Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Revised Syllabus for Ph.D. Program

in

Electronics & Telecommunication Engineering

(Revised with effect from AY 2017-18)

Course Work Structure for Ph.D. Program in Faculty of Science & Technology, University of Mumbai
(Revised with effect from Academic Year 2017-18)

Code	Name of Course	Contact Hours	Credit	Examination Scheme				
				Mid Term Test	End Semester Exam	Teamwork	Seminar Presenta tion	Total
PhD101	Research Methodology	6	6	20	80	--	--	100
PhD102	Course suggested by Guide*	6	6	20	80	--	--	100
PhD103	Seminar	-	4	-	-	50	50	100
Total		12	16	40	160	50	50	300

Grading of Research Candidates Performance

Awarding of grades to research candidates based on their performance shall be done as per the applicable ordinances and regulations for undergraduate and Post-graduate programs of Engineering under the Faculty of Science & Technology. Semester Grade Point Index (SGPI) shall be also calculated based on the ordinances and regulations applicable for engineering programs under Faculty of Science & Technology. Approved and recognized Research Centers shall prepare Ph.D. course work grade card after successful completion of course work and issue to candidates with a copy to University's concerned section for record.

Course Code	Course Name	Credits
PhDC101	**Research Methodology**	**06**

Module	Detailed content	Hrs.
1	**Definition and Characteristics of Research:** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and validity of research. Objective of research. Various functions that describe characteristics of research such as systematic, valid, verifiable, empirical and critical approach.	08
2	**Types of Research:** Pure and applied research. Descriptive and explanatory research. Qualitative and quantitative approaches. Formulating the Research Problem, Literature Review, Developing the objectives, Preparing the research design including sample Design, Sample size.	10
3	**Outcome of Research:** Relevance, interest, available data, choice of data, Analysis of data, Generalization and interpretation of analysis, Preparation of the Report on conclusions reached, Testing validity of research outcomes, Suggestions and recommendations, identifying future scope.	10
4	**Probability Distribution and Hypothesis Testing:** Theoretical: binomial, poisson, normal, exponential, hyper geometric, uniform distributions. Type I and II error, testing of mean, proportion, tests for equality of mean and variances of two populations, confidence interval, Z test and χ^2 test for goodness of fit, ANOVA (one way classification), Non parametric tests: sign test, U test.	14
5	**Correlation and Regression Analysis**: Karl Pearson's and Rank Correlation coefficient, simple linear regression: least squares method, Linear Programming: Graphical solution, simplex method, dual, sensitivity analysis, transportation and assignment problems.	10
6	**Management Decision Making & Computer Applications:** System approach, decision making under uncertainty and risk: decision tables and decision tree. Statistical data analysis: generating charts/ graph and other features. Introduction to tools: Tools used may be Microsoft Excel, Open office, Microsoft Power Point or similar tools.	08

References:

1. Practical Research Methods, Dawson, Catherine 2002, New Delhi, UBS Publishers' Distributors.
2. Research Methodology-Methods and Techniques, Kothari, C.R.,1985, New Delhi, Wiley Eastern Limited.
3. Research Methodology-A Step-by-Step Guide for Beginners, Kumar, Ranjit, 2005, 2nd edition, Singapore, Pearson Education.
4. Quantitative Techniques for Managerial Decisions, Shrivastava, Shenoy& Sharma, Wiley.
5. Goode W J & Hatt P K, Methods in social research, McGraw Hill.
6. Basic Computer Science and Communication Engineering, 2015, R. Rajaram, SCITECH.

Course Code	Course Name	Credits
PhDC102	**Course suggested by Guide*** **(Quantitative Tools for Research)**	**06**

This course is to be suggested by guide/supervisor in specific domain area of research undertaken by the research candidate. Research candidates can undertake this course in consultation with guide/supervisor as per guidelines given below;

Relevant course shall be successfully completed in IIT Bombay which has 6 credits.

OR

Relevant PG course in the research domain area of research candidate at any PG center affiliated to University of Mumbai.

In this case, PG course as per University of Mumbai syllabus is of 4 credits. Thus, additional work needs to be done for remaining 2 credits. (Any relevant PG course suggested by guide 4 credits + additional work suggested by guide for 2 credits).

Additional work may be in line with any of the following guidelines:

    i.   Minimum four assignment problems from same domain area.

OR

   ii.   Any relevant PG Laboratory course, as per University of Mumbai PG syllabus, suggested by guide.

OR

  iii.   One course project from same domain area.

OR

  iv.   One simulation based project in the domain area using relevant software tool.

Module	Detailed content	Hrs.
1	**Basic statistical concepts:** Types of statistics, Population and sample, classification of data, Sources of data, Methods of sampling, Frequency distribution, Presentation of data – bar chart, pie chart, histogram, frequency curve, frequency polygon, ogive curves, stem and leaf chart.	06
2	**Descriptive statistics:** Measures of central tendency, Measures of dispersion, Measures of position, Population parameters & sample statistics, Outliers, Skewness and Kurtosis, Box & Whisker plot.	06
3	**Test of Hypothesis, Correlation, Regression:** Concept of hypothesis testing, Writing hypotheses, Alpha and beta risk, Confidence intervals, P value, Hypothesis test process, Applying statistical hypothesis tests - test of proportions, chi square test, one sample tests, variance tests, t tests, Concept of correlation between two variables,	07

	Scatter diagram, Covariance between two variables, Spearman's rank correlation coefficient, Correlation matrix, Concept of regression, Lines of regression, Fitting of lines of regression by the least squares method, Assumptions of the regression model, Interpretation of slope and intercept, Explained and unexplained variation, Error of prediction, Overview of nonlinear regression.	
4	**Design of Experiments:** Strategy of experimentation, Typical applications of experimental design, Guidelines for designing experiments, Factorial experiments and terminology - factors, levels, interactions, treatment combination, randomization, Fractional factorial design, Experiment design using Taguchi's orthogonal arrays, Signal to noise ratio and evaluation.	08
5	**Analysis of variance (ANOVA):** ANOVA overview, ANOVA hypothesis, Partitioning variability in ANOVA, Sums of squares, Degrees of freedom, F statistic and critical Values, Coefficient of determination, Analysis of covariance (ANCOVA).	06
6	**Interpretation of research outcomes and Analysis using software:** Summarizing quantitative and qualitative data, Measures of effect for continuous data, Significance tests, Statistical significance, Statistical misconceptions.	05
7	**Overview of Multivariate tools:** Overview of dependent techniques - Binary logistics regression, Ordinal logistic regression, Nominal logistic regression, Multivariate analysis of variance (MANOVA), Multivariate analysis of covariance (MANCOVA), Discriminant analysis, Conjoint analysis, Overview of independent techniques - Cluster analysis, Exploratory factor analysis, Confirmatory factor analysis, Multidimensional scaling.	08
8	**Advanced Research Tools and Techniques for Modelling:** Structural Equation Modelling (SEM): Moving from measuring model to structural model, base structural models, models with mediation effects, models with moderation effects and multi-group moderation with formative & reflective constructs.	07
9	**Basics and Principles of MCDM:** Basic Concepts of Decision Making, Problem Structuring MCDM, Categories. **AHP Method:** Basics and Principles of AHP, Design Hierarchy and Make Judgments, Methods to Calculate Relative Weights, Calculating Total Weights, Measuring Inconsistency, Introduction to "Expert Choice". **ANP Method:** Basics and Principles of ANP, Design Hierarchy and Make Judgments, Methods to Calculate Relative Weights, Calculating Total Weights. **TOPSIS**: Identify an alternative, which is closest to the ideal solution and farthest to the negative ideal solution. Advantages, Disadvantages. **Interpretive Structural Modeling (ISM) and its application** **Data Envelopment Analysis (DEA):** Efficiencies of alternatives against each other, with the most efficient alternative having a rating of 1.0, with all other alternatives being a fraction of 1.0.	07

References:

1. Discovering Statistics using IBM SPSS Statistics, Andy Field, SAGE Publications Ltd.
2. Statistics for Business and Economics, David R. Anderson, 13th Edition, Cengage learning.
3. Tzeng, G-H. & Huang, J-J., Multiple Attribute Decision Making: Methods and Applications, Chapman and Hall/CRC, 2011.
4. Tzeng, G-H. & Huang, J-J., Fuzzy Multiple Objective Decision Making, Chapman and Hall/CRC, 2013.
5. Additional Textbooks will be recommended by Faculty Members.

Course Code	Course Name	Credits
PhDS103	**Seminar**	**04**

Following guidelines for credit seminar shall be followed:

1. Seminar should be based on thrust areas in specific research domain.
2. Research scholar should carry out a literature survey, identify the topic for seminar and finalize the same in consultation with the Guide/Supervisor.
3. Research scholar is expected to use multiple literatures and understand the topic.
4. Report should be compiled in the standard format as per the University Guidelines for report writing and presented in front of a pair of Examiners appointed by the Head of the Institute/Competent Authority.

Seminar should be assessed jointly by the pair of Internal and External Examiners.

Following points must be assessed during the presentation of the Credit Seminar

i. Quality of Literature survey and Novelty in the topic.
ii. Relevance to the specialization.
iii. Understanding of the topic and clarity of problem definition.
iv. Quality of Written and Oral Presentation.

University of Mumbai

Th/ICD/2021-22/1265   13th July, 2021

Circular:-

      The Directors / Principals / Heads / Co-ordinators of Research Institutes / Colleges / University Departments / University Sub-Campuses are instructed to note that the University has adopted the UGC guidelines issued vide D.O.No.F.1-1/2018 (Journal/CARE) of December, 2019 regarding **two credit courses** for awareness about publication misconducts entitled **"Research & Publication Ethics (RPE)"** to be made **compulsory** for all **Ph.D students** for pre-registration **course work** (attached as Annexure).

      In view of the above, the Directors / Principals / Heads / Co-ordinators of Research Institutes / Colleges / University Departments / University Sub-Campuses are requested to ensure that the above two credit courses may be made compulsory for all Ph.D. students for pre-registration course work undertaken in your Research Centre.

Deputy Registrar
Research Administration & Promotion Cell

CC for information and necessary action:-
The Directors / Principals / Heads / Co-ordinators of Research Institutes / Colleges / University Departments / University Sub-Campuses

विश्वविद्यालय अनुदान आयोग
University Grants Commission
(मानव संसाधन विकास मंत्रालय, भारत सरकार)
(Ministry of Human Resource Development, Govt. of India)

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प्रो. रजनीश जैन
सचिव
Prof. Rajnish Jain
Secretary

D.O.No.F.1-1/2018(Journal/CARE)   December, 2019

Respected Sir/Madam,

University Grants Commission in its 543rd meeting held on 9th August, 2019 approved two Credit Courses for awareness about publication ethics and publication misconducts entitled **"Research and Publication Ethics (RPE)"** to be made compulsory for all Ph.D. students for pre-registration course work (**attached as Annexure**).

In view of the above, you are requested to ensure that the above two Credit courses may be made compulsory for all Ph.D. students for pre-registration course work undertaken in your University from the forthcoming academic session.

With regards,

Yours sincerely,

(Rajnish Jain)

<u>**TO THE VICE-CHANCELLORS OF ALL UNIVERSITIES**</u>

Course Title:

- **Research and Publication Ethics (RPE)-**Course for awareness about the publication ethics and publication misconducts.

Course Level:

- 2 Credit course (30 hrs.)

Eligibility:

- M.Phil., Ph.D. students and interested faculty members (It will be made available to post graduate students at later date)

Fees:

- As per University Rules

Faculty:

- Interdisciplinary Studies

Qualifications of faculty members of the course:

- Ph.D. in relevant subject areas having more than 10 years' of teaching experience

About the course

Course Code: CPE- RPE

Overview
- This course has total 6 units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course.

Pedagogy:

- Class room teaching, guest lectures, group discussions, and practical sessions.

Evaluation

- Continuous assessment will be done through tutorials, assignments, quizzes, and group discussions. Weightage will be given for active participation. Final written examination will be conducted at the end of the course.

Course structure

- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Databases and Research Metrics	7
	Total	**30**

Syllabus in detail

THEORY

- **RPE 01: PHILOSOPHY AND ETHICS (3 hrs.)**

  1. Introduction to philosophy: definition, nature and scope, concept, branches
  2. Ethics: definition, moral philosophy, nature of moral judgements and reactions

- **RPE 02: SCIENTIFICCONDUCT (5hrs.)**

  1. Ethics with respect to science and research
  2. Intellectual honesty and research integrity
  3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
  4. Redundant publications: duplicate and overlapping publications, salami slicing
  5. Selective reporting and misrepresentation of data

- **RPE 03: PUBLICATION ETHICS (7 hrs.)**

  1. Publication ethics: definition, introduction and importance
  2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
  3. Conflicts of interest
  4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types
  5. Violation of publication ethics, authorship and contributorship
  6. Identification of publication misconduct, complaints and appeals
  7. Predatory publishers and journals

PRACTICE

- **RPE 04: OPEN ACCESS PUBLISHING(4 hrs.)**

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder / journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

- ## RPE 05: PUBLICATION MISCONDUCT (4hrs.)

  ### A. Group Discussions (2 hrs.)

    1. Subject specific ethical issues, FFP, authorship
    2. Conflicts of interest
    3. Complaints and appeals: examples and fraud from India and abroad

  ### B. Software tools (2 hrs.)

  Use of plagiarism software like Turnitin, Urkund and other open source software tools

- ## RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)

  ### A. Databases (4 hrs.)
    1. Indexing databases
    2. Citation databases: Web of Science, Scopus, etc.

  ### B. Research Metrics (3 hrs.)
    1. Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score
    2. Metrics: h-index, g index, i10 index, altmetrics

References

Bird, A. (2006). *Philosophy of Science*. Routledge.

MacIntyre, Alasdair (1967) *A Short History of Ethics*. London.

P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865

National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). *On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition*. National Academies Press.

Resnik, D. B. (2011). What is ethics in research & why is it important. *National Institute of Environmental Health Sciences*, 1–10. Retrieved from https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm

Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179–179. https://doi.org/10.1038/489179a

Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance(2019), ISBN:978-81-939482-1-7. http://www.insaindia.res.in/pdf/Ethics_Book.pdf