Rock Physics

1.1. Course Number: GE 522

1.2. Contact Hours: 3-0-0 Credits: 9

1.3. Semester Offered: 5th Year-Odd

1.4. Prerequisite: Formation Evaluation, Petroleum Geology, Petroleum Geophysics

1.5. Syllabus Committee Members: Dr. Satish Sinha and Dr. Piyush Sarkar

2. **Objective:** The objective of this course to explains geophysical data, such as seismic wave velocities or electrical conductivity in the context of mineralogy, fluid content, and environmental conditions. Rock physics employs indirect geophysical data, such as seismic impedance, sonic log velocities, laboratory measurements, and petrophysical information about porosity, fluid type, and saturation in reservoir characterization, evaluation, and monitoring.

3. **Course Content:** Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topics	Lectures
1	Basic theory	Introduction of rock physics and its application, Theory of seismic wave propagation, rock type and petrophysical properties	8
2	Hooke's law and anisotropy	Isotropic and Anisotropic Form of Hooke's law, Relationships among elastic constants in an isotropic and anisotropic medium, Thomsen's Anisotropic Parameters	4
3	Bounds and Effective medium	Effective elastic modulae, Hashin-Shtrikman bounds, Voigt-Reuss bounds, Hills Average Method, Effective medium theories.	6
4	Rock Mechanics and Diagnostic models	Physical properties of rock, and relate these properties to the mechanical behavior of the rocks, Rock and Pore Compressibility, Rock physics Diagnostics model	8
5	Gassmann fluid substitution	The effects of fluids on rock properties: Gassmann relation for fluid Substitution. Contact model, constant Model and Friable sand model	6
6	AVO	Impedance, Reflectivity and Transmittivity, Seismic Amplitude Variation with Offset (AVO)Seismic Attributes – elastic impedance, AI, GI, EEI, AVO, attenuation, anisotropy, porosity, permeability, electrical conductivity and their relationships	8
		Total	**40**

4. Readings:

4.1. Textbook:

- Introduction to the physics of rocks, Gueguen and Palciauskas, Prinston Univ. Press, 1992.
- The Rock Physics Handbook, Mavko, Dvorkin and Mukerji, Cambridge Univ. Press, 1998.

4.2. Reference books:

- Wave Propagation in Elastic Solids: North-Holland Series in Applied Mathematics and Mechanics (North-Holland Series in Applied Mathematics & Mechanics) by J. D. Achenbach and H. A. Lauwerier

5. Outcome of the course:

This course module introduces basic concepts of Rock Physics and also provides Rock Physics model to understand the velocity in the porous media.