BT 640 NEURAL IMAGING AND SIGNAL SYSTEMS (3-0-0-6)
(Department Electives)

Preamble:

Neural Imaging and Signal systems course is designed to introduce the theory and instrumentation for neural systems having clinical relevance. Specific focus would involve on monitoring brain activity non-invasively for cognitive applications and psychiatric disorders. The clinical process of diagnosis and subsequent treatment in patients (say automated monitoring of epilepsy or medical images taken with a state of art magnetic resonance imaging scanner in psychiatry), all produce vast amounts of data. To help medical practitioners make sense of this big clinical datasets, it is becoming increasingly important to develop reliable computational tools that can automatically analyse and extract clinically relevant biomarker information. The engineering methods taught in this course coupled with hands on experience in using neuroimaging software will provide excellent computational tools for clinical decision support.

Course contents:

Significance and common types of neural signals (like electroencephagram (EEG), near infrared spectroscopy etc); EEG oscillations and its link to basic neurophysiology; With reference to neural signals (mean removal across channels/recordings, interpretation of standard deviation, normalization, variance, co-variance, correlation, signal to noise ratio, filtering); evoked potentials and cognitive applications, diseases of central nervous system and EEG, processing and feature extraction of EEG signals.

Introduction to magnetic resonance imaging in psychiatry and its neurobiology basis, contrasts, pixel versus voxel, resolution, image file formats, neuroanatomy of brain primer, univariate and multivariate analysis (with reference to schizophrenia, autism and alzheimer's), multimodal frameworks, software packages to analyse neural imaging data.

Generalized medical instrumentation system, transducers and measurement of physiological systems, calibration and standardization. Portable/Wearable neural monitoring devices, practicalities of electroencephalogram measurement and experiment design. Introduction to brain computer interfaces and applications.

Annexure-130/10(c) contd…..

Texts/References:

1. K. Najarian, *Robert Splinter. Biomedical Signal and Image Processing*, 2nd Edn.,CRC Press, 2012.
2. M. Cohen, *Analyzing Neural Time Series Data, Theory and Practice*, 1st Edn., MIT Press, 2014
3. J.L.Semmlow, *Biosignal and Medical Image Processing,* **2nd Edn.,** CRC Press, 2011.
4. R. Rao, *Brain-Computer Interfacing: An Introduction*, Cambridge University Press, 2013.