



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 (2016 - 2017)
1	CE6401 - Construction Materials
2	CE6021 - Repair and Rehabilataion of Structures
3	CE6002 - Concrete Technology
4	CE6502 - Foundation Engineering
5	CE6505 - Highway Engineering
6	CE6506 - Construction Techniques, Equipment and Practice
7	GE6351 - Environmental Science and Engineering
8	CE6405 - Soil Mechanics
9	CE6402 - Strength of Materials
10	CY6251 - Engineering Chemistry – II

PRINCIPAL

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

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 Education 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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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

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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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:

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

REFERENCES:

1. Shetty M.S., "Concrete Technology - Theory and Practice", S.Chand and Company, 2008.
2. Dov Kominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
3. Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
5. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013


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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, Stationary 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 Distributors 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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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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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:**

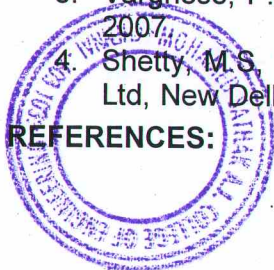
- Students completing the course will have understanding of different construction techniques, practices and equipments. They will be able to plan the requirements for substructure and superstructure a construction.

TEXTBOOKS :

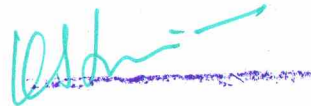
1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.
2. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.
3. Varghese, P.C. "Building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

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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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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. Gorhani, '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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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.



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OBJECTIVES:

- To impart knowledge on behavior and the performance of saturated soil. At the end of this course student attains adequate knowledge in assessing both physical and engineering behaviour of soils, mechanism of stress transfer in two-phase systems and stability analysis of slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION

9

Nature of soil – phase relationships – Soil description and classification for engineering purposes, their significance – Index properties of soils - BIS Classification system – Soil compaction – Theory, comparison of laboratory and field compaction methods – Factors influencing compaction behaviour of soils.

UNIT II SOIL WATER AND WATER FLOW

9

Soil water – static pressure in water - Effective stress concepts in soils – capillary stress – Permeability measurement in the laboratory and field pumping in pumping out tests – factors influencing permeability of soils – Seepage – introduction to flow nets – Simple problems. (sheet pile and weir).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT

9

Stress distribution - soil media – Boussinesq theory - Use of Newmarks influence chart – Components of settlement – immediate and consolidation settlement – Terzaghi's onedimensional consolidation theory – computation of rate of settlement. - $\sqrt{t}$ and $\log t$ methods – e - $\log p$ relationship - Factors influencing compression behaviour of soils.

UNIT IV SHEAR STRENGTH

9

Shear strength of cohesive and cohesionless soils – Mohr – Coulomb failure theory – Measurement of shear strength, direct shear – Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY

9

Slope failure mechanisms – Types - infinite slopes – finite slopes – Total stress analysis for saturated clay – Fellenius method - Friction circle method – Use of stability number - slope protection measures.

TOTAL: 45 PERIODS**OUTCOMES:**

- Students have the ability to determine Index properties and classify the soil. They can also know to determine engineering properties through standard tests and empirical correction with index properties.

TEXTBOOKS:

- Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2007
- Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley Eastern Ltd, New Delhi (India), 2000.
- Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2002.

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- McCarthy D.F. "Essentials of Soil Mechanics and Foundations" Prentice-Hall, 2002.
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OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
- Principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials.
- Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
- Preparation, properties and applications of engineering materials.
- Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.

UNIT I WATER TECHNOLOGY

9

Introduction to boiler feed water-requirements-formation of deposits in steam boilers and heat exchangers- disadvantages (wastage of fuels, decrease in efficiency, boiler explosion) prevention of scale formation -softening of hard water -external treatment zeolite and demineralization - internal treatment- boiler compounds (phosphate, calgon, carbonate, colloidal) - caustic embrittlement -boiler corrosion-priming and foaming- desalination of brackish water .

UNIT II ELECTROCHEMISTRY AND CORROSION

9

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, measurement and applications - electrochemical series and its significance - Nernst equation (derivation and problems). Corrosion- causes- factors- types- chemical, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method. Paints- constituents and function. Electroplating of Copper and electroless plating of nickel.

UNIT III ENERGY SOURCES

9

Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion- differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor- solar energy conversion- solar cells- wind energy. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- nickel-cadmium battery- lithium battery- fuel cell H_2 - O_2 fuel cell- applications.

UNIT IV ENGINEERING MATERIALS

9

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Refractories: definition, characteristics, classification, properties – refractoriness and RUL, dimensional stability, thermal spalling, thermal expansion, porosity; Manufacture of alumina, magnesite and silicon carbide, Portland cement- manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement-properties and uses. Glass - manufacture, types, properties and uses.

UNIT V FUELS AND COMBUSTION

9

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis of coal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) - petroleum- manufacture of synthetic petrol (Bergius process)- knocking- octane number - diesel oil- cetane number - natural gas- compressed natural gas (CNG)- liquefied petroleum gases (LPG)- producer gas- water gas. Power alcohol and bio diesel. Combustion of fuels: introduction- theoretical calculation of calorific value- calculation of stoichiometry of fuel and air ratio- ignition temperature- explosive range - flue gas analysis (ORSAT Method).

TOTAL: 45 PERIODS**OUTCOMES:**

The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.



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TEXTBOOKS:

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GEOPOLYMER LIGHTWEIGHT BRICK USING VERMICULITE

A PROJECT REPORT

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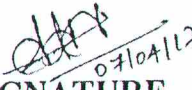

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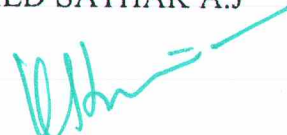
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ABSTRACT

Concrete consists of cement, sand and granite aggregates. Cement is determined the global economy, because of an indispensable for construction purposes. Cement releases greenhouse gases, when it is in production stage. During production, limestone releases CO₂ directly as a results of heat reaction, which may lead to depletion of ozone layer. The CO₂emission is directly related to how much quantity of cement used in the concrete mix. For example, 900 kg of CO₂are emitted during the manufacture of each ton of cement. The cement may be reduced by using the other cementing materials. Fly ash from the thermal power plants may be replaced with cement as a replacement.

Geopolymer is prepared by binding of silicon (Si) and aluminium (Al) in alkaline solution. Several studies conducted on Geopolymer bricks, which showed that it is potentially substitute to cement bricks. Geopolymer cement is stronger, fireproof, and waterproof characteristics, in general and it is not expanding or contract, foam in nature, high resistant to salts, acids and alkalis, as a result, it is extensively used for construction of buildings and industries.



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CHAPTER 7

CONCLUSION

- It is observed that the geopolpolymer bricks casted for 11 molarities will give better compressive strength compared to 9 molarities.
 - The replacement of coarse aggregate with vermiculite reduces the density of geopolpolymer bricks without considerlingly affecting compressive strength.
 - In the partial replacement of coarse aggregate with vermiculite as 25%,50% is comparatively good with full replacement 100%.
 - With 50 % replacement of coarse aggregate with vermiculate, geopolpolymer brick with compressive strength of 3 N/mm^2 can only be produced.
 - Partial replacement of 25% coarse aggregate with vermiculate can be used to produce Class 5 bricks as per IS 1905:1987
 - Partial replacement of 25% coarse aggregate with vermiculate will give a low water absorption (2.98%) than clay bricks.
 - By Partial replacement of 25% coarse aggregate with vermiculate can produce a brick having a compressive strength of 5 N/mm^2 with density of 2585 kg/m^3 which is light weight than cement bricks of density 3018
- **FUTURE SCOPE:**
- Lateral load test has to be conducted for $1\text{m} \times 1\text{m}$ wall
 - Different lightweight materials for improving strength properties has to be stuided for future development
 - Thermal properties has to be studied in the geopolpolymer light weight bricks using vermiculite



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DESIGN OF SMA MIX

A PROJECT REPORT

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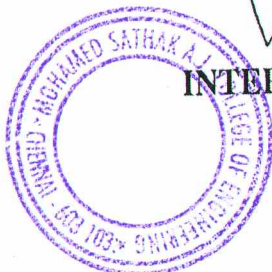

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EXTERNAL EXAMINER

ABSTRACT

Instead of using aggregates in roads & concrete construction, some of the waste industrial products can be used widely. To improve and protect environment, a cautious and efficient use of natural resources is present day need. In India, construction of ambitious highways net-working and development, of several expressways for high speed corridors need more than 8000 million tons of aggregate. Copper slag is an industrial by-product obtained during the smelting and refining of copper.

Copper slag is an abrasive blasting grit made of granulated slag from metal smelting processes (also called iron silicate). The copper is being produced from a copper concentrate containing around 30 - 35% of copper, iron and Sulphur each along with around 12% of silica and 5% of calcium.

By replacing fine aggregates as copper slag by 10 %, lime 5% is added as an additive agent and stone dust 10% is added to obtain the strength in stone matrix asphalt design mix. The replacement of copper slag will decrease the scarcity of aggregates used for road construction. SMA mixes designed with available aggregates showed good stone-on-stone contact. The SMA mixture is appropriate on pavements carrying heavy volumes of traffic or on pavements carrying heavy loads and/or high tire pressures. However, due to the stiffness of the mixture and the construction difficulties this brings, selected projects should have minimal utility adjustments or handwork requirements. The optimum binder content was more than 5.8 percent by weight of total mix at stipulated requirements of SMA mixes, the VCA mix of all the SMA mixes are less than equal to VCA_{DRC} and VMA are more than 17 percent. Thus, the SMA mixes are having a good stone-on-stone contact.



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CHAPTER 5

SUMMARY AND CONCLUSION

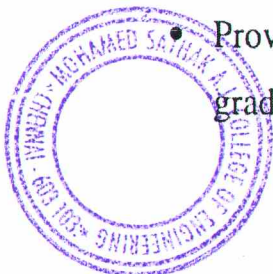
From the present study, the following conclusions can be drawn:

It can be seen that the OBC was more than 5.8 percent by weight of total mix at stipulated requirements of SMA mixes. It can also be seen that the VCA mix of all the SMA mixes are less than equal to VCA_{DRC} and VMA are more than 17 percent. Thus, the SMA mixes are having a good stone-on-stone contact.

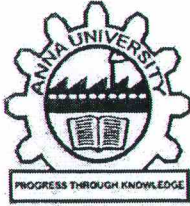
- SMA mixes designed with available aggregates showed good stone-on-stone contact.
- 17 percent voids in mineral aggregate and 4 percent air voids in the mix were fulfilled as the SMA Mix design criteria.
- TSR values are found to be more than 80 percent.
- In view of improved performance properties of SMA mixes with mineral fibre are suitable for roads subjected to slow and high volume traffic roads.
- A test section may be laid using mineral fibre so as to see the performance of fibre in SMA mixture.

In order for SMA's to perform as expected, the following design, production and construction practices must be followed1.

- Provide stone-on-stone contact through the selection of a proper gradation.



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UPLIFT CAPACITY OF PILE IN SAND

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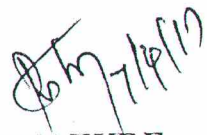
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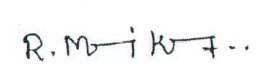
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EXTERNAL EXAMINER

ABSTRACT

Piles are long and slender members which transfer the load through the shallow soil of lower bearing capacity to deeper soil or rock of high bearing capacity. They are also used in normal soil condition to resist uplift forces or in poor soil condition to resist lateral forces. The experimental tests were conducted on straight-shafted vertical steel piles with an outer diameter of 25 mm in a wooden soil bin. The tested piles have been embedded on the soil bin with varying density of 16KN/m^3 , 17KN/m^3 , 18KN/m^3 . The soil bin was made with wooden box and the dimension of the bin was $500\text{mm} \times 300 \times 580\text{mm}$. The load was applied at without controlling the strain and loads were applied with static weights.



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CHAPTER-5

CONCLUSION

When relative density is zero uplift capacity is minimum. If relative density increase this uplift capacity will also increases. If single helical pile failure in 637N and double helical pile failure in 804N, enlarge base pile failure in 1363N.

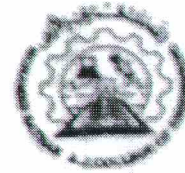
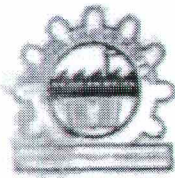
On comparing three piles, enlarged base pile has minimum uplift capacity.



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**EXPERIMENTAL STUDIES OF CORROSION
INHIBITORS ON CONCRETE**

A PROJECT REPORT

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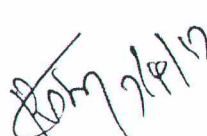
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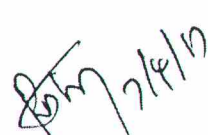
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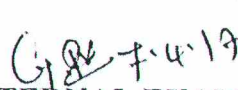
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INTERNAL EXAMINER




EXTERNAL EXAMINER

ABSTRACT

The Concrete technology passes over a tremendous changes in the chiseling of modern World the conventional concrete still possess lot of problems regarding sustainability, durability and mechanical properties. Among these corrosion is the one of the major issues in the concrete. The corrosive electrolytes and environmental factors can penetrate the concrete due to its porous nature causes corrosion.

The present investigation is to prevent the corrosion in concrete at certain extend. The effect of corrosion inhibitors such as Sodium Nitrite & Potassium Dichromate on M 30 grade concrete is studied.

This project involves the comparative studies of Mechanical Properties and Durability Properties of concrete in the case of without and with inhibitor. The inhibitors added to concrete with a dosage of 0%, 0.5% by Weight of cement has been analyzed the admixtures enhances the protection of concrete by arresting the pores.



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Key Words: Concrete, Corrosion Inhibitor, Compressive strength, Mechanical Properties, Durability Properties, SEM Analysis.