Scheme and Syllabus

for

Post Graduate (M.Tech.) Program in

CIVIL ENGINEERING

(DISASTER ASSESSMENT AND MITIGATION)

AUGUST 2021

DEPARTMENT OF CIVIL ENGINEERING

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

Institute Vision:

To create a centre for imparting technical education of international standards and conduct research at the cutting edge of technology to meet the current and future challenges of technological development.

Institute Mission:

To create technical manpower for meeting the current and future demands of industry: To recognize education and research in close interaction with industry with emphasis on the development of leadership qualities in the young men and women entering the portals of the Institute with sensitivity to social development and eye for opportunities for growth in the international perspective.

DEPARTMENT OF CIVIL ENGINEERING

Vision:
To serve the nation by providing high quality engineering education that enables students to get a profession that can improve the civil infrastructure and social welfare.

Mission:
To create an environment conducive for excellent teaching, learning and research in order to produce leading entrepreneurs and innovators in the field of civil engineering for sustainable development.

Malaviya National Institute of Technology Jaipur
Department of Civil Engineering

Master of Technology - DISASTER ASSESSMENT AND MITIGATION

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1	To prepare students for employment, profession and/or to pursue research in disaster management and/or in allied engineering disciplines.
PEO2	To provide students a solid foundation in mathematical, scientific, and engineering fundamentals required to formulate, analyze, and solve disaster related problems.
PEO3	To prepare students to acquire the knowledge and necessary skills in breadth to solve mathematical problems related to analysis and design of various components pertaining to disaster assessment and mitigation projects.
PEO4	To inculcate ethical practice and professionalism in students to work for the society and to establish safety and sustainability in work.
PEO5	To prepare the students for lifelong learning and working for excellence in global perspective with academic environment.

Program Outcome (PO)

PO1	An ability to independently carry out research / investigation and development work to solve practical problems.
PO2	An ability to write and present a substantial technical report/document.
PO3	An ability to demonstrate a degree of mastery over disaster related problems at a level higher than the appropriate bachelor program.
PO4	An ability to provide sustainable environmentally friendly technical solution using engineering skills and latest technological tools/software to solve complex engineering problems for assessment and mitigation of disaster related problems.
PO5	An ability to assess and inculcate various components of a disaster phenomenon considering social and environmental safety regarding health and legal and cultural issues in pre- and post-disaster scenario.

MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

DEPARTMENT OF CIVIL ENGINEERING

ACADEMIC CURRICULUM

M.Tech Civil Engineering (Disaster Assessment & Mitigation)

Semester I

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1.	21CET501	Spatial Data Collection and Analysis	Program Core	Theory	3	3	0	0
2.	21CET502	Natural and Manmade Disasters	Program Core	Theory	3	3	0	0
3.	21CEP503	Spatial Data Analysis Laboratory	Program Core	Practical	1	0	0	2
4.	21CET504	Hazard, Vulnerability and Risk Assessment	Program Core	Theory	3	3	0	0
5.	21CETxxx	Elective 1	Program Elective	Theory	3	3	0	0
6.	21CETxxx	Elective 2	Program Elective	Theory	2	2	0	0
7.	21CETxxx	Elective 3	Program Elective	Theory	3	3	0	0
Total Semester Credits					**18**			

Semester II

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1.	21CET505	Climate Variability and Adaptation	Program Core	Theory	3	3	0	0
2.	21CET506	Geoinformatics and Its Applications	Program Core	Theory	3	3	0	0
3.	21CEP507	Geoinformatics Laboratory	Program Core	Practical	1	0	0	2
4.	21CET508	Rehabilitation, Reconstruction and Recovery	Program Core	Theory	3	3	0	0
5.	21CETxxx	Elective 4	Program Elective	Theory	3	3	0	0
6.	21CETxxx	Elective 5	Program Elective	Theory	2	2	0	0
7.	21CETxxx	Elective 6	Program Elective	Theory	3	3	0	0
Total Semester Credits					**18**			

Semester III

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1.	21CED601	Dissertation	Program Core	Dissertation	8	0	0	16
2.	21CES602	Seminar/Minor Research Project	Program Core	Seminar	4	0	0	8
Total Semester Credits					**12**			

Semester IV

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1.	21CED603	Dissertation	Program Core	Dissertation	12	0	0	24
Total Semester Credits					**12**			
Total Program Credits					**60**			

List of Program Electives

S.No.	Course Code	Course Title	Course Category	Type	Credit	L	T	P
1.	21CET801	Disaster Resilient Structures and Retrofitting	Elective	Theory	3	3	0	0
2.	21CET802	Disaster Response and Preparedness	Elective	Theory	2	2	0	0
3.	21CET803	Disasters and Special Structures	Elective	Theory	3	3	0	0
4.	21CET804	Geohazards and Mitigation Measures	Elective	Theory	2	2	0	0
5.	21CET805	Hydrometeorological Disasters, Adaptation and Mitigation	Elective	Theory	3	3	0	0
6.	21CET806	Introduction to Sustainable Development	Elective	Theory	2	2	0	0
7.	21CET807	Lifeline Services and Disasters	Elective	Theory	3	3	0	0
8.	21CET808	Socio-Economics of Disaster and Disaster Finance	Elective	Theory	2	2	0	0

Credit Requirements:

Program Core	18-21
Program Electives	15-21
Open Electives	0-6
Dissertation/Seminar/Research Project	16-24

SYLLABUS

FOR SUBJECTS OF

M.TECH. CIVIL ENGINEERING

(DISASTER ASSESSMENT AND MITIGATION)

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET501	**Course Name:** Hazard, Vulnerability and Risk Assessment
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand the basics of Hazard and Vulnerability of structures

CO2: To understand the fundamental of Risk Assessment

CO3: To gain the knowledge about the effect of disaster on structures and their mitigation plans

Syllabus

Introduction to Hazard: Definition of hazard, Hazard estimation, Effect of hazard on structures.

Vulnerability: Definition of vulnerability, Methodologies of vulnerability assessment, Evaluation, Building Types, Micro & Macro methods, Intensity Scales, Damage probability matrix, Vulnerability functions.

Risk: Definition and components of risk, Fundamentals of risk analysis, Element at risk and their attributes, Seismic risk evaluation, Assessment for different disasters, Extreme event analysis.

Disaster: Direct and indirect damages, Ground failures in the past earthquake, Damage to structures, Associated damage due to fire, flooding and tsunami, Failure of embankments, dams and bridges.

Disaster Mitigation: The collection of data and information, Quantified risk assessment for industrial accidents; Release of toxics products, Dispersion analysis.

Books:

1. Kramer S. L., "*Geotechnical Earthquake Engineering*", Pearson Education India.
2. Sinvhal Amita, "*Understanding Earthquake Disasters*", McGraw Hill Education.
3. McGuire Robin K., "*Seismic Hazard and Risk Analysis*", EERI
4. Pitilakis K., Crowley H. and Kaynia A. M., "*SYNER-G: Typology Definition and Fragility Functions for Physical Elements at Seismic Risk*", Springer.
5. Ranke Ulrich "*Natural Disaster Risk Management*", Springer.
6. Nasim Uddin and Alfredo H. S. Ang, "*Quantitative Risk Assessment (QRA) for Natural Hazards*", ASCE.
7. Sibal Rajni Sekhri, "*Are You Prepared for a Disaster? Mitigation and Management of Disasters*", Bloomsbury.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET502	**Course Name:** Natural and Manmade Disasters
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand the occurrence of natural and manmade disaster

CO2: To characterize the different kinds of disaster and their classification

CO3: To understand the impacts of disasters and their assessment and remedies

Syllabus

Introduction to natural resources, Distribution of natural resources, Challenges, Natural disasters and their classification, Scales of disasters, Disaster Management Act and Policy, Institutional framework and mechanism, History and status of disaster management in India, Terminology and concepts in disaster risk management.

Earthquake Physics: Wave propagation, Wave types (compression, shear, surface), Attenuation; Causes: Tectonic plate motions, Magma movement, Isostatic rebound, subsurface fluid changes; Effects: No damage or massive damage, Tsunamis, Subsidence, Detection, Seismic network, Warning, Recovery; Updated building codes, Man mitigate damage. *Tsunamis Physics*: Pressure, Wave propagation, Causes: Earthquakes, Underwater landslides; Effects: Sudden rise and fall in sea level, Coastal damage, Loss-of-life; Detection: Seismic networks, Pressure gauges, Wave-height buoys, Warning, Siren, Recovery: Hampered by loss of infrastructure; Rebuild with knowledge that it can happen again, Upgrade facilities and infrastructure. *Volcanic Eruptions Physics*: Pressure, Density, Causes: Tectonic plate interactions, Hot spots; Effects: Lahars (hot mud flows), Nue Ardente (firey clouds), Lava flows over roads and buildings, Ash flows, Earthquakes, Detection: Small seismic network, Tilt meters, Laser ranging. *Landslides Physics*: Friction, Causes: Saturated soil, Unstable snow; Effects, Detection: Geologic profiles identify candidate areas, Snow depth, cohesion, etc. *Floods Physics*: Response time, Fluid flow, Causes, Excessive rain upstream, Channelizing Effects: Property loss, Life loss, Sedimentation, Change in course of river, Detection: Stream gauges, Forecast models of stream flow; Recovery: Move people & buildings, Build dykes, Flood control. *Nuclear accidents (TMI and Chernoble) Physics*: Nuclear energy, Half-life, Causes: Operational mistakes, Poor construction, Poor design; Effects: Radioactive fallout, Radiation sickness, Increased cancer rate, Detection: Radiation monitors, Radionuclide observations; Recovery: Clean-up & disposal of contaminated material, Iodine tablets. *Droughts*: Classification of droughts, Causes of droughts, Effects of droughts, Preventive measures of droughts, Drought management strategies.

Books:

1. Mohamed Gad-el-Hak, "*Large-Scale Disasters: Prediction, Control and Mitigation*", Cambridge University Press, 2008, ISBN 0521872936, 9780521872935.
2. Patrick Leon Abbott, "*Natural Disasters*", 5th Edition, San Diego State University, 2005, ISBN 0072921986.
3. William G. Ramroth, "*Planning for Disaster: How Natural and Man-Made Disasters Shape the Built Environment*", Kaplan Publishing, 2007, ISBN 1419593730, 9781419593734.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CEP503	**Course Name:** Spatial Data Analysis Lab
Credit: 1	**L-T-P:** 0-0-2
Version: 2021	**Approved on:**
Pre-requisite course:	

Course Outcomes

CO1: To learn geo-spatial data selection and ordering

CO2: To be able to process the geo-spatial data through different processing software and extraction of different information

CO3: To be able to apply and use geo-spatial data and information for solution of different geographical problems

Syllabus

1. Demonstration of different type of remote sensing data products.
2. Preparation of spectral reflectance curve – Two exercises.
3. Learning how to identify correct remote sensing data product and their referencing schemes.
4. Visual Collection of radiometric data from different surfaces using digital spectral radiometer or available data interpretation of remote sensing imageries to extract different information.
5. Demonstration of scanning of TOI Toposheets and other maps on A0 size scanner.
6. Demonstration of Remote Sensing software (ERDAS Imagine).
7. Pre-processing of remote sensing data using ERDAS Imagine software.
8. Learning image enhancement and feature extraction techniques using digital image processing techniques.
9. Unsupervised classification of remote sensing images.
10. Use GPs for collection data/surveying - Two exercises.

Books:

1. Lillesand and Keifer, "*Remote Sensing & DIP*", John Wiley & Sons, Inc.
2. Lillian, Thomas M. (2003), "*Remote Sensing and Image Interpretation*", New York: John Wiley &Sons.
3. Jensen, J. R., "*Introductory Digital Image Processing: A Remote Sensing Perspective*", Prentice Hall.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET504	**Course Name:** Spatial Data Collection and Analysis
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To be able to understand geo-spatial data collection techniques i.e., remote sensing, satellite-based positioning and laser based spatial data collection

CO2: To learn selection of appropriate geo-spatial data requirement and collection technique for different applications

CO3: To be able to extract required information from the geo-spatial data through different image processing techniques, processes and methods

CO4: To be able to analyze geo-spatial data and find solution of different geographic problems

Syllabus

Basics of map reading, Types and sources of map, Cartographic representation of data, Map coordinate system, Projections and their types, Guidelines for preparing a base map, Thematic mapping.

Aerial photographs, Mosaic, Image interpretation - Elements and methods, Stereo-model.

Physics of remote sensing: Electromagnetic spectrum and spectral signatures, Types of remote sensing, Platforms and sensors, Active and passive sensors, Aerial photographs, Satellite images, Radars, Sensor characteristics, Resolution - spatial, spectral, radiometric and temporal, Image interpretation - Elements and methods, Image correction - Geometric, Digital image enhancement techniques (stretching, filtering), Classification: supervised and unsupervised, Application of remote sensing techniques in resource and environment mapping, Monitoring case studies.

Introduction to Microwave Remote Sensing.

Global Positioning Systems (GPS): Introduction to the GPS functions, Field operation of GPS and data collection using GPS, Basic concepts and components of GIS.

Books:

1. Lillesand and Keifer, "*Remote Sensing & DIP* ", John Wiley & Sons, Inc.
2. Lillian, Thomas M. (2003), "*Remote Sensing and Image Interpretation*", New York: John Wiley & Sons.
3. J. R. Jensen, "*Introductory Digital Image Processing: A Remote Sensing Perspective*", Prentice Hall.
4. G. S. Rao, "*Global Navigation Satellite Systems (GNSS)",* Tata McGraw Hill Publications.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET505	**Course Name:** Climate Variability and Adaptation
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To study the evolution of climate science
CO2: To develop the understanding of agreements and protocols of climate change
CO3: To understand the mitigation measures for climate change
CO4: To understand the adaptation and risk adaptation for climate change

Syllabus

Climate Change Policy Framework: Climate change as a problem, Impacts of climate change, Climate variability and natural resources, United Nations Framework Convention on Climate Change (UNFCCC), Background to the Convention and its aims, Kyoto Protocol and the Flexibility Mechanisms, Emission trading.

Mitigation: Mitigation and policy evaluation, Strategies and technology options, Climate change case studies.

Adaptation: Adaptation and policy evaluation, Strategies and technology options, Case studies of adaptation, Evaluation of the effectiveness of approaches in managing climate change risk, Effectiveness of policy approaches in reducing climate change and variability risk.

Books:

1. Jon Hovi, Olav Stokke and Geir Ulfstein (eds) 2005, "*Implementing the Climate Regime: International Compliance*", Earthscan.
2. F. Yamin (ed), 2005., "*Climate Change and Carbon Markets: A Handbook of Emission Reduction Mechanisms*", Earthscan.
3. G. Boylr, B. Everest and J. Ramage (eds), 2003, "*Energy Systems and Sustainability: Power for a Sustainable Future*", Oxford.
4. Climate Change 2007, "*Mitigation of Climate Change, Summary for Policymakers*", IPCC. Available at: http://www.ipcc.ch/SPM040507.pdf.
5. Climate Change 2007, "*Impacts, Adaptation and Vulnerability, Summary for Policymakers*", IPCC. Available at: http://www.ipcc.ch/SPM13apr07.pdf.
6. Climate Change, "*The Physical Science Basis*", IPCC. Available at: http://ipccwg1. ucar.edu/wg1/wg1-report.html.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET506	**Course Name:** Geoinformatics and Its Applications
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: Ability to understand geo-spatial data/ information collection and handling through geographical information systems

CO2: Learning spatial data integration and ability to select a particular method of geo-spatial data analysis

CO3: Analysis of geo-spatial data and design of analysis strategies for different engineering problems

Syllabus

Geographical Information System: Components of GIS; Feature types, Spatial data models (raster & vector) - their advantages and disadvantages; Spatial data creation and management- methods, topology creation, editing and manipulation, attaching attribute data.

Spatial analysis: Single and multiple layer spatial analysis, Spatial querying; arithmetic and logical operations, 3D analysis, Spatial data visualization - map design and layout for thematic layers and display of tables and graphs using GIS software, Application of GIS in natural resources assessment and inventory, Change detection, Applications of GIS for assessment of disasters, Preparation of vulnerability maps for different type of disasters, Prioritization analysis for mitigation of different types of disasters.

Books:

1. Burrough, P. 1998, "*Principles of Geographical Information System*", Oxford University Press.
2. Chou, Yue-Hong, 1997, "*Exploring Spatial Analysis in Geographical Information Systems*", On Word Press, USA.
3. Christopher Jones, 2002, "*Geographical Information Systems and Computer Cartography*", Longman, London.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CEP507	**Course Name:** Geoinformatics Laboratory
Credit: 1	**L-T-P:** 0-0-2
Version: 2021	**Approved on:**
Pre-requisite course:	

Course Outcomes

CO1: Learning spatial data handling software and creation of spatial databases

CO2: Ability to select a suitable geographical data and method integration and analysis

CO3: Able to analyze geographic problems, design methodology to solve through geographical information system

CO4: Able to use GIS for different engineering problems

Syllabus

1. Demonstration of GIS Software.
2. Georeferencing of Scanned images and Reference datasets – Two exercises.
3. Creation of GIS Database (Digitization of point, line and polygon features).
4. GIS database modification and editing (for point, line and polygon features).
5. Attribute data handling in GIS.
6. GIS data retrieval (selection based on attributes and location).
7. GIS Operations (Arithmetic, Boolean, Logical operators).
8. Classification and measurements in GIS.
9. Overlay analysis in GIS.
10. Neighborhood analysis in GIS (Buffer analysis, Interpolation, topographic functions).
11. Connectivity functions.
12. Digital Elevation model and its application.
13. Optimum site selection in GIS.

Books:

1. Burrough, P, 1998, "*Principles of Geographical Information System*", Oxford University Press.
2. Chou, Yue-Hong, 1997, "*Exploring Spatial Analysis in Geographical Information Systems*", OnWord Press, USA.
3. Christopher Jones, 2002, "*Geographical Information Systems and Computer Cartography*", Longman, London.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET508	**Course Name:** Rehabilitation, Reconstruction and Recovery
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand and appreciate medium term and long-term recovery aspects from a disaster and the role of community participation in recovery of a society in a post-disaster scenario

CO2: To be able to comprehend, critique, compile, and present technical topics related to rehabilitation, reconstruction, and recovery from a disaster

CO3: To be able to understand the rehabilitation and reconstruction aspects of various types of infrastructure in a post-disaster scenario such as housing, public buildings, bridges, dams, monuments

CO4: To be able to understand the recovery and rehabilitation aspects of services such as water supply, electricity, waste management, and communication

Syllabus

Recovery and reconstruction: Introduction, Medium and long term recovery aspects, Community participation in defining objectives and their priorities, Disaster risk communication.

Rehabilitation: Physical and social infrastructure, Relocation and reconstruction of housing, public buildings, bridges, dams, archives and monuments, services such as water supply, electricity, waste management, communication, capacity building for self-help construction, Numerical condition surveys for foundation, Structural and functional deterioration, Design criteria, Materials and techniques. Predictive performance models, Repair and retrofitting: Earthquake damages of buildings, their retrofitting and restoration, Superficial repair, Structural repair, Structural strengthening of habitable spaces, public buildings, roads, bridges, dams, culverts etc.

Books:

1. Sharma, Vinod K., "*Disaster Management*", NCDM, IIPA, New Delhi, 1994
2. Mathur, G. C., "*Housing in Disaster Prone Areas*", National Building Organization and U.N. Regional Centre. ESCAP, New Delhi, 1986.
3. Mishra, P. K., "*Transforming Adversity into Opportunity: Experiences from Gujarat Earthquake Reconstruction Program*", World congress on Natural disaster mitigation proceedings, February 2004.
4. Twigg, John, "*Disaster Risk Reduction*", London: Overseas Development Institute, Humanitarian Policy Group, 2015.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET801	**Course Name:** Disaster Resilient Structures and Retrofitting
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand the fundamental of earthquake resilient structural design
CO2: To understand the behaviour of structure under fire and blast load
CO3: To gain the knowledge about different retrofitting techniques for structures and different code of practices.

Syllabus

Earthquake effects on the structures, Classification of loads, Seismic methods of analysis, Seismic design methods, Seismic damages during past earthquakes and effect of irregularities and building architecture on the performance of structures, Basic design considerations for multistoried RC and steel structure with foundation as per latest IS:1893, Capacity based design of building, Types of ductility, Factors affecting ductility, Ductile detailing as per latest IS:13920, Seismic design considerations for masonry buildings.

Fire safety of buildings, Effect of high temperatures on different types of steel and concrete structural members, Fire resistance by structural detailing, Analytical determination of the ultimate bending moment, Design of RC members for fire resistance, Introduction of IS:1642.

General characteristics of blast and effects on structures, Blast load on above and below ground structures, Response of structural elements to blast force, Dynamic strength of materials and design stresses, Load combinations for design, Introduction of IS:4991.

Sources of weakness in RC and Steel framed buildings, Classification of retrofitting techniques, Conventional and non-conventional methods, IS code provisions for retrofitting of masonry structures.

Books:

1. Thomas Paulay and Priestley M. J. N., "*Seismic Design of Reinforced Concrete and Masonry Buildings*", Wiley India Pvt Ltd.
2. Agarwal Pankaj and Shrikhande Manish, "*Earthquake Resistant Design of Structures*", PHI.
3. Datta T. K., "*Seismic Analysis of Structures*" Wiley.
4. Duggal Shashikant K., "*Earthquake Resistant Design of Structures",* 2nd Edition, Oxford.
5. Priestley M. J. N., Calvi G. M. and Kowalsky M. J., "*Displacement-Based Seismic Design of Structures*", 2nd Edition, EUCENTRE.
6. Varghese P. C., "*Advanced Reinforced Concrete Design*", 2nd Edition, PHI Learning Pvt. Ltd.
7. Cormie David, Mays Geoff and Smith Peter, "*Blast Effects on Buildings*", 3rd Edition, Thomas Telford Publishing.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET802	**Course Name:** Disaster Response and Preparedness
Credit: 2	**L-T-P:** 2-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To be able to understand and appreciate the principles and practices of disaster response operations and management

CO2: To be able to understand and appreciate the conceptual and applied issues in emergency management

CO3: To be able to understand and appreciate the principles and practice of disaster relief and recovery

CO4: To be able to understand and appreciate the methods of dealing with terrorism

Syllabus

Global Disaster: Global and Indian scenario, Science and policy, Institutional framework for disaster preparedness and mitigation, Managing natural and anthropogenic disasters, Principles and practice of disaster response operations and management, Disaster Planning, Public Administration/Policy and Emergency management, Incident command center, Training need analysis and human resource development plan, Corporate/public agency coordination, Human element in preparedness planning, Current trends in disaster preparedness. Hazard monitoring, tracking and modelling, Early warning systems, Warning protocols, Indian disaster resource network, Public health aspects of disaster management and emergency services systems, Urban hazards and disaster planning, Fire services preparedness, Emergency sanitation, Shelter environments, Conceptual and Applied Issues in Emergency Management: Operational decision making, Introduction to emergency management and planning, Organization and structure of emergency management, Emergency management research methods and analysis, Public information for emergency management, Principles and practice of disaster relief and recovery, Logistic support system, Computer applications in emergency management. Principles of natural hazard reduction, Toxicology and biohazards in emergency management, Terrorism Preparedness: Critical infrastructure and emergency management, Emergency preparedness, response, and planning for hazardous materials, Terrorism, WMD and other contemporary issues, Incident management systems and emergency operations center, Contingency planning, Community emergency response team, Community relations for environmental and emergency managers, Contingency planning for business and industry, International disasters.

Books:

1. Collins Larry R. and Schneid Thomas D., "*Disaster Management and Preparedness*", Taylor and Francis 2000.
2. Goel S.L. and Kumar Ram, "*Disaster Management*", Deep and Deep Publications, 2001.
3. Arora R. and Arora P., "*Disaster Management: Medical Preparedness, Response and Homeland Security*", Eds, 2013, CAB International.
4. Maiden R. P., Paul R., Thompson C., "*Workplace Disaster Preparedness, Response, and Management*", Routledge, 2007.
5. Beach, M., "*Disaster Preparedness and Management*", F A Davis Company, 2010.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET803	**Course Name:** Disasters and Special Structures
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand the behaviour of special structures.
CO2: To understand the effect of disaster on special structures
CO3: To gain the knowledge about different state-of-the-art of practices.

Syllabus

Introduction to Special Structures and Their Uses: Bridges, Dams, Nuclear power plants, Thermal power plants.

Underground Structures: Tunnels, Subways and Storage Tanks, Pipelines, Railways, Roads, Retaining structures, Liquid storage tanks, Waterways, Reservoirs, Wastewater infrastructure and Offshore structures.

Performance of special structures during past disaster, Vulnerability of special structures, Health monitoring, Operations and maintenance, Potential threats and risk assessments, National and international policies, Environmental impact due to damage of special structures, Case study, Emergency plan and risk reduction, Post-Disaster recovery and reconstruction.

Books:

1. Pitilakis, K., Crowley, H. and Kaynia, A. M., "*SYNER-G: Typology Definition and Fragility Functions for Physical Elements at Seismic Risk - Buildings, Lifelines, Transportation Networks and Critical Facilities*", Springer.
2. Pitilakis, K., Franchin, P., Khazai, B. and Wenzel, H., "*SYNER-G: Systemic Seismic Vulnerability and Risk Assessment of Complex Urban, Utility, Lifeline Systems and Critical Facilities - Methodology and Applications*", Springer.
3. Chopra, A. K., "*Earthquake Engineering for Concrete Dams: Analysis, Design, and Evaluation*", Wiley-Blackwell.
4. Wang, J. N., "*Seismic Design of Tunnels*", Parsons Brinckerhoff Quade & Douglas, Inc.
5. Lew, H. S., "*Wind and Seismic Effects*", National Bureau of Standards, SP-477.
6. Andrews, A. and Folger, P., "*Nuclear Power Plant Design and Seismic Safety Considerations*", Congressional Research Service.
7. Sibal, R. S., "*Are You Prepared for a Disaster? Mitigation and Management of Disasters*", Bloomsbury.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET804	**Course Name:** Geohazards and Mitigation Measures
Credit: 2	**L-T-P:** 2-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To gain an appreciation of various geologic hazards and factors that cause and contribute to such hazards

CO2: To gain an appreciation of the susceptibility of a given area to any specific type of geologic hazard

CO3: To gain an understanding about how to deal with, and mitigate the damage from a given geologic hazard

Syllabus

Sudden Geologic Hazards: Earthquakes, Tsunamis, Liquefaction, Volcanic eruptions, Pyroclastic flows and Ash falls, Landslides and Avalanches, Rock falls and Debris flow, Glacial bursts, Flash floods, Geomagnetic storms.

Gradual Geologic Hazards: Geogenic groundwater contamination (arsenic, fluoride, etc.), Stream erosion, Coastal erosion, Alluvial fans, Salt water intrusion, Ground settlement, Ground subsidence and sink holes, Sand dune migration and desertification.

Mitigation Measures: Geosynthetics in hazard prevention and containment, Hazard warning systems, Engineering and construction measures in hazard mitigation, Adaptive urban planning in hazard mitigation.

Books:

1. Bell, "*Geologic Hazards Their Assessment, Avoidance, and Mitigation*", CRC Press.
2. Kusky, "*Geological Hazards: A Sourcebook*", Oryx Press.
3. Bolt, Horn, Macdonald, Scott, "*Geological Hazards*", Springer.
4. Hunt, "*Geologic Hazards: A Field Guide for Geotechnical Engineers*", CRC Press.
5. Press, Seiver, Jordan, and Grotzinger, "*Understanding Earth*", Freeman & Co.
6. Kramer, "*Geotechnical Earthquake Engineering*", Prentice Hall.
7. Subinoy Gangopadhyay, "*Engineering Geology*", Oxford University Press.
8. Russell, Cohn, "*Geomagnetic Storm*", Book on Demand.
9. Bear, Cheng et al., "*Seawater Intrusion in Coastal Aquifers*", Springer Netherlands.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET805	**Course Name:** Hydrometeorological Disasters, Adaptation and Mitigation
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand the hydrological and meteorological phenomenon responsible for hydrometeorological disasters

CO2: To identify the hydrometeorological hazards and their likely impacts on society and environment

CO3: To gain the knowledge and understanding about possible adaptation and mitigation measures for hydrometeorological hazards

Syllabus

Hydrologic cycle, Relationship between hydrology, meteorology and climatology, Hydrometeorology, Importance of study of hydrometeorology, Hydrometeorological extreme events, Characteristics of extreme events, Climate change impacts on hydrometeorology, Hydrometeorological hazards and disasters, Flood, Drought, Storms and Heat & Cold Waves, Causes, effects and their impacts, Hydrometeorological hazard monitoring and forecasting, Early warning systems, Risk assessment and Socioeconomic responses, Resilience of communities to hydrometeorological hazards, Adaptation and Mitigation measures and considerations, Hydrometeorological hazard studies, their mapping and impact assessment.

Books:

1. Vinay Kumar Pandey and Ajai Mishra, "*Climate Change and Hydro-Meteorological Disaster*", Lambert Academic Publishing.
2. John F. Shroder, Paolo Paron and Giuliano Di Baldassarre, "*Hydro-Meteorological Hazards, Risks and Disasters*", Elsevier.
3. Philippe Quevauviller, "*Hydrometeorological Hazards*", John Wiley & Sons Inc.
4. Ven-Te Chow, David R. Maidment and Larry W. Mays, "*Applied Hydrology*", McGraw Hill Publications.
5. Ana Iglesias, Dionysis Assimacopoulos and Henny A.J. Van Lanen, "*Hydrometeorological Extreme Events*", Wiley.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET806	**Course Name:** Introduction to Sustainable Development
Credit: 2	**L-T-P:** 2-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand helix and milestones in evolution of sustainable development
CO2: To understand role of engineering and technology for sustainable development
CO3: To understand challenges and threats to sustainable development and their solutions

Syllabus

Introduction: Definitions of Sustainable development, Pillars, Principles, Evolution and parameters of sustainable development, Issues and challenges to sustainable development, MDGs, SDGs.

Tools for Sustainability: Environment management, Environmental legislations, ISO 14000, Life cycle assessment, Environmental impact assessment case studies,

Sustainable Engineering: Overview of Sustainable Engineering, Case studies in sustainable engineering, Sustainable waste water treatment, Solid waste, Sanitation practices/ methods, Nexus between technology and sustainable development, Financial sustainability.

Innovative Practices: Applications of sustainability, Sustainable development in urban system, Water conservation, Sustainable transport systems, Sustainable habitats.

Books:

1. World Commission on Environment and Development, 1987, "*Our Common Future",* Oxford: OUP.
2. UN Millennium Project, 2005, "*Investing in Development: A Practical Plan to Achieve the Millennium Development Goals, Overview"*.
3. Hazell, P. and X. Diao, 2005, "*The Role of Agriculture and Small Farms in Economic Development*", Washington, D.C.: International Food Policy Research Institute.
4. World Bank (2006), "*Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems*", World Bank: Agriculture and Rural Development.
5. Chandra Prasanna, "*Projects, Planning, Analysis, Financing, Implementation*".
6. DFID: Guidance Manual on Water & Sanitation Programme.
7. Thomas and Callan, "*Environmental Economics*".
8. Krishnan S., "*Sustainable Engineering*".

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET807	**Course Name:** Lifeline Services and Disasters
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand how society expects water and wastewater systems to perform and how the systems are actually designed to perform.

CO2: To execute various emergency processes for excreta disposal and treatment of drinking water.

CO3: To identify various systems of power generation, transmission and distribution and to apply this knowledge for safety and power restoration during a hazard.

CO4: To classify different transportation infrastructure systems and to identify vulnerable systems and potential threats.

CO5: To understand interdependencies between lifeline services and apply the knowledge from various case studies of disasters.

Syllabus

Water and Sanitation: Availability and supply of water, Water quality, Disinfection of water sources, Rehabilitating water distribution systems, Emergency treatment of drinking-water, Cleaning wells after seawater flooding, Hygiene promotion in emergencies, Measuring chlorine levels in water supplies, Planning for excreta disposal in emergencies, Technical options for excreta disposal in emergencies.

Power Sector: Generation, Transmission and Distribution System, Grid disturbance and disasters, Blackout, Causes of disaster in Power Sector, Major areas prone to disaster, Power system restoration, System Security, Safety of equipment for disasters, Hazardous and toxic materials and their management in power sector, Cyber Threats, Cyber security for Power Grid, Disaster Management in power sector.

Transportation System: Transport Infrastructure Systems, Interdependencies, Vulnerable systems, Potential threats and risks, Transportation disruption, Transportation disaster planning, Risk assessment, Preparedness, Mitigation, Response, Recovery, Transportation Resilience, Monitoring and assessment, Emergency response and risk reduction, Pre-disaster risk assessment and management, Policies, Institutions, and Processes, Technical-planning, operations and maintenance, Post-Disaster recovery and reconstruction.

Books:

1. Wisner, B., Adams, J. (2002), "*Environmental Health in Emergencies and Disasters: A Practical Guide*", Geneva, Switzerland: World Health Organization (WHO).
2. Harvey, P. A., Baghri, S., and Reed, R.A. (2002), "*Emergency Sanitation: Assessment and Programme Design*", Loughborough, UK: WEDC, Loughborough University of Technology.
3. Central Electricity Authority, Ministry of Power (2021), "*Disaster Management Plan for Power Sector*", Government of India.
4. Chang, S.E (2003) "*Transportation Planning for Disasters: An Accessibility Approach*", Environment and Planning A, Vol. 35, pp. 1051 – 1072.
5. National Academies of Sciences, Engineering, and Medicine (2014), "*A Guide to Regional Transportation Planning for Disasters, Emergencies, and Significant Events*", Washington, DC: The National Academies Press.
6. Weiland, S., Strong A. and Miller B. M. (2019), "*Incorporating Resilience into Transportation Planning and Assessment*", Santa Monica, CA: RAND Corporation.

UG/PG: PG	**Department:** Civil Engineering
Course Code: 21CET808	**Course Name:** Socio-Economics of Disasters and Disaster Finance
Credit: 3	**L-T-P:** 3-0-0
Version: 2021	**Approved on:**
Pre-requisite course: None	

Course Outcomes

CO1: To understand the economic and financial impacts of disasters
CO2: To enhance the knowledge of public finance, disaster funding and financial vulnerabilities
CO3: To increase the understanding of financial management of disaster risks

Syllabus

Disasters and the macro-economy, Public finance and disasters, Funding for Disaster Management – State Disaster Mitigation fund, State Disaster response fund (SDRF), National Disaster Response Fund (NDRF), Prime Minister National Relief Fund (PMNRF), Chief Minister Relief Fund and Role, Financing the cost of future disasters.

Information on Natural Hazards and Disaster Reduction, Financial management of disaster risks, Assessment of disaster risks, Financial vulnerabilities and the impact of disasters.

Insurance Policies for Disaster Management: Evaluation of risk funding and risk transfer policies, Catastrophe insurance pool, Reserve funds and contingent credit policies, Role of Government and market participants, Insurance policy design, Fiscal cost of relief and reconstruction, Grants and low interest loan for reconstruction.

Legal Considerations for Disaster Financial Management.

Books:

1. Report on Economic and Financial Impacts of Natural Disasters: An Assessment of Their Effects and Options for Mitigation.
2. Disaster Risk Assessment and Risk Financing - A G20 / OECD Methodological Framework Available at: https://www.oecd.org/gov/risk/G20disasterriskmanagement.pdf.
3. Case Studies on Financing models and review of Disaster insurance models.