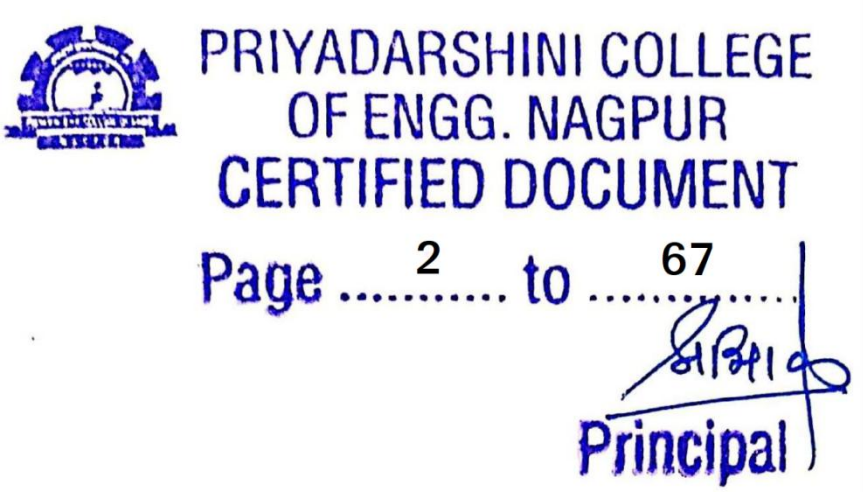
Lokmanya Tilak Jankalyan Shikshan Sanstha's
PRIYADARSHINI COLLEGE OF ENGINEERING
(Recognised by A.I.C.T.E., New Delhi & Govt. of Maharashtra, Affiliated to R.T.M.Nagpur University)
Near CRPF Campus, Hingna Road, Nagpur-440 019, Maharashtra (India)
Phone : 07104 – 236381, 237307, Fax : 07104 – 237681,
email : principal.pce.ngp@gmail.com, www.pcenagpur.edu.in

1.3.2 Average percentage of courses that include experiential learning through project work/field work/internship during last five years



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B. E –CIVIL ENGINEERING SESSION 2019-2020

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain	Page No
1	Concrete Technology	BECVE305T/P	Construction Technology, and Management	3-14
2	Surveying – I	BECVE 404T/P		
3	Building Construction & Material	BECVE 405T/P		
4	Surveying-II	BECVE602T/P		
5	Building Design and Drawing	BECVE604P		
6	Estimating and Costing	BECVE702T/P		
7	Construction Management and Law	BECVE704T		
8	Engineering Geology	BECVE304T/P	Geotechnical Engineering and Geology	15-25
9	Geotechnical Engineering-I	BECVE 402T/P		
10	Geotechnical Engineering -II	BECVE504T		
11	Environmental Engineering – I	BECVE303T/P	Environmental Engineering, Hydraulics and Water Resources Engineering	26-36
12	Fluid Mechanics -I	BECVE503T/P		
13	Hydrology & Water Resources (HWR)	BECVE505T		
14	Fluid Mechanics -II	BECVE603T/P		
15	Environmental Engineering-II	BECVE605T		
16	Elective -I : Air Pollution And Solid Waste Management	BECVE703T		
17	Irrigation Engineering	BECVE801T		
18	Elective - III : Water and Waste Water Treatment	BECVE803T		
19	Strength of Materials	BECVE302T/P	Structural Engineering	37-51
20	Structural Analysis – I	BECVE 401T/P		
21	Structural Analysis -II	BECVE501T/P		
22	Reinforced Cement Concrete (RCC) Structures	BECVE502T/P		
23	Steel Structures	BECVE601T/P		
24	Advanced Concrete Structures	BECVE701T/P		
25	Elective -I : Earthquake Resistant Design of Structure	BECVE703T		
26	Elective - III : Advanced Reinforced Cement Concrete	BECVE803T/P		

	Design			
27	Transportation Engineering – I	BECVE 403T/P	Transportation Engineering	**52-61**
28	Transportation Engineering - II	BECVE705T		
29	Elective - II : Pavement Analysis And Design	BECVE802T		
30	Applied Mathematics-III	BECVE301	Other	**62-66**
31	Communicative English & Technical Writing	BECVE506P		
32	Site Visit & Mini Project	BECVE606P		
33	Industrial Case Study and Project Seminar	BECVE706P		
34	Construction Economics and Finance	BECVE804T		
35	Project	BECVE805P		

Domain 1: Construction Technology and Management

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	Concrete Technology	BECVE305T/P	Construction Technology and Management
2	Surveying – I	BECVE 404T/P	
3	Building Construction & Material	BECVE 405T/P	
4	Surveying-II	BECVE602T/P	
5	Building Design and Drawing	BECVE604P	
6	Estimating and Costing	BECVE702T/P	
7	Construction Management and Law	BECVE704T	

BECVE 305T **CONCRETE TECHNOLOGY**

Objectives:

1. To prepare the students to understand constituents of concrete and their effect on quality of concrete.
2. The course will prepare students to apply basic rules for manufacture of plastic concrete and its mechanization.
3. To prepare students to apply various methods for testing of plastic and hard concrete.
4. To prepare students to analyse behavior of concrete structure under different environmental conditions.
5. The course will prepare students to analyse and design various basic concrete building components.

Outcomes:

a. The students would be able to check and recommend different constituent of concrete.
b. The students would be able to control method of manufacture of concrete.
c. The students would be able to test strength and quality of plastic and set concrete.
d. The students would have the understanding of application admixture and its effect on properties of concrete.
e. The students would be able to understand the effect of process of manufacturing on different properties of concrete.
f. The students would be able to understand various environmental factors which affect durability of concrete, analyse cause of deterioration of concrete components and to suggest various preventive measures to it.
g. The students would be able to test various strength of concrete by destructive and nondestructive testing methods.

Syllabus:

Unit – I Cement

Chemistry of Cement, Main constituents of cement Hydration of cement, Water required, Physical properties and testing of cement, Soundness test. Hardening and compressive strength Grades and different types of cements. Ordinary Portland cement, Rapid Hardening Cement, B.B. Blast furnace slag cement, Low heat Portland cement, Portland pozzolones cement, Portland flyash cement, Sulphate resisting cement. Field test,

Aggregates : Sources of aggregates, classification and nomenclature. Coarse and fine aggregate, normal weight (light and heavy weight aggregates). Aggregate characteristics and their significance in strength, workability, placement and compartion of concrete.Sampling. Particle shape and texture, Bond of aggregate, size & grading of aggregate strength of aggregates Mechanical properties and test-Specific gravity, Bulk density, porosity absorption of aggregates, moisture content of aggregate, bulking of sand abrasion test, impact value. Sieve analysisDeleterious substances in aggregates, organic impurities class and other fine material etc.

Water : Quality of water for concrete mixing, suitability.

Unit – II

Fresh concrete : Batching, Mechanical mixers, automatic batching and mixing plants. Efficiency of mixing. Workability Measurement – Slump cont test, compacting factor test, flow table, Vee-Bee consistometer, Factor affecting workability, setting time. W/C Law Significance of w/c ratio cohesiveness.Segregation, bleeding,

voids, permeability.Hot weather concreting.Underwater concreting, Conveyance of concrete, Placing of concrete.Compaction-vibrators. Curing of concrete Significance, methods of curing, Temperature effect on

during& strength gain. IS code on curing.Maturity of concrete.

Unit - III

Strength of concrete-

Gain of strength, Wet ratio, Factor affecting compressive strength w/c ratio. Type of cement, air entrainment, aggregates, mixing water, Admixtures, curing conditions. Tensile and flexural strength.Relation between cracking in compression.Impact strength fatigue strength. Shear strength, Bond between concrete & reinforcement. Modulus of elasticity, Poison's ratio.

Testing of Hardnessof Concrete: Compression test-cube strength & cylinder strength their relation, effect of aspect ratio on strength. Flexural strength of concrete, Determination of tensile strength.Indirect tension test.Splitting test.Abrasion resistance.Accelerated curing test.

Unit – IV

Mix Design – Process, Statistical relation between mean & characteristic strength, Variance, Standard deviation. Factor affection mix properties. Grading of aggregate, aggregate/ cement ration etc. Degree of quality control. Design mix by Road note no. 4 (BS). IS:10262:2009.

Additives and Admixtures: Types of admixtures, Natural products-Dietomaceousearth By products-Pozzolones. Fly ash, silica fume, rice husk ash, , G.G. blast furnace slag. Admixturers-air encraining, water reducing, acceletors, retarders, plasticizers & Super plasticizers, permeability reducing,surface harderners.Corrosion inhibitors & water proofing agents.

Unit – V

Special concrete : Self compacting concrete, High performance concrete, fiber reinforced & polymer concrete, Ferro cement, Shortcrete pumped concrete, Free flow concrete.

Shrinkage-Early volume changes, drying shrinkage, mechanism of shrinkage.Factor affecting shrinkage. Influence of curing & storage conditions. Differential shrinkage.Carbonation shrinkage.Creep-Factors influencing.Relation between creep & time, nature of creep, effect of creep.

Unit – VI

Durability of concrete-significance water as an agent of deterioration. Permeability of concrete, Efflorescence.
Distress in concrete structures and its causes, causes of deterioration of concrete.
Cracks in concrete: Causes, types, prevention, repairs of cracks – materials and methods
Non Destructive tests

BECVE 305 P LIST OF EXPERIMENTS

1. To determine the Normal consistency of cement .
2. To determine initial and final setting times of cement.
3. To determine soundness of cement.
4. To determine compressive strength and tensile strength of cement.
5. To determine particle shape , texture and elongation/ flakiness index of aggregate .
6. Sieve analysis and particle size distribution of aggregate.
7. To determine crushing value test, Impact value and Abrasion value of given aggregate.
8. To determine Bulk Density, Specific Gravity, Absorption & Moisture Content of Aggregate.
9. To determine Bulking and Percentage silt in sand.
10. To determine Workability - Slump test, Compaction factor of concrete.
11. Concrete mix design Road note 4 method, I.S. Method and ACI Method.
12. To determine Compressive strength of concrete cube.
13 To determine the quality of concrete by using Rebound hammer/ Ultrasonic Pulse Velocity Instrument.

Text Book

Sr.No	Title	Publication
1	Concrete Technology by GambhirMc. Graw Hill	
2	Concrete Technology by A.M. Neville	Pearson Education

RefrenceSr.No	Title	Publication
1	Properties of Concrete by A.M. Neville	

BECVE 405 T BUILDING CONSTRUCTION & MATERIAL

Objectives:

1. To prepare the students to understand components of buildings and their functions.
2. To prepare students to understand execution of various constructions activities and material.
3. To prepare students to analyse behaviour of structure under different environmental conditions.
4. To prepare students to identify & suggest rectification the various defects in civil engineering works.

Outcomes:

a. The students are able to identify components of a building.
b. The students are able to differentiate and identify types of building materials.
c. The students are able to select appropriate material for building construction.
d. The students are able to plan various construction related activities and their quality control.

Syllabus :

Unit-I :

Foundations: Necessity and types of R.C.C. foundations, Detail of Deep foundation and precast foundation in general, Details shallow foundations. Bearing capacity of soils and its assessment. Preumptive bearing capacity values from codes. Loads on foundations. Causes of failures of foundations and remedial measures, Foundation on black cotton soils Setting out foundation trenches, excavation timbering of foundation trenches. Load bearing and framed structures.

Unit-II

Brickwork :Qualities of good bricks, classification of bricks tests on bricks as per as codes.
Terms used in brickwork, commonly used types of bonds in brickwork such as header, stretcher, English andFlemish bonds, principles of construction. Reinforced brickwork, brick knogging.
Parapets, copings, sills and corbels, brief introduction to cavity walls, load bearing and partition walls.
Masonry construction using cement concrete blocks and clay walls, load bearing and partition walls.
Masonry construction using cement concrete blocks and clay blocks.
Precest construction : Introduction to method and materials. Precast elements likes poles, cover, jallies, steps corbets, truss element etc.

Unit-III:

Stone Work : Stones, cutting and dressing, selection of stones types of stone masonary, principles of construction joints in masonary. Lifting heavy stones, common building stones in India.
Arches and Lintels : Terminology in contraction, types chajjas and canopies, pre cast Lintels & Arches.
Damp Proofing : Causes and effect of dampness. Various methods of damp proofing
Damp proofing in plinth protection, New Techniques of Damp Proofing Damp Proofing in Plinth Protection,New Techniques of Damp proofing. Epoxy etc.

Unit-IV

Floors and Roofs : Floors : General principals, types and method of construction, floors finished quality, ~~testing floor tiles,~~ synthetic & Ceramic Tiles.
Roofs : Flat and pitches roofs, roof coverings, types AND their constructional features. Thermal Insulation

Unit-V :

Stairs : Types of stairs, functional design of stairs.
Doors and Windows : Purpose materials of construction and types.

Unit-VI :

Plastering and Pointing : Necessity, types and methods
Temporary Timbering : Centering and formwork shoring, underpining and scaffolding.
Painting : White washing, colour washing and distempering new materials & Techniques.

Text book

Sr. No.	Title	Publication
1	Building Construction by Rangwala	Charotar Pub. Hous

CONSTRUCTION MANAGEMENT & LAW

BECVE704T **Evaluation Scheme: (80/20)**
(L-4, T-0, P-0) Total Credits-4 **Exam Duration: 3 hrs**

OUTCOMES :
On completion of this syllabus, the students should be able to:

1. *Demonstrate the understanding of various types of projects, modern construction techniques and will exhibit the mastery in construction planning, scheduling and various controls.*
2. *Achieve the knowledge of various types' of equipments to be used in the construction and its operational cost estimates, understand manpower requirement, planning, resources utilization and management.*
3. *To know the quality control aspects in planning & management, modern trends project management, application of information system in management of construction projects, safety provisions and equipments.*
4. *Analyze the legal aspects in construction projects through the understanding of various laws pertaining to civil engineering and architectural planning & sanctioning, labor & organizational welfare measure, provisions of arbitration and litigations.*

UNIT - I :
BASIC STUDIES IN CONSTRUCTION PROJECT
Type of Project & its Financing, Detailed Project Report Analysis and Feasibility, Time of Completion, Provisions of Escalation in Time and Cost, Choice of Technology and Construction Tecniques, Site Planning.

UNIT- II :
CONSTRUCTION SCHEDULING
Network Analysis : The Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT), Bar Chart, Resource Oriented Scheduling, Allocation, Leveling, Crashing and Time/Cost Tradeoffs, Line of Balance.

UNIT III - :
MANPOWER, MATERIAL AND MACHINERY (3M) MANAGEMENT
Manpower – Requirement and methods of calculating Productivity, Staffing, planning, directing & controlling. Organisational Charts, Duties and Responsibility of Personal Manager

Material – Requirement, Procuring, Storing & Delivery. Quality Checks, Inventory Control techniques, construction Waste generation and Management .

Machinery – different type of construction equipments and their applications- Excavators, Dozer,Rollers, Hoisting and Hauling equipments, Cost & Working Hour analysis, Depreciation analysis,

UNIT- IV:
QUALITY AND SAFETY MANAGEMENT
Concept of Total Quality Management, Safety Provisions as per National Building Code of India, Safety Equipments, MIS in Construction Project, Project Management System-MS Project.

UNIT –V :

LEGAL ASPECTS IN CONSTRUCTION PROJECTS

Town Planning Requirements, Acts and codes related to planning, Regional Town Planning, Housing Development act, Highway Act, Irrigation act, Local Rules (Gunthewari),

UNIT –VI :

INTRODUCTION TO DIFFERENT LAWS

Environmental (Protection) act, Forest Conservation - Water Pollution and air pollution, Transfer of property act – sale, purchase, lease. Land Acquisition and Rehabilitation act, Indian Contract act.

Reference Books :

1. Construction Planning and Management – Purifoy
2. Construction Planning and Management – Dr U K Shrivastava, Galgotia Publ.
3. Project Planning & Management – B C Punmia
4. Laws related to buildings and engineering contracts in India- Gajaria G T, LexisNexis Butterworths India Publisher, 2000
5. Construction Contracts- Jimmie Hinze McGraw Hill,
6. Contracts and the legal Environment for Engineers and Architects- Joseph T Bockrath, McGraw Hill,

TO STUDY THE FEASIBILITY OF USE OF RECYCLED AGGRGATES IN CONCRETE

A Project Work submitted in partial fulfillment of the requirement
for the award of the Degree of

BACHELOR OF ENGINEERING
IN
CIVIL ENGINEERING

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY
NAGPUR

Submitted By

SRUSHTI CHINDHALORE

SAGAR GAIDHANE

DEEPAK GAKARE

ANKIT KHANDEKAR

HAMMAD UL HAREEM

RANVIJAY MUNDA

Under the guidance of

Prof. V. A. GANVIR

Ass. Professor
Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING
PRIYADARSHINI COLLEGE OF ENGINEERING
NAGPUR-440019

March – 2020

PRIYADARSHINI COLLEGE OF ENGINEERING
NAGPUR

CERTIFICATE

This is to certify that the work presented in this project entitled **"TO STUDY THE FEASIBILITY OF USE OF RECYCLED AGREGATES IN CONCRETE"** has been completed by,

SRUSHTI CHINDHALORE

SAGAR GAIDHANE

DEEPAK GAKARE

ANKIT KHANDEKAR

HAMMAD UL HAREEM

RANVIJAY MUNDA

Students of B.E (Civil Engineering) of this institute in satisfactory manner and in partial fulfillment of the requirement for the award of the degree of Bachelor of Engineering in Civil Engineering of the Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur during the year 2019 – 2020.

Prof. V. A. GANVIR
Asst. Prof., Civil Dept.
P.C.E., Nagpur

Prof. S. A. Dhale
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ABSTRACT

The construction industry has gained very fast growth in recent decades due to the increase in the population, increase in industrialization and also introduction of new infrastructure projects resulted in increase of construction industry drastically. Reduce, Reuse, Recycle philosophy is highly useful in handling of construction and demolition waste. The better practice to handle Construction and demolition waste is to minimize generation of it, but sometimes it is unavoidable due to various issues such as change orders for demolition requirements for redevelopment. Government policies are also found to be helpful in study of management of CDW. Paper briefs about the characterization, its importance and results obtain from them. The Materials were bought from two different sites and then the materials were separated as (concrete , concrete Mortar, Bricks, Brick Mortar, Mortar).

Test were performed to find out the physical and mechanical properties of materials of construction and demolition waste. Analysis is carried out to find out upto what extent it can be used in concrete by replacing natural aggregate with recycled aggregate. As concrete is mainly made up of fine aggregate and coarse aggregate so replacement is carried out in the same fashion by replacing coarse and fine aggregate by 10%, 20%, 30% and 40% respectively.

Keywords: Construction and demolition waste and recycled aggregate.

CONSTRUCTION AND DEMOLITION WASTE

Construction and demolition waste is generated whenever any construction demolition activity takes place like , building roads, bridges, flyover, subway, remodelling, etc. It consist mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastic, etc. A part of this waste involves the municipal stream.

These wastes are heavy, having high density, often bulky and occupy considerable space for storing either on the road or communal waste bin/container. It is not uncommon to ascertain huge piles of such waste, which is heavy also, stacked on roads especially in large projects, leading to traffic jam and disruption. Waste form small generators like individuals house construction or demolition, find its way into the nearby municipal bin/vat/waste/storage depots, making the municipal waste heavy and degrading its quality for the further treatment like composting or energy recovery. Often it finds its way into surface drains, choking them. It constitutes about 10-20 you look after the municipal solid waste (excluding large construction projects).

It is estimated that the development industry in India generates about 10-12 million plenty of waste annually. Projections for artifact requirement of the housing sector indicate a shortage of aggregates to the extent of about 55,000 million cu.m. An additional 750 million cu.m. aggregates would be required for achieving the targets of the road sector. Recycling of aggregate material form construction and demolition waste may reduce the demand-supply gap in both the sectors.

While retrievable items like bricks, wood, metal, titles are recycled, the concrete and masonry waste, accounting for quite 50% of the waste from construction and demolition activities, are not being currently recycled in India.

Concrete and masonry waste are often recycled by sorting, crushing and sieving into recycled aggregate. This recycled aggregate are often wont to make concrete for construction and artifact. Work on recycling of aggregates has been done at Central Building Research Institute (CBRI), Roorkee, and Central Road Research Institute (CRRI), New Delhi.

Domain 2: Geotechnical Engineering and Geology

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	Engineering Geology	BECVE304T/P	Geotechnical Engineering and Geology
2	Geotechnical Engineering-I	BECVE 402T/P	
3	Geotechnical Engineering -II	BECVE504T	

B.E. III SEM (CIVIL ENGINEERING)
SUBJECT: ENGINEERING GEOLOGY

UNIT-I: General Geology

Definition and scope of Geology, Internal structure of the earth.Introduction to continental drift and plate tectonics.Volcanoes type and their products.Principles of stratigraphy, Geological Time Scale, Physiographic and tectonic divisions of India.Introduction to Indian stratigraphy. (4)

Geomorphology: Weathering and erosion, Geological action of Wind, River and Ground water and resulting land forms. Geomorphic forms and their consideration in civil engineering works. (3)

UNIT-II:Mineralogy:

Definition and classification of minerals, Physical properties of Minerals, introduction to common rock-forming minerals (3)

Petrology: Rock cycle, **Igneous rocks:** Formation of Igneous rocks, textures and structures, forms and tabular classification of Igneous rocks. Common Igneous rocks and their uses. **Sedimentary rocks:** formation of sedimentary rocks, classification of sedimentary rocks. Common Sedimentary rocks and their uses.**Metamorphic rocks:**Definitions, agents of metamorphism, types of metamorphism, zones of metamorphism, Common Metamorphic rocks and their uses. (6)

UNIT-III: Structural Geology:

Introduction, outcrops, dip and strike of beds. Problems on dip, strike, thickness and three bore hole problems. **Folds**: parts of fold, classification, effects on outcrops, their identification in field, Importance of folds in civil engineering projects .**Joints**: definition, nomenclature and classification, Importance of joints in civil engineering projects. **Faults**: terminology, classification, mechanics of faulting, recognition of faults in the field, Importance of faults in civil engineering projects. **Unconformity**: Formation of unconformity, Types of unconformity. (10)

UNIT-VI: Earthquake Engineering:

Introduction, Terminology, Earthquake waves, Causes and effects, Intensity, MMI and MSK intensity scale and magnitude, magnitude scales, Liquefaction, location of epicenter, Tsunami, Seismograph and seismogram, Classification of earthquake, Earthquake zones of India, Aseismic structures.(3)

Landslides and Subsidence: Introduction, Terminology, Causes of landslides, classification of landslides, stable and unstable slopes, Control of landslides, causes of land subsidence, subsidence hazard mitigation.(3)

UNIT-V: Geohydrology:

Introduction, Hydrologic cycle, Origin of groundwater, Occurrence and distribution of ground water, water table and water table contour maps, Aquifer, Aquitard, Aquiclud and aquifuges, confined and unconfined aquifers, perched aquifer, Artesian and flowing wells, Importance of groundwater studies in Civil Engineering works. (3)

Site Investigations: Surface and sub-surface investigation: Geological mapping, Drilling, Bore hole logs, geophysical methods: Electrical Resistivity and Seismic methods. (3)

UNIT-VI: Application of geology to civil engineering works:

Engineering properties of rocks. Engineering classification of rocks based on compressive strength. RQD, Rocks as a construction material: Building stone, Road metal, Railway ballast. (3)

Dams: Parts and terminology, Classification of dams, geological problems at dam site, dam location on different rocks and their stability, Reservoirs study,(2)

Tunnels: Terminology, soft ground tunneling, rock tunneling and their stability. (2)

Text Books

1. Geology for Engineers: FGH Blyth
2. Engineering and General Geology: Parbin Singh
3. Engineering Geology: B.S. SathyaNarayanswami
4. Principles of Engineering Geology: K.M. Bangar
5. Basic Geotechnical Earthquake Engineering: Kamalesh Kumar
6. Rock Mechanics for Engineers: B.P. Verma

Laboratory Work

1. Megascopic study of common rock-forming Minerals.
2. Megascopic study of common Rocks.
   a) Igneous Rocks
   b) Sedimentary Rocks
   c) Metamorphic Rocks
3. Geological Maps: Drawing of geological cross sections with civil engineering projects.
4. Field visit to civil engineering construction sites with reference to geological studies.

BECVE 402 T GEOTECHNICAL ENGINEERING-I

Objectives:

1. To impart knowledge about origin and classification of soils.
2. To impart knowledge about index properties and their determination.
3. To impart knowledge about engineering properties and their determination.
4. To impart knowledge about stress distribution in soil mass.

Outcomes:

a. Students would be able to determine the index and engineering properties of the soil.
b. Students would be able to determine the suitability of foundation for a particular type of soil.
c. Students will be able to classify the soils.
d. Students would be able to evaluate the stresses in the soil mass.

Syllabus :

Unit I

1. Introduction : Formation of soil, residual & transported soil, major deposits found in India, soils generally used in practice such as sand, gravel, organic soil, clay, Betonies, , black cotton soil etc. Introduction to clay mineralogy.
2. Phases of soil: Various soil weight & volume inter-relationship. Density index, methods of determining in situ density.

Unit II

Index Properties & Their Determination, Water content, specific gravity, sieve analysis, particle size distribution curve, sedimentation analysis, Differential and free swell value, Consistency of soil, Atterberge's limits . Classification of Soil : Particle size classification, Textual classification, Unified & I.S. classification system, field identification of Expansive soil, Swelling pressure.

Unit III

3. Permeability: Darcy's law & its validity, Discharge & seepage velocity, factors affecting permeability, Determination of coefficients of permeability by Laboratory and field methods, permeability of stratified soil.
4. Seepage : Seepage pressure, quick sand condition, characteristics & uses of flownets, Preliminary problems of discharge estimation in homogeneous soils, Effective, Neutral and total stresses in soil mass.

Unit IV

5. Stress Distribution : Stress distribution in soil Mass, Boussinesque equation, point load and uniformly distributed load over rectangular & circular areas, Use of Newmarks charts.

Unit V

6. Consolidation : Compression of laterally confined soil, Terzaghis 1-D consolidation theory (formation of Differential equation), Determination of coefficient of consolidation, Degree of consolidation. Determination of preconsolidation pressure, Settlement, Rate of settlement.
7. Compaction : Mechanism of compaction, factors affecting compaction, standard & modified proctor Tests, field compaction equipments, quality control, Advance compaction Techniques, Nuclear density meter.

Unit VI

8. Shear Strength : Introduction, Mohr Coulombs theory, Drainage condition, Measurement of shear strength by direct shear test, triaxial test, unconfined compression test, vane shear test, sensitivity.

BECVE 402 P PRACTICAL: GEOTECHNICAL ENGINEERING - I

These shall comprise ~~of~~ ten experiments and terms work to be presented in the form of journal for assessment of sessional and practical examination.

A. List of Experiments : Any 10

1. Moisture content and Specific gravity of soil.
2. Grain size Analysis – (Sieve Analysis).
3. Consistency limit, plastic limit and liquid limit of soil.
4. Hydrometer Analysis.
5. Constant Head Permeability test ~~of~~ or Falling Head Permeability test.
6. Consistency limit of soil (shrinkage limit).
7. Field Density by sand replacement method.
8. Field Density by core cutter method.
9. Unconfined compression test.
10. Direct shear Test.
11. Triaxial shear test (Demonstration).
12. Proctors compaction Test and Proctor needle test.

B. One field visit or one case study included in journal.

C. Use of plasticity Chart or Newmarks Chart.

Text book

Sr. No.	Title	Publication
1	Soil Mechanics & Foundation Engg. by K.R. Arora	Std. Publisher
2	Soil Mechanics & Foundation Engg.by B.C.Punmia	Laxmi Publication
3	Basic & Applied Soil Mechanics by Gopal Rajan & Rao	Newage international Pub.
4	Geotechnical Engg.by P. Raj	Dorling Kindersley Pvt. Ltd
5	Geotechnical Earthquake Engg. by Steven L. Kramer	Prentice Hall

Refrence book

Sr. No.	Title	Publication
1	Soil Mechanics & Foundation Engg by Modi	Std. Publisher
2	Soil Mechanics & Foundation Engg by V.N.S.Murthy	CBS Publisher

GEOTECHNICAL ENGINEERING-II

BECVE504T **Evaluation Scheme: (80/20)**

(L-3 Hrs./Week, T-1 Hr./Week); Total Credits- 4 **Exam Duration: 3hrs**

COURSE OUTCOMES: The students shall be able to

1. Use the knowledge of different soil exploration techniques to ascertain the properties of soil
2. To analyze the stability of natural slopes, safety & sustainability of the slopes, design of retaining structures, reinforced earth walls, etc.
3. Practice Ground Improvement Techniques.
4. Design the shallow & deep foundation.

Unit- I: GEOTECHNICAL EXPLORATION

Importance and objective of field exploration , geophysical methods and its limitations, methods of subsurface exploration, methods of boring, number, location and depth of boring, types of soil samples and samplers, principles of design of samplers, collection & shipments of samples, boring and sampling record.

Unit- II: STABILITY OF SLOPES

Causes and types of slope failure, stability analysis of infinite slopes, Taylor's stability numbers & stability charts, stability analysis of finite slope for purely C- soils and C - soils, center of

critical slip circle, (Swedish circle method), slices method for homogeneous C - soil slopes with pore pressure consideration, Friction circle method, method of improving stability of slopes; types, selection and design of graded filters.

Unit- III: LATERAL EARTH PRESSURE

Earth pressure at rest, active and passive pressure; general & local states of plastic equilibrium in soil. Rankine's and Coulomb's theories of earth pressure. Effects of surcharge & submergence. Determination of Active earth pressure through graphical construction; Rebhann's and Culman's method

Unit- IV: GROUND IMPROVEMENT

Need of ground improvement, ground improvement techniques, stabilization using lime, cement & flyash; prealoading concept, vibrocompaction/flotation, concept of sand drains, stone columns, encased stone column, concept of NPVD (natural prefabricated vertical drain) and PPVD (polymer prefabricated vertical drain). Basic concept of reinforced soil, different types of Geo- synthetics, Geo-synthetic application and functions in civil engineering

Unit- V: SHALLOW FOUNDATION

Bearing capacity of soil: Factor affecting bearing capacity, Terzaghis theory, its validity and limitation, types of shear failure in foundation soil, effect of water table on bearing capacity, (introduction to IS method, factor affecting bearing capacity, field determination of bearing capacity through plate load test and standard penetration te

st,)

Settlement of shallow foundation: Causes of settlement, elastic and consolidation settlement, differential settlement, control of excessive settlement. (Standard penetration test, corrections for N - values to obtain design soil parameters.**)**

Unit- VI: PILE FOUNDATION

Classification of piles, constructional features of cast- in – situ & pre cast concrete piles. Pile driving methods, effect of pile driving on ground. Pile capacity by static formula & dynamic formulae, pile load test, group action of piles, spacing of piles in group, settlement of group of pile (pile group,) negative skin friction and its effect on pile capacity, general features of under reamed piles.

REFERENCE BOOKS:

1. Gopal Ranjan &Rao: Basic &Applied Soil Mechanics, New Age international Publisher, 2005
2. Arora K.R. : Soil Mechanics & Foundation Engineering
3. Punmia B. C. : Soil Mechanics & Foundation
4. P Raj : Geotechnical Engineer,Mc Graw Hill Education,2000

BEHAVIOUR OF REINFORCED AND UNREINFORCED SOIL SLOPE UNDER VERTICAL LOADING

A Project Work Submitted In partial fulfillment of the requirement for the award of the Degree of

BACHELOR OF ENGINEERING

IN

CIVIL ENGINERRING

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY

NAGPUR

Submitted by:-

Raghvendra Katarpawar

Pranjali Vaidya

Lochan Tighare

Sayali Gaikwad

Sundaram Rahangdale

Under the guidance of

Asst. Prof. V. S. Ghutke

Dept. of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING,

NAGPUR

SESSION 2019 – 2020

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR

CERTIFICATE

This is certified that the work presented in this project entitled **"BEHAVIOUR OF REINFORCED AND UNREINFORCED SOIL SLOPE UNDER VERTICAL LOADING"** has been completed by Raghvendra Katarpawar, Pranjali Vaidya, Lochan Tighare, Sayali Gaikwad, Sundaram Rahandale students of B.E. Civil Engineering of this institution in satisfactory manner and in partial fulfilment of the requirements for the award of the degree of bachelor of engineering in civil engineering of Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur during session 2019-2020.

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Guide
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ABSTARCT

In the present experimental work, the behaviour of unreinforced and reinforced soil slopes under different vertical surcharge load is carried out experimentally. The slopes are constructed of sand size soil with two different soil slope angles of 45° and 60° with the horizontal. A gradual increasing load is applied on the bearing plate mounted on the crest of soil slope to observe the load vs. settlement behaviour. These soil slopes are then reinforced by placing Geonet, Geogrid, Geofoam and Jute Geotextile at two different inclinations. It is observed that maximum load is carried by the slope with 45° slope angle than the 60° slope angle. Also Geogrid placed at 45° was found to provide maximum stability and was more efficient.

INTRODUCTION

1.1 General:

A landslide (landslip) is a geological phenomenon that comprises a wide range of ground movements, such as rock falls, deep failure of slopes etc. landslides can occur in offshore, coastal and onshore environment. It can be controlled by the use of proper slope stabilization techniques. Soil stabilization is a term in which the natural soil is changed in order to meet the engineering purpose by means of physical, chemical, biological and combined method of either two of them or all three. Weight bearing capacity and the performance of the in-situ soil and sand can be increased by soil stabilization technique.

Owing to rapid urbanization and the dearth of land, structures such as foundations for bridge abutment, electrical transmission tower, building, railways, and highways on hills are being built on slope, often close to its edge. In contrast to plane ground, foundations on the slope exhibit less bearing capacity and stability of the slope is also vulnerable. For that reason, stability of such slopes needs to be improved significantly. Over the years, several slope stabilization methods such as modification of slope geometry, grouting of soil mass with cement, lime etc., installation of retaining walls, piles, and reinforcing the soil through polymeric geo-synthetics (geotextiles, geogrids, geocells, geofabrics, geomembranes, etc.) are being used by several researchers.

Various types of geo-synthetics are used for slope stability such as geo-nets, geo-foam, geo-membranes, geocells. Geo-synthetic aresynthetic products used to stabilize the soil. Nonwoven synthetic fibers like polyester, polyamide, polyethylene, polypropylene, fibers etc. can be used to reinforce the soil. Strength of soil can be enhanced using geotextiles, genets, geogrids which improves the bearing capacity, shear strength, stiffness and permeability characteristics, reduce the differential settlement etc. of soil through friction interaction between soil and geosynthetic material.

Reinforced earth structures are utilized to design earth retaining buildings and foundation. Reinforced earth is created by combining soil with geosynthetics such as geogrid, geonet and geotextile type of materials. Reinforced earth structures are preferred because of the high tensile strength, fast construction, high resistance to earthquake, economic feasibility and aesthetic appearance also.

Geosynthetic is a planar product produced from polymeric material used with rock, earth, soil and other geotechnical engineering material as an essential part of a man-made structure, project or system. Geotextile is a permeable geosynthetic that is made of woven textiles with different dimensions and filament properties.If the soil is good in compression, geotextile is good in tension. Thus, geotextiles are used to remove the risk of local tearing for clayey soils and in the case of less strength fine-grained silt. Geotextile has instant, eco-friendly and economical utilization in various geotechnical areas with more steel reinforcement and vegetation. Also, Geogrid is a mesh like material manufactured from polymeric materials with rib properties and variable space according to standards. All these reinforcements are utilized to increase soil bearing capacity and to decrease both vertical and horizontal distortions in case of failures like sliding, displacement, overturning, pullout failure and other general failures.

Geotextile is being used successfully in number of occasions to stabilize steep slope in residual soil and weathered rock. Geotextile is used as tensile reinforcement and filter to stabilized slopes or embankments. The geotextiles are generally placed in horizontal layers within the slope. Its placed along the slope cutting across potential sliding surfaces in the soil. The geotextile reduces

Domain 3: Environmental Engineering, Hydraulics and Water Resources Engineering

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	Environmental Engineering – I	BECVE303T/P	Environmental Engineering, Hydraulics and Water Resources Engineering
2	Fluid Mechanics -I	BECVE503T/P	
3	Hydrology & Water Resources (HWR)	BECVE505T	
4	Fluid Mechanics -II	BECVE603T/P	
5	Environmental Engineering-II	BECVE605T	
6	Elective -I : Air Pollution And Solid Waste Management	BECVE703T	
7	Irrigation Engineering	BECVE801T	
8	Elective - III : Water and Waste Water Treatment	BECVE803T	

BECVE 303 TENVIRONMENTAL ENGINEERING – I

Objectives:

1. To prepare students to apply basic knowledge of environmental engineering in conventional civil engineering practice involving water supply engineering in particular.
2. The course will provide students knowledge regarding the sources, of water demands, population forecasting, and conveyance of water.
3. To prepare students to analyze, plan, and design of various phases of water supply systems.
4. To provide the students the knowledge regarding the various characteristics of water, estimation of the quantity of water.
5. The course will provide students with fundamentals of solid waste management

Outcomes:

a. The students would be able to understand the importance and necessity of water supply.
b. The students would be able to determine the capacity of water supply scheme.
c. The students would have the basic knowledge related to the conveyance systems and the appurtenances used.
d. The students would have knowledge of characteristics of water, drinking water standards and necessity of treatment.
e. The students would be able to design various units of conventional water treatment plant.
f. The students would be equipped with the basic knowledge related to design of water supply system.
g. The students should be able to understand of necessity of treatment, types of treatment processes and disposal methods for solid waste.

Syllabus :

Unit – I

Introduction: Importance and necessity of water supply scheme.

Water Demand: All types of water demand, empirical formulae, factors affecting per capita demand, variation in demand, design period, population forecasting methods and examples.

Sources of water: Rain water, Ground water-springs, infiltration galleries, Dug wells, tube wells, Surface water-stream, lake, river, impounding reservoirs, ponds & sea.

Intake structures: Location, types river, lake, canal, reservoir etc.

Unit – II

Conveyance of water: Types of pipes, joints, fittings, valves & appurtenances.

Hydraulic design aspects: Friction, Manning's, DarcyWeishbach& Hazen Williams equationand problem.

Rising main and pumps: Concept of rising main, Classification, working, merits and demerits, selection of pumps.

Unit – III

Water quality: Physical, Chemical and bacteriological characteristics of water, Health effects of various water characteristics, Standards of drinking water. (WHO 2011, CPHEOO, IS 10500). Water born diseases

Water treatment: Objective of treatment, unit operations and processes, house hold & community based rural water treatment, decentralized water treatment, flow sheet of conventional water treatment plant.

Aeration: Purpose, types of aerators, design of cascade aerator.

Coagulation and Flocculation: Definition, Principles, types of coagulants and reactions, coagulant doses, types of mixing and flocculation devices.

Unit – IV

Sedimentation: Principles, types of setting basins, inlet and outlet arrangements, simple design of sedimentation tank.

Clariflocculators: Principles and operation.

Filtration: Mechanism of filtration, types of filters-RSF, SSF, Pressure filters, elements of filters sand specification, operational problems in filtration, Design of SSF and RSF, Membrane filtration technique of water treatment.

Unit – V

Disinfection: Purpose, Mechanism, criteria for good disinfectant, various disinfectants, their characteristics, disinfection by chlorination using different forms of chlorine. Types of chlorination.

Distribution systems: Requirements of a good distribution system, methods of distribution systems and layouts, Leakage and leak detector, Study of fire hydrants.

Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.

Unit – VI

Municipal solid waste management : Generation sources, composition, Methods of Collection, transportation, disposal, Recycle, Reuse.

Examples on simple hydraulic design of pipes, estimation of population and water quality, plain sedimentation tanks, cascade aerators, filters, pumps, dose of chlorine). Visit to Water treatment plant (compulsory).

ENVIRONMENTAL ENGINEERING-II

BECVE605T **Evaluation Scheme: (80/20)**
(L-3 Hrs/Week, T-1 Hrs/Week); Total Credits-4 **Exam Duration: 3 hrs.**

COURSE OUTCOMES: The students shall be able to

1. Use the concept related to water & its quality, sewage, sewer, storm water, etc in its hydraulic design
2. Apply the knowledge of different components of sewer in construction, testing & maintenance of sewers,
3. To test the sample of waste water in the laboratory for physical & chemical characteristics.
4. Take-up functional planning, layout and design of water treatment plant components.
5. Take-up functional planning, layout and design of sewage treatment plant components.
6. Plan for rural sanitation provisions, perform functional design of septic tank,
7. Analyze the industrial waste water for its treatment units.
8. Make use of knowledge & effect of air pollution, solid waste in planning for its prevention and control.

Unit-I

General Aspects of Environmental Engineering – Study of waste water, black water & grey water. System of collection and conveyance of sewage- separate and combined systems, patterns of sewage collection systems. Quantity of storm water and sanitary waste water, Sewer: Types, Shapes, Hydraulic Design (Capacity, Size, Grade, etc.)

Unit - II

Construction of sewer - Shoring, Trenching and laying to grade. Sewer materials, Sewer Appurtenances - manhole street inlets, storm water overflows, inverted syphons, flushing and ventilation: House plumbing systems, sanitary fitting and appliances, traps, anti-syphonage, inspection chambers and intercepting traps. Sewage pumping - location of pumping station and types of pumps. Sewer testing and maintenance.

Unit - III

Physical and chemical characteristics of wastewater, significance of BOD, COD, BOD rate constant, Sewage treatment flow sheet, site selection for sewage treatment plant. Preliminary and primary treatment - Screens, Grit chambers, oil & grease removal. Primary settling tank (including simple design)

Unit- IV

Secondary treatment - Principle of Biological Treatment Activated sludge process, trickling filter, (Indian Standard for disposal), Methods of disposal, Sewage farming, self purification of stream (Streeter

Phelp's equation, Oxygen sag curve). Recycle & reuse of sewage (Zero discharge concept). Sludge digestion, sludge drying beds.

Unit - V

Rural sanitation; Pit privy, aqua privy, bio-gas recovery Septic tank including soak pit, including design problem (as per relevant I.S. Code) Sullage collection and disposal

Industrial Waste Water Treatment - Significance of Industrial Waste Water Treatment, important physical and chemical parameters, unit operations and processes (flow equalization, neutralization, adsorption, chemical and biological treatment (in brief)

Unit VI

Air pollution and solid waste: Sources, classification, Effects, prevention and control. Introduction to carbon credit system and climate change

REFERENCE BOOKS

1. B.C.Punmia," Waste Water Engineering" - Laxmi Publication
2. S.K.Garg, "Environmental Engineering" -Vol II Standard Publication
3. G.S.Birdie, "Water Supply & Sanitary Engineering"
4. M.J.Macghee, "Water Supply & Sewage" – McGraw Hill Publication
5. M.N.Rao & HV.N.Rao, "Air 'Pollution" McGraw Hill Publication
6. C.S.Rao,"Enviromental Pollution Control Engineering".

AIR POLLUTION AND SOLID WASTE MANAGEMENT (ELECTIVE-I)

BECVE703T **Evaluation Scheme: (80/20)**
(L-3 Hrs/Week, T-1 Hrs/Week); Total Credits-4 **Exam Duration: 3 hrs**

COURSE OUTCOMES:-The students will be able to

1 Understand different aspects of air pollutants, its sources and effects on man and material etc.
2 Design controls methods and equipments for air pollution to reduce its impact on environment.
3 Understand problems arriving in handling large amount of solid waste generated ,its collection and transportation, processing and will bw able to design safe collection and disposal methods.

Unit - I

Introduction to air pollution : Definition, air pollution episodes, atmosphere & its zones.

Classification and sources of air pollutants, Standards for air pollution (as per Indian Standards and CPHEEO). Effects of air pollutants on man, and materials.

Unit - II

Meteorological parameters and Air sampling: Primary and secondary parameters, atmospheric stability, plume behavior. Wind rose diagram, wind data analysis & wind impact area diagram, Stack height determination.

Air sampling and measurement : ambient air sampling and stack sampling, collection of particulate and gaseous pollutants, site selection criteria methods of estimation.

Unit – III pollution control

Air pollution controls methods and equipments ; Principles of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters, cyclones and wet scrubbers, (adsorption, absorption, incineration, condensation)

Automobile exhaust :Introduction to Pollution due to diesel & petrol engines,

Noise Pollution : Sources, ill effects, control measures.

Unit - IV

Introduction to solid waste management.(SWM) : Structure , necessity and responsibility,

Sources, Quantity and quality, Sources of solid waste, classification and components, physical and chemical characteristics, per capita contribution, sampling and analysis.

Unit – V : Collection and Transportation methods:

Collection and transportation of solid waste: Method of collection, equipment used for collection and transportation, transfer stations, optimization of transport route.

Solid waste processing : Methods of processing, choice of methods, merits and demerits of various methods, gas control measures.3R concept

Unit – VI : Disposal methods:

Composting of waste, methods of composting, factors affecting composting

Sanitary land filling : Site requirements, methods, leachate management., control of gases.

Incineration: Principles of incineration, types of incinerators, advantages and disadvantages.,3T Diagrams

REFERENCE BOOKS

1. M.N. Rao & H.V.N.Rao, " Air Pollution", Tata McGraw Hill Publishing Co. Ltd.
2. C.S.Rao, "Environmental Pollution Control Engineering", Wiley Estern Ltd. New Delhi.
3. Stern A.C., "Air Pollution" Vol I to X.
4. A. D. Bhide, & Sunderesan B.B., "Solid Waste Management in developing countries, INSDOC, N. Delhi.
5. Tchobanoglous, "Integrated Solid Waste Management in Engineering principles and management isssues,
6. K.V.S.G. Murlikrishna" Air Pollution" JTNU, Kakinada.

"EFFECTIVE TREATMENT OF DAIRY WASTE WATER BY USING NATURAL COAGULANT"

A Project report submitted in partial fulfillment of the

requirements For the degree of

BACHELOR OF ENGINEERING IN

CIVIL ENGINEERING

OF

RASHTRASANTH TUKDOJI MAHARAJ NAGPUR UNIVERSITY

NAGPUR

Submitted By

PRADHNYA V. KOLHE

PRACHI NAIDU

HIMANSHU B. BADOLE

ABHISHEK S. ZANZAD

PUNIT S. MALLELWAR

Under the guidance of

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DEPARTMENT OF CIVIL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING

NAGPUR-440019

2019- 2020

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR

DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE

This is to certify that the project entitled — **"EFFECTIVE TREATMENT OF DAIRY WASTE WATER BY USING NATURAL COAGULANT"** has been completed by PRADHNYA KOLHE, ABHISHEK ZANZAD, PRACHI NAIDU, PUNIT MALLELWAR, HIMANSHU BADOLE, student of B.E (Civil Engineering) of this college in satisfactory manner in partial fulfilment of the requirement for the degree of Bachelor of Engineering, of RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY, Nagpur in year 2019-2020.

Mr. Vikash R. Agrawal
(Assistant Professor)
(Guide)
Department of Civil Engineering

Dr. S. A. Dhale
(H.O.D)
Department of Civil Engineering

Dr. M. P. Singh
Principal
P.C.E. Nagpur

ABSTRACT

Demand for milk and milk product cause vast growth of dairy industries in most countries of the world. Consequently the amount of waste water and waste material generated and discharge from these industries has also increased one of the most important solid –liquid separation processes is coagulation and flocculation that is extensively used in primary treatment of industrial waste water in this study ,Dolichos Lablab is used as an eco-friendly coagulant in the enhanced primary treatment of of amul industry effluent was investigated .It's performance in terms of turbidity removal was examined local dolichos lablab seeds from Nagpur city was used conventional jar test was conducted for enhancing the primary treatment of dairy waste water from amul industry .for this reason, comparitve coagulation test were performed using alum .Indeed ,in terms of 70%, 80% were obtained from dolichos lablab and alum respectively. Because dolichos lablab is a natural resource that is locally available, an eco-friendly coagulant, non-toxic and biodegradable and does not affect the pH of water thus it use allows avoiding numerous disadvantages of conventional coagulants like alum.

KEYWORDS: - Dolichos Lablab, Coagulation, Jar test, Natural Coagulant

INTRODUCTION

1.1 GENERAL

- The dairy industry is generally considered to be the largest source of food processing wastewater in many countries.
- As awareness of the importance of improved standards of wastewater treatment grows, process requirements have become increasingly stringent.
- Although the dairy industry is not commonly associated with severe environmental problems, it must continually consider its environmental impact particularly as dairy pollutants are mainly of organic origin.
- The milk processing industry is one of the world's staple industries, thus the treatment possibilities of dairy effluents have been attracting more and more attention.
- The dairy industry includes the transformation of raw milk into pasteurized and sour milk, yoghurt, hard, soft and cottage cheese, cream and butter products, ice cream, milk and whey powders, lactose, condensed milk, as well as various types of desserts.
- The general distinctions among these foods are due to the reuse of non- -fat milk and whey (a by-product in cheese manufacturing) and the evaporation of the free water from the coagulum as well as from milk and whey powders.
- With the rapid industrialization observed in the last century and the growing rate of milk production (around 2.8% per annum), dairy processing is usually considered the largest industrial food wastewater source, especially in Europe.
- Moreover, in around 50% of the world's whey production, especially concerning acid whey, it is untreated prior to disposal.
- The effluents originating from various production technologies are not discharged simultaneously, thus forming a stream with wide qualitative and quantitative variations.
- Notwithstanding the differences in composition, attributable to the manufactured product and technological operations, dairy effluents are distinguished by their relatively increased temperature, high organic content and a wide pH range, which requires special purification in order to eliminate or reduce environmental damage.

Domain 4: Structural Engineering

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	Strength of Materials	BECVE302T/P	Structural Engineering
2	Structural Analysis – I	BECVE 401T/P	
3	Structural Analysis -II	BECVE501T/P	
4	Reinforced Cement Concrete (RCC) Structures	BECVE502T/P	
5	Steel Structures	BECVE601T/P	
6	Advanced Concrete Structures	BECVE701T/P	
7	Elective -I : Earthquake Resistant Design of Structure	BECVE703T	
8	Elective - III : Advanced Reinforced Cement Concrete Design	BECVE803T/P	

BECVE 302 T STRENGTH OF MATERIALS

Objectives:

1. To make students learn and apply basic theories and concepts of equilibrium, shear force, bending moment in beams and frames, bending stress, shear stress, torsional stress and stress-strain lawsto different materials for different conditions of loading.
2. To make students learn and understand the concept and theory of deflection of beams, frames,trusses.

Outcomes:

a. The students would be able to understand the behavior of materials under different stress and strain conditions.
b. The students would be able to draw bending moment, shear force diagram, bending stress and shear stress distribution for beams under the different conditions of loading and calculate the deflection.

Syllabus :

Unit – I

Mechanical properties and uniaxial problems.
Types of force distribution, concept of stress and strain, Stress strain behavior of ductile and brittle material in uniaxial state of stress, elastic, plastic and strain hardened zones stress-strain relations, Elastic constants, relation between elastic constant, Uniaxial loading and deformation of simple cases of statically indeterminate problems under axial loading, temperature change etc., Thin wall pressure vessels cylindrical and spherical subjected to internal pressure.

Unit – II

Axial force, shear force and bending moment diagram
Concepts of free body diagrams, types of loads, Determination of axial forces, shear forces and bending moment at a section, axial force, shear force and bending moment in beams and simple frames, Differential relations between shear force and bending moment, Relation between load and shear force.

Unit – III : Stress in beams

Bending stresses in simple beams, Assumptions and derivation of simple bending theory relation between bending moment, bending stress and curvature of homogeneous and composite beams, Shear stresses in simple beams, Shear flow and shear stress distribution, shear stress in composite beams, combined effect of bending moment and axial force.

Unit – IV : Torsion

Torsion of circular section, assumptions and derivation of relations between torsional moment, shear stress and angle of twist, Torsional stress in solid and circular sections, Introduction to Torsion in rectangular section, Torsion in thin walled hollow section

Unit – V : Deflection of beams

Derivation of differential equation of moment curvature relation, Differential equation relating deflection and moment, shear and load, Deflection of simple beams by integration, Introduction to Deflection of linearly varying beams by integration.

Unit –VI : State of stress in two dimensions

State of stress in two dimensions, differential equation of equilibrium, Transformation of stresses, principal stresses, maximum shear stresses, Mohr's circle, Combined bending and torsion, Combined effect of torsion and shear, Shear flow in thin walled section, Concept of shear centre of thin wall sections, unsymmetrical bending.

BECVE 302 P : STRENGTH OF MATERIALS
(Any Eight practicals)

1. To study various types of Strain Gauge apparatus.
2. To determine the Tensile Strength of Steel specimen.
3. To perform Hardness test on various metals. (Brinell's hardness test & Dynamic hardness test)
4. To perform standard Torsion test on metals.
5. To perform the Impact test on metal (Izod/ Charpy).
6. Compression test on Bricks and Stones.
7. To determine the spring constant of Closely Coiled Spring.
8. To perform shear test on different metals.
9. To perform fatigue test on mild steel bar.
10. To perform the bending test on wooden beam and find its Flexural Rigidity.

Text Book:

Sr.No	Title	Publication
1.	Strenght of Materials by S.P. TimoShenko	Mc. Graw Hill
2	Mechanics of Materials by Ferdinand P. Beer, E. Russell John StonJr	Mc. Graw Hill

Refrence :Sr.No	Title	Publication
1	**Strength of materials by Singer**	**Haper and Row**

BECVE 401 T STRUCTURAL ANALYSIS – I

Objectives:

1 To make students understand the determinate and indeterminate structures, their method of analysis And construction of influence lines.

2 To make students understand the behavior of beams and frame using, Column Analogy Method, strain energy method, slope deflection method etc.

Outcomes:

a. The student would be able to apply knowledge to analyse concept of deflection, bending moment and shear force diagram in beams, frames, trusses and columns under various loading conditions using different analysis methods.
b. The student would be able to apply knowledge to determine forces in determinate and indeterminate structures by the force and matrix method.
c. The students would be able to perform ILD analysis of determinate beams and trusses.

Syllabus:

Unit – I

Introduction of Statically indeterminate Structures : Concept of Static indeterminacy,
Analysis of fixed and continues beams by theorem of three moments, effects of sinking of support.

Unit – II

Rolling loads on simply supports beams with concentrated and uniformly distributed loads, maximum B.M. and S.F. Influence lines for reactions, bending moments and shear forces in simply supported beam, cantilevers and beams with overhangs. Influence lines for forces in members of simple trusses and for BM and SF in panels of simple trusses.

Unit – III

Strain energy method as applied to the analysis of redundant frames and redundant truss up to two Degrees, Determination of deflection of trusses. Castiglinos theorems. Maxwells reciprocal theorem. Bettis theorem.

Unit – IV

Bucking of columns and beams. Eulers and Rankines formula.
Analysis of Two-Hinged arches. Three Hinged Arch, S.F. and normal thrust, parabolic arches.

Unit – V

Slope defection method as applied to indeterminate beams & continues beams portal frames. Frame with inclined legs upto 3 degree of freedom.
Approximate method: Analysis of multi-stored frame, portal,cantilever and substitude frame methods.(max. three bay three storey).

Unit – VI

Introduction to flexibility method upto two DOF, Column Anology Method.

STRUCTURAL ANALYSIS –II

BECVE501T **Evaluation Scheme: (80/20)**
(L-3 Hrs/Week, T-1 Hr/Week); Total Credits- 4 **Exam Duration: 3 hrs**

COURSE OUTCOMES: The students shall be able to

1. Apply the different methods of analysis of frames in practical problems
2. Formulation of stiffness matrix, transformation matrix, load matrix for various structural components for analysis purposes.
3. Understand the basics of finite element method in the analysis of structural components.
4. Understand the concepts related to structural dynamics.

Unit – I

Kani's Method applied to symmetrical and unsymmetrical frames with sway (Up to single bay Two storey)

Unit - II

Analysis of Continuous Beams & Simple Portal frames (sway and Non Sway) Using Moment Distribution.

Unit - III

Basic concept, Degree of Freedom, Basic concept of Direct Stiffness Method. Formulation of elemental/local stiffness matrix and global stiffness matrix for plane truss. Transformation Matrix, Assembly of Global/ Structural stiffness matrix up to (8x8). Member load matrix including lack of fit, temperature, Assembly of Global/ Structure load matrix, Solution to problems with maximum degree of freedom three.

Unit - IV

Formulation of element/local stiffness matrix and global stiffness matrix for beam members (without axial deformations) for continuous beams, Transformation matrix Assembly of global/ structural stiffness matrix, Member load matrix due to concentrated loads, uniformly distributed Loads, Assembly of global/ structure load matrix up to Three Elements. Solution to problems with maximum degree of freedom Three.

Unit – V

Formulation of element/ local stiffness matrix and global stiffness matrix for Plane frame members (without axial deformations), Transformation matrix Assembly of global/ structural stiffness matrix, Member load matrix due to concentrated loads, uniformly distributed Loads, temperature Moments Assembly of global/ structural load matrix.

Solution to Plane frame problems with maximum degree of freedom six inclined member problems.

Unit - VI

Introduction to structural dynamics, D'Alembert principle, inertia force, equation of motion (free vibration), SDOF system, Damping, natural frequency, (MDOF (up to 3 DOF), mode shape and nodal frequency).

Introduction to finite Element method, basic concepts, discretization of structures, Rayleigh Ritz method for bar elements (prismatic/Non-prismatic) Displacement based bar elements (Prismatic/Non-prismatic)

REFERENCE BOOKS:

1. C K Wang, 'Intermediate Structural Analysis"
2. S P Timoshenko, 'Theory of Structure'
3. Jain, Jain Krishna, 'Plain & Reinforced Concrete Structures', Vol-II
4. Rally and Dally, 'Experimental Stress Analysis'

STRUCTURAL ANALYSIS –II

BECVE501P **Evaluation Scheme: (25-Internal/25-External)**
(P – 2 Hrs/Week); Total Credit - 1

Student shall undertake Practicals on:

Minimum Eight Problems, on complete syllabus with hand calculations using scientific calculators and also solution to same problems by using available application software.

(Solution is restricted to four degree of freedom problems and assembly restricted to eight degree of freedom problems)

REINFORCED CEMENT CONCRETE (RCC) STRUCTURES

BECVE502T **Evaluation Scheme: (80/20)**
(L-3 Hrs/Week, T-1 Hr/Week); Total Credits- 4 **Exam Duration: 4 hrs**

COURSE OUTCOMES: The students shall be able to

1. Understand the basic concepts of structural design Methods of RCC to the practical problem
2. Understand the composite action of reinforced steel and concrete in reinforced concrete structural members
3. Use the knowledge of the structural properties of materials i.e. steel and concrete in assessing the strength.
4. Use the knowledge in structural planning and design of various components of buildings.
5. Apply the concepts and applications of prestressed concrete in real problems

Unit – I

Introduction to the Working Stress Method of RCC design. Basic concepts in design for flexure, assumptions, design constants. Analysis of the rectangular section, Balanced, under-reinforced and over-reinforced sections; Drawbacks and limitations of Working stress methods.

Unit – II

Prestressed Concrete: Properties of high grade/strength materials, concepts of prestressed concrete, methods of prestressing, losses in prestressing. Various systems of prestressing with particular reference to Freyssinet, Magnel Blatton and Gifford Udall systems Analysis of rectangular, T and I section. Design of prestressed slab/ rectangular beam

Unit - III

Introduction to Limit State Design: Concept of probabilistic design and limit state design. Characteristic values, partial safety factors, stress strain relationship stress block parameters, failure criteria, types and properties of reinforcement, limit state of Serviceability and limit state of collapse, other limit states. Review of IS – 456-2000.

Limit state of collapse in flexure: Analysis and design of singly reinforced rectangular section. Balanced failure mode, primary tension failure mode and primary compression failure mode

Analysis & Design of Doubly reinforced sections

Unit - IV

Limit state of collapse in flexure: Analysis and design of Tee and L-beam section.
Limit state of collapse in compression: Analysis & design of short axially loaded column. Columns subjected to uniaxial bending, use of interaction curves.

Design of rectangular pad/ slopped footing for axial load

Unit - V

Limit state of Collapse in Shear & Bond: Design of beam for shear, shear span, post cracking resistance, shear mechanism approach, shear failure modes and collapse loads, interaction of shear, flexure and force. Check for bond.

Limit state of Serviceability:

Causes and control cracking: Crack in plastic concrete at early age, Cracks due to temperature and shrinkage, restrain induced cracks, Cracks due to loading. Needs for crack width control

Moment- curvature relationship, deflection control of beams; Deflection calculation for beam.

Limit state of collapse in torsion: Concepts of interaction to torsion, shear and flexure Analysis & design of rectangular section for torsion, shear and flexure

Unit – VI (with LSM)

Design of one-way, simply supported, single span and cantilever slabs, and continuous slab/ beam with IS coefficients.

Design of RCC Two way slab with various end conditions using IS code coefficient. Deflection calculation for one-way slabs

REINFORCED CEMENT CONCRETE (RCC) STRUCTURES

BECVE502P **Evaluation Scheme: (25-Internal/25-External)**
(P – 2 Hrs/Week); Total Credit - 1

Student shall undertake Practicals on:

1. Design of beams, columns, slab and foundation as per relevant IS Code
2. Understanding the professional RCC drawing.
3. Minimum One Site visit pertaining to above design

VI Semester

STEEL STRUCTURES

BECVE601T **Evaluation Scheme: (80/20)**
(L-3 Hrs/Week, T-1 Hrs/Week); Total Credits-4 **Exam Duration: 4 hrs**

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COURSE OUTCOMES: The students shall be able to

1. Use the knowledge of structural properties in assessing its strength for the construction purpose.
2. Apply the knowledge of various techniques in analyzing the steel structural components.
3. Make use of knowledge of analysis in structural planning and design of various components of buildings.

NOTE: Use I.S Code. - 800-2007

Unit – I

Steel as a structural material, various grades of structural steel properties; various rolled steel sections (including cold formed section, structural pipe (tube) sections) and their properties. Introduction to I.S. 800, 808, 816, 875 etc.

Introduction to Plastic Analysis, Shape Factor, Plastic hinge formation Collapse mechanism for beams

Design of axially loaded members: (a) Tension members. (b) Compression members. Design of roof truss: Load assessment for DL, LL and WL.

Unit - II

Structural Fasteners:

Behavior of bolted and welded connections (types, Designation, properties, permissible stresses), failure of bolted and welded joints. Strength of bolt and strength of weld. Efficiency of joints. Design of simple bolt and welded connections. Moment resistant bolted and welded connection (bending and torsion)

Design of connection: Beam to beam, beam to column

Unit – III

Design of simple and built up beams: Laterally restrained and un-restrained, (symmetrical as well as unsymmetrical section). Curtailment of flange plates. (Design of welded plate girder.)

Unit - IV

Design of single rolled steel section column subjected to axial load and biaxial moment including base design.

Design of axially loaded built up columns. Laced and battened (Column bases, slab base, gusseted base, and moment resistant bases).

STEEL STRUCTURES

BECVE601P **Evaluation Scheme: (25-Internal/25-External)**
(P-2 Hrs/Week); Total Credits-1

Term Work –

Minimum three design assignment based on above topics along with the detailed structural drawings on A2 size sheets.

Practical Examination shall be based on the above Practical work.

EXPERIMENTAL STUDY ON IMPACT RESISTANCE OF STEEL FIBER REINFORCED CONCRETE

A Project work Submitted in partial fulfillment of

The requirements for the degree of

BACHELOR OF ENGINEERINGINCIVIL ENGINEERING

OF

RASHTRASANT TUKDOJI MAHARAJ NAGPUR UNIVERSITY

NAGPUR

Submitted by

Sahil Pantawane

Vinay Somani

Yogita Rajabhoj

Indrayani Vyas

Shubhangi Baranwal

Under the Guidance of

Prof V.S.Vairagade

Asst. Prof, Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING NAGPUR-440019

SESSION 2019-2020

PRIYADARSHINI COLLEGE OF ENGINEERING

NAGPUR

CERTIFICATE

This is certified that the work presented in this project entitled "**Experimental Study on the Effect of Impact resistance of Steel Fibre Reinforced Concrete**" has been completed by Sahil Pantawane, Vinay Somani, Indrayini Vyas, Shubhangi Baranwal and Yogita Rajabhoj students of BE Civil Engineering of this institution in satisfactory manner and in partial fulfillment of the requirements for the award of the degree of bachelor of engineering in civil engineering of Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur during session 2019-2020

Prof. V. S. Vairagade
Guide
Asst. Professor, Civil Dept.
PCE, Nagpur

Dr. S. A. Dhale
Vice Principal & HOD Civil Dept.
PCE, Nagpur

Dr. M. P. Singh
Principal
PCE, Nagpur

Chapter 1

Introduction

1.1) General

Concrete is an intrinsically brittle material prone to damage through the impact of heavy items and loads particularly at exposed edges and arises. Impact damage is a major cause of a reduction in life span of any concrete construction, leading ultimately to early replacement.

Today, the structural Engineers are facing the problem of ensuring the safe structures which will withstand for the impact loads in addition to static loads. Many concrete structures are often subjected to dynamic loads too. These loads originate from sources such as impact from missiles and projectiles, wind gusts, earthquakes and machine vibrations. The need to accurately predict the structural response under such loading has Ted researches to investigate the mechanical properties of component materials at such high rates of strain, Impact is a complex dynamic phenomenon. The use of fibers was found to be advantageous in impact conditions. It has been observed that addition of fibers greatly increases the energy absorption and cracking resistance characteristics of concrete (U). In the recent times, the impact resistance of concrete is recognized as an important property of an infrastructure construction. Several methods have been suggested by different guidelines that evaluate the impact resistance of FRC (ACI committee 5442R-89) such as Charpy test, projectile test, explosive test and drop weight test. Among them drop weight test is simplest, popular method suggested by ACI committee 544.2R-89 [2].

Impact resistance is one of the important attributes of FRC. Conventionally, impact resistance has been characterized by measure of the number of blows in a "repeated impact" test to achieve a prescribed level of distress in the specimen. Steel Fiber Reinforced Concrete (SFRC) promises good ductility. The addition of steel fibers to concrete improves the impact and fracture of the concrete. Steel fibers bridge these cracks and restrain their widening and thus improve the post peak ductility and energy

Domain 5: Transportation Engineering

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	Transportation Engineering – I	BECVE 403T/P	Transportation Engineering
2	Transportation Engineering - II	BECVE705T	
3	Elective - II : Pavement Analysis And Design	BECVE802T	

BECVE 403 T TRANSPORTATION ENGINEERING – I

Objectives:

1. To educate the students on the various components of Highway Engineering and Bridge engineering.
2. To expose the students to highway planning, engineering surveys for highway alignment, Design of Geometric Elements of Highways and Urban roads, Flexible and Rigid pavements design, Traffic Engineering, traffic safety analysis, transportation planning and Highway material testing.
3. To make them understand desirable properties and testing procedures of highway materials as per BIS standard and Indian Roads Construction (IRC) for various practices adopted for construction.
6. To educate students on the various components of Pavements.
7. It exposes the student to learn types of pavements, components and functions of pavements, types of highway vehicles and aircrafts, IRC loadings, equivalent axle loading and load factors, Flexible and Rigid design methods, etc.

Outcomes:

a. A person with broad vision and complete knowledge of design and construction practices in highway engineering and pavement.
b. The student will be able to test highway materials and draw appropriate conclusion.
c The student will be able to maintain and propose measurement.
d. The student will be able to undertake Traffic studies.

Syllabus:

Unit -I

Highway Development & Planning: Principles of Highway planning, Road development in India Classification of roads, network patterns, Planning, Surveys.
Highway Alignment: Requiremnts, Engineering Surveys.
Highway Materials: Properties of sub grade and pavement component materials, Tests on subgrade soils, aggregates and bituminous materials. Application of Geosynthetics.

Unit - II:

Highway Geometric Design: Cross Section elements, carriageways, camber, stopping & overtaking sight distances Horizontal alignment- Curves, design of super elevation, widening, transition curves, vertical curves.

Unit- III

Pavement Design: Types of pavements & characteristic, Design parameters, Axle & Wheel load, tyre pressure, ESWL for dual Wheels, repetitions, Group Index & IRC method of flexible pavement design. Analysis of load & temperature stresses of rigid pavement, joints

Highway Construction & Maintenance: Earthen/Gravel road, Water Bound Macadam, Wet Mix macadam, Bituminous pavement, Cement Concrete pavement. Pavement failures, Pavement evaluation, Maintenance and strengthening measures.

Unit-IV

Traffic Engineering: Traffic characteristics (Road User, Driver and Vehicular characteristics)
Traffic Studies (Volume studies, speed studies, parking studies and accident studies.)
Traffic Safety (Causes and types of accidents, Use of intelligent transportation system)

Unit- V

Bridge Engineering: Classification, identification and site selection.
Flood discharge, waterways, scour depth, economic span.
IRC classification of Loads, Forces, Stresses: IRC Specification & code of practices,Critical combinations.

Unit-VI

Sub-Structure: Types of foundations & their choice, Open, Pile and well foundation, pneumatic Caissons, cofferdams. Abutment, Piers & Wing walls, Their types general design principles (empirical.)

Super Structure: Different structural forms
Rating and Maintenance: Methods & Techniques of rating of existing bridges Inspection, Repairs, maintenance, corrosion-causes and prevention, Aesthetics.

PRACTICAL : BECVE 403 P TRANSPORTATION ENGINEERING - I

Every student must carry minimum of 10 (Ten) experiments from the following:

1. Sub grade Soil: CBR test
2. Sub grade Soil: AASHO Classification
3. Aggregates: crushing value test.
4. Aggregates: Los Angeles abrasion value test.
5. Aggregates: impact test.
6. Aggregates: shape test.(Elongation Index, Flakiness index and Soundness test)
7. Aggregates: Specific Gravity and Water absorption test.
8. Bitumen: Penetration Value.
9. Bitumen: Ductility Test.
10. Bitumen: Softening point test.
11. Bitumen: Flash and Fire point test.
12. Bitumen: Specific gravity.
13. Bitumen: Adhesion Test.
14. Short Field Visit

Text book

Sr. No.	Title	Publication
1.	Highway Engineering: Khanna and Justo.	Nem Chand
2.	Bridge Engineering by S. P. Bindra.	**Dhanpat Rai Publication**
3.	Bridge Engineering by S. C. Rangwala.	Charotar Publishing House Pvt. Limited
4.	Principles and practices of Highway Engineering by S. K. Sharma	Khanna Publication

Refrence book

Sr. No.	Title	Publication
1	. Pavement Design: Yoder and Witzak	Wiley
2	Traffic Engineering: L.R.Kadiyali	Khanna Publisher

TRANSPORTATION ENGINEERING-II

BECVE705T **Evaluation Scheme: (80/20)**

(L-3 Hrs/Week, T-1 Hrs/Week); Total Credits-4 **Exam Duration: 3 hrs**

COURSE OUTCOMES:-The students are able to

1. Understand the functions of various elements of railways, airports, tunnels and docks and harbor.
2. Plan and design various elements of railways, airports, tunnels and docks and harbor.
3. Understand the various principles traffic control in railways, airports, tunnels and docks and harbor.
4. Understand layout, design and construction permanent way, runway, taxiways, tunnels, births and jetty.
5. Understand the maintenance of various elements of railways, airports, tunnels and docks and harbor.

Unit – I : RAILWAYS

Classification of Rail way: lines and their track standards.

Traction and Tractive Resistance, Hauling capacity and Tractive effort of locomotives, Different Typesof tractions

Permanent Way: (Ideal permanent way), gauges, track section. Coning of wheels, Stresses in railwaytrack, High speed track.

Unit – II

Rail types and functions, selection for rails, wear & defects, creeps of rails, long welded rails., sleepers -function, types, merits and demerits, sleeper density. Ballast cushion. Ballast section, Spikes,fishplates, hook bolts, Dog bolt, pondrot clip .

Geometric design of railway track, Gauge, Gradients speed, super elevation, cant deficiency, Negativesuper elevation, objectives of transition curves, grade compensations.

Unit - III

Points & crossings: Left and right hand turnouts, design calculations for turnouts ,-Station and Yards: Types, functions, Railway signaling and interlocking: Objects of signaling, principles of signaling. Classification and types of signals. Necessity of interlocking methods and mechanical devices Railway track construction, inspection & modern techniques of maintenance. Modern technology related to track, signaling & controlling.

Unit – IV : AIRPORTS

Aircraft components and characteristics, Airport site election. modern aircrafts.

Airport obstructions: Zoning Laws, Approach and turning Zone, clear zone, . (vertical) Clearance for Highway & Railway.

Runway and taxiway design: Wind rose, cross wind component, Runway Orientation and configuration. Basic runway length and correction, runway geometric design standards. Taxiway Layout and geometric design standards, Exit Taxiway.

Unit – V

Airport layout and classification: Terminal Area, Aircraft parking, configuration and system. Aprons,Hangers, Helipads and Heliports,

Visual Aids: AirPort marking and Lighting for runway, Taxiway and other areas.

Air traffic control: Need, network, control aids, instrumental landing systems, Microwave loadingsystem

Unit – VI (Tunnel Engineering and Docks and Harbors)

16. Tunnel (Engineering) – surveys, Drainage, Ventilation, Lighting ~~(~~and Lining~~)~~

Text Books and Reference Book:

1 A text book of Railway Engineering *by*S.C.Saxena and S.P.Arora, Dhanpat Rai Publicatios, N.Delhi.
2 Railway Track Engg. *by* J.S.Mundray, Tata McGraw-Hill Publishing Co. Ltd. N.Delhi.
3 Airport Planning and Design *by*S.K. Khanna, M.G.Arora, Nem Chand Bros., Roorkee.
4 Planning and Design of Airports *by*RobortHornjeff, McGraw Hill Book Co.
5 Air Transportation Planning and Design *by* Virender Kumar &Satish Chandra, Galgotia Publications, N.Delhi.
6 Mundary, J.S. Railway Track Engineering, Tat McGraw Hill, New Delhi.
OZA, Docks and Harbours, Charotar Publisher)
7 Air Planning and Design by G.V. Rao

A

PROJECT REPORT

ON

REUSE OF PLASTIC WASTE IN PAVER BLOCK

This project report is submitted to Rashtrasant Tukdoji Maharaj Nagpur University in partial fulfillment of requirement for the award of degree of

Bachelor of Engineering

In

Civil Engineering

Submitted by

Mr. AMAN BHAGAT **Miss. ANAGHA INGOLE**

Mr. SUNNY SAROJ **Mr. ABHISHEK MASTKAR**

Mr. VAIBHAV BARASAGADE

Under the guidance of

PROF. Veena Ganvir (Guide)

PROF. Kirti Thakre (Co-Guide)

Asst. Professor

Dept. of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING
PRIYADARSHINI COLLEGE OF ENGINEERING,
NAGPUR-440019

YEAR 2019-2020

PRIYADARSHINI COLLEGE OF ENGINEERING

NAGPUR

CERTIFICATE

This is to certify that the thesis entitled "**Reuse of plastic waste in paver block**" Is bonafied work carried out by Aman Bhagat, Anagha Ingole, Abhishek Mastkar, Sunny Saroj, and Vaibhav Barasagade under my guidance in satisfactory manner and submitting to the Rashtrasant Tukdoji Maharaj Nagpur University. The project report submitted is the Impartial fulfilment of the requirement for the degree of Bachelor of engineering in Civil Engineering.

Prof. Veena Ganvir
Asst. Prof. & Guide
Department of Civil Engg

Dr, S.A Dhale
Head of Dept &
Vice Principal

Prof. Kirti Thakre
Asst. Prof. & Co-Guide
Department of Civil Engg.

Dr. M.P Singh
Principal,
PCE, Nagpur

ABSTRACT

The aim of this project is to replace the bonding of given by cement in paver blocks with the melted plastic waste. Around 9.46 million tons of plastic waste is generated in the country per annum. The degradation of plastic is very long process; it may take thousands of years. Hence, project is helpful in reducing the plastic waste. In this project, we have used plastic waste in different ratio with fine and coarse aggregate. The paver blocks were prepared and tested. The water absorption capacity of plastic paver block is less. The main aim is to use the plastic nature in construction fields with limited additions. It will be definitely a cost economical and can be applied in different forms.

Keyword: Plastic Waste, Paver block, Fine and Coarse Aggregate

CHAPTER 01

INTRODUCTION

1.1 INTRODUCTION

Building materials like bricks, paver block, tiles, etc. are popularly used in construction. However, these materials are expensive and hence common people find it difficult to easily afford them. Moreover, these building materials require certain specific compositions to obtain desired properties.

Paver block paving is versatile, aesthetically attractive, functional, and cost effective and requires little or no maintenance if correctly manufactured and laid. Most concrete block paving constructed in India also has performed satisfactorily but two main areas of concern are occasional failure due to excessive surface wear, and variability in the strength of block.

Plastic is innovative material for using it in construction purposes. Plastic application is related with their special properties, low density, easy processing, good mechanical properties, good chemical resistance, excellent thermal and electrical insulting properties and low cost. Plastic is also one of the recent engineering materials which have appeared in the market all over the world. It is a material consisting of a wide range of synthetic or semi-synthetic organic compounds that are malleable and can be molded into solid objects.

By definition, plastics can be made to different shapes when they are heated. It exists in the different forms such as cups, furniture, basins, plastic bags, food and drinking containers and they become waste material. Accumulation of such wastes can result into hazardous effects to both human and plant life. Therefore, need for proper disposal, and if possible, use of these wastes in their recycled forms arises.

Plastic waste is increasing day by day throughout the world. Where proper garbage collection system is not available, waste plastics are strewn everywhere which becomes eyesore. It also pollutes the environment. A large amount of waste plastic is discarded or burned which leads to the contamination of environment and air. The large volume of materials required for infrastructure construction is potentially a major area for the reuse of waste materials. Recycling the plastics has advantages since it is widely used worldwide and has a long service life, which means that the waste is being removed from the waste stream for a long period. Reuse of waste plastics has environmental benefits not only related to the safe disposal of bulk waste, but also to the reduction of environmental impacts that arises due to burning of plastics.

The present research is performed to study the properties of paver block manufactured by mixing fine & coarse aggregate and waste plastics. This study is expected to provide some information regarding the suitability of such plastic paver blocks for use in construction industry.

Domain 6: Other

Sr. No	Name of the course that include experiential learning through Project work/ Internship	Subject Code	Domain
1	Applied Mathematics-III	BECVE301	Other
2	Communicative English & Technical Writing	BECVE506P	
3	Site Visit & Mini Project	BECVE606P	
4	Industrial Case Study and Project Seminar	BECVE706P	
5	Construction Economics and Finance	BECVE804T	
6	Project	BECVE805P	

INDUSTRIAL CASE STUDY & PROJECT SEMINAR

BECVE706P **Evaluation Scheme: (50-Internal/50-External) (P-3 Hrs /Week); Total Credits-3**

Industrial Case Study

The student is expected to prepare Mini project report on the basis of data collected in Summer Training (ST-2) of 3 / 4 Weeks and submit detailed report .

Project & Seminar

This includes preparation of preliminaries for the project work to be under taken in 8th Semester.

1. Finalizing the title of the Project .
2. Literature Survey
3. Collection of Data
4. Scope of the project

Each group shall deliver seminar on the work done during the semester. In addition student will deliver one more seminar on the topic finalized by him with the consent of his guide.

INDUSTRIAL CASE STUDY REPORT ON MATERIALS TESTING AND DESIGN OF MIXES IN GOLDCRETE RMC PLANT AT

"GOLDCRETE READY MIX CONCRETE PLANT, MIDC HINGNA NAGPUR"

Submitted for the fulfilment of the requirement for the award of

the degree of

BACHELOR OF ENGINEERING

IN

CIVIL ENGINEERING

OF RTMNU NAGPUR UNIVERSITY ,

Submitted by-

1.VAIBHAV SAMRIT (32)

2.GAJANAN TODETI (38)

3.RAHUL MESHRAM (26)

4. ANIKET GAYAKWAD (18)

5.ASHWIN LOKHANDE (20)

GUIDED BY

Mr. Vikash Agrawal

Asst. Professor

Dept. of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING

PRIYADARSHINI COLLEGE OF ENGINEERING

NAGPUR

2019-20

PRIYADARSHINI COLLEGE OF ENGINEERING, NAGPUR
DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE

This is to certify that **RAHUL MESHRAM ,**VII semester B. E. Civil Engineering of Priyadarshini College of Engineering , Nagpur has successfully completed the summer internship/ industrial case study at **Goldcrete RMC plant MIDC, Hingna** and submitted the report on **"MATERIALS TESTING AND DESIGN OF MIXES IN GOLDCRETE RMC PLANT"** as a part of fulfillment of of the requirement for the award of the degree of bachelor of engineering in civil engineering of RTMNU NAGPUR UNIVERSITY , NAGPUR under the guidance of Mr. Vikas Aggarwal (Asst. Professor) during the academic year 2019-2020.

Mr. Vikash Agrawal
Guide
Asst. Professor , Civil Dept.
PCE, Nagpur.

Mr. Vishal Ghutke
Co-ordinator
Asst. Professor, Civil Dept.
PCE, Nagpur.

Dr. S.A. Dhale
Vice Principal
H.O.D. Civil Dept.
PCE, Nagpur.

1. INTRODUCTION

1.1 WHAT IS A READY MIX CONCRETE

- Ready-mix concrete, or RMC as it's also known, refers to concrete that is specifically batched or manufactured for customers' construction projects, and supplied to the customer on site as a single product. It is a mixture of Portland or other cements, water and aggregates: sand, gravel, or crushed stone.

- Ready-mix concrete is often used over other materials due to the cost and wide range of uses in building, particularly in large projects like high rise buildings and bridges. It has a long life span when f 30 years under high traffic areas.compared to other products of a similar use, like road ways. It has an average life span o

1.2 WHAT IS MEANT BY R.M.C. PLANT

Ready mixed concrete refers to concrete that is batched for delivery from a central mixing plant instead of being mixed on the job site. Each batch of ready-mixed concrete is tailor-made according to the specifications of the contractor or concrete mix design and is delivered to the site in green or plastic condition, usually in the cylindrical trucks often known as "Transit mixers". Concrete constituents occupy a large space for storage at construction site. Further, the builder has to spend a lot of time and effort to source these materials and test their quality before use. Ready Mixed Concrete (RMC) suppliers take care to collect and store all these materials and supply the required quantity of concrete at the specified time and place so that construction can proceed smoothly. Metropolitan Cities are hard-pressed for Storage Space. Therefore, RMC greatly relieves the space problem. RMC is a specialized material in which the cement aggregates and other ingredients are weigh-batched at a plant in a central mixer or truck mixer, before delivery to the construction site in a condition ready for placing by the builder. Thus, `fresh' concrete is manufactured in a plant away from the construction site and transported within the requisite journey time.