APPENDIX - XIV

Course Type	Course Code	Name of the Course	L	T	P	Credits
DC	GPC203	Lab on Rock Physics	0	0	2	2

Course Objective
This course aims to impart practical skills for analyzing rock properties using seismic data in subsurface exploration and reservoir characterization. It covers techniques such as calculating elastic modulus from seismic wave velocities and density, estimating stiffness coefficients from isotropic media, and characterizing fluid type from seismic attributes. Additionally, it includes methods for computing bulk modulus, pore compressibility, and seismic velocities using various models.

Learning Outcomes
This course module introduces basic concepts of Rock Physics and also provides Rock Physics model to understand the velocity in the porous media. By the end of this course, students will be able to apply practical techniques for analyzing and interpreting rock properties using seismic data in subsurface exploration and reservoir characterization. They will gain proficiency in estimating elastic modulus from seismic wave velocities and density, using seismic attributes to characterize the fluid type and estimate stiffness coefficients for isotropic media, and calculating seismic velocities and bulk modulus for dry rock constituents. Additionally, students will learn various models for estimating seismic velocities.

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1.	Computation of elastic modulus from seismic wave velocities and density.	2	The ability to compute elastic modulus from seismic wave velocities and density for aiding reservoir characterization.
2.	Estimation of stiffness coefficient for an isotropic medium.	2	Enhanced capability to estimate the stiffness coefficient for isotropic media, improving interpretation of rock properties in subsurface exploration characterization.
3.	Estimation of Thomsen’s parameter for anisotropic medium.	2	Improved proficiency in estimating Thomsen's parameter for anisotropic media, enhancing the characterization of seismic anisotropy in subsurface structures.
4.	Analysis of variation in anisotropy parameter with depth, Hydrogen index, Kerogen content, and bulk density. Study the correlation between P wave anisotropy (ε) and S wave anisotropy parameter (γ) with δ, and explain the anisotropy behavior.	2	Understanding of anisotropy parameter variations and correlations, improving subsurface interpretation.
5.	Computation of impedance, reflection coefficient, and synthetic seismogram using the homogeneous and isotropic properties of the reservoir rock.	2	Generation of seismic seismogram, aiding in subsurface exploration and reservoir evaluation.
6.	Plot acoustic reflectivity against the incidence angle and characterize the AVO classification.	2	Improving AVO classification skills through the analysis of acoustic reflectivity plotted against the incidence angle.
7.	Plot different seismic attributes and characterize the fluid type.	2	Fluid characterization through analysis of various seismic attributes.
8.	Computation of P-wave and S-wave velocities, density, and bulk modulus of the reservoir rock using the Gassman fluid substitution model.	2	Proficiency in calculating rock properties with the Gassman fluid substitution model.
9.	Compute the bulk modulus for a dry rock constituent using Voigt-Reuss bounds.	2	Ability to compute dry rock bulk modulus using Voigt-Reuss bounds.

10.	Computation of pore compressibility.	2	Proficiency in computing pore compressibility.
11.	Estimation of seismic velocities using contact model.	2	Ability to estimate seismic velocities using a contact model.
12.	Estimation of seismic velocities using constant model.	2	Skill to estimate seismic velocities using a constant model.
13.	Estimation of seismic velocities using Friable sand Model.	2	Proficiency in estimating seismic velocities using a Friable sand Model.
14.	Estimation of seismic velocities using shaly sand Model.	2	Ability to estimate seismic velocities using a shaly sand Model.
	Total	**28**	

Textbooks
1. Gueguen, Y., Palciauskas, V. Introduction to the Physics of Rocks. Princeton University Press, 1992.
2. Lowrie, W., Fundamentals of Geophysics. Cambridge Univ. Press, 2007.
3. Mavko, G., Mukerji T., Dvorkin, J. The rock physics handbook. Cambridge University Press, 2020.
4. Philip, K., Brooks, P., Hill, I. An introduction to Geophysical Exploration. Black Well Science, 2002
5. Telford, W.M., Geldart, L.P., Sheriff, R.E. Applied geophysics. Cambridge University Press, 1990.

Reference Books
1. Jones, E.J.W. Marine Geophysics. John Wiley & Sons, 1999.
2. Howell, B. F. Introduction to Geophysics. Mc-Graw Hill, 2012.
3. Stanislav M., Tvrdy, S. Introduction to applied geophysics. Springer Dordrecht, 1984.