

Ph.D. COURSEWORK EXAMINATION IN BIOSCIENCE, AUGUST 2025**Course II—THEORY AND CONCEPT - BIOSCIENCE****(2020 Admission onwards)****Time : Three Hours****Maximum : 50 Marks****Part A***Answer any ten questions.**Each question carries 4 marks.*

1. Differentiate between bright field, phase contrast and fluorescence microscopy.
2. Explain the principle and applications of density gradient centrifugation.
3. Describe the Henderson-Hasselbalch equation and its importance in buffer preparation.
4. Explain simple staining and differential staining.
5. Write about the principles of agarose gel electrophoresis and SDS-PAGE.
6. Define ELISA and explain its applications in biological research.
7. What is meant by molecular markers ? Explain RFLP and RAPD techniques.
8. Explain sterilization techniques in microbiology and their significance.
9. How are DNA sequencing and amino acid sequencing performed ? Describe briefly.
10. Explain chemotaxonomy and its role in classification of plants.
11. State and explain various haematological analysis techniques used in animal physiology.
12. Explain in detail the principles of X-ray crystallography and NMR spectroscopy.

(10 × 4 = 40 marks)**Turn over**

Part B

Answer any one question.

The question carries 10 marks.

13. Explain in detail the various chromatographic and electrophoretic techniques for biomolecule separation, including their principles and applications.
14. Discuss plant and animal tissue culture techniques, including culture media preparation, inoculation, maintenance, and applications in biotechnology.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN BOTANY, AUGUST 2025**Course II—THEORY AND CONCEPT – BOTANY**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Short Answer type questions.**Each question carries 4 marks.*

1. What is the isoelectric point (pI) ? Explain its relevance for proteins and enzymes.
2. Describe the light-dependent reactions of photosynthesis.
3. Describe a general method for the extraction of plant-derived alkaloids.
4. Explain any *two* cold or heat-based extraction methods for biomolecules.
5. Explain the use of HPLC in phytochemical analysis.
6. Write a detailed note on 2D gel electrophoresis and its significance.
7. Explain the steps involved in RNA isolation from plant tissue.
8. How does SNP analysis help in plant breeding ? Explain.
9. Describe any *two* techniques for soil sampling in environmental analysis.
10. Define remote sensing and its application in vegetation mapping.
11. Describe the role of staining techniques in microbial identification.
12. Describe the method of anther culture and its significance.

(10 × 4 = 40 marks)

Turn over

Part B*Essay Type Questions.*

*Answer any **one** of the following questions.*

Each question carries 10 marks.

13. Discuss the cultivation techniques of edible mushrooms and microalgae.
14. Describe different centrifugation techniques for separating cellular components.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN CHEMISTRY, AUGUST 2025**Course II—THEORY AND CONCEPT – CHEMISTRY**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Short Answer type questions.**Each question carries 4 marks.*

1. Distinguish between IR and Raman spectroscopy with suitable examples.
2. (a) How is AES used in metal ion analysis ?
(b) What is the selection rule for NQR spectroscopy ?
3. Describe the working principle of Secondary Ion Mass spectroscopy (SIMS).
4. (a) What are the limitations of optical microscopy in nanoscale imaging ?
(b) What is the role of polarizer and analyzer in a polarizing microscope ?
5. (a) Differentiate between heat flow and heat capacity in Differential Scanning calorimetry (DSC).
(b) What type of material properties can be studied using Thermo Mechanical Analysis (TMA) ?
6. (a) What are the basic components of a Gas Chromatography (GC) instrument ?
(b) Explain the separation principle in size exclusion chromatography.
7. (a) How is XRD used to determine crystal structure and phase identification ?
(b) How is WAXD used to determine crystallinity in polymers ?
8. (a) What is the principle behind osmometric methods for molecular weight determination ?
(b) Compare membrane osmometry with vapour pressure osmometry.

Turn over

9. (a) What is impedance in electrical systems and how is it measured spectroscopically ?
(b) Describe the method to measure volume resistivity of insulating materials.
10. (a) What is the difference between compressive and tensile testing ?
(b) Define stress relaxation and explain its relevance in viscoelastic materials.
11. (a) How is the flow behavior of Newtonian and non-Newtonian fluids characterized ?
(b) Mention two advantages and limitations of capillary rheometry.
12. (a) Define haze. How is it measured and what does it indicate about a material ?
(b) Explain the principle of fluorescence and give an example of a fluorescent material.

(10 × 4 = 40 marks)

Part B

Essay Type Questions.

Answer any one of the following questions.

Each question carries 10 marks.

13. Describe the working principle and instrumentation of atomic absorption spectroscopy. Explain the role of a hollow cathode lamp and flame/graphite furnace. Discuss at least two analytical applications of AAS.
14. Describe the quantum mechanical principle of Scanning Tunnelling Microscopy (STM). Explain the instrumentation and discuss how it achieves atomic resolution. Mention its advantages and limitations.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN COMMERCE, AUGUST 2025**Course II—THEORY AND CONCEPT – COMMERCE**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Short answer type questions.**Each question carries 4 marks.*

1. Explain the features of globalization.
2. What is the impact of globalization on financial services ?
3. List the factors affecting capital structure.
4. Differentiate between explicit and implicit cost of capital.
5. What are the determinants of working capital ?
6. What is meant by capital structure ? Explain.
7. What is branding ? State its objectives.
8. What are the core functions of marketing in modern business ?
9. Define Human Resource Planning. What are its main objectives ?
10. What are the key principles of HRD ?
11. Explain International Financial Reporting Standards.
12. What is financial re-engineering ? Explain.

(10 × 4 = 40 marks)

Turn over

Part B*Essay Type Questions.*

Answer any **one** of the following questions.

Each question carries 10 marks.

13. Explain in detail the factors influencing the Supply Chain Management.
14. What do you understand by the term Customer Relationship Management ? Explain the different techniques/methods of Customer Relationship Management.

(1 × 10 = 10 marks)

**Ph.D. COURSEWORK EXAMINATION IN COMPUTER SCIENCE
AUGUST 2025**

Course II—THEORY AND CONCEPT – COMPUTER SCIENCE

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A

Answer any ten questions.

Short Answer type questions.

Each question carries 4 marks.

1. Explain the key components of Pattern Recognition Systems. Provide the role of each of these components in the pattern recognition process.
2. Describe the accuracy measures and metrics commonly used in classification and clustering tasks.
3. Explain some of the problems faced in digital image processing. How are they addressed ?
4. Which are the different ways in which images are represented digitally ?
5. Discuss two image transforms. How do these image transforms help in analyzing an image ?
6. Distinguish with examples, symmetric and asymmetric cryptographic techniques. Discuss their advantages and limitations in terms of security and efficiency.
7. What are the common threats to database security ? Describe the mechanisms used to protect databases.
8. Explain the concepts of frequent itemsets and association rules. Discuss the Apriori algorithm for mining frequent itemsets and association rules.
9. What is spatial data mining ? Discuss any *two* spatial data clustering algorithms.
10. Distinguish between parallel and distributed computing. How do these paradigms improve computational efficiency and scalability in large-scale applications ?

Turn over

11. Discuss the key differences between grid computing and cloud computing. How do these paradigms enhance resource sharing ?
12. Describe the architecture and key components of web-based applications.

(10 × 4 = 40 marks)

Part B

Essay Type Questions.

*Answer any **one** of the following questions.*

Each question carries 10 marks.

13. What is the role of cryptographic protocols in ensuring end-to-end security in networked environments? What are the challenges of a researcher in this research area ?
14. What are the challenges and research opportunities in mining unstructured and heterogeneous data types such as spatial, multimedia, and web data ? Suggest methods that will improve accuracy and scalability of mining algorithms.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN ECONOMICS, AUGUST 2025**Course II—THEORY AND CONCEPT – ECONOMICS**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Short Answer type questions.**Each question carries 4 marks.*

1. What do you mean by Efficiency Wage Model ?
2. Distinguish between adverse selection and moral hazard with suitable examples.
3. What is meant by intertemporal production ? Explain.
4. Explain the relevance of portfolio theory and capital markets.
5. What do you mean by Disequilibrium in Economic theory ? How are rectifications possible ?
6. Explain the Relevance of Endogenous Growth Theories.
7. Summarise Paul Krugman's contribution to International Trade Theory.
8. Define financial inclusion and mention its key components.
9. What is dependency theory ? How does it explain underdevelopment ?
10. What was the impact of the global recession on the Indian economy ?
11. What are Pigovian taxes ? Give an example from the Indian context.
12. Briefly describe any *two* recent employment generation programmes in India.

(10 × 4 = 40 marks)

Turn over

Part B*Essay Type Questions.*

*Answer any **one** of the following questions.*

Each question carries 10 marks.

13. Analyse and explain the Review of Hicks, Hansen, Patinkin and the Synthesis of the Keynesian Model in the context of post Keynesian Economics.
14. Discuss the steps taken by Government of India to boost the infrastructure sector.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN EDUCATION, AUGUST 2025**Course II—THEORY AND CONCEPT – EDUCATION**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Short Answer type questions.**Each question carries 4 marks.*

1. State two major contributions of Indian philosophy to value-based education.
2. Write two ways in which Western culture has influenced Indian educational values.
3. What is social constructivism in education ? Give two key features.
4. Define women empowerment. Give *two* ways it can be promoted through education.
5. What are *two* key components of Gagne's conditions of learning ?
6. What are *two* features of Emotional Intelligence in Goleman's model ?
7. Differentiate between Computer-Aided Assessment and Computer-Managed Assessment.
8. What is meant by lesson transcript in the context of teaching models ? Explain.
9. State two advantages of using rubrics in assessment.
10. What are the key components of a good grading system ?
11. What are *two* challenges faced by government primary schools in Kerala ?
12. What is meant by transforming information into dynamic knowledge ? Explain.

(10 × 4 = 40 marks)

Turn over

Part B*Essay Type Questions.*

*Answer any **one** of the following questions.*

The question carries 10 marks.

13. Discuss the significance of personality theories (Freud, Rogers, and Bandura) in classroom management and student behaviour.
14. Compare and contrast concept mapping and mind mapping as tools for teaching and assessment. How can they be used to enhance student understanding ?

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN ENGLISH, AUGUST 2025**Course II—THEORY AND CONCEPT – ENGLISH**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Each question carries 4 marks.*

1. Examine how Marshall Berman attempts to reclaim the concept of Modernity for Marxism.
2. Explain the key concepts introduced by Homi Bhabha in *The Location of Culture*.
3. Discuss the definition and origins of New Criticism and its main features.
4. Write briefly on Critical theory and Marxist criticism.
5. Discuss the origin and development of Nationalism and the notion of Nation according to Anderson.
6. What is Postcolonialism in literature ? Explain with reference to the major practitioners of Colonial and Postcolonial theories.
7. Examine the main tenets of Structuralism VS Post Structuralism
8. Discuss how the *Dialectic of Enlightenment* critiques the Enlightenment and "Culture industry".
9. K. N. Panikkar's *Colonialism, Culture and Resistance* offers a discussion of the different forms of Resistance and Colonialism and their role in the formation of alternative Modernity in India. Discuss.
10. Examine how Spivak's observations in her works have fundamentally reshaped feminist theory.
11. Examine how Said encourages a critical engagement with cultural texts to understand the complex ways in which culture and power are intertwined thereby challenging dominant narratives.

Turn over

12. Examine Foucault's *What is an Author* as a response to Barthes' rejection of author as the creator and proprietor of his works in *The Death of the Author*.

(10 × 4 = 40 marks)

Part B

Answer any one question.

The question carries 10 marks.

13. Examine in detail the emergence of Modernity in Europe and how the Non-European conceptualisation of Modernity debates about multiple Modernities.
14. Dalit writers' rejection of the hegemony of a caste-based Universalism challenges the neat binary world of Postcolonial theory and calls attention to the internal contradictions of Indian society. Discuss.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN HINDI, AUGUST 2025**Course II—THEORY AND CONCEPT—HINDI**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

खंड 'क'

किन्हीं दस प्रश्नों के उत्तर लिखिए ।

*Answer any ten questions.
Each question carries 4 marks.*

1. हिंदी साहित्य पर भूमंडलीकरण के असर का निरूपण कीजिए ।
2. साहित्यालोचन में संरचनात्मक भाषाविज्ञान और संकेतविज्ञान की भूमिका पर प्रकाश डालिए ।
3. हिंदी साहित्य पर मार्क्सवादी विचारधारा के प्रभाव पर प्रकाश डालिए ।
4. हिंदी साहित्य में विभिन्न वादों के क्रमिक विकास की रूप रेखा प्रस्तुत कीजिए ।
5. उत्तराधुनिकता की साहित्यिक उपलब्धियों को रेखांकित कीजिए ।
6. उत्तराधुनिकता संबंधी पश्चिमी अवधारणों को व्याख्या कीजिए ।
7. सौंदर्य शास्त्र की पश्चिमी संकल्पनाओं का विवेचन कीजिए ।
8. हिंदी साहित्य में विखंडनवाद की प्रवृत्तियाँ ।
9. उत्तराधुनिक साहित्य विमर्श के परिप्रेक्ष्य में दूधनाथ सिंह के साहित्यिक दृष्टिकोण की समीक्षा कीजिए ।
10. समकालीन हिंदी कहानी साहित्य में चर्चित प्रमुख समस्याओं का उल्लेख कीजिए ।
11. समकालीन हिंदी कथा साहित्य की भाषा-शैलीगत नवीनताओं को रेखांकित कीजिए ।
12. उत्तराधुनिकता के परिप्रेक्ष्य में कमलेश्वर के उपन्यासों में प्रतिपादित समस्याओं पर विचार कीजिए ।

(10 × 4 = 40 marks)

Turn over

खंड 'ख'

*Answer any one question.
The question carries 10 marks.*

13. साहित्य और समाज पर सोशल मीडिया के असर के विभिन्न पहलुओं पर विचार कीजिए।
14. हिंदी के बदलते साहित्यिक एवं संस्कृतिक प्रतिमानों पर आलोचनात्मक चर्चा प्रस्तुत कीजिए।

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN HISTORY, AUGUST 2025**Course II—THEORY AND CONCEPT – HISTORY**

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A*Answer any ten questions.**Each question carries 4 marks.*

1. Environmental history explores the ways in which the bio physical world has influenced the course of human history. Explain.
2. Examine the views of R.S. Sharma on urban decay in India.
3. Estimate the contributions of Judith Butler to the growth of post -modern feminism.
4. Describe the salient aspects of post structuralist movement with particular reference to the binary oppositions.
5. How did Meta modernism become post modernism ?
6. Assess the relevance of theory in the study of history with suitable examples.
7. Review the merits and defects of the Marxian interpretation of Indian history.
8. Discuss the important contributions of Irfan Habib and his ideas of history.
9. Sketch the Braudelien concept of history.
10. What is Geo structuralism ?
11. What are the major writings of Sumit Sarkar and how it reflect his ideology ?
12. Attempt a critique of subaltern studies in the context of post-colonial and post- imperial societies.

(10 × 4 = 40 marks)

Turn over

Part B

Answer any one question.

The question carries 10 marks.

13. Historical Materialism is a major tenet in the Marxist theory that regards material economic forces as the base on which socio- political institutions and ideas are built. Comment.
14. Describe the new perspectives on historical writing.

(1 × 10 = 10 marks)

F 6813

Reg. No......

Name.....

Ph.D. COURSEWORK EXAMINATION IN HOME SCIENCE, AUGUST 2025

Course II—THEORY AND CONCEPT – HOME SCIENCE

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A (Short Answer Type Questions)

Answer any ten questions.

Each question carries 4 marks.

1. Explain in brief about basic five food groups.
2. Discuss the factors to be considered in planning diet for elderly people.
3. What is the role of a dietitian in a hospital ? Explain.
4. Briefly explain the uses of geo-textiles and techno textiles.
5. What are organic textile finishes ? Explain.
6. What are the elements of design in apparel designing ? Explain.
7. Write a note on the factors influencing child development.
8. Briefly explain cognitive development during early childhood.
9. Briefly explain the importance of counselling for maintaining mental well-being.
10. Discuss about the selection of ideal flooring and floor coverings in different rooms in the house.
11. Discuss the qualities of good leader.
12. Discuss the factors to be considered in preparing audio visual aids for communication.

(10 × 4 = 40 marks)

Part B (Essay Type Questions)

Answer any one of the following questions.

The question carries 10 marks.

13. Discuss the principles of art and design for interior designing and interior space planning with special interference to selection and arrangement of furniture's and furnishings.
14. Explain the values of play for the overall development for young children.

(1 × 10 = 10 marks)

F 6815

Reg. No.....

Name.....

Ph.D. COURSEWORK EXAMINATION IN MALAYALAM, AUGUST 2025

Course II—THEORY AND CONCEPT – MALAYALAM

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A

പത്തു ചോദ്യത്തിന് രണ്ടു പുറത്തിൽ കവിയാതെ ഉത്തരമെഴുതുക.
ഓരോ ചോദ്യത്തിനും 4 മാർക്ക് വീതം.

1. ചോംസ്കിയുടെ രചനാനുരണ പ്രജനകവ്യാകരണത്തെക്കുറിച്ച് എഴുതുക.
2. തിണസങ്കല്പം സാഹിത്യസിദ്ധാന്തത്തെ സ്വാധീനിക്കുന്നതെങ്ങനെ ? വിശദീകരിക്കുക.
3. വക്രോക്തി സിദ്ധാന്തം അവതരിപ്പിക്കുന്ന കാവ്യസങ്കല്പം എന്താണ് ? വിശദമാക്കുക.
4. സന്ദേശകാവ്യങ്ങൾ നിർവഹിക്കുന്ന സാംസ്കാരിക ധർമ്മമെന്ത് ? വിവരിക്കുക.
5. പാട്ടുപ്രസ്ഥാനത്തിലെ പ്രമുഖ കവികളെയും കൃതികളെയും പരിചയപ്പെടുത്തുക.
6. മലയാള കവിതയിലെ ആധുനിക പ്രവണതകൾ എന്തെല്ലാമായിരുന്നു ? വ്യക്തമാക്കുക.
7. മലയാളത്തിലെ തനതു നാടകങ്ങളുടെ വളർച്ചയും പരിണാമവും നിരൂപണം ചെയ്യുക.
8. ആത്മകഥാസാഹിത്യത്തിൽ വർത്തമാന കാലത്തുണ്ടായ മാറ്റങ്ങൾ എന്തെല്ലാം ? അതിനു കാരണമായ വസ്തുതകൾ എഴുതുക.
9. സംസ്കാരത്തെക്കുറിച്ച് റെയ്മണ്ട് വില്യംസ് പുലർത്തിയിരുന്ന കാഴ്ചപ്പാടെന്തായിരുന്നു ? വിശദമാക്കുക.
10. അനുഷ്ഠാനകലകൾ എന്നാലെന്ത് ? വിശദീകരിക്കുക.
11. മലയാളത്തിലെ ചലച്ചിത്ര സാഹിത്യത്തിന്റെ സുഭാവം വിവരിക്കുക.
12. കേരളത്തിലെ ഭക്തിപ്രസ്ഥാനം നവോത്ഥാന പ്രവർത്തനങ്ങളുടെ മുന്നോടിയായിരുന്നു എന്നു കരുതാമോ? വിലയിരുത്തുക.

(10 × 4 = 40 marks)

Part B

ഒരു ചോദ്യത്തിന് നാലു പുറത്തിൽ കവിയാതെ ഉത്തരമെഴുതുക.
ഈ ചോദ്യത്തിന് 10 മാർക്ക്.

13. പാട്ടും മണിപ്രവാളവും രണ്ട് കാവ്യപ്രസ്ഥാനങ്ങൾ എന്നതിലുപരി രണ്ടു സംസ്കാരങ്ങളുടെ പ്രതീനിധാനങ്ങളാണ്—ശരിയോ ? നിരൂപണം ചെയ്യുക.
14. മലയാള ചെറുകഥയിലെ ആധുനികാനന്തര പ്രവണതകൾ എന്തെല്ലാമാണ് ? വിവരിക്കുക.

(1 × 10 = 10 marks)

F 6816

Reg. No.....

Name.....

**Ph.D. COURSEWORK EXAMINATION IN MANAGEMENT STUDIES
AUGUST 2025**

Course II—THEORY AND CONCEPT – MANAGEMENT STUDIES

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A (Short Answer Type Questions)

Answer any ten questions.

Each question carries 4 marks.

1. Explain the evolution of management thought with reference to any one major schools of thought.
2. What are the emerging trends in modern management practices ?
3. What is ERP? How does it benefit managerial decision-making ?
4. What is the Time Value of Money (TVM) ? Why is it relevant in financial decision making ?
5. Write a short note on the role of the money market in financial management.
6. Explain Walter's model of dividend policy.
7. Differentiate between values and attitudes with suitable examples.
8. Define collective bargaining. What are its basic features ?
9. Briefly describe the steps involved in the marketing management process.
10. Briefly explain the components of the promotion mix.
11. Explain the use of moving average in forecasting.
12. State the objectives of Total Quality Management.

(10 × 4 = 40 marks)

Part B (Essay Type Questions)

Answer any one of the following questions.

The question carries 10 marks.

13. What is cost of capital ? Discuss the factors affecting capital structure decisions.
14. Explain any two models of Organizational Behaviour and their relevance in today's work environment.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN MATHEMATICS, AUGUST 2025

Course II—THEORY AND CONCEPT – MATHEMATICS

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A

*Answer any ten questions.**Short Answer type questions.**Each question carries 4 marks.*

1. State and prove Cantor's Theorem. What is its implication on the cardinality of power sets ?
2. Define a partially ordered set. Give an example that is not a totally ordered set.
3. Define a topology on a set. What is a basis for a topology ? Give an example.
4. What is the difference between absolute and conditional convergence ? Illustrate with examples.
5. Expand $\frac{1}{z(z-1)}$ as a Laurent series in $0 < |z| < 1$.
6. State and prove the First Isomorphism Theorem for groups.
7. Prove that the intersection of two subspaces of a vector space is also a subspace.
8. Determine the largest eigen value and its corresponding eigen vector of :

$$\begin{pmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & -3 \end{pmatrix}.$$

9. Solve the non-homogeneous ODE : $y'' + y = \sin x$.
10. Find the general solution of the PDE $\frac{\partial z}{\partial x} = 3x^2$.

Turn over

11. Show that the intersection of two σ -algebras need not be a σ -algebra.
12. Define Eulerian and Hamiltonian graph with an example each.

(10 × 4 = 40 marks)

Part B

Essay Type Questions.

Answer any one of the following questions.

Each question carries 10 marks.

13. Define a vector space. Show that the set of all polynomials over $\mathbb{R}$ forms a vector space.
14. Define countable and uncountable sets. Prove that the set of real numbers $\mathbb{R}$ is uncountable and the set of rational numbers $\mathbb{Q}$ is countable.

(1 × 10 = 10 marks)

F 6818

Reg. No.....

Name.....

**Ph.D. COURSEWORK EXAMINATION IN PHYSICS
AUGUST 2025**

Course II—THEORY AND CONCEPT – PHYSICS

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A (Short Answer Type Questions)

Answer any ten questions.

Each question carries 4 marks.

1. Briefly explain the Free Electron Theory in three dimensions.
2. Describe the motion of electrons in a magnetic field.
3. What are ferromagnetic domains ? Explain.
4. Differentiate between radiative and non-radiative recombination processes.
5. Define the Stokes shift and explain its origin in optical transitions.
6. Explain the process of two-photon absorption and its significance in optical applications.
7. What are gluons and what role do they play in the quark model ?
8. Write short notes on Einstein's static model of the universe.
9. Explain in brief the scalar tensor theory.
10. What is the electromagnetic field tensor ? Mention its importance in relativistic electrodynamics.
11. What is the significance of the Dirac equation in relativistic quantum mechanics ?
12. State and explain H-theorem.

(10 × 4 = 40 marks)

Part B (Essay Type Questions)

Answer any one of the following questions.

The question carries 10 marks.

13. Describe the principles and methods of X-ray diffraction.
14. Discuss the Friedmann model of the universe.

(1 × 10 = 10 marks)

F 6819

Reg. No.....

Name.....

**Ph.D. COURSEWORK EXAMINATION IN POLITICAL SCIENCE
AUGUST 2025**

Course II—THEORY AND CONCEPT – POLITICAL SCIENCE

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A

Answer any ten questions.

Each question carries 4 marks.

1. Define the importance of ontology and epistemology in Social Science research.
2. Define New Social Movements. How significant are NSMs in modern democracies ?
3. Define Eco-feminism. What constitutes its foundational principles ?
4. Discuss Habermas' concept of public sphere and deliberative democracy.
5. Elucidate base and superstructure in Marxism.
6. Examine how caste and class are related in India.
7. "International political economy has a clear North-South divide". Comment.
8. How does the New Media remake the contemporary world ?
9. What are the key features of multiculturalism ?
10. Explain critical theory. How does it differ from Marxism ?
11. Explain globalization's impact on culture.
12. "Neoliberalism as political and economic ideology has profoundly transformed the world". Explain.

(10 × 4 = 40 marks)

Part B

Answer any one question.

The question carries 10 marks.

13. "Though colonialism has gone, post-colonialism persists". Discuss.
14. Trace the transformation of liberalism as political Ideology over the centuries.

(1 × 10 = 10 marks)

F 6820

(Pages : 2)

Name.....

Reg. No.....

Ph.D. COURSEWORK EXAMINATION IN SANSKRIT, AUGUST 2025

Course II—THEORY AND CONCEPT—SANSKRIT

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

*Answers may be written either in Sanskrit or in English.
In writing Sanskrit, Devanagari script should be used.*

Part A

*Answer any ten questions.
Each question carries 4 marks.*

उत्तराणि खण्डिकारूपेण लिखत :

1. उपनिषद् ।
2. योगदर्शनम् ।
3. लघुपाणिनीयम् ।
4. गीतगोविन्दम् ।
5. आयुर्वेदः ।
6. वास्तुविद्या ।
7. कालिदासनाटकानि ।
8. पञ्चमहाकाव्यानि ।
9. श्रीकृष्णविलासकाव्यम् ।
10. Word Processing.
11. Critical Edition.
12. Melputhur Narayanabhattatiri.

(10 × 4 = 40 marks)

Turn over

Part B

*Answer any one question.
The question carries 10 marks.*

13. दशरूपकाणि विवृणुत ।
14. चतुर्वेदानधिकृत्य उपन्यस्यत ।

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN SOCIOLOGY
AUGUST 2025

Course II—THEORY AND CONCEPT – SOCIOLOGY

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A (Short Answer Type Questions)

Answer any ten questions.

Each question carries 4 marks.

1. What is the role of values in sociological research ? Explain.
2. Explain two ways in which ethnomethodology criticizes mainstream sociology.
3. Briefly describe Alfred Schutz's contribution to phenomenological sociology.
4. What is Lyotard's notion of meta-narratives in postmodern theory ?
5. How does the Marxist theory explain gender inequality ?
6. Explain masculinity and femininity as social constructs with examples.
7. What is the functionalist perspective on the relationship between education and the economy ?
8. How do regional or cultural differences contribute to inequality in education ?
9. What is the sociological importance of mass communication ?
10. How has globalization influenced mass media content and reach ?
11. Briefly explain Everett Lee's push and pull theory of migration.
12. How does migration contribute to social change ?

(10 × 4 = 40 marks)

Part B (Essay Type Questions)

Answer any one of the following questions.

The question carries 10 marks.

13. Explain the socio-economic theories of migration with reference to the contributions of Zelinsky and Hoffmann-Nowotny.
14. What are the key features of structuralism ? Discuss Claude Lévi-Strauss's role in applying structuralist thought to culture.

Ph.D. COURSEWORK EXAMINATION IN STATISTICS, AUGUST 2025

Course II—THEORY AND CONCEPT – STATISTICS

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A

*Answer any ten questions.**Short Answer type questions.**Each question carries 4 marks.*

1. Differentiate between absolute convergence and conditional convergence of a series.
2. Explain the difference between symmetric and skew-symmetric matrices.
3. Find the eigenvalues and eigenvectors of the matrix $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$.
4. State the mean and variance of the Binomial and Poisson distributions. Under what condition does Binomial approximate Poisson ?
5. Apply Central limit theorem to approximate the probability that the sum of 100 i.i.d. random variables with mean 10 and variance 4 exceeds 1050.
6. State and prove the Rao-Blackwell theorem.
7. Compare method of moments and maximum likelihood estimation.
8. State the Neyman-Pearson Lemma. Why is it considered fundamental in hypothesis testing ?
9. Describe orthogonality property of principal components.
10. Define Hotelling's T^2 statistic for one-sample tests and state its distribution under H_0 .

Turn over

11. What is multinomial distribution ? Give the form of its joint density.
12. Derive the MLEs of the mean vector and covariance matrix of a multivariate normal distribution.

(10 × 4 = 40 marks)

Part B

Essay Type Questions.

*Answer any **one** of the following questions.*

Each question carries 10 marks.

13. Define an unbiased test. Discuss the concept of Uniformly Most Powerful Unbiased (UMPU) tests.
14. State and prove Weak Law of Large Numbers.

(1 × 10 = 10 marks)

Ph.D. COURSEWORK EXAMINATION IN ZOOLOGY
AUGUST 2025

Course II—THEORY AND CONCEPT – ZOOLOGY

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A (Short Answer Type Questions)

Answer any ten questions.

Each question carries 4 marks.

1. Explain the significance of molecular diversity in conservation biology.
2. Explain in brief the strategies used for the conservation of endangered species.
3. Describe the role of molecular tools in modern taxonomy.
4. Explain the use of sampling techniques for biodiversity assessment.
5. Define EIA. What are its key characteristics ?
6. What is an Environmental Impact Statement (EIS) ? What does it include ?
7. What is the role of the Department of Biotechnology (DBT) in formulating biosafety guidelines in India ?
8. List the responsibilities of the Institutional Animal Ethics Committee.
9. Write the principle and applications of centrifugation in biomolecular research.
10. Differentiate between Southern and Northern blotting.
11. Write a note on Protein sequencing.
12. Explain the principle and usage of scanning electron microscopy (SEM).

(10 × 4 = 40 marks)

Part B (Essay Type Questions)

Answer any one of the following questions.

The question carries 10 marks.

13. Explain the principle and steps of Polymerase Chain Reaction (PCR). Discuss its applications in molecular biology and diagnostics.
14. Outline the major stages involved in the EIA process. How are impacts predicted, evaluated, and mitigated ?

Ph.D. COURSEWORK EXAMINATION IN GEOLOGY
AUGUST 2025

Course II—THEORY AND CONCEPT – GEOLOGY

(2020 Admission onwards)

Time : Three Hours

Maximum : 50 Marks

Part A

Answer any ten of the following questions.

Each question carries 4 marks.

1. What are pressure belts ? Explain with examples.
2. Differentiate between Koppen's and Thornthwaite's climate classification.
3. Briefly describe the Quaternary Ice Ages.
4. Define geochemical cycle and explain its significance.
5. Write a short note on geochemical anomalies and their significance.
6. Explain factors affecting evaporation from free water surfaces.
7. What is a Hydrograph ? Mention its importance.
8. Explain the concept of spectral reflectance of vegetation.
9. Differentiate between vector and raster data models in GIS.
10. Write a short note on terrain analysis in GIS.
11. Mention the role of drilling in mineral exploration.
12. Write a short note on litho-geochemical surveys.

(10 × 4 = 40 marks)

Part B

Answer any one question from the following.

The question carries 10 marks.

1. Explain in detail the layered structure of the atmosphere and its significance in climatic processes.
2. Explain the principles of remote sensing with special emphasis on energy-atmosphere interactions.

(1 × 10 = 10 marks)

F 6848

(Pages : 2)

Reg. No.....

Name.....

Ph.D. COURSEWORK EXAMINATION IN PHYSICS, AUGUST 2025

Course II—RECENT DEVELOPMENTS IN PHYSICS

(Prior to 2019 Admissions)

Time : Three Hours

Maximum : 80 Marks

Part A

Answer any twelve of the following questions.

Each question carries 5 marks.

1. Define effective mass. Explain the concept of effective masses of electrons and holes.
2. Define exciton. Distinguish between Frenkel and Mott-Wannier excitons.
3. Explain ferromagnetic domains and their role in magnetization.
4. What is superparamagnetism ? How does it differ from ordinary paramagnetism ?
5. Explain the process of electron-hole pair formation in semiconductors.
6. Write short notes on deep level transitions and their optical significance.
7. Define non-linear optics. What is meant by second-order and third-order non-linear phenomena ?
8. What is stimulated Raman scattering ? Explain its basic mechanism.
9. Explain the concept of colored quarks and gluons in the quark model.
10. Define the Grand Unified Theories (GUTs) and their significance in particle physics.
11. Explain the concept of redshift and how it provides evidence for the expansion of the universe.
12. Write short notes on the Boltzmann transport equation.
13. Describe the Einstein static model of the universe.
14. Write short notes on the Dirac equation and its significance.

Turn over

15. State Noether's Theorem and explain its importance in classical mechanics.
16. Write short notes on relativistic electrodynamics.

(12 × 5 = 60 marks)

Part B

*Answer any **two** questions from the following.*

Each question carries 10 marks.

17. Explain the formation of energy bands in solids using the Kronig-Penney model. Discuss the origin of the energy gap.
18. Discuss band-to-band, donor-acceptor, and impurity band transitions in semi-conductors. Explain their optical significance and differences.
19. Explain the perfect cosmological principle and its significance in cosmology.
20. Explain relativistic field theories with suitable examples. Discuss the differences from classical field theories.

(2 × 10 = 20 marks)