Semester	JAN 2022
Open to semester	6,8
Course code	**EC3234**
Course title	**Physics of Geological Processes**
Credits	4 /
Course Coordinator & participating faculty (if any)	Arjun Datta*, Guest Faculty Prof. R.G. Sastry (Visiting Professor, IIT Bhubaneswar)
Nature of Course	Lectures
Pre-requisites	Courses - The Solid Earth
Objectives (goals, type of students for whom useful, outcome etc)	This is a course on Earth's gravity and its relationship to Earth structure.
Course contents (details of topics /sections with no. of lectures for each)	1. Introduction: Brief review of plate tectonics. Role of gravity in isostasy and plate tectonic modeling. 2. Preliminaries: Gravity potential and geoid, Governing equations (Laplace's in different coordinate frames), gravity anomaly source(s), gravity measurements and reductions; Global gravity and Spherical harmonic analysis ; Global gravity and moment of inertia (Mac Cullogh's formula). Analytic continuation of potential fields. Gravity moments (Zeroeth order, first order and higher order moments using multipole expansions); Interpretation of Bouguer gravity data including numerical forward modeling and quantitative interpretation procedures. 3. Isostasy, theory of elastic plates and flexure of the Lithosphere: Introduction, Airy and Pratt's models of isostasy, local versus regional compensation, isostasy and plate tectonics. Elasticity and Flexure, Linear Elasticity, Uniaxial Stress and Strain, Plane stress and strain, Pure and simple shear, Isotropic stress, Two-Dimensional Bending or Flexure of Plates under applied Moments, Vertical and Horizontal Load, Application to the Earth's Lithosphere-Periodic and End Load, Bending of the Elastic Lithosphere under the Loads of Island Chains, Ocean Trench Flexure and the Structure of Sedimentary Basins, Thin- versus Thick-Plate Flexure. Flexure of beams, beams of unlimited length, Heteny's function, thin versus thick plate flexures, bending of plates under applied moments and vertical loads, flexure of

	lithosphere. 4. Geological examples of the flexural model of isostasy: Lithosphere as a filter, gravitational admittance, isostatic response functions, estimates of admittance, coherence and isostatic response functions from observations, relationship of elastic parameters to load and plate age, yield strength envelops, time-dependent flexure, elastic thickness and earthquakes, bending of elastic lithosphere under the loads of island chains and ocean trenches, flexure and structure of sedimentary basins.
Evaluation /assessment	End-Sem Examination-40% Mid-Sem Examination-40% Others-20%
Suggested readings (with full list of authors, publisher, year, edn etc.)	Books: 1. Grant, F. S. & West, G. F. (1965). Interpretation theory in applied geophysics. New York: McGraw-Hill. 2. Watts, A. B. (2001). Isostasy and Flexure of the Lithosphere. Cambridge University Press. 3. Turcotte, D. L., & Schubert, G. (2002). Geodynamics. Cambridge University Press.