Ph.D. COURSE WORK IN FORENSIC SCIENCE W.E.F. 2020-21

Duration : One Semester (Six months)
Total Credit requirement : 14 credits
Program Structure : Ph.D. in Forensic Science

SEMESTER 1						
Course Code	**Nomenclature of Course**	**Theory marks (end semester examination)**	**Internal Assessment marks**	**Maximum marks**	**Hours /Week**	**Credits**
20FSPH11C1	Research Methodology	80	20*	100	4	4
20MPCC1 (Compulsory for all Ph.D. Course work)	Research & Publication Ethics	40	10**	50	2	2
20FSPH11C3	Basics of Computers & statistical Analysis	80	20*	100	4	4
20FSPH11C4	Forensic Science and Research Techniques	80	20*	100	4	4
Total Marks/ Credits				**350**	**14**	**14**

Note: i. The compulsory course on 'Research and Publication Ethics' shall be offered by Ch. Ranbir Singh Institute of Social and Economic Change for all UTDs/Centres/Institutes passed vide Resolution No. 27 of the 271st meeting of EC held on 29.7.2020.

*Internal Assessment:
    Two assignments of 5 marks each
    Two presentations of 5 marks each
**Internal Assessment:
    One assignments of 5 marks each
    One presentations of 5 marks each

PROGRAM SPECIFIC OUTCOMES (PSO)

Ph.D. Course work in M.Sc. Forensic Science is designed to meet out the following program specific outcome:

Learning outcomes

PSO-1:   Students will be able to understand the basics of research and they will become better prepared for future research in Forensic Science.

PSO-2:   They will better delineate research ethics and issues.

PSO-3:   Students will be able to use computer and statistical methods of analysis in research development.

PSO-4:   They would be able to explore different fields available for research in forensic science.

PSO-5:   They would have a broader understanding of various methods and techniques used in forensic research.

Name of the Program	Ph.D. Course work in Forensic Science	Program Code	FSPH
Name of the Course	Research Methodology	Course Code	20FSPH11C1
Hours/Week	4	Credits	4
Max. Marks.	80	Time	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)

Course Objectives:
1. To impart knowledge about Purpose and types of Research in scientific fields.
2. To make students understand about component of research planning.
3. To make students aware of different funding agencies of India aiding research work.
4. To develop Identification and designing a research problem.
5. To develop a better understanding of writing of research events.

Course Outcomes:
1. Students would be able to understand purpose, characteristics and types of Research in forensic science.
2. They would be able to know about different funding agencies of India aiding forensic research work.
3. They would know about Ethical, legal, social and scientific issues in Forensic research.
4. They would be able to write research proposals.
5. Students would be able gain the basic knowledge of organizing conferences, symposia, workshop, exhibition etc and their role in research enhancement.

Unit – I

Meaning, Purpose and Characteristics and Types of Research in scientific disciplines, Process of Research, Formulation of objectives, Formulation of Hypotheses, Types and methods of testing Hypotheses, Research plan and its components, Methods of Research: Survey, Observation, case study, experimental, historical and comparative methods.

Unit – II

Identification and formation of research problem (Hypothesis). Elements in research methodology: Research design (CRD, RBD, and LSD).

Unit – III

Introduction to Funding agencies aiding research in India especially DST, DBT, ICMR, CSIR, UGC, and role of DFSS and BPR&D towards R&D aid in Forensic Science. Role of IPR in Research and Development.

Unit – IV

Writing of Research Proposal, Report and Research Paper: Meaning and types -Stages in preparation - Characteristics - Structure - Documentation: Footnotes and Bibliography - Editing the final draft- Evaluating the final draft- Checklist for a good proposal/report/research paper. Basic knowledge of organizing conferences, symposia, workshop, exhibition etc. Basics of finding and publishing in good forensic journals.

References:
1. Adèr, H. J., & Mellenbergh, G. J. (1999).*Research methodology in the social, behavioural and life sciences*. London, : SAGE Publications, Ltd doi: 10.4135/9780857029027
2. Baldi, B., & Moore, D. S. (2014). *The practice of statistics in the life sciences*.
3. Verma, A. K. (2017). *Research methodology in Indian music: A step by step guide for beginners*.
4. Flick, U. (2015). *Introducing research methodology: A beginner's guide to doing a research project*. London: Sage Publications.

5. Kapoor, D. R., & Saigal, P. (2013). *Research methodology: Methods and techniques*. New Delhi: Regal Publications.
6. Llewelyn, D., Aplin, T. F., & Cornish, W. R. (2019). *Intellectual property: Patents, copyright, trade marks and allied rights*.
7. India., & National Science & Technology Management Information System (India). (1998). *Funding pattern of sponsored research by scientific agencies, 1990-91 to 1994-95*. New Delhi: Ministry of Science and Technology, Dept. of Science and Technology, Govt. of India.
8. Sharat, K., & Mathew, M. (2005). *Funding windows and research in India*. Delhi: Shipra.

Name of the Program	Ph.D. Course work in Forensic Science	Program Code	FSPH
Name of the Course	Research & Publication Ethics	Course Code	20MPCC1
Hours/Week	2	Credits	2
Max. Marks.	40	Time	2 hours
Note: i. The compulsory course on 'Research and Publication Ethics' shall be offered by Ch. Ranbir Singh Institute of Social and Economic Change for all UTDs/Centres/Institutes passed vide Resolution No. 27 of the 271st meeting of EC held on 29.7.2020.			

Name of the Program	Ph.D. Course work in Forensic Science	Program Code	FSPH
Name of the Course	Basics of Computers & Statistics Analysis	Course Code	20FSPH11C3
Hours/Week	4	Credits	4
Max. Marks.	80	Time	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)

Course Objectives:
6. To impart knowledge of statistical analysis & computers in students.
7. To make students understand about data types in research analysis.
8. To make students aware probability, variance and test for hypothesis in sciences.
9. To make students conversant with broader aspects of research statistical tools.
10. To develop a better understanding of computers and related tools and software used in routine forensic research.

Course Outcomes:
1. Students would be able to understand importance of various statistical methods in research analysis.
2. They would understand Tests of hypothesis in research work.
3. They would have broader knowledge of attributes, Z-test and probability etc.
4. They would be able to interpret statistical data.
5. They would be able to gain basic knowledge of computer and various softwares used in scientific research.

Unit – I

Types of Data: Basic concepts of frequency distribution, Measure of central values-Mean, median and mode, Measures of dispersion, range, mean deviation and standard deviation Correlation and Regression analysis.

Probability: Theory, Classical definition of Probability, Basic terms . Events, Trails, Mutually exclusive events, Favourable events, Exhaustive events etc, Bayes Theorems of probability, Addition Theorem, Multiplication Theorem, Conditional Probability & Coincidence Probabilities

Unit – II

Variance . Coefficient of Variation, Moment, Skewness and kurtosis, binomial, distribution, Normal distribution, hyper geometric distribution, correlated Measurements.

Discriminating power . Derivation, evaluation of evidence by discriminating powers Combination of independent systems, correlated attributes, Transfer of evidence . likelihood ratio, probability of guilt correspondence probabilities, direction of transfer.

Tests of significant of attributes, Z-test of significance and coefficient of correlation, Small sample test, T-test, Paired Test, Chi-square test, F test of equality of variance, Large sample test, Normal test. Brief introduction to SPSS, R (R Foundation for Statistical Computing), MATLAB (The Mathworks), Microsoft Excel, SAS (Statistical Analysis Software) and Minitab.

Unit – III

Computer basics; Introduction and need of Computers, Operating system and basics of Windows, User Interface, File management, File Transfer (ftp, WSftp), DOS, UNIX. Various Online modes and softwares of teaching and research.

Unit – IV

Computer Presentation and Internet basics: Difference between presentation and document, introduction to Notepad, MS-Office word, MS-Excel, Power Point, Opening Documents and Closing documents, introduction to Paint and Photoshop. Computer Communication and Internet, LAN, MAN,

WAN, www. Electronic mails, Communication on Internet, Surfing the Internet.

References:

1. Weaver, K. F. (2018). *An introduction to statistical analysis in research: With applications in the biological and life sciences.*
2. Elliott, A. C., & Woodward, W. A. (2007).*Statistical analysis quick reference guidebook*. Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781412985949
3. Huizingh, E. (2007). *Applied statistics with SPSS*. London, : SAGE Publications, Ltd doi: 10.4135/9781446249390
4. Vogt, W. P. (2011). *SAGE quantitative research methods*. Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9780857028228
5. Miller, D. C., & Salkind, N. J. (2002).*Handbook of research design & social measurement*. Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781412984386
6. Mortera, J. & Dawid, P. (2008). Probability and evidence. In Rudas, T. *Handbook of probability: Theory and applications* (pp. 403-422). Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781452226620
7. Robertazzi, T. G. (2012). Basics of computer networking. New York, NY: Springer.
8. Computer software. (1985). New York: W.H. Freeman.
9. Knight, G. (1968). *Computer software*. Washington: Cambridge Communication Corporation.
10. Barksdale, K., Rutter, M., & Teeter, R. (2002). *Internet basics*. Boston, Mass: Course Technology.

Name of the Program	Ph.D. Course work in Forensic Science	Program Code	FSPH
Name of the Course	Forensic Science and Research Techniques	Course Code	20FSPH11C4
Hours/Week	4	Credits	4
Max. Marks.	80	Time	3 Hours

Note: The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks)

Course Objectives:
11. Inculcate knowledge of forensic science in students.
12. To make students understand about forensic research.
13. To make students aware about basic Tools and techniques used in forensic sciences.
14. To make students conversant with broader aspects of research areas and trends.
15. To develop a better understanding of lacunae and solutions in forensic research.

Course Outcomes:
1. Students would be able to understand importance of research in Forensic science.
2. They would understand techniques used in forensic chemical sciences;
3. They would have broader knowledge of forensic biological methods and techniques.
4. They would be able to gain knowledge of research in forensic physical sciences.
5. They would acquire a better understanding of lacunae in forensic research.

Unit – I

Basics of Forensic Science: Forensic Science Laboratories development and set-ups of R&D work, Need and Scope of Forensic Science research, Basic Principles of Forensic Science, Branches of Forensic science, and Future research perspectives in Forensic Science. National and international forensic science avenues.

Unit – II

Forensic Chemical Techniques: Forensic Chemical evidences and related cases, Laboratories dealing with Forensic chemical evidences, Preliminary/screening and Instrumental cum Confirmatory techniques in forensic chemical sciences, analytical approaches (including qualitative, quantitative, destructive, non-destructive, specific and sophisticated), Research utilities and limitations of TLC, HPTLC, HPLC, GC, GC-MS, LC-MS, UV-vis, FTIR, AAS, and Mass Spectrometry in forensic chemical analysis. Recent research trends in FCS.

Unit - III

Forensic Biological Techniques: Need of biological analysis on Forensic Science, Electrophoretic Techniques: Theory, General Principles and Forensic applications. DNA Fingerprinting Techniques: DNA extraction, quantification, PCR and its modifications, RFLP, Combined DNA Index System (CODIS).

Unit - IV

Forensic Physical Techniques: Conventional and recent techniques and trends in the fields of Forensic Fingerprinting, Forensic Ballistics, Forensic Physics, Voice analysis, QDE, and Computer and Cyber forensics. Role of Light Microscopy, Electron Microscopy, Comparison Microscopy in forensic physical examination, use of Polygraph and BEOS and their legal prospectus.

References:
1. Nanda, B. B., & Tewari, R. K. (2001). *Forensic science in India: A vision for the twenty-first century*. New Delhi: Select Publishers.
2. Siegel, J. A. (2016). *Forensic science*.
3. Saferstein, R. (2020). *Criminalistics: An introduction to forensic science*.
4. National Institute of Justice (U.S.). (2004). *Education and training in forensic science: A guide*

for forensic science laboratories, educational institutions, and students. Washington, DC: U.S. Dept. of Justice, Office of Justice Programs, National Institute of Justice.

5. Willard, H. H., Merritt, L. L., & Dean, J. A. (1974). *Instrumental methods of analysis: [by] Hobart H. Willard, Lynne L. Merritt [and] John A. Dean*. New York: Van Nostrand.
6. Kaur, H. (2010). *Pragati's Instrumental methods of chemical analysis*. Meerut, India: Pragati Prakashan.
7. McNair, H. M. (2019). *Basic Gas Chromatography*. Wiley & Sons Canada, Limited, John.
8. Browning, D. R. (1969). *Chromatography*. London: McGraw-Hill.
9. Settle, F. . (1997). *Handbook of instrumental techniques for analytical chemistry*. Upper Saddle River, NJ: Prentice Hall.
10. Koppenhaver, K. (2007). *Forensic document examination: Principles and practice*. Totowa, N.J: Humana Press.