SARDAR PATEL UNIVERSITY Programme & Subject: M.Sc (Earth Science) Semester: IV Syllabus with Effect from: June - 2014

Paper Code: PT04EESC01 Title Of Paper: Advanced Geophysics

Total Credit: 4

Unit	Description in Detail	Weightage (%)
Ι	Signal Processing and Field Theory: Continuous and discrete signals; Fourier series; linear time invariant systems with deterministic and random inputs; band limited signal and sampling theorem; discrete and Fast Fourier transform; Z-transform; convolution; Filters: discrete and continuous, recursive, non-recursive, optimal and inverse filters; deconvolution; Newtonian potential; Laplace and Poisson's equations; Green's Theorem; Gauss' law; Continuation integral; equivalent stratum; Maxwell's equations and electromagnetic theory; Displacement potential, Helmhotz's theorem and seismic wave propagation.	25%
П	Numerical analysis and inversion: Numerical differentiation and integration, finite element, and finite difference techniques; Simpson's rules; Gauss' quadrature formula; initial value problems; pattern recognition in Geophysics. Well posed and ill-posed problems; method of least squares; direct search and gradient methods; generalized inversion techniques; singular value decomposition; global optimization.	25%
III	Seismology and Tomography: Seismometry: short period, long period, broad band and strong motion; elements of earthquake seismology; seismic sources: faulting source, double couple hypothesis, elastodynamics, Haskell's function, seismic moment tensor, focal mechanism and fault plane solutions; seismic gaps; seismotectonics and structure of the earth; Himalayan and stable continental region earthquakes, reservoir induced seismicity; seismic hazards; earthquake prediction; Seismic Methods: Generalized Snell's Law; Ray theory; reflection, refraction, diffraction; Zoeppritz's equation; seismic energy sources; detectors; seismic noises and noise profile analysis; seismic data recording and telemetry devices; reduction to a datum and weathering corrections; Interpretation of a refraction seismic data by graphical and analytical techniques; CDP/CMP; seismic reflection data processing, velocity analysis, F- K filtering, stacking, deconvolution, migration before and after stack; bright spot analysis; wavelet processing; attenuation studies, shear waves, AVO; VSP; introduction to 3D seismics; seismic stratigraphy.	25%
IV	Gravity, Magnetic and Well logging Methods: Gravimeters and magnetometers; data acquisition from land, air and ship; corrections and reduction of anomalies; ambiguity; regional and residual separation; continuation and derivative calculations; interpretation of anomalies of simple geometric bodies, single pole, sphere, horizontal cylinder, sheet, dyke and fault. Forward modelling and inversion of arbitrary shaped bodies and 2-D, 3-D interfaces. Interpretations in frequency domain; Well logging and other methods: Open hole, cased hole and production logging; Electrical logs; lateral, latero, induction, S.P; porosity logs; sonic, density, neutron; natural gamma; determination of formation factor, porosity, permeability, density, water saturation, lithology; logging while drilling. Radioactive and geothermal methods.	25%



Basic Text & Reference Books:-

- Geophysical Exploration, Wiley-Blackwell (Blackwell Science)(2002)
- G.R. Foulger, C. Peirce, Geophysical Methods in Geology, Wiley-Blackwell Science(2002)
- William Lowrie, Fundamentals of Geophysics, Cambridge University Press (2007)

