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WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
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5-Year Bachelor of Architecture (B.Arch.) Curriculum and Syllabus

Sixth Semester

Course Code	Course Title	Contact Hrs. / Week			Credit
		L	S	P	
Theory					
TIU## - 6##	Design of Structures - II	3	0	0	3
TIUAR - 601	Pre-fabrication & Modular Co-ordination	3	0	0	3
TIUAR- 602	Architectural Acoustics	2	0	0	2
TIUAR- 603	Contemporary Architecture II	2	0	0	2
Practical					
TIUAR/E- 604A/B	Construction Management OR Building System Integration	0	0	2	1
Sessional					
TIUAR- 605	Architectural Design - V	0	12	0	8
TIUAR- 606	Working Drawing - II	0	6	0	3
TIUAR- 607	Disaster Resistant Architecture	4	2	0	3
Institute Programme					
TIUFY- 6##	Career Advancement Skill Development	3	0	0	3
TIUFY- 6##	Entrepreneurship Skill Development	0	0	0	2
Total Credits					**30**

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DESIGN OF STRUCTURE II (TIU##-6##) **L – S – P (3 – 0 – 0)**

Credits-3

Course Objective:

- To explain the structural property of structural steel
- To list the various market form of structural steel section available and their respective use
- To analyze the equilibrium of a riveted and welded joint
- To design a beam for a given system of loading and structural geometry, for flexure and shear
- To design a column and associate foundation for given axial load and moments
- To design a case specific connection between beam to beam and beam to column
- To outline the features of IS code provisions regarding design method of steel structure

MODULE I

Basic Material Properties & Design Concept

Material property of steel, Ductility, Behaviour of steel in cyclic loading, Different structural steel section used in India and their use. Different types of steel structural systems. Steel cable structural system, Structural configuration of tall steel structures Innovative use of structural steel, Hollow Tubular steel sections, Corrosion and fire resistance property of steel.

MODULE II

Rivet & Weld

Rivet and Welded connections. Property and the merits and demerits of Rivet and Weld. Different types of joints, Failure of Rivet and Weld. Rivet value. Bracket connection with eccentricity with Rivet and Weld. Numerical Problems

MODULE III

Design of Beam

Design Fundamental of Beam, Laterally supported and laterally unsupported beam, IS code provisions, Built-up-beams. Numerical Problems

MODULE IV

Design of Truss

Design fundamental of compression and tension member with angles. Design of simple trusses. Numerical Problems.

MODULE V

Design of Column

Design Fundamental of Axially and eccentrically loaded column, IS code provisions, Built-up-Columns, Lacing and battened column. Column Splice, Numerical Problems

MODULE VI

Design of Connection

Framed connection; unstiffened and stiffened seated connections for the connection for beam and beam-column-beam, Numerical Problems

MODULE VII

Design of Foundation

Slab base and gusseted base, column base subjected to axial load and moment; design of isolated grillage foundation, Numerical Problems

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IS Codes:

1. IS 800
2. Steel Section Handbook

Recommended Books:

1. S.K.Duggal; Design of Steel Structures , Tata McGraw Hill, New Delhi.
2. Ramchandra; Design of Steel Structures (Vol. I).
3. Negi; Design of Steel Structures.
4. Sarwer Alam Raz; Structural Design in Steel, New Age International Publication
5. Thomas Burns; Structural Steel Design, Delmar Publication

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PRE-FABRICATION & MODULAR CO-ORDINATION (TIUAR - 601)

L – S – P (3 – 0 – 0)

Credits-3

Objectives:

- Application of provisions of National Building Code [India] or any other such case example with respect to modular coordination in building design and standardisation of building units & components
- Application of prefabrication principles and processes as may be followed in small scale in a project site
- Application of principles of specifying tolerances for building units & components
- Application of construction techniques for different types of cost effective & environment friendly Technologies of building construction [partial prefabrication/pre-casting]

MODULE I

Introduction to the concepts of Standardization

- Need, Importance and aim
- Evolution of practice of standardization
- Classification, Requirements & Validity of standards
- Terms and definitions
- Process of standardization & Actions for establishment of standards

MODULE II

Introduction to concepts of Modular Coordination

- Objectives of Modular coordination & Definition of Basic Module
- Modular controlling dimensions, Planning Modules and preferred Multi-modules,
- Nominal size vis-à-vis Actual size
- Planning & placing of components
- Annotations for Modular Drafting practice
- IMG recommendations on choice of multi-modules & BIS (NBC) recommendation on choice of modules for various building components

MODULE III

Concepts of System Building & Number Patterns

- Definition and classification of systems buildings
- Concept of open system and closed system
- Preferred sizes & need of Number Patterns
- Number Series and preferred sizes
- Ehrenkratz‘s Modular Number Pattern

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MODULE IV

Introduction to concepts of prefabrication

- Factors affecting the growth of prefabrication industry
- Advantages & disadvantages of onsite & off-site prefabrication with respect to Indian scenario
- Terms & Definitions as in IS (NBC)
- Methods of prefabrication & Examples of prefabricated components
- Process of prefabrication
- Various issues related to prefabrication industry & Examples of early prefabrication concepts

MODULE V

Concepts of Standardization of Joints and Tolerances

- Importance of standardization of Joints & classification of joints
- Considerations for corner connections & examples of various joints
- Concept of Tolerance for Deviations in component sizes
- Tolerance equalization at joints

MODULE VI

Cost Effective & environment Friendly Technologies

- Innovative Building materials:- Sand-lime, Flyash lime, clay- flyash bricks, pre-cast concrete blocks, precast concrete stone masonry blocks
- Cost Effective Foundation & walling techniques: arch foundation. Rat trap bond etc.
- Cost effective roofing techniques: Ferro-cement vaults, Wardha technique, Pyramidal roof

MODULE VII

Cost Effective Pre-cast Roofing & Flooring Components

- RCC Planks & Joists, Pre-cast Channel units, Thin RC ribbed slab, Pre-cast Waffle slabs, Pre-cast RC/ Pre-stressed cored slabs, Pre-cast Brick panels
- Pre-cast RC Door & window frames, Pre-cast manhole covers, Ferro-cement door shutters, Ferro-cement water tanks

Recommended Books:

1. Kelly; The Prefabrication of Houses
2. Nagarajan R.; Standards in Building;
3. Standards & Specifications for Cost-Effective, Innovative Building Materials and Techniques; BMTPC; New Delhi
4. Nissen H.; Industrialized Building and Modular Design; Cement & Concrete Association; London; 1972
5. Time Saver Standards: Design Data;
6. National Building Code; Bureau of Indian Standards; New Delhi; 1983

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ARCHITECTURAL ACOUSTICS (TIUAR - 602) L – S – P (2 – 0 – 0)

Credits-2

Course Objective:

- To explain the various characteristics of sound including origin, propagation and auditory sensation of sound.
- To distinguish the behaviour of sound for enclosed spaces and open spaces
- To identify the acoustical design criteria for theatres, cinema halls, auditorium, conference halls etc.
- To identify different acoustical defects and their remedies.
- To apply the Sabin's equation for reverberation time calculation
- To classify the different types of sound system and their suitability for different acoustical conditions.
- To classify the different types of acoustical materials and their suitability for different acoustical conditions.

MODULE I

Sound Engineering:

Introduction to architectural acoustics - Characteristic and measurement of sound, frequency, intensity, decibel scale, auditory range, effects of sound on humans, loudness.

MODULE II

Room Acoustics:

Acoustics and acoustical environment, Behavior of sound in an enclosed space. Principle of geometrical acoustics, Different acoustical defects in auditorium and its solution, reverberation and reverberation time calculations – Sabine's formula and its interpretation, dead and live room.

MODULE III

Design of Auditorium:

Size, shape, sitting arrangement design criteria for speech and music, acoustical correction design and modification techniques, broadcasting studio, television studio, classroom, lecture hall, church and Cathedral.

MODULE IV

Electro-acoustics:

Introduction of Electro-acoustical systems, Unidirectional and Stereophonic sound system, Digital and Surround-sound systems, Design criteria for Theatres, Motion picture halls, Multiplexes and Multipurpose Auditoriums.

MODULE V

Open air Acoustics:

Free field propagation of sound, absorption from air and natural elements, effect of barriers, effect of landscape element, thermal and wind gradient. Design of open-air theatre and planning of building. Reduction of noise by screening, Screening by Planting.

MODULE VI

Environmental Noise Control:

Noise sources, air borne and structure borne sound, NC curve, Propagation of noise of mechanical operation and impact noise, sound transmission through wall and partition, Vibration isolation – control of mechanical noise, floor, wall, ceiling treatment. Design

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Principles- reduction of noise at the source, Reduction of noise near the source. Application of sound absorption material, Reduction of noise by Structural Defence. Planning and analysis of problem. Reduction of noise by Town Planning and Regional Planning consideration.

MODULE VII

Acoustical Material:

General description of acoustical materials - acoustical tiles, fiberboard, resonator absorption unit absorber, carpets, acoustical plaster, resilient packing composite materials, etc. – Their use, selection criteria and construction.

Recommended Books:

1. A. B. Wood; A Text book of sound.
2. T. M. Yarwood; Acoustics.
3. Duncan Templeton; Acoustics in The Built Environment.
4. J E Moore; Design for good Acoustics and noise control.

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CONTEMPORARY ARCHITECTURE II (TIUAR– 603) L – S – P (0 – 0 – 2)

Credits-2

EVOLUTION OF INDIAN CONTEMPORARY ARCHITECTURE

MODULE I

Architecture in colonial India

Early colonial period – Examples – St.Pauls Cathedral, Calcatta –Architectural character of Indo-Saracenic and Classical revival –University of Madras Senate House & Rippon Building, Central railway station Chennai.– Later Colonial period – Contribution of Edwin Lutyens & Herbert Baker to the lay-out and Architecture of New Delhi – Rashtrapathi Bhavan & Parliament House.

MODULE II

Post-Nehruvian modernist architecture

Modernism, utilitarian modernism and neo-modernism, brutalism. Criticisms on the modern movement in India, countering the stigma of colonialism, the neo-vernacular, the community architectural movement, integrating the new and the old, revivalism and post-modernism.

MODULE III

Modernism after Corbusier and Khan

Corbusier‘ works in India – Chandigarh and the Ahemadabad buildings – their influence on the modern rationalists; Louis Kahn‘s works in India - their influence on the empiricists.

MODULE IV

Post independent architecture

Influences by post independence Architects- Architecture of Charles Corea - British council Library Delhi, Kanchenjunga Apartments, Mumbai, Achuyut Kanvinde – IIT, Kanpur, Nehru science center, Mumbai, Anant Raje- Bhopal Development Authority Headquarters, Institute for Forest Management, Bhopal, B.V.Doshi – Sangath Office ,Ahemedabad, IIM Bangalore, Raj Rewal – Pragati Maidan New Delhi ,Asian Games village, New Delhi, Uttam jain - University of Jodhpur, Jodhpur, Neelam Cinema Theatre, Sanchore Hasmukh C Patel's - Entrepreneurship Development Institute of India, Gandhinagar, Sabarmathi River front Development, Ahmedabad.

MODULE V

Works of contemporary architects

Architects and their ideologies and philosophies towards architecture - Sanjay Mohe – Lecturer hall block , IIM Bangalore, Karunashraya, Bangalore, Sanjay Puri- Mosaic hotel, Delhi CIE ,Cochin CNT - Tata Dhan Academy, Madurai , Dr. Reddy's laboratory, Hyderabad, Morphogenesis- Pearl Academy of Fashion, Jaipur, PVR, Bangalore, Jaisim –C R Simha, Bangalore , IIPM , Bangalore, Bhooshan – Le olive Garden, The village, Mysore .

EVOLUTION OF INDIAN CONTEMPORARY ARCHITECTURE

MODULE VI

Self Conscious Modernity

Neo classicism, industrial revolution and its impact, new materials – steel, glass, concrete, arts and crafts movement, art nouveau – works of Gaudi, Chicago school, art deco, Louis

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Sullivan works, Adolf Loos and his arguments on ornamentation, Futurism, Expressionism – works of Mendelssohn and taut, destijl movement, Walter Gropius: Bauhaus and Harvard, Peter Behrens and the German Werkbund.

MODULE VII

Early Modern Architecture

Cubism, Constructivism, works of architects Philip Johnson – Glass house, Connecticut, Seagram Building,New York, Mies Vander Rohe - Barcelona Pavilion, Illinois Institute of Technology, Chicago, F.L.Wright- Falling water, Pennsylvania, Guggenheim Museum, New York , Richard neutra - Kaufmann Desert House, California, Oscar Niemeyer - Cathedral of Brasília, Museu Oscar Niemeyer ,Brazil Alvar Alto - Finlandia Hall, Finland, Le corbusier – Villa Savoye, France, Notre damn Ronchamp, Paris, Louis khan - The National Assembly Building, Bangladesh, Kimbell Art Museum, Texas

MODULE VIII

Later Modern Architecture

Post modernism and international style .Ideas and works of – Paul Rudolph- Arts and architecture building, Yale university, Orange County Government Center, New York, I.M.Pei - Grand Louvre, Paris, Everson Museum of Art, Kenzo Tange –Olympic arena, Tokyo, Fuji, Broadcasting center, Tokyo, Minoru Yamasaki – Dahran International airport, McGregor Memorial Conference Community Center, Detroit, Kisho Kurokawa - The Museum of Modern Art, Wakayama, Capsule tower, Tokyo, Richard Meier – Jubilee church ,Los Angeles , Smith house, Connecticut, Toyo Ito - U House, Tokyo , Serpentine Pavilion, London

MODULE IX

Alternative Practices and Ideas

Critical regionalism, works and ideas of Hassan Fathy, Geoffrey Bawa, Tado Ando, Laurie baker and Paulo Soleri

MODULE X

21st Century Architecture

Deconstructivism – Works of Zaha Hadid- London aquatic complex, 2012 Olympics, Zaragoza bridge pavilion, Spain , Daniel libeskind – Jewish museum, Berlin, World trade center, New York, Frank O Gehry – Guggenheim museum, Bilbao, Spain, Peter Eisenman Cardinal stadium, Arizona ,City of Culture of Galicia, Santiago Calatrova and his structural concepts- Lyon-satolas station, France, Milwaukee art museum, U.S.A , News forms and ideas of Norman Foster - American Air Museum, Cambridge, UK, Standsted Airport, London, Greg Lynn – Embryological house, U.S.A

Recommended Books:

5. Kenneth Frampton, Modern Architecture: A Critical History, Thames and Hudson, London.
6. Sigfried giedion, .Space time and Architecture: The Grwoth of a New tradition, Harvard University Press.
7. Tzonis Alexander, Santiago calatrova , International Publications, January 2005, New York.
8. Steele James, Hassan fathy - The complete works , London : Thames and Hudson.
9. Miki Desai, Architecture and independence, Oxford University Press, 2000.
10. Vikram Bhatt and Peter Scriver, Contemporary Indian Architecture: After the Masters, Mapin.
11. Lang, Desai, Desai – Architecture & Independence, Oxford University Press, New Delhi.
12. Sarbjit Bahga et all, Modern Architecture in India, Galgotia Publishing Company, New Delhi.

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CONSTRUCTION MANAGEMENT (TIUAR/E – 604A) L – S – P (0 – 0 – 2)

Credits-1

Course Objective:

- Develop a bar chart for construction project of medium scale
- Analyze the recourse allocation and cost requirement from bar chart
- Apply the network theory to assess the critical path for a project
- Compare the financial feasibility of various project options
- Evaluate the optimum cost-time relation of a small scale project
- Explain and adopt the concept of different project monitoring technique

MODULE I

Introduction and various stages of Construction Management.

Introduction to Management Principles. Introduction and objective of Construction Management. Types of construction Projects. Responsibilities of Project Manager. Life cycle of Project and various stages of Construction Management.

MODULE II

Bar Chart & Milestone chart

Introduction to Construction Planning & Scheduling techniques. Traditional techniques: concept of Bar Charts and Milestone charts. Cost & Resource Scheduling through Bar Chart Examples. Merits and demerits of Bar Chart.

MODULE III

Network Theory –I (CPM)

Introduction of Network Theory. Definitions and different types of: Event, activity, dummy, Network rules, Network event numbering (Fulkerson Rule), Hierarchies of complex network, Examples. CPM. Different element of CPM network with examples, Floats, Numerical Problems. Introduction of Project management software.

MODULE IV

Network Theory –II (PERT)

Introduction to PERT, Conceptual difference between PERT and CPM, Time Estimates, Event times, Slack, Time Computations with normal probability theory. Numerical Problems

MODULE V

Project Feasibility & Monitoring Technique

Project alternative selection technique, Time value of money, Investment Criteria: Pay Back Period, IRR NPV, Benefit Cost Ratio, and Break-Even Analysis. Project Monitoring Technique: Work Breakdown Structure, Progress Curve Method, Line of Balance.

MODULE VI

Cost & Resource Optimization Techniques

Cost Model: Direct & Indirect Cost component of Project, Cost Slope. Project Cost-Time analysis and optimization. Resource Usage Profile, Histograms. Resource allocation, smoothing & levelling techniques. Project Updating

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MODULE VII

Construction Equipments, safety and quality control

Different types of Construction Equipments, Construction Safety requirements, Factor effecting quality of construction, Introduction to computer aided project management techniques.

Recommended Books:

1. Dr. B. C. Punmiya and K. K. Khandelwal – Project Planning and Control with PER\CPM Laxmi Publications, New Delhi, 1987.
2. Jerom wiert and F. K. Lavy; -A management Guide to PERT/CPM
3. S. P. Mukhopadhaya; -Project Management for Architect and Civil engineers
4. Peurifoy & Schexnayder; -Construction Planning, Equipment, and Methods
5. Prasanna Chandra; -Projects Planning, Analysis, Financing, Implementation, & review
6. D.Upadhayay; -Construction Management
7. Mantri Institute; -Building Construction Management
8. James J .O'Brien,Fredrick L Plotnik,;CPM in Construction Management; Mc Grawhill;Construction Engineering.

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BUILDING SYSTEM INTEGRATION (TIUAR/E – 604A) L – S – P (0 – 0 – 2)

Credits-1

PURPOSE

To impart knowledge about the special service requirements of tall buildings and to create awareness about the systems, equipment and materials that are commonly employed in high rise buildings.

OBJECTIVES

- Understanding the special systems required in mechanical, electrical and Fire safety services.
- The ability to design vertical transportation systems, HVAC systems and Fire protection systems in line with the various standards, building codes and safety requirements.

MODULE I

Vertical Transportation

Introduction to passenger elevator codes – Express & Local Elevators, Sky lobbies etc., - Study of elevator equipments, control systems and spatial requirements – Escalators and Capsule elevators – Stairways & Ramps

MODULE II

Fire Protection

Designing for fire safety – NBC – Fire alarm systems – Smoke detectors – Fire fighting support systems – Fire rating of materials - Fire escape stairs & Safety regulations – Lightning protection.

MODULE III

Thermal Control Systems

Calculation of Heating and Cooling loads – Selection of suitable HVAC system – Special equipments and systems for heating and cooling – Spatial requirements for HVAC plants – Design of duct layouts etc.,

MODULE IV

Water Supply and Sewage Disposal

Basic planning for water supply – Calculation of capacity for sumps and water tanks -–Skip stage pumping etc., - Rainwater harvesting methods – Sanitation arrangements in high rise structures – Service floors – Ducts and vertical shafts – Waste treatment etc.,

MODULE V

Electrical Systems

Planning transformer & generator rooms, Preparation of electrical layouts for tall buildings – Spatial requirements of electrical rooms and ducts – Intelligent systems for electrical and illumination.

Recommended Books:

1. Stein Reynolds Mc Guinness – Mechanical and Electrical equipment for buildings – vol 1 & 2 – John Wiley & sons
2. Francisco Asensio Cerver – The architecture of Skyscrapers – Hearst Book International - New York, 1997

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3. Bennetts Ian & others – Tall building structural systems
4. Proceedings of the council for tall buildings – vol 1 & 2

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ARCHITECTURAL DESIGN V (TIUAR– 605) L – S – P (0 – 12 – 0)

Credits-8

Objectives:

- Application of Design theory and principles and Design of Low rise / medium rise /high rise buildings with complex issues to be tackled covering functional relationship, climatic condition, social aspects along with structural considerations and building services
- Application and use of relevant building bye-laws and provisions of **National Building Code**

Main Design Exercise Duration (approx.)

1. Sports Complex / Three Star Hotel
2. Auditorium (1000 Capacity) / Amusement park
3. Bank / Post Office

Design (Time) Exercise Duration

Any one of the above, not covered in the class 8 hrs.

Viva voce

Final Viva-vice on all the design assignments to be conducted at the end of the semester

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WORKING DRAWING II (TIUAR – 606) L – S – P (0 – 6 – 0)

Credits-3

Objectives

Building construction drawings to be prepared as a part of contract document with proper labelling and dimensioning techniques. Working drawings to be made in continuation of Working Drawing I for the building complex chosen earlier in Working Drawing I.

Prerequisites: Working Drawing I, Architectural Detailing.

- Details of toilets including plan, elevation, sections of it.
- Details of kitchen including plan, elevation, sections of it.
- Layout of sanitary and plumbing lines on site and connection with the main sewer/ septic tank
- Designing and detailing of septic tank and soak pit and a typical G.T., I. Chamber etc.
- Electrical layout of a typical floor including specification of fixtures
- Detail Flooring Plan and internal Finishing Plan
- Specific details required in the building complex, eg, Special carpentry detail, Metal finish detail, etc
- Municipal submission drawings

Minimum of 11 sheets to be done in the semester.

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DISASTER RESISTANT ARCHITECTURE (TIUAR – 607) L – S – P (4 – 2 – 0)

Credits-3

Course Objectives:

- Define the scope and objectives of the field of disaster management.
- Introduce concepts and terms of disaster assistance examine tools and methods, and learn some technology appropriate to the field.
- Develop knowledge on various types of disasters, acquire techniques for lessening impact of disaster and be all to involve community in disaster preparedness.
- Apply modern skills and scientific technologies to combat disasters.

MODULE I

Contemporary, Natural & Man-made Disaster: Fundamentals of Disaster, Dimension & typology of Disaster, Phases of Disaster, Social & Political imperatives, Scale of Disaster, Causes of Disaster, and Disaster Cycle.

MODULE II

Agencies in Relief: Organisations dealing with disaster, UNDRO's mandate in Disaster relief and management, Role of UN in emergencies, IDNDR. Risk assessment & Analysis: Estimation of Risk, Problems with risk assessment, Risk perception and communication, instruments and equipments involved, Objectives of assessment, Type of risk.

MODULE III

Common Disasters: Causes, General characteristics, Predictability, Factor contributing to vulnerability, Risk reduction measures, Management measures, Specific preparedness, Plan for cyclone, flood, drought, earthquake, landslides and arsenic contamination.

MODULE IV

Earthquakes: Causes, Plate tectonic and seismic waves, Magnitude and Intensity of earthquake, Seismic Zones, BIS provisions on earthquake resistant built environment for non-engineered and reinforced concrete buildings. Fundamental of ductile detailing.

MODULE V

Planning Considerations: Study of disaster and effects on settlements, disaster atlas, Intervention into land use plan. Post disaster action, Community rehabilitation, Temporary and permanent basis, Institutional involvement and policy institutes

MODULE VI

Capacity building of disaster management teams, Role of Financial Institutions in Mitigation Effort, Group Dynamics, Concept of Team Building, Motivation Theories and Applications, School Awareness and Safety Programmes.

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MODULE VII

Remote-sensing and GIS applications in real time disaster monitoring, prevention and rehabilitation, Laser Scanning Applications in Disaster Management, Quick Reconstruction Technologies, Role of Media in Disasters, Management of Epidemics, Forecasting / Management of Casualties.

Recommended Books:

(Disaster Management)

1. Vinod Kr. Sharma; Disaster Management, IIPA, New Delhi.
2. Robest McNamara; Blundering into Disaster, 1987, Bloomsbusy, London.
3. Disaster Prevention and Mitigation, 1984, UNDRO Publication, Geneva.
4. Disaster Response,- A Handbook for Emergencies, Babu Thomas, 1993