Code No.	G – 1911

Ph.D. ENTRANCE EXAMINATION, MAY 2019

Time : 3 Hours | Max. Marks : 100

Instructions **:**

1) *Answer **any ten** questions from Part/Section **A** and **B**.*
2) ***All** questions carry **equal** marks.*
3) *Candidates should clearly indicate the **Part/Section, Question Number** and **Question Booklet Code** in the answer booklet..*
4) *The candidates are **permitted** to answer questions **only** from the subject that comes under the **faculty** in which he/she seeks registration as indicated in the **application** form.*

Name of candidate	
Register Number	
Answer Booklet Code	
Signature of Candidate	
Signature of Invigilator	

FACULTY OF SCIENCE

1. **Aquatic Biology & Fisheries**
2. **Botany**
3. **Chemistry**
4. **Statistics**

FACULTY OF SCIENCE

1. Aquatic Biology and Fisheries

Part – A

Research Methodology

Answer **any 10** questions. **Each** question carries **5** marks. **(10 × 5 = 50 Marks)**

1. Types and methods of Sampling.
2. Define the research problem.
3. Explain briefly about construction of research design.
4. Data collection: (a) primary and (b) secondary
5. Mean, Median and Mode.
6. Testing the hypothesis.
7. Basic principle of ANOVA.
8. Correlation and Regression.
9. Cluster analysis.
10. Fish biodiversity assessment method.
11. Literature survey.
12. Types of graphs.
13. Result interpretation.
14. Manuscript writing.
15. Scopus and WoS.

Part – B

Aquatic Biology and Fisheries

Answer **any 10** questions. **Each** question carries **5** marks. **(10 × 5 = 50 Marks)**

1. Estuaries in India.
2. Food chains in aquatic ecosystems.
3. Marine National parks in India.
4. List out any three exotic fishes and its impacts on biodiversity.
5. Shrimp culture in India.
6. Elaborate notes on red tides.
7. Seaweed culture and its benefits.
8. Climate change impacts on fisheries.
9. Fishery trades in India.
10. Sustainable aquaculture practices.
11. Impacts of pollution from aquaculture ponds.
12. Capture Fisheries of Kerala coasts.
13. Measurement of physicochemical parameters in aquaculture.
14. Fish feed types and production.
15. Types of fishing nets and gears.

2. Botany

Part – A

Research Methodology

Answer **any 10** questions. **Each** question carries **5** marks. **(10 × 5 = 50 Marks)**

1. What are the points to be kept in mind while selecting and formulating a research problem?
2. What are the various methods of Data collection? Discuss in detail along with their advantages and disadvantages?
3. Explain the various steps involved in writing a research report.
4. Write a note on ethics, conduct and misconduct in scientific research.
5. Differentiate between descriptive and analytical research.
6. What are the different methods to present a scientific data?
7. Explain the need for Multidisciplinary and Interdisciplinary research.
8. Write a note on the measure of central tendency.
9. 'Processing of research data implies editing, coding, classification and tabulation'. Describe these operations pointing out the importance of each in research.
10. Write notes on bibliography and footnotes.
11. What are the stages involved in filing a patent?
12. Elucidate the applications of correlation, regression, ANOVA and SPSS in experimental research.
13. What are the components involved in literature search and review.
14. Enumerate the principles of good laboratory practices.
15. How to write a project proposal? Explain the scientific approach for it.

Part – B

Botany

Answer **any 10** questions. **Each** question carries **5** marks. **(10 × 5 = 50 Marks)**

1. Write a note on Phycocolloids.

2. Write a short note on Molecular systematics.

3. Give an account of ecological significance of Bryophytes.

4. Explain the types of enzyme inhibition with examples.

5. Explain Cytoplasmic inheritance with suitable examples.

6. Explain different techniques for monitoring plant diversity.

7. Write a note on DNA finger printing.

8. Explain drought resistance mechanisms in plants.

9. Write a note on Somaclonal variations. What is its reasons?

10. Explain the mode of action of any two enzymes used in recombinant DNA technology.

11. Briefly describe the procedures of Mutation breeding. Mention its merits and demerits.

12. Write an essay on cytology in relation to Taxonomy.

13. Describe various types of DNA polymorphisms.

14. Discuss timber yielding plants with reference to processing of wood, diagnostic characters and uses.

15. Write with appropriate examples how Phycoremediation is a major process of Bioremediation.

3. Chemistry

Part – A

Answer **any 10** questions. **(10 × 5 = 50 Marks)**

1. Write an account of selection of topic for your Ph.D. research work.

2. Describe the manuscript preparation, formats used to publish a research paper in any journal of Chemistry. Provide name of any two chemistry journals.

3. Give an account of the general format of a Ph.D. thesis.

4. Write short notes on multiple linear regressions.

5. Write short notes on online search of chemistry databases and name a few useful softwares for chemistry students.

6. What are primary, secondary and tertiary literatures? Explain its importance for research.

7. Write note of good laboratory practices.

8. Write short notes on Patents (types of patents, patent offices, patent treaties).

9. Write short notes on Plagiarism. What are the tools available to check the Plagiarism?

10. What do you understand by impact factor, h-index and citation index.

11. What are the tools available for the data analysis, Explain its advantages.

12. Define Intellectural Property Rights. How long will you protect the knowhows? Why is it required?

13. What are the general principles of test, measurement and evaluation?

14. Explain the normal distribution of random errors.

15. (a) Why safety and security are required in the laboratory?

    (b) What are the materials required in the first-aid box?

Part – B

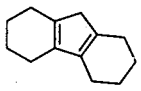
Chemistry

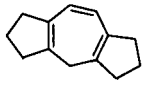
Answer **any 10** questions. **(10 × 5 = 50 Marks)**

1. Provide any two methods each to generate carbenes, nitrenes and benzynes.

2. Explain Hofmann and Zaitsev rules with the help of examples.

3. (a) Which one of the following is more acidic and why?

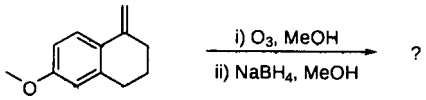

A

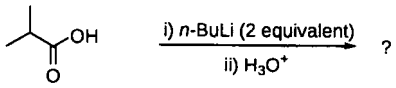

B

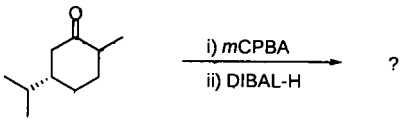
(b) Which one of the following is more basic and why?

$H_3CCOO^{(-)}$ $(CH_3)_3COO^{(-)}$

4. Predict the products and suggest the mechanism for the following reactions

(a) 

(b) 

(c) 

5. Deduce the structure from the spectral data as given below:

(a) Molecular formula C_8H_7N

IR : 2220, 1620, 1510 cm^{-1}

PMR δ : 2.4 (s, 3H); 7.2 (d, $J = 8Hz$, $2H$); 7.5 (d, $J = 8Hz, 2H$)

(b) Molecular formula $C_5H_{10}O$

IR : 2850, 2720, 1715 cm^{-1}

PMR δ : 1.0 (d, $j = 7Hz$, $6H$); 2.1 (m, 1H); 2.4 (t, 2H); 9.7 (t, 1H)

6. (a) Explain bonding in Ferrocene.

   (b) Discuss how infrared spectroscopy is useful to determine the structure of organometallic compounds.

7. (a) How do you distinguish between Cnv and Cnh point groups?

   (b) What is the point group symmetry of cyclopropane and benzene?

   (c) Provide the classification of borohydrides.

8. (a) What are carboranes? Give different types of carboranes with structures.

   (b) Write note on phosphazenes.

9. Draw the structures for the following:

   (a) $Si_2O_7^{6-}$ (b) BrF_3 (c) $Al_2(Ph)_2(Et)_4$ (d) N_2O_5 (e) $AsPh_5$

10. (a) Why d-d transitions are weak?

    (b) Write a note on dynamic John-Teller effect

    (c) Why are nickelocenes and cobaltocenes unstable?

11. (a) Define Debye-Huckel constants A and B.

    (b) Define electrochemical series.

    (c) Under what conditions chain reactions become explosive.

12. (a) What is steady state approximation? How does it simplify the reaction scheme.

    (b) How electrodes are classified? Give examples.

13. Construct C_{2v} character table.

14. Write notes on zero-field splitting.

15. (a) Define chemisorption.

    (b) What are the applications of X-ray photoelectron spectroscopy?

4. Statistics

Part – A

Answer **any 10** questions. **Each** question carries **5** marks. **(10 × 5 = 50 Marks)**

1. Describe the meaning of research in research methodology.
2. Write a note on the objectives of research methodology.
3. What is meant by a research design? Discuss the features of a good research design.
4. Explain the different types of sample design.
5. Discuss the classification of measurement scales.
6. Explain how you would select a research topic.
7. Enunciate the significance of literature survey in a project or research report.
8. What is a research report? Explain the basic characteristics to be fulfilled in a research report.
9. Distinguish between patent and copyright.
10. What do you understand by intellectual property rights? Write a short on administration of IPR in India.
11. What is a Journal? Bring out the significance of few journals of international repute in Statistics discipline.
12. What is meant by plagiarism in research? Suggest the ways of avoiding plagiarism.
13. Explain the salient steps which are involved in the formulation of a sample design.
14. Describe any of the methods of determining the sample size for a sample survey.
15. What is meant by experimental design? Explain its basic principles.

Part – B

Statistics

Answer **any 10** questions. **Each** question carries **5** marks. **(10 × 5 = 50 Marks)**

1. Let $f:(0,\infty)\to\Re$, show that if $x_0\in(0,\infty)$, then f is continuous at x_0.

2. If ϕ is convex on an open interval I and X is a random variable whose support is contained in I and has finite expectation, show that $\phi|E(X)|\le E|\phi(X)|$.

3. Examine whether the weak law of large numbers holds for the sequence $|X_k|$ of independent random variables defined with the probabilities $P(X_k=\pm 2^k)=2^{-(2k+1)}$ and $P(X_k=0)=1-2^{-2k}$.

4. Let X be a gamma random variable with parameters $\alpha=r/2$ and $\beta>0$, where r is a positive integer. Identify the distribution of $Y=2X/\beta$ and find its density function.

5. Let $Y_1<Y_2<Y_3<Y_4$ denote the order statistics of a random sample of size 4 from a distribution having the density function $f(x)=\begin{cases}2x, & 0<x<1\\ 0, & \text{Otherwise}\end{cases}$. Compute $P\left(\frac{1}{2}<Y_3\right)$.

6. Let $X_1,X_2,\ldots,X_n$ be independently and identically distributed random variables with the density function $f(x;\theta),\theta\in\Omega$. For a specified function g, let $\eta=g(\theta)$ *be* a parameter of interest. If $\hat{\theta}$ is the maximum likelihood estimator of θ, show that $g(\hat{\theta})$ is the maximum likelihood estimator of $\eta=g(\theta)$.

7. Let $X_1, X_2, \ldots, X_n$ denote a random sample of $n > 2$ from a distribution with density function $f(x) = \begin{cases} \theta x^{\theta-1}, & 0 < x < 1 \\ 0, & \text{Otherwise} \end{cases}$. Find the Fisher's information $I(\theta)$ and the maximum likelihood estimator of θ.

8. Let $X_1, X_2, \ldots, X_n$ denote a random sample of n from a $N(\theta, \sigma^2)$ distribution. For every fixed values of the variance, show that the sample mean is a complete sufficient statistic for θ.

9. State (a) Bayes' theorem and (b) Rao-Blackwell theorem. Bring out their significance.

10. Describe SPRT procedure.

11. Explain the concept of interpenetrating subsamples in sample surveys.

12. Discuss factorial experimental designs with a simple illustration.

13. Distinguish control limits, specification limits and natural tolerance limits.

14. Define power spectral density spectrum of a random process. State its properties.

15. Let $|X(t)|$ and $|Y(t)|$ be random processes with $X(t) = A\cos wt + B\sin wt$ and $Y(t) = B\cos wt + A\sin wt$, where w is a constant, A and B are independent random variables both having zero mean and constant variance. Find the cross correlation of $X(t)$ and $Y(t)$. Verify whether $X(t)$ and $Y(t)$ are weak sense stationary processes jointly.

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