Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST/ SECOND SEMESTER 2020-2021

Course Handout Part II

Date: 18-08-2020

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : BITS E661 (5 – Units)
Course Title : Research Methodology I
Instructor-in-Charge : Prof. AravindaRaghavan (IC), Dr. MurariR RVarma, and Dr. AswathyRaveendran

Scope and Objective of the Course: In this course, a PhD student will contextually learn and apply research methods. The context will be a relevant impactful problem that requires research. A PhD student is an aspiring scientist. To engage like a scientist is to be curious about phenomenon around us. To understand and solve problems entail making observations, formulating questions, framing hypothesis, gathering evidence in a reproducible manner, making scientific claims based on evidence and modelling using existing scientific knowledge, communicating results, revising the explanation or revisiting the experiment based on critique from the community, apply ethical principles concerning human beings and animals. In essence, the goal is to formally introduce PhD students to research through an inquiry based approach.

Textbooks: No formal book is prescribed. The material for reading will be provided.

Course Plan:

Lecture No.	Learning outcomes	Topics to be covered	Resource(s)/Output
1	State the objectives of the course	Why research methodology?	Slides, Video
2-3	List a few research areas pursued in our campus	Why are you interested in your research problem?	Group discussion, fun voting
4-5	Identify the most important problems pursued world-wide	Identify the characteristics of an impactful research problem	Group discussion, fun voting
6-7	Select a research problem and form a group	How to choose a research problem and collaborators?	Slides, Group discussion
8	State the strategies of literature survey	The need for literature survey	Slides, Video / Online Quiz
9	Discuss the strategies of literature survey	Using SCOPUS and Google scholar	Slides, Group discussion

10	Using reference management software	Demonstration of *Mendeley*, *Jabref*	Live Video
11-13	Demonstrate ability to review research and identify gaps	Discussion of literature review assignment	Slides, Group discussion
14	Explain the elements of a good problem design	Research design for a problem	Slides
15	Differentiate a good hypothesis from a bad one	Discussion on elements of a good hypothesis	Discussion
16-17	Construct hypothesis for a research problem	Research question, hypothesis, independent and dependent variables	Group discussion
18	Determine the control experiments	Positive and negative controls for each project	Group discussion
19-20	Estimate the sample size for hypothesis testing	p-value, confidence interval, standard error	Slides
21	Recognize the elements of a research presentation	How to project your problem?	Slides, video
22-24	Design experiments for a research problem	Group presentation	Slides/ Group Presentation
25-28	Demonstrate the ability to gather data and present the data	Group presentation: On data collected to test their hypothesis	Group presentation using graphs and figures
29	Interpret the data	Modelling data, understanding errors: systematic and random, Gaussian distribution	Slides
30-32	Model data	Rejection of data, weighted averages, Least square fitting, correlation, What is computer modelling?	Introduction to error analysis, by J. R. Taylor, Slides
33-35	Apply data analysis principles	Group presentation: Data modelling and explanation	Group presentation
36-37	Summarize ethics in science reporting	Types of ethics, Research conduct: Professional standards, ethics in science reporting	Video, slides
38	Summarize ethics in experiments involving animals	Case studies on animal experiments	Group discussion
39	Summarize ethics in experiments involving human	Case studies on animal experiments	Group discussion
40	Explain intellectual property rights	Who is interested in your research?	Guest lecture
41-43	Demonstrate ability to write a research article	Discussion and feedback on the research articles written by the groups on their research project.	Submission of document in a journal format

Evaluation Scheme:

Component	Duration	Weightage (%)	Date & Time	Nature of Component
Quiz	10 minutes	5	TBA*	OPEN
Group Discussion	Throughout the semester	10	TBA	OPEN
Literature survey	TBA	15	TBA	OPEN
Design of experiments	TBA	20	TBA	OPEN
Data collection and data representation	TBA	20	TBA	OPEN
Data Modelling	TBA	15	TBA	OPEN
Scientific article writing	TBA	15	TBA	OPEN

*TBA stands for To be announced

Chamber Consultation Hour: All the instructors (Tuesday, 3.00-4.00PM)

Notices: The initial notices will available on CMS course page. The content delivery platform would be announced on course page in CMS

Make-up Policy: Prior information is mandatory**.** In case of issues of debilitating medical conditions, requests have to be supported by valid certificates.

Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

INSTRUCTORS
Prof. AravindaRaghavan
Dr. Murari R R Varma
Dr. AswathyRaveendran