Course Type	Course Code	Name of Course	L	T	P	Credit
DC	**NGPC501**	**Seismology**	**3**	**1**	**0**	**4**

Course Objective

The course introduces essential principles of earthquake seismology aimed at offering students a comprehensive understanding. The subjects covered are especially pertinent for students pursuing further research in observational and strong-motion seismology. Nevertheless, the principles and techniques taught hold significance for broader fields such as general geophysics, appealing to students from various disciplines interested in topics like Earth structure, earthquake physics, and hazards.

Learning Outcomes

Through the exploration of earthquake seismology, students will develop a heightened comprehension of techniques like forward modeling and inversion. They will demonstrate proficiency in deriving earthquake mechanisms from waveform data and discuss how earthquake observations contribute to enhancing Earth models. Additionally, students will engage in analyzing various facets of inverse problems within the field of earthquake seismology.

	Topics to be Covered	Lecture Hours (L + T)	Learning Outcome
1.	Basic seismological theory, waves on a string, stress and strain, seismic waves.	**4L + 1T**	Seismic wave propagation analogous to the wave travelling along string
2.	Snell's law, Plane wave reflection and transmission.	**4L + 1T**	Learning reflection and transmission coefficients.
3.	Surface waves, dispersion.	**4L +1T**	Types, group and phase velocities and Tsunami dispersion.
4.	Normal modes of the earth.	**4L +1T**	Earth's normal modes.
5.	Refraction seismology, Reflection seismology.	**4L +1T**	Brief on shallow Earth exploration seismology.
6.	Seismic waves in a spherical earth, Body wave travel time studies.	**4L +1T**	Travel time curves, Low and high velocity zones.
7.	Anisotropic earth structure, Attenuation and Anelasticity.	**3L +1T**	Anisotropic behaviour of Earth, Types of Anisotropy.
8.	Composition of the mantle and core.	**3L +1T**	Reference Earth models, Earth structure, temperature and density variations.

9.	Earthquakes, focal mechanisms, moment tensors.	**3L +1T**	P-and S-wave radiation patterns, Earthquake mechanisms, beach balls.
10.	Brief on Earthquake geodesy.	**3L +1T**	GPS, InSAR, Coseismic and Interseismic deformations, seismic cycle
11.	Source parameters, Earthquake statistics.	**3L +2T**	Magnitudes, types, fractal scaling, Omri's Law etc.
12.	Seismology and Plate tectonics, Spreading centers, Subduction zones.	**3L +2 T**	Plate tectonics.
	Total	**42L +14T**	

Text books

1. Stein, S. and Wysession, M. 2003. An Introduction to Seismology, Earthquakes and Earth Structure, Oxford: Blackwell Publishing.

Reference books

2. Shearer, P. 1999. Introduction to Seismology, Cambridge: Cambridge University Press.
3. Lowrie, W., 2007. Fundamental of Geophysics, Cambridge: Cambridge University Press.
4. Stein, S. and Wysession, M. 2003. An Introduction to Seismology, Earthquakes and Earth Structure, Oxford: Blackwell Publishing.
5. Båth, M., 1976. Introduction to Seismology, Birkhäuser Basel.
2. Agustin, U., 2000. Principles of Seismology, Cambridge: Cambridge University Press.
3. KIyoo Mogi, 1985. Earthquake Prediction, Academic *Press.*
4. *Kasara, K., 1981. Earthquake mechanics,* Cambridge University Press.
5. Bullen, K. E. and Bolt, B. A. 1985. An Introduction to the Theory of Seismology, Cambridge: Cambridge University Press.
6. Richter, C. F. 1945. Elementary Seismology, W H Freeman, San Francisco, W. H. Freeman & Co. 7. Kulhanek, O. 1970. Anatomy of Seismograms, Seismological section, University of Uppsala, Uppsala, Sweden.
8. Leon Reiter, 1991. Earthquake Hazard Analysis, Columbia University Press, 254pp.
9. Scholz, C.H., 2019. The mechanics of earthquakes and faulting, Cambridge University Press, 494pp
10. Gubins D., 1990. Seismology and Plate Tectonics, Cambridge University Press, 348pp.