

Master of Technology

Batch: 2014-2016

*Department of
C.E. – Building Science &
Technology*

I to IV Semesters

Course Matrix & Syllabus



School of Engineering and Technology
Jain Global Campus
Jakkasandra Post, Kanakapura Taluk, Ramanagara District
Pin Code: 562 112

JAIN UNIVERSITY

Declared as Deemed-to-be University u/s 3 of the UGC Act 1956

Course Matrix
Department of Civil Engineering
M.Tech. Program in "Building Science and Technology"
I- Semester

Sl. No.	Name of the Subject	Subject Code	Credit	L-T-P	Internal Assessment		End Semester Examinations		Minimum Passing Marks	Total Max. Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks		
1	Environmental and Sustainable Engineering	14BST11	4	4 - 0 - 0	50	25	50	25	50	100
2	Green Technology	14BST12	4	4- 0 - 0	50	25	50	25	50	100
3	Heating Ventilation and Air Conditioning Design (HVAC)- I	14BST13	4	3 - 1 - 0	50	25	50	25	50	100
4	Building Services; Plumbing, Drainage, Lifts, Escalators, and Wiring System	14BST14	4	3 - 1 - 0	50	25	50	25	50	100
5	Building Materials for Sustainable Development	14BST15	3	3- 0 - 0	50	25	50	25	50	100
6	Software Eng. Laboratory	14BSTL16	1	0- 0 - 3	25	13	25	12	25	50
Total (credits)			20		275	138	275	137	275	550

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Course Matrix
Department of Civil Engineering
M.Tech. Program in "Building Science and Technology"
II- Semester

Sl. No.	Name of the Subject	Subject Code	Credit	L-T-P	Internal Assessment		End Semester Examinations		Minimum Passing Marks	Total Max. Marks
					Max. Marks	Min. Marks	Max. Marks	Total Max. Marks		
1	Demolition Methods and Cutting Edge Technology	14BST21	4	4 - 0 - 0	50	25	50	25	50	100
2	Heating, Ventilation and Air Conditioning Design (HVAC) - II	14BST22	4	3 - 1 - 0	50	25	50	25	50	100
3	Carbon Foot Print & Measurement -All Types of Buildings	14BST23	4	3 - 1 - 0	50	25	50	25	50	100
4	Elective - I	14BST241X	3	3 - 0 - 0	50	25	50	25	50	100
5	Elective - II	14BST242X	4	3 - 1 - 0	50	25	50	25	50	100
6	Building Insulation Laboratory	14BSTBSTL25	1	0 - 0 - 3	25	13	25	12	25	50
Total (credits)			20		275	138	275	137	275	550

Elective - I

Sl. No.	Name of the Subject	
1	Modeling of Air and Pollutants Flows in Buildings	14BST2411
2	Global Warming and Cooling	14BST2412
3	Smart Materials for Green Buildings	14BST2413
4	Green Building Policies and Incentives	14BST2414

Elective-II

Sl. No.	Name of the Subject	
1	Project Management System	14BST2421
2	Modern Constructions Methods and Mechanization	14BST2422
3	Utilization of Renewable Energy Sources	14BST2423
4	Applied Sensor Technology	14BST2424

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Course Matrix
Department of Civil Engineering
M.Tech. Program in "Building Science and Technology"
III- Semester

Sl. No.	Name of the Subject	Subject Code	Credit	L-T-P	Internal Assessment		End Semester Examinations		Minimum Passing Marks	Total Max. Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks		
1	Life Cycle Assessment & Materials Selection	14BST31	4	3 - 1 - 0	50	25	50	25	50	100
2	Firefighting & Alarm Systems	14BST32	4	3 - 1 - 0	50	25	50	25	50	100
3	Tropical Housing and Buildings	14BST33	4	3 - 1 - 0	50	25	50	25	50	100
4	Elective - III	14BST341X	4	4 - 0 - 0	50	25	50	25	50	100
5	Elective - IV	14BST342X	4	4 - 0 - 0	50	25	50	25	50	100
Total (credits)			20		250	125	250	125	250	500

Elective-III

Sl. No.	Name of the Subject	Subject Code
		14BST341X
1	Building Rating Systems with Case Studies	14BST3411
2	Retrofitting of Buildings	14BST3412
3	Green Architecture for Sustainable Engineering	14BST3413

Elective-IV

Sl. No.	Name of the Subject	Subject Code
		14BST342X
1	Resource Management	14BST3421
2	Design of Energy Efficient and Healthy Buildings	14BST3422
3	Water Conservation Practices in Buildings	14BST3423

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Course Matrix
Department of Civil Engineering
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IV- Semester

Sl. No.	Name of the Subject	Subject Code	Credit	L-T-P	Internal Assessment		End Semester Examinations		Minimum Passing Marks
					Max. Marks	Min. Marks	Max. Marks	Min. Marks	
1	Project Work with Case Studies	14BST41	20	0 - 0 - 0	100	50	400	200	250
Total			20		100	50	400	200	250

Total credits=20+20+20+20=80

Date:

Head of the Department

Master of Technology

*C.E. – Building Science &
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I

Semester Syllabus

Environmental and Sustainable Engineering

Subject Code: 14BST11

Credits: 04

Total No of Hrs: 60

Hours per week: 04

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. Environment and Development** **08 Hrs**
Challenges and efforts, Sustaining life support systems, land degradation water management, urbanization and industrialization, conservation of bio-diversity. Agenda21, Declaration at earth summit, Dunkel draft, a forestation, sustainable mechanism, clean development mechanism.
- 2. Air and Water Pollution** **07 Hrs**
Environmental pollutants, kinds of pollution, Acid rains, measurement of air quality, control of air pollution, sources of water pollution, Ground water pollution marine pollution, Heavy metal pollution, measurement of water quality, wet land conservation.
- 3. Environmental monitoring and Impact Assessment** **08 Hrs**
Different methods of environmental monitoring, impact assessment and strategic management. Application to residential buildings, industrial complexes, and other sectors.
- 4. Environmental Law** **07 Hrs**
Challenges in implementing environment law, Indian environmental law and national policy.

PART - B

- 5. Sustainability metrics:** **08 Hrs**
Systems analysis approaches – life cycle analysis, simulation models, risk based models, Measures of sustainability, indicators and different types societal change, sustainable developments.
- 6. Industrial Energy Usage:** **07 Hrs**
Lifecycle analysis and design for sustainability – Different types of industries, Issues on sustainable engineering
- 7. Commercial and Residential Buildings** **08 Hrs**
Lifecycle analysis for Residential building design, commercial buildings, indoor air quality assessment
- 8. Synergetic Complex Systems** **07 Hrs**
Complex systems view, decision analysis techniques, case studies,

Text Books:

1. Sustainable energy by choosing options Jefferson W.T etal (2005), P H, learning pvt Ltd New Delhi-11000

Green Technology

Subject Code: 14BST12

Credits: 04

Total No of Hrs: 60

Hours per week: 04

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

1. Concept of Green Buildings:

Green building initiatives, its origin, characteristics of a green building, green buildings in India, certification of green buildings rating systems (BREEAM, USGBC, LEED, IGBC, TERI-GRIHA,) criteria for rating, sustainability.

08 Hrs

2. Sources of Energy:

Renewable and non renewable sources of energy ; coal, petroleum, nuclear, wind, solar, hydro, geothermal sources; potential of these sources, hazards, pollution; global scenario with reference to demand and supply in India. Energy arises

07 Hrs

3. **Carbon Emission:** Forecasting, control of carbon emission, air quality and its monitoring carbon foot print; environmental issues, minimizing carbon emission.

08 Hrs

4. **Green Building Materials:** Depleting natural resources of building materials; renewable and recyclable resources; energy efficient materials; green cement, biodegradable materials, smart materials, engineering evaluation of these materials.

07 Hrs

PART - B

5. **Green Building Planning and Specifications** for green buildings

08 Hrs

6. **Design of Green Buildings;** Sustainable sites, impact of building on environment, life cycle assessment. Design on Bioclimatic and solar passive architecture, considerations of energy consumption, water use, and system reliability, indoor air quality, noise level, comfort, cost efficiency in building design.

07 Hrs

7. **Construction of Green Buildings:** Energy efficient construction, practices for thermal efficiency and natural lighting. Eco- friendly water proofing; ECB codes building rating, maintenance of green buildings.

08 Hrs

8. **Case studies** of residential and commercial green buildings

07 Hrs

Text Books:

1. Tropical housing and buildings climate design (1973). By Koenig's Berger Ltd, ingeesle, T-G Alan mayhew, s zokoloy S.v University press (India) pot-Ltd Hyderabad.

Heating Ventilation and Air conditioning Design 1(HVAC Design 1)

Subject Code: 14BST13

Total No of Hrs: 60

Credits: 04

Hours per week: 04

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

1. Scope and uses of airconditioning: Components of Airconditioning Human comfort- Comfort Standards-Organizational flow chart building planning and design team and building construction team Licencing-
Physical principles-US and SI systems pressure-work-power and energy-First law of thermodynamics-Properties of liquid, vapours and change of state-Energy utilization (second law of thermodynamics)

08 hrs

2. Heating Loads: Basics of heat transfer-Overall heat transfer-Different types of heat loads-Summary of heat load calculation procedures.

Hydronic piping systems and terminal units: Different types of piping arrangements 2 pipe 3 pipe 4 pipe unit heaters and fan coil units-system design procedures.

07 Hrs

3. Cooling Load calculations: The various components of cooling load through the structure internal loads, ventilation, ducts and related areas-Residential cooling load

Psychrometrics –Air-conditioning processes and analysis of the air conditioning system

08 Hrs

4. Fluid Flow in piping and ducts-piping, valves, ducts and insulation: Design of piping systems and duct systems as applied to air conditioning

07 Hrs

PART - B

5. Fans and distribution devices: design of distribution system

08 Hrs

6. Centrifugal pumps, expansion devices and venting: Design of pressure drop in the closed piping systems and selection of pumps.

07 Hrs

7. Air-conditioning systems and equipments: Zoning of air conditioned area-VAV systems- Room units- Unitary air conditioner- Roof top units- Air handling units-Air cleaning devices-Air Energy conservation

08 Hrs

8. Refrigeration systems: Types of compressors-Flow control devices-safety controls-Package refrigeration unit-Chillers Selection-cooling towers

07 Hrs

Automatic control systems, instrumentation testing and balancing

Design of chilled water system, pump selection, pipe sizing, ducting, selection of terminal devices as international standards and codes of practice with relevant IS codes, ASHRAE standards

References:

1. Carrier Hand Book Trane manual on design HVAC systems ASHRAE standards
2. Air-conditioning Principles and systems, PHI Learning Private Limited

Building Services

Subject Code: 14BST14

Credits: 04

Total No of Hrs: 60

Hours per week: 04

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. Introduction**-Importance and necessity, municipal requirement,
Water demands- various types of water demands -Factors affecting losses and wastes, Design periods **08 hrs**
- 2. Design of pipe systems**, materials of pipes, Layout of water supply pipes, Testing of the water mains (pipe lines) **07 Hrs**
- 3. Design of Pumps**- Calculation of pressure losses in piping systems , Selection of pumps, Economic design and selection of pipe lines **08 Hrs**
- 4. Quality control of municipal and industrial water supplies, Purification of water supplies** **07 Hrs**

PART - B

- 5. Distribution System**-Design of distribution system for a lay out and its analysis **08 Hrs**
- 6. Water Supply Plumbing systems in Buildings and Houses**-Hot water appliances and installations-Design calculations-solar water heaters, centralized systems **07 Hrs**
- 7. Design of swimming pools** **08 Hrs**
- 8. Drainage**- Design of drainage systems using IS standards and BS standards for all types of building residential commercial, malls, and five star hotels. Recycling of waster using waste water treatment plants. **07 Hrs**

The design, installation, commissioning of the plumbing and the drainage will be based on the international standard, BS, AS and IS standards using relevant codes of practice.

References:

1. Water Supply and Waste disposal, G.M.Fair &JC Geyer John Wiley and sons, New York.
2. Public Health engineering, E.B Phelps &CJ Velj John Wiley and sons, New York.
All relevant IS codes and BS Codes of practice

Building Materials for Sustainable Development

Subject code: 14BST15

Credits: 03

Total No of Hrs: 45

Hours per week: 03

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit-1 Introduction: Alternate Building, Materials for sustainability, new techniques such as masonry with dry mortar pre cost light weight panels.

05 Hrs

Unit-2 Embodied energy of different construction materials, like brick concrete wall glass and other metallic building materials

06 Hrs

Unit-3 High performance metallic building materials and plastics, admixtures

06 Hrs

Unit-4 Role of self-compacting concrete in sustainable engineering, construction of multi storied complexes, flyovers metro rail and other civil engineering infrastructures.

05 Hrs

PART - B

Unit-5 Sustainable flooring- residential complexes industrial buildings shopping complexes

05 Hrs

Unit-6 Corrosion inhibitors and corrosion control design: different types of sacrificial anode system design, anode output anode configuration.

06 Hrs

Unit-7 Organic paints: different types of organic paints for application of different types of buildings and civil engineering infrastructure.

06 Hrs

Unit-8 Nondestructive testing of materials and components: evaluation of strength and strain characteristics of materials in as is varies condition and components of buildings, non destructive evaluation of various engineering parameters.

06 Hrs

Text Book: Sustainable energy by choosing options Jefferson W.T etal (2005) P H, learning Pvt. Ltd New Delhi-1100

Software Engineering Laboratory

Sub code: 14BSTL16

Credit: 01

0-0-3 3hrs/week

No. of weeks: 15

1. Application of various softwares like STAAD, Auto cad, E20 in the design and evaluation of different types of Buildings.
08 classes
2. Analysis of planning, drainage system for buildings using above softwares.
07 classes

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II

Semester Syllabus

Demolition and Cutting Edge Technology

Subject Code: 14BST21

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit 1: Introduction:

8 hrs

Scope of Demolition work-health and safety responsibilities in relation to demolition work-risk management associated with demolition work-Components to be removed-Regulatory Analysis.

Unit 2: Planning of demolition work:

7 hrs

Notifiable demolition work-safe work method-Details of adjoining buildings-Essential services (under and above ground) Demolition licensing

Unit3: Site Description:

8 hrs

Size, topography, Natural and manmade features to be protected-water bodies-Ancillary Structure-Access routes

Unit 4: Controlling risk in Demolition work:

7 hrs

Hazardous materials and substances, Securing the work area equipment and machinery, Biological hazards -powered mobile machinery

PART - B

Unit5: Demolition methods and working constraints:

8 hrs

Manual demolition-Mechanical demolition, induced collapse-using explosives-Removal and material handling methods Transportation of Debris -fire prevention controlled demolition

Unit6: Demolition of special structure:

7 hrs

Concrete structures -lift shafts-Basement, cellars, vaults-domes-arched roofs-chimneys-storage tanks and pipe lines-masonry brick arches.

Unit7: Cutting edge Technology:

8 hrs

Silent Technology, controlled electrical chipping, concrete cutting, core drilling, Hydraulic splitting-rock blasting,-Dust dimension - partial dismantling of foundations

Unit8: Materials recycling and codes of practices:

7 hrs

Recycling of concrete, wood, steel, aluminium-Recycling analysis.

Heating Ventilation and Air Conditioning Design

Subject Code: 14BST22

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit1:

8 hrs

Direct contact heat mass transfer, combined heat and mass transfer-spray chambers-cooling towers-heat transfer-single component fluids-Transport coefficients inside outside tubes and compact surface, sensible heat transfer

Unit 2:

7 hrs

Control theory:-Elementary control and action –energy sources-measurement

Unit 3:

8 hrs

Pneumatic control devices, -Introductions –devices-Control cabinets-air circulation

Unit 4:

7 hrs

Fluid and flow control devices -wall attachment devices-Turbulences amplifiers-vertex, Amplifiers-Radial Jet, Amplifiers-Fluid transducers- manual switches-dampers

PART - B

Unit 5:

8 hrs

Elementary control devices.

-outside air controls-air stratification –heating and cooling coils-humidity control and dehumidifies-static pressure control-gas and oil fired heat-fire and smoke control-Electrical interlocks and sensors

Unit 6:

7 hrs

Complete control and electric control systems-single zone system, Multi-zone air handling and dual-duct systems-variable volume systems-reheat and heat reclaim system

Unit 7:

8 hrs

Ventilating system-Packed equipment, radiant heating and cooling radiators and convectors –heat exchangers-solar heating and cooling system

Unit 8:

7 hrs

Control plant pumping systems and retrofitting-Diversity, constant and variable flow systems,-Building interfaces-economic analysis for retrofit-economy. Cycle controls-single zone multi-zone and dual –ducts systems-control valves and pumping arrangements-dynamic response and tuning

Text Books:

1. Heating, ventilating and air conditioning-Analysis and design-F.C.Mcquiston.J.DParker and Jeffrey.D.Spitler-John.Wiley and sons, 2001
2. Control system for heating, ventilating and air conditioning-R.W.Hines and D.C.Hittle,(6th Edition)spings-2006

Carbon Foot Print and Measurement all Types of Buildings

Subject Code: 14BST23

Total No of Hrs: 60

Credits: 4

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit 1 Trends in building sector emission:

8 hrs

Energy consumption in different sectors like residential, commercial and public buildings, offices, markets, hospitals, research laboratories. Environmental data in these sectors. -Carbon emission resulting from energy use in buildings.

Unit 2 GHG mitigation options in buildings:

7 hrs

Energy efficiency principles, building energy management systems, -lighting systems, day-lighting, appliances, on-site power, and cost estimate of GHG mitigation in buildings.

Unit 3 Low carbon refurbishment in buildings:

8 hrs

Low carbon refurbishment process-3 different phases (prepare, design, construct) refurbishment policy, embodied energy considerations for existing buildings in different sectors.

Unit 4 Carbon Foot printing during construction:

7 hrs

Social and economic aspects. -Promoting low carbon construction materials- reducing environmental impacts during construction, - aspects of sustainability.

PART - B

Unit 5 Road map for reducing emissions:

8 hrs

GHG inventory, baseline measures- strategic climatic action plans, - implementation mechanism

Unit 6 Carbon foot print measurement:

7 hrs

Methodology of calculating carbon foot print, carbon trust, - system boundary, functional units, life cycle inventory data, carbon credit.

Unit 7 Constraints in adopting building techniques:

8 hrs

Limitations of traditional building designs- misplaced incentives- regulatory barriers- social engineering (culture, behavior, rebound effect)- interaction of mitigation options with vulnerability and adaption.

Unit 8 Techniques to reduce energy consumption in building:

7 hrs

Ten steps to be adopted for reduction, usage of low carbon materials, green travel, transport carbon- case study analysis(at-least one)

Text books:

1. What colour is your building? David H. Clark, RIBA publishing house, London-2013

ELECTIVE I

Modeling of Air Pollutants Flow in Building

Subject code: 14BST2411

Credits: 03

Total No of Hrs: 45

Hours per week: 3

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. INDOOR AIR DISTRIBUTION :** Motivation for modeling- contaminant concentration, Air flow in stair well, contaminant concentration in kitchen, human exposure to different pollutant type, thermal comfort and indoor air quality **6 Hrs**
- 2. CFD MODELING AND PARAMETERS:** Introduction to CFD, continuity and momentum equation application of CFD for building air flows, simulation of IAQ parameters, thermal comfort parameters, accuracy and validation of building air flows **5 Hrs**
- 3. AEROSOLS:** Modeling of aerosols, air and pollutant flows in the vicinity of occupants, Turbulence models, Numerical methods and parameters. **5 Hrs**
- 4. BUILDING ECOLOGY:** Thermal delight in architecture, site design, community planning, passive cooling, day lighting, thermal envelope, architectural acoustics, building access and egress, architecture of well temper environment **6 Hrs**

PART - B

- 5. IMPACT OF ENERGY SYSTEMS ON ENVIRONMENT:** Environmental degradation due to energy production and utilization, primary and secondary pollution, depletion of ozone layer, physiological, ecological environment and health problems due to energy plants **6 Hrs**
- 6. POLLUTION DUE TO THERMAL, HYDEL AND NUCLEAR PLANTS:** Potential sources in thermal plants, environmental pollution limits guideline, thermal power plant pollution control, various pollution control equipments, water pollution in thermal plant, Hydrothermal plant environmental assessment, pollution and control measures in nuclear plants **6 Hrs**
- 7. WASTE AND WASTE ENERGY RECOVERY IN BUILDINGS:** Domestic and solid waste as a source of energy, causes, process and exhaust gases and its control, mechanism and devices of pollution control **6 Hrs**
- 8. HYDRO-ELECTRIC POWER STATIONS BUILDINGS:** Ecology and Environment around power stations, waste and effluent treatment **5 Hrs**

Global Warming and Cooling

Subject Code: 14BST2412

Credits: 3

Total No of Hrs: 45

Hours per week: 3

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Text Book:

1. "Climate Change" The Science of Global Warming and Our Energy Future, Edmond Mathez, Columbia University, Press, 2009
1. **CLIMATOLOGY:** Weather and climate, origin, composition and structure of atmosphere, atmospheric pressure and its distribution, general circulation of planetary winds, walker circulation, climate sensitivity **8 Hrs**
2. **CLIMATE CHANGE:** Historical perspective, carbon cycle, the global carbon cycle, the ocean carbon cycle, the terrestrial carbon cycle, modeling the carbon cycle **7 Hrs**
3. **PALEOCEANOGRAPHY AND PALEOCLIMATOLOGY:** Pale oceanographic changes, relation to earth system, impact of ocean on climate changes, evolution of earth through the Cenozoic, ocean gateways and their role in controlling global climate, reconstructing quaternary climate and oceanographic history on shorter time **8 Hrs**
4. **SOLAR VARIABILITY AND TEMPERATURE CYCLES:** Cosmic rays, irradiance, temperature, humidity, evaporation, condensation, dynamics and types of precipitation, droughts, floods, ENSO and LA Nina origin of monsoon and stream flows **7 Hrs**

PART - B

5. **WEATHER SYSTEMS:** Extra-tropical and tropical cyclones, climate classification, global warming and its inputs, dynamics and types of precipitation, stability and instability of atmosphere air masses and fronts, heat budget storm surges **8 Hrs**
 6. **GLOBAL CLIMATE MODELS:** Models and forecasts, radiation, clouds, feedback factors and radio-active forcing, carbon sulphide, diffuse light, iodo compounds, nitrous oxide, methane, demethyle sulphide, aerosols **7 Hrs**
 7. **OBSERVATION:** Temperature records, Paleoclimate past 1000 years records, urban heat islands, satellite data, finger prints, sea level rise **8 Hrs**
 8. **GLOBAL COOLING:** Climate cooling during cenotoic era, earth's glaciations, global climatic cooling due to increase in CO2 content, glacial and interglacial periods, possible measures against a cold period, global climate change assessment of gap models, design to mitigate global climate change **7 Hrs**
2. "Global Warming and Global Cooling, Evolution of Climate on earth" O.G.Sorokhtin, G.V Chilingav & L.F. KHILYOK, Elsavier, Amsterdam, 2007

Smart Materials for Green Building

Subject Code: 14BST2413

Credits: 3

Total No of Hrs: 45

Hours per week: 3

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Text Book:

- 1. INTRODUCTION:** Introduction to Intelligent buildings - Basic concepts – Intelligent building automation - Building automation system - Cost analysis of intelligent buildings – Introduction to smart materials. **6 Hrs**
- 2. INTRODUCTION TO SMART MATERIALS AND STRUCTURES** – Instrumented Structures Functions And Response– Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors. **5 Hrs**
- 3. ACTUATOR TECHNIQUES** – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magneto structure Material – Shape Memory Alloys – Electrorheological Fluids– Electromagnetic actuation – Role of actuators and Actuator Materials. **6 Hrs**
- 4. STUDY OF ADVANCED BUILDING MATERIALS** like, aluminum, glass, fabric, various types of finishes & treatments, Construction chemicals – sealants, engineering grouts, mortars , admixtures and adhesives **6 Hrs**

PART - B

- 5. POLYMERS** in Civil Engineering-Structural Plastics And Composites- Polymer Membranes- Coatings-Adhesives, Non - Weathering Materials-Flooring And Facade Materials- Glazed Brick, Photo Catalytic Cement, Acid Etched Copper And Composite Fiber. **6 Hrs**
Metals-Metals And Special Alloys Of Steel-Water Jet Cut Stainless Steel, Mill Slab Steel.
- 6. BUILDING SYSTEMS:** lighting – day lighting; ventilation – natural ventilation; indoor air quality; heating/cooling – geothermal; passive and active systems for energy production and conservation; water conservation – grey water reuse, water saving plumbing fixtures **6 Hrs**
- 7. BUILDING ELECTRONICS:** Introduction - Microprocessor based control - Programmable logic controller – Communication principles - Telephone systems - Communal aerial broadcasting - Satellite communication – Fibre optic system. **5 Hrs**
- 8. NANOMATERIALS FOR "GREEN" SYSTEMS:** Green materials, including biomaterials, biopolymers, bioplastics, and composites Nanotech Materials for Truly Sustainable Construction: Windows, Skylights, and Lighting. Paints, Roofs, Walls, and Cooling. Multifunctional Gas Sensors, Biomimetic Sensors, Optical Interference Sensors Thermo-, light-, and stimulus-responsive smart materials Nanomaterials **5 Hrs**
 1. Brain Culshaw – *Smart Structure and Materials* Artech House – Borton. London-1996.
 2. Srinivasan ,A.V and Michael McFarland . D, "*Smart Structures – Analysis and Design*, Cambridge University Press, 2001.

Green Building Policies and Incentives

Subject Code: 14BST2414

Credits: 3

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

Total No of Hrs: 45

Hours per week: 3

PART - A

Unit 1 – PRODUCTS AND MATERIALS

Re examining properties in green buildings, living building challenges, Materials and products role, Energy embodiment, Glasses Understanding of carbon footprints in Buildings, bamboo in construction.

5 Hrs

Unit 2 – CERTIFICATION

Green products and material certification, parameters making products green, products transparency movement. Cradle to cradle certification.

6 Hrs

Unit 3 – PRODUCT EMISSIONS AND HAZARDS

Product emission testing, chemistry for building designers, hazards understanding

5 Hrs

Unit 4 – SPECIFICATION AND OPERATIONS

Durability, green construction guide, Volatile organic compounds, green paints.

6 Hrs

PART - B

Unit 5 – STRUCTURE AS FINISHES

Life cycle concerns of concrete, Masonry, wood, composites, Reduction on Environmental impacts of concrete and cement, pros and cons of leaving off layers. Transportation of Debris –fire prevention controlled demolition

5 Hrs

Unit 6 – WET APPLIED MATERIALS

Indoor air quality, material hazards, performance, interior staining, finishing, floor sealant, coatings 8hr adhesives, making floors, walls, carpets, windows, doors environmental friendly.

6 Hrs

Unit 7 – MATERIALS VS PRODUCT LEVEL SELECTION

Interior window treatment, resilient flooring, water proof coatings, plumbing safety and security

6 Hrs

Unit 8 - INCENTIVES AND POLICIES

Carbon trust, carbon credit, returns on investments, savings Policies towards electrical power in India. Privatization in generation – Case study. Tax credits, Grants.

6 Hrs

References:

Nick Hanley, Jason, F.Shogren and Ben White. (2001) *Introduction to Environmental economics*, Oxford University Press.

ELECTIVE II

Project Management Systems

Subject Code: 14BST2421

Credits: 4

Total No of Hrs: 45

Hours per week: 3

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

1. Application of Statistics in Project management

8 Hrs

Design of Experiments: Simple as well as multiple linear regressions, residual analysis Factorial Regression, Multiple linear regressions, residual analysis. Factorial Regression, with random blocks, Response Surface, Analysis of variance (ANOVA). Experimental Design: Hypothesis formation, formation of Null hypothesis; validation or otherwise by doing experiment. Statistical methods of Optimization using line of steepest ascent, sequential simplex search various software's such as Excel and other commercially available form.

2. Quantitative Techniques in Project management

8 Hrs

Introduction to Integer programming. Solution of Integer programming by various methods, introduction to Goal programming and parametric programming; Dynamic programming models; various models in queuing; inventory control models; network theory-maximal flow and minimal spanning tree problems; Game theory linear programming methods to solve mixed strategy games. Simulation Introduction to Integer programming. Solution of Integer programming by various methods, introduction to Goal programming and parametric programming

3. Computer simulation and analytical Tools

7 Hrs

Design and development of computer simulation models for hypothetical applications in project management for both pre-implementation (preconstruction) and implementation (construction) phases.

4. Human Factors in Project management

7 Hrs

Definition of Ergonomics and its significance in designing workplace layout and detailed motion plan of work, Man-Machine Symbiosis, Human Factors in design & manufacturing, Viz. pressure of the environment, temperature, humidity etc.,

PART - B

5. Unit 5 Supply chain and Logistic management

7 Hrs

Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Competitive and supply chain strategies. Designing the Supply Chain Network, Distribution Network - Role, Design. Supply Chain Network (SCN) - Role, Factors, Framework for Design Decisions. Models for Facility Location and Capacity Allocation. Impact of uncertainty on SCN - Discounted Cash Flow Analysis, Evaluating Network Design Decisions using Decision Trees. Analytical problems.

6. Management Information System (MIS)

Definitions, objective, structure, operating elements, MIS structure based on Management activity, organizational function. System concepts - Definition, Types of systems, system decomposition, system entropy, system stress, methods of simplification, design concepts. SDLC approach - System development life cycle approach, system requirement specifications, entity relationship diagram, data dictionary, report generation, database administration. Object Oriented Analysis and Design Introduction, concepts of objects, class, encapsulation, various steps of OOA, methods like Booch, Rumbaugh etc. Domain Analysis,

7. Decision Support System

7 Hrs

Introduction to decision support system, experts systems, hardware and software acquisition, legal Issues. Information Management and society: Computer security, privacy, manual versus electronic information, back up protection, user interfaces, encryption, responsibility and ethics. Ethical challenges in Information Systems.

8. Safety Engineering (Hazard Analysis)

8 Hrs

Introduction & Scope, various aspects of safety analysis of equipment. Hazard rate and its variation along the life cycle of product/asset. , make estimation of reliability & maintainability with hazards rate varying as Weibull distribution. Define degraded effectiveness of equipment. Cause-Effects diagram, Criticality of the components using quantitative techniques etc. Calculation of Hazards & risks quantitatively using potential laws. Safety devices – overload relay, motor type relays, sensors, voltage

Text Book:

1. Statistical Methods for Engineers – G.Geoffrey Vinning Duxbury, Press1998.
2. Industrial Organization and Management – S. K. Basu, K.C. Sahu and Rajiv B, PHI New Delhi, Nov 2012. ISBN No. 9788120344211.

Modern Construction Methods and Mechanization

Subject Code: 14BST2422

Credits: 4

Total No of Hrs: 60

Hours per week:

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

1. SUB STRUCTURE CONSTRUCTION

7 Hrs

Box jacking pipe jacking – under pinning, trenchless technology, innovative road Construction techniques; immerse tube tunneling. Smart tunnels: application and construction (Case study)

2. SUPER STRUCTURE CONSTRUCTION FOR BUILDING

8 Hrs

Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – in situ prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures.

3. CONSTRUCTION OF SPECIAL STRUCTURES

8 Hrs

Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques for offshore structures – construction sequence and methods in domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

4. Form works for different construction techniques

7 Hrs

PART - B

5. OTHER CONSTRUCTION EQUIPMENT

8 Hrs

Equipment for Dredging, Trenching, Tunnelling, Drilling, Blasting Erection
Equipment Types of pumps used in Construction Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment – Equipment for Demolition.

6. CONSTRUCTION EQUIPMENT MANAGEMENT IDENTIFICATION –

7 Hrs

Planning Equipment Management in Projects Maintenance Management – Replacement
Cost Control of Equipment Depreciation Analysis – Safety Management

Equipment for Earthwork: Fundamentals of Earth Work Operations Earth Moving Operations Types of Earth Work Equipment Tractors, Motor Graders, Scrapers, Front end Loaders, Earth Movers.

7. EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING

8 Hrs

Crushers – Feeders Screening Equipment Handling Equipment Batching and Mixing
Equipment Hauling, Pouring and Pumping Equipment – Transporters

8. MODERN EQUIPMENT

7 Hrs

Road construction equipment: Graders, compaction, automated pavers. Bar bending equipments, heavy duty cranes, and trenchless excavators.

Text Book:

1. Construction Dewatering: New Methods and Applications by Patrick Powers. J., John Wiley & Sons, 1992.
2. Advanced Construction Techniques by Jerry Irvine, CA Rocketr, 1984.

Utilization of Renewable Energy Resources

Subject Code: 14BST2423

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. SOLAR ENERGY:** Sun as a source, availability of solar energy, nature of solar energy, solar energy and environment, application of solar energy, photo thermal, photovoltaic, photosynthesis, present and future scope of solar energy **8 Hrs**

- 2. WIND ENERGY:** Basics and power analysis, wind resource assessment, power conversion technologies and applications, wind power estimations, principles of wind turbine designs, wind turbine generation, site selection, cost economics and viability of wind farm **7 Hrs**

- 3. GEOTHERMAL TIDE AND WAVE ENERGY:** Availability of Geo-thermal energy- size and distribution, recovery of Geo-thermal energy, various types of systems to use Geo-thermal energy, direct heat applications, power generation using geo-thermal heat, sustainability of Geo-thermal source, status of Geo-thermal technology, economics of Geo-thermal energy. **8 Hrs**

- 4. HYDEL ENERGY :**Hydro power: potential, Hydro power generation and distribution, Mini and Microhydel power(MHP), Generation: classification of hydel plants, concept of micro hydel, merits, MHP plants: Components, design and layout, Turbines, efficiencies, status in India. Integrated energy systems and their cost benefit analysis **8 Hrs**

PART - B

- 5. NUCLEAR ENERGY:** Potential of nuclear energy, international nuclear energy policies and regulations, nuclear energy technologies, fuel enrichment, different types of nuclear reactors, nuclear waste disposal and nuclear fusion. **8 Hrs**

- 6. BIO MASS ENERGY:** Biomass: Generation and utilization, Properties of biomass, Agriculture Crop & Forestry residues used as fuels. Biochemical and Thermo-chemical Conversion, Combustion, Gasification, Biomass gasifiers and types etc.
Applications of Gasifiers to thermal power and Engines, Biomass as a decentralized power generation source for villages
Concept of Bio-energy: Photosynthesis process, Bio-fuels, Biomass resources Bio based chemicals and materials
Thermo-chemical Conversion: Pyrolysis, Combustion, Gasification, Liquification. **8 Hrs**

- 7. HYDROGEN ENERGY:** **8 Hrs**
Hydrogen as a renewable energy source, Sources of Hydrogen, Fuel for Vehicles.
Hydrogen Production: Direct electrolysis of water, thermal decomposition of water, biological and biochemical methods of hydrogen production. Storage of Hydrogen: Gaseous, Cryogenic and Metal hydride

- 8. BIO METHANATION:** Importance of biogas technology, Different Types of Biogas Plants. Aerobic and anaerobic bioconversion processes, various substrates used to produce Biogas (cow dung, human and other agricultural waste, municipal waste etc.)
- Individual and community biogas operated engines and their use. Removal of CO₂ and H₂O, Application of Biogas in domestic, industry and vehicles. Bio-hydrogen production. Isolation of methane from Biogas and packing and its utilization.

Text Book:

1. "Construction Planning, Equipment and Methods" , Eighth Edition [Robert L. Peurifoy](#), [Clifford J. Schexnayder](#), [Aviad Shapira](#), [Robert Schmitt](#), [Robert Peurifoy](#)

Applied Sensor Technology

Subject Code: 14BST2424

Credits: 3

Total No of Hrs: 45

Hours per week: 3

Examination Question Paper Pattern

6 Hrs

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit 1: Introduction: Characteristics of sensors, Transducers and Actuators. Types and classification selection of Transducers to be employed for detection, measurement and control of various physical parameters

Unit 2: Strain gauges and load cells-Types, specifications range and applications.

5 Hrs

Unit 3: Electrical, mechanical, magnetic, optical and Biosensors-principal, operation, control and application of Hall effect transducers, capacitive and inductive transducers and piezoelectric transducers.

6 Hrs

Unit 4: Temperature measurement and control using thermocouple, Thermistors, Thermo devices and resistance thermometers.

5 Hrs

PART - B

Unit 5: Measurement of force, torque, displacement, thickness, velocity, mass acceleration, flow pressure and level.

6 Hrs

Unit6: Actuators-Electro mechanical actuators, fluid power actuators, piezoelectric and magnetostrictive actuators, solenoid displacement, servomotors, micro switches and proximity switches

6 Hrs

Unit7: Fiber optic sensors and their applications. Fundamentals of HVAC(Heating, ventilating and Air-conditioning)controls, sensors, controllers and parameters controlled, source of energy and benefits of controls

5 Hrs

Unit8: Concept of Digital Transducers and MEMS devices and smart sensors.

5 Hrs

References:

- 1.Ristic L(Ed)Sensor technology and devices Artech House London, 1994
2. DeSilva.C.W.Control Sensors and Actuators Eaglewoodcliffs NJ prentice Hall1989
- 3.Mechatronics N.P.Mahalik Tata Mc graw-Hill-2003
4. Textbook of Mechatronics R.K.Rajput,S.Chand &Co.Ltd.
5. Francis.T.S YU Fibre optic sensors marcel Dekker Inc.Newyork
6. Fundamentals of, HVAC systems Ashrae Learning Institute.
7. Fidanboyluk etc Fibre optic sensors and their applications keynote address 5th International Advanced Tech Symposium-2009 Karbuk-Turkey

Building Insulation Laboratory

Credit: 1

No. of weeks: 15

SUB CODE: 14BSTL25

- 1.** Application of various types of insulation system, polimetric materials, wood, electrical wiring, protective system for various households. **8 classes**
- 2.** Layout planning of various insulation systems including AC ducting, application of waterproofing system against rain and snow fall. **7 classes**

Master of Technology

*C.E. – Building Science &
Technology*

III

Semester Syllabus

Life Cycle Assessment and Material Selection

Subject Code: 14BST31

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Text Book:

- 1. INTRODUCTION AND TERMINOLOGY :** History of LCA, Aspects of LCA, variants of LCA, Life cycle stages, end of life, Functional unit, System boundary, Life Cycle Inventory (LCI) data base, Life Cycle Management (LCM), Life Cycle Energy Analysis (LCEA), Carbon Accounting **08 Hrs**
- 2. LIFE CYCLE ASSESSMENT IN BUILDING INDUSTRY:** Material level, Product Level, Building level, Industry level, LCA and Design process, Pre-design, Schematic Design and Design Development Stage. **7 Hrs**
- 3. LCA PROCESS AND IMPACT CATEGORIES:** Inventory Analysis, Impact assessment, interpretation, Different impact categories like Global Warming Potential (GWP), Acidification Potential (AP), Eutrophication Potential (EP), Smog Formation Potential, Fossil fuel and Ozone Depletion Potential **8 Hrs**
- 4. DIFFERENT TOOLS FOR LCA :** Configuration of a tool, Classification of tools, Impact estimator and eco-calculator, Building for Economic and Environmental Sustainability (BEES), International LCA Tools, Related tools, Green footsteps & eco-friendly applications **7 Hrs**

PART - B

- 5. GREEN BUILDING MATERIALS SELECTION :** Figure of Merit (FOM), Parameter selection for FOM, Selection based on FOM, Building into components-three phase building breaking down a materials, Criteria for material selection **8 Hrs**
- 6. GUIDELINES TO INTEGRATE:** LCA with design and evaluation, Different Scenarios of use of LCA, Sustainability targets, Selection of a LCA tools, LCIA. **7 Hrs**
- 7. LIFE CYCLE COSTING (LCC) TOOL:** Component characteristics of an element group, Input for energy Calculation, LCC calculations conduct of LCI and LCC calculations, Selective Assessment, Normalization and Weighing Factors, LCA and LCC for different materials. **8 Hrs**
- 8. CASE STUDIES:** Two and Three variants of a house, office building, retrofitting buildings **7 Hrs**

1. Arnold Tukker, "Eco Efficiency in Industry and Science" Vol.1, Kluwer Academic Publishers, London, 2004

Fire Fighting and Alarm Systems

Subject Code: 14BST32

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. INTRODUCTION:** Occurrence and causes of fire, protection systems against fire, different types of protection systems, benefits of fire protection, communication among agencies involved during a fire and fire department. **7 Hrs**
- 2. BUILDING FEATURES AFFECTING FIRE EXTINGUISHING:** Thermal characteristics of materials used in residential and commercial buildings; doors, windows, interiors, finishes, roofs and roof coverings. Design requirements for evacuation strategies, special requirements for handicapped persons. **8 Hrs**
- 3. PROTECTION AGAINST FIRES:** Fire rating of building materials and components, Insulation and Coatings, Fire and smoking barriers, exit signage, door and window locking systems. Storage of flammable and hazardous materials, Fire risk Assessment, Fire drill **8 Hrs**
- 4. WATER BASED SYSTEMS FOR FIRE EXTINGUISHING :** Water as an effective fire extinguisher, properties of water, sources of water, storage distribution and piping, water hydrants, sprinkler systems **7 Hrs**

PART - B

- 5. NON-WATER BASED SYSTEMS FOR FIRE EXTINGUISHING:** Foam systems, carbon dioxide systems, fire pumps, halogenated systems, dry and wet chemical extinguishing systems, flame inhibitors, portable fire extinguishers **7 Hrs**
- 6. FIRE ALARM SYSTEMS:** purpose, general requirements, basic components, types of detectors, hazards of smoke, heat, toxicity and flame. Their detection and monitoring, testing and monitoring of alarm systems **8 Hrs**
- 7. FIRE EXTINGUISHING UNDER SPECIAL LOCATIONS:** **7 Hrs**
Brief study on site consideration, fire extinguishing methods and systems at locations of storage, explosives, electric power generation, Hospitals, Libraries, cryogenic storage and nuclear installations.
- 8. CODES AND STANDARDS FOR PROTECTION AND SAFETY OF BUILDINGS:** Introduction to and brief study of National Building Code and bureau of Indian Standards Codes connected to fire extinguishing systems, fire alarm systems and related appliances, Safety audit **8 Hrs**

Text Book:

1. Department of Veterans Affairs, Fire Protection Manual, 6th Edition, 2011
2. NBC (Part-4) IS 1641-1646, 3034, 11460, 12456, 13716, 14435 etc:-

Tropical Housing and Buildings

Subject Code: 14BST33

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. CLIMATE:** The given factors, global climate factors, Elements of climates, Classifications of tropical climates, Site climate **8 Hrs**
- 2. COMFORT:** the desirable conditions, thermal comfort factors ,thermal comfort indices, effective temperature-its use, **7 Hrs**
- 3. PRINCIPLES OF THERMAL DESIGN:** Thermal quantities ,Heat exchange of buildings, Periodic heat flow, **8 Hrs**
- 4. MEANS OF THERMAL CONTROL:** Mechanical control, Structural controls Ventilation and air movements **7 Hrs**

PART - B

- 5. LIGHT AND LIGHTING:** Light principles, Daylight ,Prediction techniques, **8 Hrs**
- 6. NOISE AND NOISE CONTROL:** Sound: principles ,Noise control, Noise problem in the tropics, **7 Hrs**
- 7. APPLICATIONS:** Shelter for hot-dry climates ,Shelter for hot humid climate ,Shelter for composite climates Shelter for tropical upland climates **8 Hrs**
- 8. DESIGN AIDS:** forward analysis stage ,Plan development stage ,Elements design stage ,Models and analogues **7 Hrs**

Text Book:

Manual of Tropical Housing and building, O.H.Koenigsberger, T.G.Irgersoll,Alan Mayhew,S.V.Szokolay-University press(India)Private limited 2010

ELECTIVE 3

Building Rating System with Case studies

Subject Code: 14BST3411

Credits: 3

Total No of Hrs: 45

Hours per week: 3

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

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| 1. INTRODUCTION: Need of rating system, different types of rating system(GRIHA, LEED), rating system weightage, screening analysis of rating system, rating system summaries | 8 Hrs |
| 2. GREEN DEVELOPMENT SPECTRUM: Preparations and realities, economic case for green buildings, important of integrated design market for green buildings, segmenting the market, need for green development spectrum | 7 Hrs |
| 3. RATING OF COMMERCIAL COMPLEXES : Minimum of 2 examples of Residential complexes | 8 Hrs |
| 4. GREEN RATING OF RESIDENTIAL BUILDINGS: Working of at least 2 examples | 7 Hrs |

PART - B

- | | |
|---|--------------|
| 5. GREEN RATING ANALYSIS OF EDUCATIONAL BUILDINGS: Working of at least 2 examples | 8 Hrs |
| 6. GREEN RATING OF HOSPITALS: Working of at least 2 examples | 7 Hrs |
| 7. GREEN RATING OF RETROFITTED: Working of at least 2 examples | 8 Hrs |
| 8. COMPARISON OF DIFFERENT RATING SYSTEMS: Case studies comparison –at least 2 cases | 7 Hrs |

Text Book:

1. IGBC GRIHA manual
2. "Sustainable Building Rating Systems" by K.M.Fowler, E.M.Rauch , July 2006 , Pacific Northwest National Laboratory, U.S Department of Energy.

Retrofitting of Buildings

Subject Code: 14BST3412

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit 1: Concept of Retrofitting: Definition, Significance of retrofitting, Principles of design for retrofitting, Benefits of retrofitting, Step by step method of retrofitting, changes over time in performance of retrofitted buildings. **8 Hrs**

Unit 2: Inspection and Evaluation of Buildings: Methods of Evaluation of buildings, Concepts for reliability assessment of buildings, inspection for mechanical performance of material in the building, Deformation and crack inspection, Reliability assessment methods. Damage degree assessment method. **8 Hrs**

Unit 3: Retrofit Solutions: Behavior change, Energy saving solutions, Renewable energy and water saving solutions, climate change adaptation. **7 Hrs**

Unit 4: Retrofitting design of Beams and Slabs: Causes of capacity insufficiency section enlarging, addition of Tensile reinforcement, prestress retrofitting, Sticking steel reinforcement method, Practical example. **7 Hrs**

PART - B

Unit 5: Retrofitting of columns and roof trusses: Problems in reinforced concrete columns and analysis, encased steel technique, section – enlargement, replacement method, Analysis of concrete roof trusses, retrofitting of roof trusses, Practical examples **8 Hrs**

Unit 6: Retrofitting of Masonry Components: Repairing and strengthening of wall cracks, Retrofitting of the wall, retrofitting of brick columns for bearing capacity deficiency. Retrofitting of wall between windows, strengthening the integrity of masonry structures, connections retrofitting, and Practical examples. **7 Hrs**

Unit7: Retrofitting design of wooden members: Reasons for retrofitting, Principles of retrofitting in wooden member, Retrofitting of beams, Columns, roof trusses, frames, purlins, Ceilings, Stair cases. **8 Hrs**

Unit8: Seismic assessment and retrofitting of concrete buildings: Seismic vulnerability of concrete buildings, Deficiencies, predicament of force based and performance based seismic assessment, liability problems in seismic assessment and retrofitting, strategies, stiffening and strengthening of the structure as a whole, usage of different materials. **7 Hrs**

References:

1. Retrofitting Design of Building Structures edited by Xilin Lu

Green Architecture for Sustainable Engineering

Subject Code: 14BST3413

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit 1: Green Architecture overview: Overview within ecosystem, Roles & Responsibilities of Architects, Relationship between architecture & technology, Site design & Environmental analysis, Sustainable design practice, Green movement & ecology. **8 Hrs**

Unit 2: Energy bench marking: Primary energy, Demand for indoor climate conditioning, Heating energy demand, Cooling energy demand, Electricity demand for artificial lighting, Energy demand over life cycle of a building. **7 Hrs**

Unit 3: Green Building materials: Bio based & Bio-degradable materials, recycling materials, Light Weight construction and insulation materials, Multi functional materials, Energy generating & Light influencing materials sustainable production process. **8 Hrs**

Unit 4: Materials for sustainable sites: Definition - Input, Output & impacts of construction materials, Evaluation of materials, Designing with reclaimed, reprocessed & recycled content materials, Environmental hazards, Glass & Ceramics. **7 Hrs**

PART - B

Unit 5: Site Work & Landscaping: Aggregate surfacing, Brick pavers, Erosion protection, Flexible paving, Landscape edging, Landscape timbers, Sound barriers, Turf & grasses, Rigid paving, Porous pavers, Precast concrete pavers. **7 Hrs**

Unit 6: Energy and Atmosphere: High performance building energy design strategy, Passive design strategy, Internal load reduction, Active mechanical system, Innovative energy optimization strategy, Smart buildings & energy management system, Ozone-depleting chemicals in HVAC & R, Fire suppression **8 Hrs**

Unit7: Building Hydrologic System: Green building fixtures, Hydrologic cycle, Water supply & waste water strategy in high performance buildings, Land scaping water efficiency. **8 Hrs**

Unit8: Green Building Implementation: Site protection planning, Safety planning, Construction and demolition waste management, Reduction of foot print of construction operations, Building commissioning, Articulating performance goals for future green buildings. **7 Hrs**

References:

1. *Green Architecture- Advanced Technologies & Materials*, by Osman Attmann, McGrawhill education publication 2010

ELECTIVE IV

Resource Management

Subject Code: 14BST3421

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

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|--|--------------|
| 1. WATER MANAGEMENT : Moisture-crop relationship, irrigation requirements, irrigation efficiencies (Conveyance losses lined/unlined channels), trickle, sprinkler and furrow irrigation of arid lands, drainage of irrigation land, salinity of soil, salinity control, quality of irrigation water, contaminants and their effect on various crop types, operation of reservoirs, water management policy during droughts, predicting effect of water shortage on crops, rainwater management. | 8 Hrs |
| 2. WASTE RESOURCE MANAGEMENT: Design of septic tanks and effluent disposal system | 7 Hrs |
| 3. RESOURCE MANAGEMENT IN MULTI BLOCK SYSTEM : Oxidation ditch, secondary and tertiary treatments, reusability of treated water in buildings for non-potable activities | 8 Hrs |
| 4. UTILIZATION OF WASTE MATERIAL AS RESOURCE: Segregation of organic and inorganic components, recycling of demolished material, GGBS, crumb rubber, Fly ash | 7 Hrs |

PART - B

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| 5. WATER CONVEYANCE SYSTEM: Power canals, alignment, design of power canals, flumes, covered conduits and tunnels, drainage and ventilation in tunnels, penstock- alignment, types of penstocks, economic diameter of penstocks, anchor blocks | 8 Hrs |
| 6. FINANCE MANAGEMENT: Relationship between financial management and other areas of management, source and forms of finance share term loans | 7 Hrs |
| 7. CONSTRUCTION EQUIPMENT MANAGEMENT:
Optimum utilization of different construction machines, remedial measures for keeping environment green | 8 Hrs |
| 8. CASE STUDIES: Application of CPM & PERT for effective utilization of time management in construction | 8 Hrs |

Text Book:

1. Richard H Cuenca; Irrigation system design-An Engineering Approach, prentice hall Inc. New Jersey, 1986

Design of Energy Efficient & Healthy Buildings

Subject Code: 14BST3423

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

Unit 1: Introduction to modeling of process systems: Systematic approach to model building, Classification of models, Conservation principles, thermodynamic principles. **8 Hrs**

Unit 2: Introduction to Development Based on first principles: Steady state and dynamic, Lumped and distributed parameter models, Block diagrams and computer simulation. Modeling of process elements consisting of Mechanical (translational and rotational), Electrical, Electro – mechanical, Fluid flow, Thermal and Chemical reaction system elements. **7 Hrs**

Unit 3: Development of Models (Example): Grey box models, Empirical modelbuilding, Statistical model calibration and validation. Population balance models;Examples. **7 Hrs**

Unit 4: Solution strategies for Lumped parameter models; Solution methods for initial value and boundary value problems, Euler’s method, R-K method, Shooting methods, Finite difference methods. Solving the problems using MATLAB/SCILAB. **8 Hrs**

PART - B

Unit 5: Solution strategies for Disturbed parameter models; Solving parabolic, elliptic and hyperbolic partial differential equation. Finite element and Finite volume methods. **7 Hrs**

Unit6: Biochemical Conversion – Industrial, Agro Residues – Anaerobic Digestion – Biogas Production – Types of Biogas Plant – Thermochemical Conversion – Gasification – Types – Briquetting – Industrial Applications of Gasifiers – Environment Benefits **8 Hrs**

Unit7: Source and Nature of Hazardous Waste – Impact on Environment – Hazardous Waste – Disposal of Hazardous Waste, Underground Storage Tanks Construction, Installation & Closure **8 Hrs**

Unit8: Size Reduction – Aerobic Composting: Sources, Types, Compositions, Properties Physical, Chemical and Biological – Collection – Transfer stations – Waste minimization and recycling of Building waste. **7 Hrs**

References:

1. K.M.Hangos and I.T.Cameron, "Process Modeling and Model Analysis", Academic Press, 2001.
2. Shah, Kanti L., Basics of Solid & Hazardous Waste Management Technology, Printice Hall, 2000

Water Conservation Practices in Buildings

Subject Code: 14BST3423

Credits: 4

Total No of Hrs: 60

Hours per week: 4

Examination Question Paper Pattern

- All questions carry equal marks
- Answer any FIVE full questions, selecting at least two from each PART A & PART B

PART - A

- 1. WATER CONSERVATION ENGINEERING:** Basic concepts of soil erosion; control of soil erosion; Mechanics of wind and water erosion; water and wind erosion control practices; concept of runoff and its estimation; Design, construction and maintenance of vegetated waterways; Planning, Design, Construction and maintenance of terraces, contours and bunds; Design of water harvesting structures and farm ponds **8 Hrs**
- 2. WATERSHED DEVELOPMENT AND WATERSHED MANAGEMENT:** Concept of watershed development and management; collection of hydrological data; watershed characteristics and hydrologic cycle; problems of land degradation; Land use capability classification and topographical characteristics of watershed; Appropriate soil and water conservation measures, Hydrological and sediment monitoring of watershed; Estimation of peak design runoff rate; Planning, management and economic evaluation of watershed development projects; case studies **7 Hrs**
- 3. WASTE LAND DEVELOPMENT AND MANAGEMENT:** Land suitability classification according to USBR; Land suitability categories according to FAO framework; Land evaluation; Mapping of degraded soil through soil survey; Rehabilitation and management of ravine lands; Selection, Design and management of drainage systems in wastelands; Economic evaluation of wasteland development projects. **8 Hrs**
- 4. WATERSHED PLANNING AND MANAGEMENT:** Concept of characteristics of watershed, causes and consequences of watershed deterioration, Identification of watershed Management, people's participation in watershed Management, Socio economic survey of watershed, Land use capability, classification, appropriate soil and water conservation measures for watershed Management, Integrated multi disciplinary approach for watershed Management. **7 Hrs**

PART - B

- 5. FOREST WATERSHED MANAGEMENT:** Concept, characteristics and hydrology of forest watershed; Investigation of streams; Impact of land use changes; Deforestation, road building and other forest uses on forest stream quality and quantity; Radiation energy and water balance; Interception process and estimation; Precipitation and run-off estimation; Soil erosion in forest watershed; Selection and design of soil and water conservation structures; Simulation of hydrological processes in forest watershed. **8 Hrs**
- 6. WATER CONSERVATION PROJECTS:** Procedure for planning of soil and water conservation projects; Survey and investigation; Analysis of watershed problems; Calculation techniques of different watershed parameter; Legal, organizational and financial aspects of soil and water conservation projects; Responsibilities of different operation offices; Economic and financial analyses of soil and water conservation projects; Project evaluation; Management of soil and water conservation projects; Education, training and peoples participation in watershed development projects; Case study. **7 Hrs**

- 7. GROUND WATER ENGINEERING:** Soil physical characteristics related to water movement; Movement of soil water; Energy concept of soil water; Flow of water in saturated and unsaturated soils; Water retention and flow in field soils; Basic flow equations; Steady and unsteady flow and its boundary value problems; Darcy's, Laplace, Dupuit and Boussinsq equations and approximation; Numerical solution of flow problems, ground water recharge. **8 Hrs**
- 8. LAND RECLAMATION:** Causes of Land degradation; salinity and sodicity; extent of water logging and salinity problem in India. De-salinization and de-sodification; Reclamation and management of saline soils; Leaching method and period; Salt Balance; Salinity control and Leaching requirements; Estimating Leaching requirements; Reclamation and management of sodic soils; Reclamation of water logged and salt affected soil through drainage systems; Economic and social aspects of Land Reclamation. **7 Hrs**

Master of Technology

*C.E. – Building Science &
Technology*

IV

PROJECT WORK

Head of the Department
Dr. Shashishankar A,
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Professor and Head
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