



Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)

Project Title	Developing a neuro-probe to screen degree of adolescent depression
Project Summary (Minimum 500 and maximum 2000 characters)	The rise in adolescent depression (AD) over the past two decades, poses a substantial health burden, affecting up to 21% of Indian adolescents. AD individuals (10-19 years) experience hopelessness, concentration difficulties, and suicidal ideation. A key symptom, rumination of thoughts (repetitive dwelling on negative thoughts) may stem from poor ‘executive’ control over intrusive thoughts. Understanding why individuals transition to rumination and struggle to inhibit negative thoughts is crucial for effective therapies. Mind-wandering, where thoughts drift from the task-at-hand, may contribute by impairing executive control. While mind-wandering is also seen in healthy individuals, ‘unintentional’ mind-wandering is linked to depression, obsessive thoughts, and may evolve into rumination. Our project investigates mind-wandering and visual tracking-related cortical microstates in AD patients, examining their effects on executive control and their potential in diagnosing. Objectives: Aim 1: Examine how differential patterns of mind-wandering influence cortical microstates and executive control in relation to AD severity. Aim 2: Investigate visual search profiles and assess their diagnostic utility by relating these features to AD severity. Aim 3: Apply big-data analytics to classify EEG features that distinguish intentional from unintentional mind-wandering, and evaluate their association with AD severity to test diagnostic utility. The goal is to create a quantitative diagnostic tool for AD using big-data classifiers that integrate differential psychological states with cortical microstates. The project will deliver a two-phase deployable tool: Phase 1, a search-task-based screening tool for AD patients presenting at the OPD, and Phase 2, a lab-based short-duration EEG protocol to assess disease severity in screened patients.

Ph.D. Supervisors
(Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)

Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official) & Contact Number
Supervisor 1	Dr Sumitash Jana	Department of Humanities and Social Sciences, IIT Delhi	sjana@hss.iitd.ac.in
Supervisor 2	Dr Suman Das	Department of Physiology, AIIMS Delhi	drsumandas@aiims.edu

Project requirements (Student qualifications, experience required, etc)
*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)

- The prospective candidate for this Ph.D. position should have B.E./ B.Tech/ M.Sc/ MCA/ MS or equivalent degree throughout bachelor master should be distinction 75% and ideally possess background in computer Science/ Electrical/ related and demonstrate a strong track record in various aspects:
- Research Experience:** We seek candidates who have actively engaged in research activities and have worked in collaboration with teams smoothly, preferably in areas relevant to EEG, Acoustic data analysis, machine learning, Deep learning, LLM etc. Previous research experience and publication will be highly valued. While academic research is essential, candidates with exposure to the industry or innovation sector will have a distinct advantage. Practical experience in translating research into tangible solutions or products is desirable.

Source of fellowship/funding and project number (CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)
Institute Fellowship/ Project Fellowship /Part Time

Role of Faculty Members involved:	
Supervisor-1	Dr. Sumitash Jana has 10+ years of experience in cognitive neuroscience research. He has used EEG and behaviour to study executive control and has published several journal articles on the same. His lab focuses on studying mind wandering and executive control. He has also received several funding to study these topics.
Supervisor-2	Dr. Suman Das has over 15 years of experience in Medical Neurophysiology and Biomedical Engineering. His expertise includes electrophysiological signal processing, vocal acoustic profiling and clinical diagnostics. His research spans from single-neuron recordings to high-density macroscale recordings.

Note :-

1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Institute Fellowship (Category-wise)" for selecting the students in SRe.
2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SRe student.
3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.
4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.
5. A candidate applying with a valid JRF/INSPIRE/any national level fellowships should have at least two-year validity from the date of joining of the Ph.D program.
6. The third supervisor name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.
7. If Institute fellowship is being sought then DRC approval of the parent department of Supervisor 1 is required at the time of selection.