handwritten signature in blue ink: *Shetty*

Principal's Office stamp: **PRINCIPAL'S OFFICE**
ANNA UNIVERSITY, CHENNAI
 34 Rajiv Gandhi Road, Siruseri, Tamil Nadu
 Chennai-603 103.

ANNA UNIVERSITY: CHENNAI 600 025

BONAFIDE CERTIFICATE

Certified that this project report "EXPRIMENTAL AND COMPARATIVE STUDY ON FLEXURAL STRENGTH OF RCC BEAM USING GFRP REBAR" is the bonafide work of " S.AJMAL KHAN(311816103002) M.HEMANATHAN (311816103005) J.LINGESHWARAN (311816103007)" who carried out the project work under my supervision.



SIGNATURE

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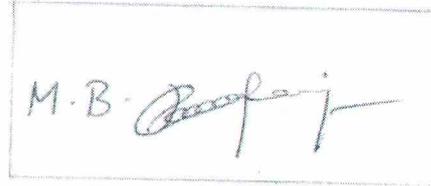
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Assistant Professor

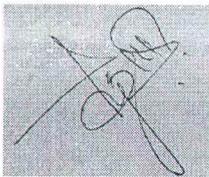
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Submitted for VIVA-VOICE examination held on 22/09/2020



INTERNAL EXAMINER



EXTERNAL EXAMINER

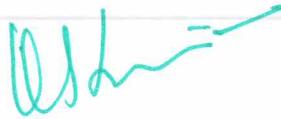


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ABSTRACT

When deals with salty offshore projects , Extreme condition the corrosion of steel is the major problem. So in order to rectify this problem the GFRP rebar is used as a reinforcement in concrete .The sand coating is provided for GFRP rebar to increase the bonding strength . In addition we use the slag cement as a binding material in concrete for improving the durability and workability. Because of high durability the maintenance and repair cost is very low , and also improve the life span .So the GFRP is economical compare to normal conventional Steel .The specimen beam will cast with convention reinforcement beams and GFRP reinforced beams. After the curing the beam will be tested for flexure strength with the curing period of 7,14,28 days. For bonding strength determination the pull out test is carried in cube with 28 days of curing . The beam is designed as per is 456-2000

Key Words: GFRP Rebar GFRP Reinforced Concrete, GFRP rebar



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CHAPTER 9

CONCLUSION

- GFRP reinforcing bar has higher tensile strength and higher corrosion resistance than steel rebar in addition, moderate flexural strength, these properties make GFRP is good alternative of steel in foundations application
- Tensile strength of bare GFRP bar is high, because they are anisotropic composite materials, GFRP rebar achieved yield tensile strength about 13% higher than that the steel rebar, while yield strain of GFRP is higher than steel about 58%.
- Bend strength of bare GFRP bar is good; where yield strength of GFRP rebar achieved 72% of steel rebar strength while yield strain of GFRP is higher than steel about 20%.
- Compressive strength of unreinforced concrete is 25.67 KN this value is acceptable according to British Standard specification

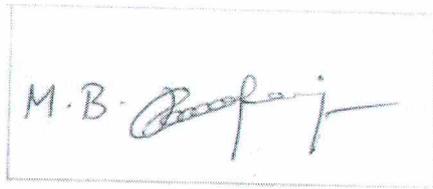


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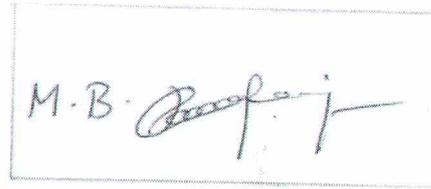
Certified that this project report “**EXPERIMENTAL INVESTIGATION ON PROPERTIES OF CONCRETE BY PARTIAL REPLACEMENT OF CEMENT WITH GGBS**” is the bonafide work of **MAHRITH MOHAMED N (311816103008), MOHAMED SALMAN A (311816103016), SUMAN E (311816103026)** who carried out the project work under my supervision.



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Project Viva-Voice held on 22 09 2020



INTERNAL EXAMINER



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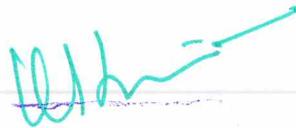


EXTERNAL EXAMINER

ABSTRACT

The broad aim of this work was to investigate the effects of partially replaced Portland pozzolana Cement fly ash (PPC) by **ground granulated blast furnace slag (GGBS)**. GGBS is the by-product of iron and steel industry which is produced in large quantities as a solid waste. It is highly cementitious. The replacement percentages of cement (PPC) with GGBS are 5%, 10%, 15% and 20% by weight. These combinations of materials were used to study **compressive strength, slump cone** and the results obtained were compared with the control concrete. It is observed that the optimum replacement percentages of GGBS.

Keywords: GGBS, **High-Performance Concrete.**



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CONCLUSION

1. Durability and service life are improved by preparing High-Performance Concrete.
2. With the addition of 10% of GGBS as a replacement of Cement for an M25 grade of concrete, there is an increase in the strength compared to the normal concrete.
3. As GGBS is partially replaced with the cement, the consumption of the cement is reduced and also the cost of construction is reduced.
4. Thus the workability is improved by the partial replacement of the GGBS with cement.



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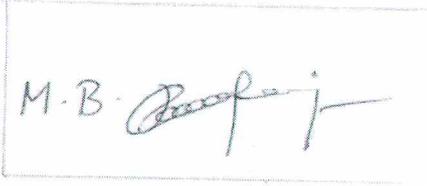
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BONAFIDE CERTIFICATE

Certified that this project report **“EFFECTIVE RECYCLING OF PLASTIC WASTE AND UTILIZATION IN THE MANUFACTURING OF PAVER BLOCKS”** is the bonafide work of **N. MANAS AHAMED (311816103009), A. MOHAMED ASLAM (311816103012), M. MOHAMED HASHIR (311816103302)** who carried out the project work under my supervision.



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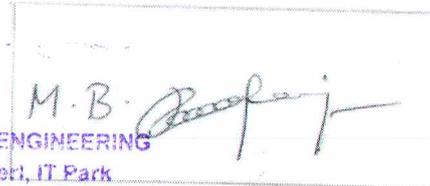


Project Viva-Voce held on 22/09/2020



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EXTERNAL EXAMINER



ABSTRACT

Plastic is used in day today life. At present nearly 56 lakhs ton of plastic waste is produced in India per year. Plastics are generally non-degradable hence, they take centuries to decay. This is due to the intermolecular bonds that constitutes plastic, whose structure insure that the plastic neither corrode nor decompose. The use of waste plastics in concrete pavement block is a partial solution to the environmental and ecological challenges associated with the use of plastics. The aim of this project is to reduce environmental pollution by using waste plastic to produce pavement blocks. The plastic material is first shredded and then River sand, M sand and Fly ash were added in their respective ratios and the pavement blocks were casted. The paver block were tested for Compressive strength and Abrasion resistance. The obtained results were compared with the results of conventional cement concrete paver block. From the findings, it can be seen that plastic pavement blocks have a good strength and can therefore be used for specific requirements namely footpaths, parking areas etc. Hence the project is helpful in reducing plastic waste in a useful way and an effective way of disposal of plastic wastes with having adverse on the environment.



A handwritten signature in green ink, appearing to be 'M. Sathak', written over a horizontal line.

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CHAPTER - 9

CONCLUSION

The conclusions were drawn from the experimental investigation such as follows;

1. The utilization of waste plastic in production of paver block has productive way of disposal of plastic waste.
2. Paver blocks made using plastic waste, quarry dust, coarse aggregate give better result.
3. The cost of paver block is reduced when compared to that of concrete paver block.
4. Paver block made using plastic waste along with flyash, M-sand have shown better result.
5. It also shows good heat resistance and strength.
6. It can be used in Non-traffic and light traffic road.
7. It is computed to use the 20% Recycled plastic aggregate in concrete which does not affect the properties of concrete.
8. Using plastic in concrete mix reduces the weight of block by 15%.
9. The cost of Plastic paver block is reduced when compare to that of concrete paver blocks.
10. Both physical and mechanical properties of plastic concrete pavement blocks were affected when plastic was used as a replacement for aggregate.
11. Usage of various Waste material in the Manufacture of Paver blocks enables Utilization of Different type of waste and helps in achieving Eco Friendly Condition.
12. Compressive Strength of Paver Block is increased compared to the nominal Paver Block with used of waste material in optimum mix design.
13. Plastics block drains and gutters and causes floods.

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BONAFIDE CERTIFICATE

Certified that this project report titled **“EXPERIMENTAL INVESTIGATION ON PROERTIES OF LOW COST ROOFING TILES USING AGRICULTURAL”** is the bonafide work done by **B.IRFAN AHAMED (311816103006), MOHAMED THAMEEM ANSARI . B (31181610317), MOHAMED GHOUSE (311816103015)** who carried out the project work under my supervision.

M.B. Shanmuharajan

S. Hemavathi

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Project Viva-Voce held on 22-09-2020

W.H.



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M.B. Shanmuharajan
EXTERNAL EXAMINER

ABSTRACT

Roof tiles are designed mainly to keep out rain, and are traditionally made from locally available materials such as terracotta or slate. Modern materials such as concrete and plastic are also used and some clay tiles have a waterproof glaze. On the other side, proper and efficient disposal of agricultural wastes is being the key factor in solid waste management in most of the Indian States. In this project we have prepared and evaluated the performance of low cost roofing tiles using agricultural wastes as raw material. Based on the results, it is suggested that we can efficiently replace significant quantity of M-sand in making roofing tiles with the rice husk powder in appropriate proportions which gave compressive strength as similar as before replacement. By replacing the M-sand in making roofing tiles would reduce its manufacturing cost as well as selling price and makes it more affordable. Thus preparation of such sand replaced roof tiles will significantly reflect healthy environmental and economic benefits.

Keywords: M-sand, Red soil, Clay, Rice husk ash, compressive strength.



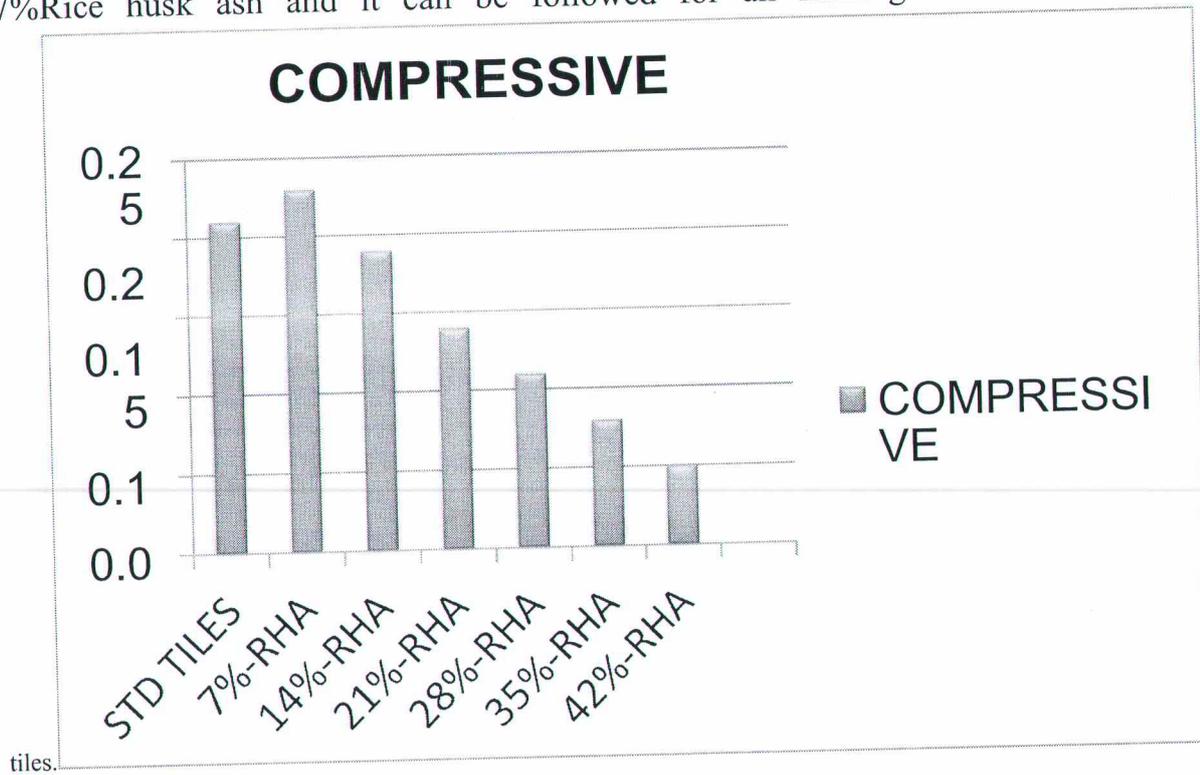
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6. CONCLUSION

- From our experimental study, we conclude that replacement of Rice husk ash in making roof tiles will be light effective if the replacement ratio lies below 7%. This study prove that 7% replacement of Rice husk ash in roof tiles with similar compressive strength, it would be a great benefit in both economic and environmental concern. And further replacement of Rice husk ash at the percentage of (14%, 21%, 28%, 35% and 42%) effectively, it will indirectly reduce the strength of the low cost roof tiles. Thus, both economic and environmental benefits occurs at the percentage of 7% Rice husk ash and it can be followed for an making of low cost roofing



W

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BONAFIDE CERTIFICATE

Certified that this project report "STUDY ON INFLUENCE OF MICROSTRUCTURE AFFECTING DURABILITY PROPERTIES OF TMTBARS USING TM RING TEST " is the bonafide work of " M.GULAMKADHAR (311816103004) M.MOHAMED YASEEN (311816103018) R. WALI WAHID (311816103028)" who carried out the project work under my supervision.

M.B. 



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Submitted for VIVA-VOCE examination held on 22/09/2020





PRINCIPAL

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INTERNAL EXAMINER

EXTERNAL EXAMINER

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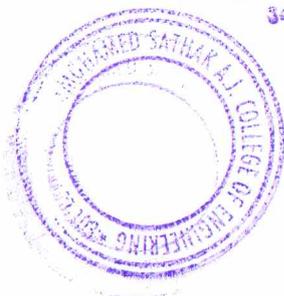
ABSTRACT

The Thermo-Mechanically Treated (TMT) steel is commonly referred to as Quenched and Self-Tempered (AST) steel. The cross-section of good TMT reinforcing bars(rebars) is required to have a ductile core of ferrite-pearlite' (FP) and a continuous, uniformly thick, and hard 'tempered martensite' (TM) microstructure as the peripheral ring. However, recent studies on TMT in the Indian market show the presence of discontinuous, eccentric, and non-uniform TM-phases at the periphery, which can be attributed to the improper quenching. This could result in localized corrosion and variations in the mechanical properties. Although IS 1786: 2008 mentions the etching of steel to identify the microstructural phases, it is an incomplete (lacks necessary test protocols; leads to unreliable results) and non-mandatory provision given in the annexure. In this scenario, a standardized test is essential to assess the quality of TMT rebars. This paper fine-tunes and proposes the "TM-ring test" to characterize the cross-sectional phase distribution in TMT.

Key words: TMT, Ferrite, Pearlite, Quenching, Tempering, Etching, Quality Control

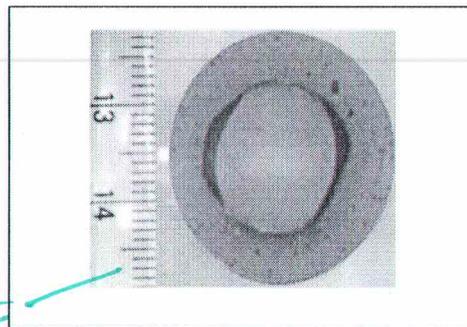


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6.CONCLUSIONS

Indicate an ideal rebar showing a continuous, concentric, and uniformly thick TM-ring. Through the laboratory tests on various steel rebars collected from the market, it was found that this kind of perfect TM-rings are mostly seen in large diameter rebars and lacking in rebars with less than 16 mm diameter. Moreover, such small diameter rebars are used as stirrups with smaller cover depth than that of primary reinforcement with larger diameter. This hints that better quality control is required for such smaller diameter rebars



Case of continuous, eccentric, and non-uniform TM phase. The ring

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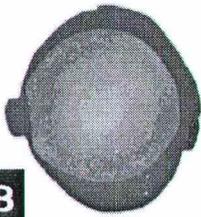
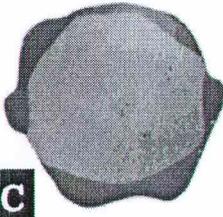
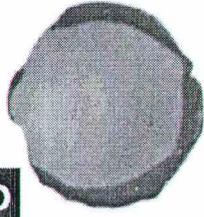
thickness is very small at two regions on the left side in the image.

This could probably occur if the coolant temperature or pressure is not uniform along the circumference. As a result, differential temperature



needs to be studied. It is recommended that the CSPD must be assessed for at least one specimen from each rebar lot. Therefore, a feasible and easily employable acceptance criteria for TMT/QST rebars is necessary as part of the 'TM-ring' test.

Datasheet for 'TM-Ring' test

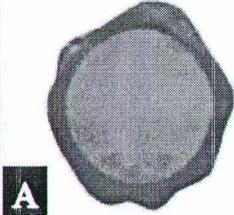
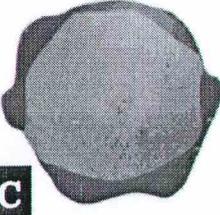
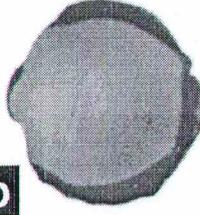
REFERENCE CASES																
																
L1	Y	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	N	N	N
L2	Y		Y		-				-				-			
	Accepted				Rejected				Rejected				Rejected			

LEVEL 1 (L1) ACCEPTANCE CRITERIA		
No.	Question	Answer (circle one)
1	Is a dark grey peripheral region and light grey core seen?	Yes / No
2	Does the dark grey peripheral region form a continuous outer ring?	Yes / No
3	Are the dark grey peripheral region and light grey core	Yes / No



needs to be studied. It is recommended that the CSPD must be assessed for at least one specimen from each rebar lot. Therefore, a feasible and easily employable acceptance criteria for TMT/QST rebars is necessary as part of the 'TM-ring' test.

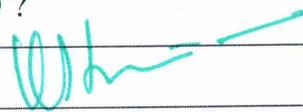
Datasheet for 'TM-Ring' test

REFERENCE CASES																
																
L1	Y	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	N	N	N
L2	Y		Y		-				-				-			
	Accepted				Rejected				Rejected				Rejected			

LEVEL 1 (L1) ACCEPTANCE CRITERIA		
No.	Question	Answer (circle one)
1	Is a dark grey peripheral region and light grey core seen?	Yes / No
2	Does the dark grey peripheral region form a continuous outer ring?	Yes / No
3	Are the dark grey peripheral region and light grey core	Yes / No



	concentric?	
4	Is the thickness of the dark grey peripheral region uniform?	Yes / No
Decision		
If all the answers are 'Yes', then accept the rebar lot		
If any one or more answers are 'No', then reject the rebar lot		

LBRYL 2 (L2) ACCRPTANC£ CRITERIA		
No.	Observatio ns	in mm
1	Diameter of rebar, D	
2	Measured thickness of TM, UM	
No.	Question	Answer (circle one)
1	Is $t_{TM} \geq 0.07 D$?	Yes / No
2	Is $t_{UM} \geq 0.10 D$?	Yes / No
		
If all the answers are 'Yes', then accept the rebar lot		
If any one or more answers are 'No', then reject the rebar lot		



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Minimum expected thickness of TM t,,,,,= where, D=Nominal diameter of rebar,

$$\sqrt{\frac{A}{\pi}} \sqrt{\frac{A_{FP}}{\pi}} \sqrt{\frac{A}{\pi}} \sqrt{\frac{0.75A}{\pi}}$$

$$\sqrt{\frac{A}{\pi}} = 0.134 \sqrt{\left(\frac{\pi D^2}{4}\right)}$$

= 0.134

D,,= Diameter of FP core area.

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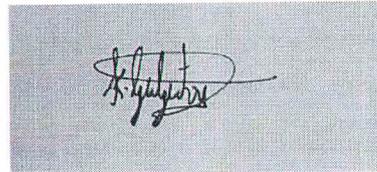


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BONAFIDE CERTIFICATE

Certified that this project report **“EXPERIMENTAL STUDY ON THE COMPRESSIVE STRENGTH OF CONCRETE USING PLASTIC WASTE AND ALUMINIUM POWDER”** is the bonafide work of **ABDUL GAFOOR JASSIM (311816103001), SHAHID AFRIDI.B (311816103025), THAMEMUL ANSARE (311816103027)** who carried out the project work under my supervision.



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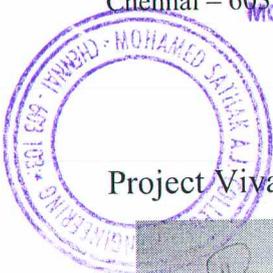
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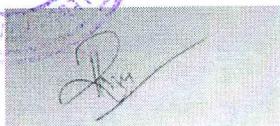
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Project Viva-Voce held on 22-09-2020



INTERNAL EXAMINER



EXTERNAL EXAMINER

ABSTRACT

This project in particular deals with the possibility of using the waste polypropylene (pp) bags as partial replacement of fine aggregate in concrete. Concrete with 0%, 10%, 20%, 30% polypropylene granules is prepared after doing the mix design. Various tests on cement like specific gravity, fineness, setting time, etc., tests on coarse and fine aggregates like sieve analysis, fineness modulus, specific gravity, etc. are performed. In addition, Aluminum powder is used to minimize the weight of concrete and plastic itself is lighter than sand which results in lightweight concrete. Mix design using IS Code method is done and cubes are cast for M25 grade concrete with and without plastics and tests on concrete like slump, cube tests are performed to understand their behavior and usefulness as replacement. The standard mechanical properties of concrete like compressive strength are tested and compared with the results of standard specimen.



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INCREASE IN PERCENTAGE OF PLASTIC WASTE FOR A CURING PERIOD OF 28 DAYS.

From the above graphs it is noted that with increase in percentage of plastic there is a decrease in the compressive strength. Therefore optimum percentage is taken as 10%.

CHAPTER 10

CONCLUSION

To study the effect of plastic waste on the performance of concrete, compressive tests were conducted for 10%, 20% and 30% replacement of fine aggregate by weight. Also a comparative analysis was carried out with the curing periods as 7, 14 and 28 days. As a part of this research, a set of test specimens were prepared with the addition of 0.5% of Aluminum powder to form aerated concrete. Thus a comparison of Light weight concrete over the normal concrete was made. Based on the results, analysis was done and the following were concluded.

- Addition of Aluminum powder to the normal and the light weight concrete did not result in any reduction of the concretes compressive strength for 7, 14 and 28 days curing.



- For normal concrete mix, the compressive strengths archived were 26.9N/mm^2 , 24.59N/mm^2 and 14.859N/mm^2 when the fine aggregate was replaced by 10%, 20% and 30% respectively using plastic waste.
 - For light weight concrete cubes, the compressive strengths archived were 26.73N/mm^2 , 24.23N/mm^2 and 14.82N/mm^2 when the fine aggregate was replaced by 10%, 20% and 30% respectively using plastic waste.
 - Thus, as the percentage replacement of plastic waste was increased, there was a considerable reduction in the compressive strength of concrete both with and without aluminum powder.
 - This study showed that for M25 grade, light weight aerated concrete with required compressive strength can be obtained by 0.5% addition of aluminum powder and 10% of fine aggregate being replaced by plastic waste.
-
- The replacement of fine aggregates helps reduce the requirement of sand and M sand to in great extend in large scale projects.
 - Also the addition of optimum percentage of aluminum powder as an air entraining agent results in obtaining light weight concrete for a required compressive strength.



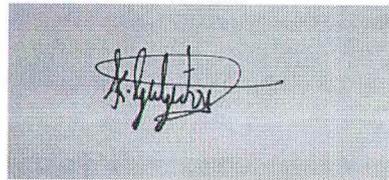
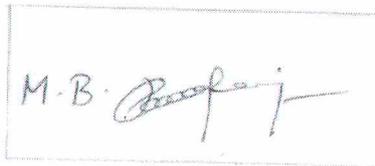
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Certified that this project report **“EXPERIMENTAL INVESTIGATION ON CONCRETE BY PARTIAL REPLACEMENT OF FINE AGGREGATE BY IRON SLAG”** is the bonafide work of **S.MOHAMED FAZITH (311816103014), A.RAHUMANULLAH (311816103019), Z.RASMI AKKEEL (311816103021)** who carried out the project work under my supervision.



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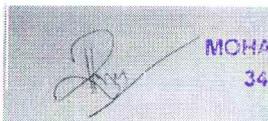
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INTERNAL EXAMINER



EXTERNAL EXAMINER

CHAPTER 7

CONCLUSION

From the above result, it has been concluded that the iron slag has the ability to give strength in concrete.

The partial substitution of natural aggregate with iron slag aggregate permits a gain of compressive, tensile and modulus of elasticity of concrete up to an optimum value of replacement.

The following benefits can also be obtained,

- ❖ Cost reduction
- ❖ Social benefits&
- ❖ Mass utilization of waste material is possible in constructed by using steel slag as a partial replacement material for fine aggregates in concrete.



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Certified that this design project report titled **“EXPERIMENTAL INVESTIGATION ON PROPERTIES OF BASALT AND CARBON FIBRE REINFORCED PERVIOUS CONCRETE”** is the bonafide work done by **K. RSIWIN (311816103022), M. AMEER SUHAIL (311816103301), I. SABARI MURUGAN (311816103303)**, who carried out the project work under my supervision.



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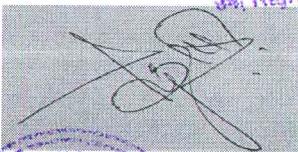
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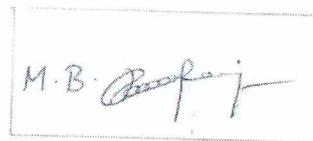


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INTERNAL EXAMINER



EXTERNAL EXAMINER

ABSTRACT

Pervious concrete is a light-weight concrete which is prepared by eliminating the fine aggregate from conventional concrete, also known as 'no fine concrete' or 'porous concrete'. It is combination of graded coarse aggregates, cement materials, water.

Now-A-days we are very much interested in sustainable and eco-friendly means of construction. Particularly in a country, like India where flooding and water logging problems are the major environmental issues. Various means are being implemented to these problems where pervious concrete is one of them.

For the better performance we have added basalt fibre and carbon fibre to pervious concrete which is abundantly available in the site.

In this study our main aim is to analyse the hydrological and structural properties of pervious concrete which is reinforced with basalt fibre and carbon fiber in various ratios (0.1%,0.2%,0.3% by weight of cement). Compressive strength and flexural strength obtained is compared with the normal pervious concrete.

Pervious concrete is a composite material consisting of coarse aggregate, Portland cement and water. The result is a concrete with high percentage of interconnected voids that, when functioning correctly permits the rapid percolation of water through the concrete. It is used in parking areas, residential streets, pedestrians' walkways etc. It is an important application for sustainable construction. The project aims at studying the engineering properties and prove the importance of basalt and carbon fibre reinforced pervious concrete in ground.



CHAPTER 7

CONCLUSION

The main purpose of this investigation is to study the effects of basalt and carbon fibres on the workability, compressive strength, split tensile, flexural strength, Abrasion test, permeability test, porosity test of M20 grade concrete. For comparison, reference specimens were tested without basalt and carbon fibers. The following conclusion is identified from our project

- **WORKABILITY** Major changes are not observed in workability condition since fibres are added in less amount (i.e 0.1 to 0.4% mix proportion)
- **COMPRESSIVE STRENGTH** In this test following results were founded,
Maximum basalt fibre reinforced pervious concrete is achieved in 0.3%
Maximum Carbon fibre reinforced pervious concrete is achieved in 0.2%
- **SPLIT TENSILE STRENGTH** In this test following results were founded,
Maximum basalt fibre reinforced pervious concrete is achieved in 0.3%
Maximum Carbon fibre reinforced pervious concrete is achieved in 0.3%
- **FLEXURAL STRENGTH** In this test following results were founded,
Maximum basalt fibre reinforced pervious concrete is achieved in 0.3%
Maximum Carbon fibre reinforced pervious concrete is achieved in 0.2%
- **POROSITY TEST** In this test following results were founded,

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Maximum basalt fibre reinforced pervious concrete is achieved in 0.1%

Maximum Carbon fibre reinforced pervious concrete is achieved in 0.1%

➤ **PERMEABILITY TEST** In this test following results were founded,

Maximum basalt fibre reinforced pervious concrete is achieved in 0.1%

Maximum Carbon fibre reinforced pervious concrete is achieved in 0.2%

➤ **CANTABRO LOSS** In this test following results were founded,

Maximum basalt fibre reinforced pervious concrete is achieved in 0.3%

Maximum Carbon fibre reinforced pervious concrete is achieved in 0.3%

We find that the carbon fibre reinforced pervious concrete gives comparatively optimum strength in the tests performed in our project.



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CHAPTER-8

FUTURE SCOPE OF THE PROJECT

- ✓ The studies of **corrosion inhibitor** on concrete deeply studied by adding some other green corrosion inhibitors.
- ✓ In the present investigation 0.5% of inhibitor was study. The various dosage of inhibitor may be suggested for further studies.
- ✓ The various durability properties such as **Rapid Chloride penetration test** will be studied for **various dosage of inhibitor** add in concrete.
- ✓ May conduct Corrosion test for increasing the dosages.



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