DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,BHOPAL

SCHEME OF STUDIES & EXAMINATIONS (IMPLEMENTED FROM SESSION : JULY 2023)

SCHEME	NAME OF BRANCH	BRANCH CODE	SEMESTER
OCBC JULY 2022/2023	CIVIL ENGINEERING	C03	FIFTH (V)

S.N.	PAPER CODE	SUBJECT CODE	SUBJECT NAME	THEORY COMPONENT								PRACTICAL COMPONENT					TOTAL CREDITS	TOTAL MARKS
				HRS PER WEEK	CREDITS	TERM WORK				THEORY PAPER		HRS PER WEEK	CREDITS	LAB WORK	PRACTICAL EXAM/VIVA			
						QUIZ/ASSIGNMENT	MID TERM TEST*		TOTAL	MARKS	DURATION				MARKS	DURATION		
							I	II										
1	7380	501	DESIGN OF STEEL AND RCC STRUCTURES	4	4	10	10	10	30	70	03 Hrs.	6	3	20	30	03 Hrs.	7	150
2	7381	502	ESTIMATING AND COSTING	3	3	10	10	10	30	70	03 Hrs.	6	3	20	30	03 Hrs.	6	150
3	7382	511	TRAFFIC ENGINEERING OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7383	512	SOLID WASTE MANAGEMENT															
4	7384	521	PAVEMENT DESIGN AND MAINTENANCE OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7385	522	GREEN BUILDING AND ENERGY CONSERVATION															
5	7601	531	RENEWABLE ENERGY TECHNOLOGIES OR	3	3	10	10	10	30	70	03 Hrs.	0	0	0	0	0	3	100
	7602	532	INTERNET OF THINGS															
6			SUMMER INTERNSHIP-II**	0	0	0	0	0	0	0	0	0	3	20	30	03 Hrs.	3	50
7			MAJOR PROJECT***	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
8			RECOVERY CLASSES/LIBERARY etc.	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0
TOTAL				16	16				150	350		20	9	60	90		25	650

NOTE - (1)* Two Best, out of Three Mid Term Tests (Progressive Tests) Marks should be entered here.

(2)** 4-6 Weeks Summer Internship after IV Semester.

(3)***One Credit will be carried forward to the Six semester major project evaluation.

GRAND TOTAL OF CREDITS	GRAND TOTAL OF MARKS
25	650

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	DESIGN OF STEEL AND RCC STRUCTURES
PAPER CODE	:	7380
SUBJECT CODE	:	501
TREORY CREDITS	:	04
PRACTICAL CREDITS	:	03

Course Objectives:

Following are the objectives of this course:

- To learn the concept of limit state design for tension and compression steel members.
- To learn the concept of limit state design of steel beams.
- To understand design of RCC elements.
- To know the design of short and long RCC columns.

Course Content:

Unit – I Design of Steel Tension and Compression Members (Limit State Method)

- Types of sections used for Tension members.
- Strength of tension member by- yielding of section, rupture of net cross-section and block shear.
- Design of axially loaded single angle and double angle tension members with bolted and welded connections.
- Types of sections used as compression member, Calculation of effective length, Radius of gyration and slenderness ratio, Permissible values of slenderness ratio as per IS 800, Design compressive stress.
- Introduction to built up sections, lacing and battening (Meaning and purpose), Diagrams of single and double lacing and battening system. (No numerical problems).
- Design of axially loaded single and double angle struts connected by bolted and welded connections with gusset plate.

Unit– II Design of Steel beams (Limit State Method)

- Standard beam sections, Bending stress calculations.
- Design of simple I and channel section.
- Check for shear as per IS 800.

Unit– III Design of Reinforced Concrete Beams by Limit State Method

- Concept of Limit state, Stress block diagram, Introduction to singly and doubly reinforced sections, IS 456
- Design of singly reinforced beam, concept of under reinforced, over reinforced and balanced section, Simple numerical problem on ultimate moment of resistance and design of beam section
- Design of doubly reinforced sections, stress and strain diagrams, depth of neutral axis, simple numerical problems on ultimate moment of resistance of reinforced beam, Calculation of A_{st} and A_{sc}.

Unit– IV Shear, Bond and Development length in Design of RCC member

- Nominal shear stress in RCC section, Design shear strength of concrete, Design of shear reinforcement, Minimum Shear Reinforcement, Provisions of IS 456, forms of shear reinforcement
    - Types of bond, Bond stress, check for bond stress, Determination of Development length in tension and compression members and check as per codal provisions, Anchorage value of 90^0 hook, Lapping of bars.
    - Simple numericals on: Shear reinforcement, Adequacy of section for shear.
    - Introduction to serviceability limit state check

Unit– V Design of axially loaded RCC Column

- Definition and classification of column, Limit state of compression members, Effective length of column.
- Provisions of IS 456 for minimum steel, cover, maximum steel, spacing of ties etc.
- Design of axially loaded short column - Square, Rectangular, and Circular only.

Suggested learning resources:

- Shah, V. L., and Gore, V., Limit State Design of Steel Structures, Structures Publications, Pune.
- Dayarathnam P., Design of Steel Structures, S. Chand and Company, Delhi.
- Subramanian N., Design of Steel Structures, Oxford University Press.
- Sairam, K.S., Design of Steel Structures, Pearson Publication, Chennai, Delhi.
- Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune,2014.
- Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
- Krishna Raju, and N. Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
- Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
- Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

Course outcomes:

After competing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel I and Channel sections.
- Design of singly and doubly reinforced RCC beam.
- Design of RCC beam for shear and development length.
- Design of short and long RCC columns.

DESIGN OF STEEL AND RCC STRUCTURES LAB

Course Objectives:

Following are the objectives of this course:

- To learn the concept of limit state design of tension and compression steel members.
- To understand design of steel beams.
- To learn the concept of limit state design of RCC beams.
- To know the limit state design of RCC columns.

List of Practical to be performed:

1	Draw any five commonly used rolled steel sections and five built up sections.
2	Summarize the provisions of IS 800 required for the design of tension member in report form.
3	Compile relevant clauses from IS 800 required for the design of a compression member and submit it in report form.
4	Draw sketches for single & double lacing of given built up columns.
5	Draw sketches for battening of given built up columns.
6	Prepare a report on the IS 800 provisions pertaining to design of lacing & battening along with its significance.
7	Draw cross section, strain diagram & stress diagram for singly reinforced section.
8	Draw cross section, strain diagram & stress diagram for doubly reinforced section.
9	Design simply supported I section steel beam for udl.
10	Design beams section for shear as per IS 800 provisions.
11	Draw sketches of different types of column footings.
12	Interpret the actual RCC Structural Drawings used on site with reference to reinforcement details of various structural elements.
13	Prepare a checklist for reinforcement provided from actual drawings used on site for various structural elements.
14	Prepare a detailed report of site visit for reinforcement detailing of structural elements like beams, columns, staircase & footing.
15	Prepare a detailed report of site visit for study of rolled steel tension & compression members used in various structures.

Suggested learning resources:

1. Shah, V. L., and Gore, V., Limit State Design of Steel Structures, Structures Publications, Pune.
2. Dayarathnam, P., Design of Steel Structures, S. Chand and Company, Delhi.
3. Subramanian N., Design of Steel Structures, Oxford University Press.
4. Sairam, K.S., Design of Steel Structures, Pearson Publication, Chennai, Delhi.
5. Shah, V. L., and Karve, S.R., Limit State Theory and Design of Reinforced Concrete Structures, Structures Publications, Pune,2014.
6. Sinha N.C., and Roy S.K., Fundamentals of Reinforced Concrete, S. Chand & Co., New Delhi.
7. Krishna Raju, and N.Pranesh, R.N., Reinforced Concrete Design Principles and Practice, New Age International, Mumbai.
8. Pillai, S.U., and Menon, Devdas, Reinforced concrete Design, McGraw Hill Publications, New Delhi.
9. Varghese, P. C., Limit State Design of Reinforced Concrete, Prentice Hall India Learning Private Limited, Delhi.

Course outcomes:

After competing this course, student will be able to perform:

- Design of steel tension and compression member.
- Design of steel beams including check for shear.
- Design of singly and doubly reinforced RCC beam.
- Design of shear reinforcement in RC beams.
- Design of RCC column as per IS 456.

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	ESTIMATING AND COSTING
PAPER CODE	:	7381
SUBJECT CODE	:	502
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	03

Course Objectives:

Following are the objectives of this course:

- To learn the procedure for estimating and costing of Civil Engineering works.
- To perform rate analysis for different items associated with construction projects.
- To use software for detailed estimate related to civil infrastructural projects.

Course Content

Unit – I Fundamentals of Estimating and Costing

- Estimating and Costing – Meaning, purpose, Administrative approval, Technical Sanction and Budget provision.
- Types of estimates – Approximate and Detailed estimate.
- Types and Uses of Estimates: Revised estimate, Supplementary estimate, Repair and maintenance estimate, renovation estimate.
- Roles and responsibility of Estimator.
- Checklist of items in load bearing and framed structure.
- Standard formats of Measurement sheet, Abstract sheet, Face sheet.
- Modes of measurement and desired accuracy in measurements for different items of work as per IS:1200.
- Rules for deduction in different category of work as per IS:1200.
- Description / specification of items of building work as per PWD /DSR.

Unit– II Approximate Estimates

- Approximate estimate- Definition, Purpose.
- Methods of approximate estimate - Service unit method, Plinth area rate method, Cubical content method, Typical bay method, Approximate quantity method (with simple numericals)
- Approximate estimate for roads, Railways, bridges/culvert, irrigation projects and water supply projects.

Unit– III Detailed Estimate

- Detailed Estimate- Definition and Purpose, Data required for detailed estimate - Civil cost, GST, Contingencies, Supervision charges, Agency charges, Procedure for preparation of detailed estimate- Taking out quantities and Abstracting.
- Methods of Detailed Estimate- Unit quantity method and total quantity method (with simple numericals)
- Long wall and Short wall method, Centre line method.

- Bar bending schedule for footing, column, beam, Lintel, chajja and slab elements
- Provisions in detailed estimate: contingencies, work charged establishment, percentage charges, water supply and sanitary Charges and electrification charges etc.
- Prime cost, Provisional sum, Provisional quantities, Bill of quantities, Spot items or Site items.

Unit– IV Estimate for Civil Engineering Works

- Earthwork - Quantities for roads, Embankment and canal by – Mid sectional area method, mean sectional area method, Prismoidal and trapezoidal formula method.
- Detailed estimate for septic tank, Community well.
- Use of computer /softwares / programmes for detailed estimate Preparation of Civil Engineering Works.

Unit– V Rate Analysis

- Rate Analysis: Definition, purpose and importance.
- Lead (Standard and Extra), lift, overhead charges, water charges and contractors' profit,
- Procedure for rate analysis.
    - Task work- Definition, types. Task work of different skilled labour for different items.
    - Categories of labours, their daily wages, types and number of labours for different items of work.
    - Transportation charges of materials - Lead and Lift, Hire charges of machineries and equipments.
    - Preparing rate analysis of different items of work pertaining to buildings and roads.

Suggested learning resources

1. Datta, B.N., Estimating and Costing in Civil engineering, UBS Publishers Distributors Pvt. Ltd. New Delhi.
2. Peurifoy,Robert L. Oberlender,Garold, Estimating construction cost (fifth edition), McGraw Hill Education, , New Delhi.
3. Rangwala,S.C., Estimating and Costing, Charotar Publishing House PVT. LTD., Anand.
4. Birdie,G.S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd. New Delhi.
5. Patil,B.S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai.
6. Chakraborti,M., Estimating and costing, specification and valuation in civil engineering, Monojit Chakraborti, Kolkata.
7. PWD Schedule of Rates.
8. Ministry of Road Transport and Highways (MORT&H) Specifications and Analysis of Schedule of Rates.
9. Manual of Specifications and Standards for DBFOT projects, EPC works.

Course outcomes:

After competing this course, student will be able to:

- Select modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Use relevant software for estimating the quantities and cost of items of works.
- Justify rate for given items of work using rate analysis techniques.

ESTIMATING AND COSTING LAB

Course Objectives:

Following are the objectives of this course:

- To learn the procedure for estimating and costing of Civil Engineering works.
- To perform rate analysis for different items associated with construction projects.
- To use software for detailed estimate related to civil infrastructural projects.

List of Practical to be performed:

1	Prepare the list of items to be executed with units for detailed estimate of a given structure from the given drawing.
2	Prepare a report on market rates for given material, labour wages, hire charges of tools & equipments required to construct the given structure as mentioned in at Serial number 1 above.
3	Study of items with specification given in the DSR (for any ten item)
4	Recording in Measurement Book (MB) for any four items
5	Prepare bill of quantities of given item from actual measurements. (any four items).
6	Prepare approximate estimate for the given civil engineering works.
7	Calculate the quantity of items of work from the given set of drawings using standard measurement sheet for load bearing residential structure using description of item from DSR (1BHK Building with staircase).
8	Prepare detailed estimate from the given set of drawings using "standard measurement and abstract format" for RCC framed structure using description of item from DSR along with face sheet and prepare quarry chart, lead statement (G+1 Building) .
9	Calculate the reinforcement quantities from the given set of drawings for a room size of 3 m X 4 m with bar bending schedule (footing, column, beam, lintel with chajja, slab)
10	Prepare rate analysis for the given five item of works.
11	Prepare detailed estimate of road of one kilometre length from the given drawing.
12	Prepare detailed estimate of small Septic tank from the given set of drawings.
13	Prepare detailed estimate of well from the given set of drawing.
14	Use the relevant software to prepare detailed estimate of a Road.
15	Use the relevant software to prepare detailed estimate of a residential building.

Suggested learning resources:

1. Datta, B.N., Estimating and Costing in Civil engineering, UBS Publishers Distributors
2. Peurifoy, Robert L. Oberlender,Garold, Estimating construction cost (fifth edition), McGraw Hill Education, , New Delhi.
3. Rangwala,S.C., Estimating and Costing, Charotar Publishing House, Anand.
4. Birdie,G.S., Estimating and Costing, Dhanpat Rai Publishing Company(P) Ltd. Delhi.
5. Patil,B.S., Civil Engineering Contracts and Estimates, Orient Longman, Mumbai.
6. Chakraborti,M., Estimating and costing, specification and valuation in civil engineering, Monojit Chakraborti, Kolkata.

7. PWD Schedule of Rates.
8. Ministry of Road Transport and Highways (MORT&H) Specifications and Analysis of Schedule of Rates.
9. Manual of Specifications and Standards for DBFOT projects, EPC works.

Course outcomes:

After competing this course, student will be able to:

- Select modes of measurements for different items of works.
- Prepare approximate estimate of a civil engineering works.
- Prepare detailed estimate of a civil engineering works.
- Use relevant software for estimating the quantities and cost of items of works.
- Justify rate for given items of work using rate analysis techniques.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	TRAFFIC ENGINEERING
PAPER CODE	:	7382
SUBJECT CODE	:	511
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To understand the issues involved in traffic flow.
- To know and understand the tools for traffic studies.
- To delineate various traffic control measures.
- To understand measures for preventing accidents.

Course Content:

Unit – I Fundamentals of Traffic Engineering.

- Traffic engineering- Definition, objects, scope
- Relationship between speed, volume and density of traffic
- Road user's characteristics-physical, mental, emotional factors.
- Vehicular characteristics-width, length, height, weight, speed, efficiency of breaks.
- Road characteristics - gradient, curve of a road, design speed, friction between road and tyre surface.
- Reaction time - factors affecting reaction time. PIEV Theory.

Unit– II Traffic Studies

- Traffic volume count data- representation and analysis of data.
- Necessity of Origin and Destination study and its methods.
- Speed studies - Spot speed studies, and its presentation.
- Need and method of parking study.

Unit– III Road Signs and Traffic Markings

- Traffic control devices –definition, necessity, types.
- Road signs - definition, objects of road signs.

- Classification as per IRC: 67-Mandatory or Regulatory, Cautionary or warning, informatory signs, Location of cautionary or warning sign in urban and non-urban areas, Points to be considered while designing and erecting road signs.
- Traffic markings- definition, classification, carriage way, kerb, object marking and reflector markers.

Unit– IV Traffic Signals and Traffic Islands

- Traffic signals- Definition, Types, Traffic control signals, pedestrian signals.
- Types of traffic control signals - Fixed time, manually operated, traffic actuated signals and location of signals.
- Compute signal time by fix time cycle, Webster's and IRC method and sketch timing diagram for each phase.
- Traffic islands –Definition, advantages and disadvantages of providing islands.
- Types of traffic islands - rotary or central, channelizing or Refuge Island.
- Road intersections or junctions - Definition, Types of road intersection.
- Intersection at grade- Types, basic requirements of good intersection at grade.
- Grade separated intersection- advantages and disadvantages, types - flyovers-partial and full Cloverleaf pattern, Diamond intersection, Trumpet type, underpass.

Unit– V Road Accident Studies and Arboriculture

- Road Accidents-Definition, types and causes for collision and non-collision accidents.
- Measures to prevent road accidents.
- Collision and condition diagram.
- Street lighting –definition, necessity, types-luminaire, foot candle, lumen, factors affecting their utilization and maintenance.
- Arboriculture- definition, objectives, factors affecting selection of type of trees.
- Maintenance of trees-protection and care of road side trees.

Suggested learning resources:

1. Khanna S.K., Justo, C E G and Veeraragavan, A., Highway Engineering, Nem Chand and Brothers, Roorkee.
2. Kadiyali L.R., Transportation Engineering, Khanna Book Publishing Co., Delhi
3. Vazirani, V N , Chaondola, S P, Transportation Engineering Vol. I & II, Khanna Publishers. Delhi.
4. Saxena, S C, Traffic planning and design, Dhanpat Rai & Sons Delhi.
5. Kumar R S, Introduction to Traffic Engineering, University Press (India), Pvt. Ltd.

Course outcomes:

After competing this course, student will be able to:

- Analyze road traffic characteristics.
- Undertake various types of road traffic studies.
- Use relevant road traffic signs, signal and markings.
- Identify the intersection depending on the traffic flow.
- Suggest preventive measures to avoid accidents by analyzing the traffic conditions at site.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	SOLID WASTE MANAGEMENT
PAPER CODE	:	7383
SUBJECT CODE	:	512
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To know various sources of solid.
- To learn techniques of collection and transportation of solid waste.
- To know various methods of disposal of solid waste.
- To understand and identify different biomedical and E-waste and their subsequent disposal techniques.

Course Content:

Unit – I Introduction

- Definition of solid waste, different solid waste – domestic Waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc.
- Sources of solid waste, Classification of solid waste – hazardous and non- hazardous waste.
- Physical and chemical characteristics of municipal solid waste.

Unit– II Storage, Collection and Transportation of Municipal Solid Waste

- Collection, segregation, storage and transportation of solid waste.
- Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable and stationary bin.
- Transportation vehicles with their working capacity -Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station- meaning, necessity, location.
- Role of rag pickers and their utility for society.

Unit– III Composting of Solid Waste

- Concept of composting of waste, Principles of composting process. Factors affecting the composting process.
- Methods of composting – Manual Composting – Bangalore method, Indore Method, Mechanical Composting – Dano Process, Vermi composting.

Unit IV Techniques for Disposal of Solid Waste

- Solid waste management techniques – solid waste management hierarchy, waste prevention and waste reduction techniques
- Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste

- Incineration of waste: Introduction of incineration process, Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste – Definition, Methods

Unit– V Biomedical and E-waste management

- Definition of Bio medical Waste.
- Sources and generation of Biomedical Waste and its classification
- Bio medical waste Management technologies.
- Definition, varieties and ill effects of E- waste,
- Recycling and disposal of E- waste.

Suggested learning resources:

1. Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co., Delhi Ed. 2018
2. Bhide, A. D., Solid Waste Management, Indian National Scientific Documentation Centre, New Delhi.
3. George Techobanoglous, Kreith, Frank., Solid Waste, McGraw Hill Publication, New Delhi.
4. Sasikumar, K., Solid Waste Management, PHI learning, Delhi.
5. Hosetti, B.B., Prospect and Perspectives of Solid Waste Management, New Age International Publisher.

Course outcomes:

After competing this course, student will be able to:

- Identify the sources of solid waste.
- Select the relevant method of collection and transportation of solid waste.
- Suggest an action plan for composting of solid waste.
- Devise suitable disposal technique for solid waste
- Use the relevant method for disposal of Bio-medical and E-waste.

DIPLOMA WING
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DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	PAVEMENT DESIGN AND MAINTENANCE
PAPER CODE	:	7384
SUBJECT CODE	:	521
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To know types of pavements and their uses.
- To learn issues in design of flexible and rigid pavements.
- To understand methods of pavement evaluation.
- To learn pavement maintenance methods.

Course Content:

Unit – I Basics of pavement Design

- Types of pavement - Flexible, Rigid and Semi Rigid
- Comparison of Rigid and flexible pavement according to Design precision, life maintenance, initial cost, stages of construction, availability of materials, surface characteristic, penetration of water in the pavement, utility location, glare and night visibility.
- Functions and characteristics of pavement.
- Factors affecting selection of type of pavement.

Unit– II Fundamentals of pavement design

- Factors affecting pavement design-design wheel load ,Traffic factors, Environmental factors, Road geometry and material, Characteristics of soil and Drainage situation.

Unit– III Design overview of Flexible and Concrete pavement

- Methods of flexible pavement design-Theoretical method, Empirical method with and without soil strength test.
- IRC37 guidelines for design of flexible pavement (overview only)
- Factors affecting design of concrete pavement.
- IRC58 guidelines for design of concrete pavement (overview only)
- Joints-Need, Types, requirements, spacing of joints
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Unit– IV Pavement evaluation

- Definition and purpose of pavement evaluation
- Methods of Pavement evaluation –Visual rating, Pavement serviceability index, Roughness measurements, Benkelman Beam deflection method

Unit V - Pavement Maintenance

- Types of pavement maintenance - routine, periodic, and special. Need for inspection and maintenance schedule. Causes of pavement failure and remedial measures. Typical flexible and rigid pavement failures
- Types and causes of damages in flexible pavement, surface defects, cracks. Deformations - Rutting, fatigue, settlement and upheaval. Disintegration- loss of aggregate, stripping, pot-hole. Remedial measures - slurry seal, liquid seal, fog seal, patching, ready mix patch.
- Types of damages to rigid pavement - cracking, spalling, slab rocking, settlement, joint sealant failure. Methods of repair - repair of spalled joints, full depth reconstruction, replacement of dowel bars.

Suggested learning resources

1. Kadiyali, L.R., Highway Engineering, Khanna Book Publishing House, New Delhi
   (ISBN: 978-93-86173-133)
2. Chakroborty, Partha Das, Animesh., Principles of Transportation engineering, Prentice-Hall of India Pvt.Ltd
3. Vazirani, V N, Chaondola, S P., Transportation Engineering Vol. I & II, Khanna Publishers. Delhi
4. Yoder, E J, Principles of Pavement Design, Wiley India Pvt Ltd.
5. Bindra, S P., Highway Engineering, Dhanpat Rai Publications (P) Ltd
6. Kumar R S, Pavement Evaluation and Maintenance Management system, University Press (India), Pvt. Ltd.
7. Sharma S K, Principles, Practice and Design of Highway Engineering, S Chand, New Delhi.

Course outcomes:

After competing this course, student will be able to:

- Identify the components of the given type of pavement.
- Suggest the type of pavement for the given situation.
- Design the flexible pavement using the provisions of IRC
- Design the concrete pavement using the provisions of IRC
- Decide type of maintenance required under different damaged conditions

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	GREEN BUILDING AND ENERGY CONSERVATION
PAPER CODE	:	7385
SUBJECT CODE	:	522
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Objectives:

Following are the objectives of this course:

- To know various aspects of green buildings
- To use different steps involved in measuring environmental impact assessment.
- To relate the construction of green building with prevailing energy conservation policy and regulations.
- To know and identify different green building construction materials.
- To learn different rating systems and their criteria.

Course Content:

Unit I : Introduction to Green Building and Design Features

- Definition of Green Building, Benefits of Green building, Components/features of Green Building, Site selection, Energy Efficiency, Water efficiency, Material Efficiency, Indoor Air Quality.
- Site selection strategies, Landscaping, building form, orientation, building envelope and fenestration, material and construction techniques, roofs, walls, fenestration and shaded finishes, advanced passive heating and cooling techniques, waste reduction during construction
-

Unit–II Energy Audit and Environmental Impact Assessment (EIA)

- Energy AudiT: Meaning, Necessity, Procedures, Types, Energy Management Programs
- Environmental Impact Assessment(EIA): Introduction, EIA regulations, Steps in environmental impact assessment process, Benefits of EIA, Limitations of EIA, Environmental clearance for the civil engineering projects.

Unit– III Energy and Energy conservation

- Renewable Energy Resources: Solar Energy, Wind Energy, Ocean Energy, Hydro Energy, Biomass Energy
- Non-renewable Energy Resources: Coal, Petroleum, Natural Gas, Nuclear Energy, Chemical Sources of Energy, Fuel Cells, Hydrogen, Biofuels.
- Energy conservation: Introduction, Specific objectives, present scenario, Need of energy conservation, LEED India Rating System and Energy Efficiency.

Unit– IV Green Building

- Introduction: Definition of Green building, Benefits of Green building,
- Principles: Principles and planning of Green building
- Features: Salient features of Green Building, Environmental design (ED) strategies for building construction.
- Process: Improvement in environmental quality in civil structure

- Materials: Green building materials and products- Bamboo, Rice husk ash concrete, plastic bricks, Bagasse particle board, Insulated concrete forms. reuse of waste material-Plastic, rubber, Newspaper wood, Nontoxic paint, Green roofing

Unit V Rating System

- Introduction to (LEED) criteria,
- Indian Green Building council (IGBC) Green rating,
- Green Rating for Integrated Habitat Assessment. (GRIHA) criteria
- Heating Ventilation Air Conditioning (HVAC) unit in green Building
- Functions of Government organization working for Energy conservation and Audit(ECA)-
- National Productivity council(NPC)
- Ministry of New and Renewable *Energy* (MNRE)
- Bureau of Energy efficiency (BEE)

Suggested learning resources:

1. Kibert, C.J., Sustainable construction: Green Building design and Delivery, John Wiley Hobo-u ken, New Jersey.
2. Chauhan, D S Sreevasthava, S K., Non-conventional Energy Resources, New Age International Publishers, New Delhi.
3. O.P. Gupta, Energy Technology, Khanna Publishing House, New Delhi
4. Jagadeesh, K S, Reddy Venkatta Rama & Nanjunda Rao, K S., Alternative Building Materials and Technologies, New Age International Publishers, Delhi.
5. Sam Kubba., Handbook of Green Building Design and Construction, Butterworth-Heinemann.
6. Means R S, Green Building - Project Planning and Cost Estimating, John Wiley & Sons
7. Sharma K V, Venkataseshaiah P., Energy Management and Conservation, IK International.

Course outcomes:

After completing this course, student will be able to:

- Identify various requirements for green building.
- Use different steps in environmental impact assessment.
- Relate the construction of green building with prevailing energy conservation policy and regulations.
- Supervise the construction of green building construction using green materials.
- Focus on criteria related to particular rating system for assessment of particular Green building.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	RENEWABLE ENERGY TECHNOLOGIES
PAPER CODE	:	7601
SUBJECT CODE	:	531
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Learning Objectives:

- To understand present and future scenario of world energy use.
- To understand fundamentals of solar energy systems.
- To understand basics of wind energy.
- To understand bio energy and its usage in different ways.
- To identify different available non-conventional energy sources.

Course Content:

UNIT-I: Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.

Unit-II: Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-III: Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-IV: Bio-Energy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-V: Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi, 2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

Course outcomes:

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

CO1	Understand present and future energy scenario of the world.
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems.
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	INTERNET OF THINGS
PAPER CODE	:	7602
SUBJECT CODE	:	532
TREORY CREDITS	:	03
PRACTICAL CREDITS	:	00

Course Content:

Unit I - Introduction to Internet of Things

- Define the term "Internet of Things"
- State the technological trends which have led to IoT.
- Describe the impact of IoT on society.

Unit II - Design consideration of IoT

- Enumerate and describe the components of an embedded system.
- Describe the interactions of embedded systems with the physical world.
- Name the core hardware components most commonly used in IoT devices.

Unit III Interfacing by IoT devices

- Describe the interaction between software and hardware in an IoT device.
- Explain the use of networking and basic networking hardware.
- Describe the structure of the Internet.

SUGGESTED LEARNING RESOURCES:

S. No.	Title of Book	Author	Publication
1	Internet of Things	Raj Kamal	McGraw Hill Education; First edition (10 March 2017) ISBN 978-9352605224
2	internet of Things: A Hands-On Approach	Arsheep Bahge and Vijay Madisetti	Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. https://www.raspberrypi.org/blog/getting-started-with-iot/
2. https://www.arduino.cc/en/IoT/HomePage
3. https://www.microchip.com/design-centers/internet-of-things
4. https://learn.adafruit.com/category/internet-of-things-iot
5. http://esp32.net/

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DIPLOMA WING
RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL
DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	SUMMER INTERNSHIP - II
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	03

SUMMER INTERNSHIP - II

4-6 weeks summer internship after IVth Semester.

It should be undertaken in an Industry only.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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DIPLOMA WING

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

DIPLOMA IN CIVIL ENGINEERING (C03)

SEMESTER V

COURSE TITLE	:	MAJOR PROJECT
PAPER CODE	:	--
SUBJECT CODE	:	--
TREORY CREDITS	:	00
PRACTICAL CREDITS	:	00 (ONE CREDIT WILL BE CARRIED FORWARD TO THE VI SEM. MAJOR PROJECT EVALUATION)

MAJOR PROJECT

It should be based on real/live problems of the Industry/Govt./NGO/MSME/Rural Sector or an innovative idea having the potential of a Startup.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

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