B. Tech. Civil Engineering/ GEC1				
Course code: Course Title	**Course Structure.**			**Pre-Requisite**
CE307: Applications of Geo-informatics, Remote Sensing, and GIS in Engineering	L	T	P	Nil
	3	0	2	

Course Objective: To equip the students with the knowledge of geo-informatics and GIS, and empower them for its applications in a multi-disciplinary environment in the field.

S. No	Course Outcomes (CO)
CO1	To understand the basics of Geoinformatics, Remote Sensing, GIS and GPS.
CO2	To acquire skills for Remote Sensing.
CO3	To have knowledge and skills for using digital experimentation.
CO4	To analyse data obtained from various digital resources in the domain.
CO5	Students are able to apply knowledge about geo-informatics to the socio-engineering scenario.

S. No	Contents	Contact Hours
UNIT 1	**Introduction to Geoinformatics**, Remote Sensing, GIS and GPS: Definitions of Geoinformatics, Remote Sensing, GIS and GPS, sources of energy, electromagnetic spectrum, electromagnetic radiation, reflection, transmission and absorption, black body radiation, Stefan-Boltzmann law, Wein's displacement law, emissivity, Kirchoff's law, thermal emission, Planc's formula. Platforms and sensors, active and passive sensors, PAN, Multi and hyperspectral remote sensing data acquisition systems in optical wavelength region, basic principles of data acquisition and measurement in natural scenes, multi and hyperspectral data statistics, digital data file formats. GPS satellite network	8
UNIT 2	**Optical, Thermal and Microwave Remote Sensing**: Brief review of Optical, thermal and microwave remote sensing, their utility, merit and demerits, Interaction of EMR with atmosphere, scattering, refraction, absorption, transmission, atmospheric windows, interaction of EMR with earth surface, spectral characteristics of remote sensing data, optical radiation models, summary of visible to shortwave region models, spectral reflectance curves, radiation calculation, thermal sensors and their characteristics. Thermal infrared region models, radiation components – surface-emitted component, surface-reflectance, atmospheric emitted component, path-emitted component, total at-sensor, emitted radiance, interpretation of thermal images – day and night images, emissivity consideration, thermal inertia considerations. Factors affecting analysis of thermal images, data models for thermal image analysis.	8

UNIT 3	**Basic Photogrammetry and Digital Image Processing:** Photogrammetry, aerial and terrestrial, applications of photogrammetry, types and geometry of aerial photograph, flying height and scale, relief (elevation) displacement. Stereoscopy, measurement and parallax and height determination, photogrammetric mapping. Digital data bank, digital image, digital image processing introduction to, preprocessing, enhancement, classification, visual image interpretation, Introduction to software - MATLAB, ENVI, ERDAS, AutoCAD etc.	9
UNIT 4	**Maps, Datums, Projections Systems and spatial data analysis** - Plane and Geodetic surveying, Classification of surveys, Basic Principles of Surveying, Types of maps, scales and uses, plotting accuracy, map sheet numbering. Datums, coordinates and map projection systems. Data retrieval and querying, measurements in GIS, classification, and accuracy.	9
UNIT 5	**Applications of Geoinformatics**, Remote Sensing, GIS and GPS: Land cover classification survey and Mapping, Digital elevation model (DEM), GPS surveys, Introduction to SAR data processing and SAR interferometry, Applications in Disaster management, geology, forest security and military projects. Appropriate experiments would be taken up.	8
	TOTAL	**42**

References

S. No	Name of Books/Authors/Publishers	Year of Publication Reprint
1	Agarwal, C.S. and Garg, P.K., "Remote Sensing in Natural Resources Monitoring and Management", Wheeler Publishing House(ISBN 6-74-268173-4)	2000
2	Bossler, J.D., "Manual of Geospatial Science and Technology", Taylor and Francis. (ISBN 0-74-68914355-7)	2002
3	Burrough, P.A. and McDonnell, R.A., "Principles of Geographic Information Systems", Oxford University Press. (ISBN 0-07-985256-4)	2000
4	Chandra, A.M. and Ghosh, S.K., "Remote Sensing and Geographical Information Systems", Alpha Science. (ISBN 0-07-8452567-1)	2005
5	Gopi, S., "Global Positioning System: Principles and Applications", Tata McGraw-Hill.(ISBN 0-07-7691528-1)	2005

B. Tech. Civil Engineering/ GEC2				
Course code: Course Title	**Course Structure**			**Pre-Requisite**
CE 306: Infrastructure Resilience and Socio-Economic Dynamics	**L**	**T**	**P**	Nil
	3	1	0	

Course Objective: Fostering students' competence in assessing risks, improving infrastructure resilience, and understanding their impact on society.

S. No	Course Outcomes (CO)
CO1	Introduction to the impacts of disasters and their risks on infrastructure.
CO2	Assessment of risk and strategy towards improving resilience.
CO3	Estimating potential losses from multi-hazards using a software approach and mitigating effects.
CO4	Modelling risk given societal impact.
CO5	Students can assess the impact of hazards on society in terms of economics and living conditions.

S. No	Contents	Contact hours
UNIT 1	**Introduction**: Intersection of disasters, people, policy, infrastructure, and the environment; Private and public infrastructure.	8
UNIT 2	**Risk and resilience**, Infrastructure as a hazard amplifier, Risk and equity, Individual response to risk, Modelling risk.	8
UNIT 3	**The emergency management cycle:** Direct vs. Indirect losses, Structural fragility, Assessment of hazard using software tools and databases such as HAZUS-HM. System-level post-disaster operability, gathering situational awareness for resilience, Building codes for recovery and resilience, Interdependent infrastructure, Hazard memory and education, Resilience for infrastructure preparation for disasters with and without warning.	9
UNIT 4	**Sociological concepts and methods:** man and environment relationships, socio-economic profile of Indian society, and urban transformation, traditions and modernity in the context of urban and rural settlements.	9
UNIT 5	**Economic growth and development** due to infrastructure projects, Quality of life, Human development index, Employment and livelihood, Economic principles of land use planning, Policies and strategies of economic planning, Balanced vs. unbalanced growth.	8
	TOTAL	**42**

References

S. No.	Name of Books/Authors/Publishers	Year of Publication / Reprint
1	Critical Infrastructures Resilience: Policy and Engineering Principles: Auroop Ratan Ganguly, Udit Bhatia, Stephen E. Flynn (ISBN-13: 978-1498758635)	2018
2	Resilient Structures and Infrastructure: Noroozinejad Farsangi, E., Takewaki, I., Yang, T., Astaneh-Asl, A., Gardoni, P. (ISBN 978-981-13-7446-3)	2019
3	Strategic Infrastructure Development for Economic Growth and Social Change: Nilanjan Ray (ISBN-13: 978-1466674707)	2015
4	Developing Disaster-Risk Resilience in Cities: Training Module for Urban Local Bodies, including Contexts of Climate Risk and Children's Resilience: Anil K Gupta, Nivedita Mani, Banku Bihari Sarkar, Swati Singh (ISBN: 978-81-933285-3-8)	2019