University of Rajasthan
Jaipur

SYLLABUS

M.A. History

Annual Scheme

M.A. (Previous) Examination 2024
M.A. (Final) Examination 2025

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University of Rajasthan
JAIPUR

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KALWAR, JAIPUR-303706

SCHEME OF EXAMINATION
(Annual Scheme)

Each Theory Paper	3 hrs. duration	100 Marks
Dissertation/Thesis/ Survey Report/ Field Work, if any.		100 Marks

2. The number of papers and the maximum marks for each paper/practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in the practical part (wherever prescribed) of a subject/paper separately.

3. A candidate for a pass at each of the Previous and the Final Examinations shall be required to obtain (i) atleast 36% marks in the aggregate of all the papers prescribed for the examination and (ii) atleast 36% marks in practical(s) wherever prescribed at the examination, provided that if a candidate fails to secure atleast 25% marks in each individual paper at the examination and also in the dissertation/ survey report field work, wherever prescribed, he shall be deemed to have failed at the examination note ithstanding his having obtained the minimum percentage of marks required in the aggregate for that examination. No division will be awarded at the Previous Examination. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the Previous and the Final Examinations taken together, as noted below :

First Division 60%
Second Division 48%] of the aggregate marks taken together of the Previous and the Final Examinations.

All the rest will be declared to have passed the examination.

4. If a candidate clears any papers(s) / Practical(s) / Dissertation prescribed at the Previous and/or Final Examination after a continuous period of three years then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper(s) / Practical(s)/ Dissertation are cleared after the expiry of the aforesaid period of three years: provided that in case where a candidate requires

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SYLLABUS

M.A. Hindi

Annual Scheme

M.A. (Previous) Examination 2024
M.A. (Final) Examination 2025

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SCHEME OF EXAMINATION
(Annual Scheme)

Each Theory Paper	3 hrs. duration	100 Marks
Dissertation Thesis/ Survey Report/ Field Work, if any.		100 Marks

2. The number of papers and the maximum marks for each paper/practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in the practical part (wherever prescribed) of a subject/paper separately.

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First Division 60% }	of the aggregate marks taken together
Second Division 48%	of the Previous and the Final Examinations.

All the rest will be declared to have passed the examination.

4. If a candidate clears any papers(s) / Practical's) / Dissertation prescribed at the Previous and/or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper(s) / Practical(s)/ Dissertation are cleared after the expiry of the aforesaid period of three years; provided that in case where a candidate requires more than 25% marks in order to each the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.

5. The Thesis/ Dissertation! Survey Report Field Work shall be type-written and submitted in triplicate so as to reach the office of the Registrar at least 3 weeks before the commencement of the theory examinations. Only such candidates shall be permitted to offer Dissertation/ Field Work! Survey Report Thesis (if provided in the scheme of examination) in lieu of a paper as have secured at least 55% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme and I and II semester examinations taken together in the case of semester scheme. irrespective of the number of papers in which a candidate actually appeared at the examination.

N.B. Non-collegiate candidates are not eligible to offer dissertation as per provisions of O. 170-A.

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एम.ए. पूर्वार्द्ध राजनीति विज्ञान परीक्षा

M.A. PREVIOUS POLITICAL SCIENCE EXAMINATION

प्रश्न–पत्रों की रूपरेखा

प्रत्येक प्रश्न–पत्र 3 घण्टे की अवधि का होगा तथा प्रत्येक प्रश्न–पत्र के अधिकतम 100 अंक होंगे।

प्रत्येक प्रश्न–पत्र के तीन खण्ड होंगे। प्रथम खण्ड 20 अंको का होगा। इस खण्ड में दो अंकों के 10 अनिवार्य प्रश्न होंगे। जिनमें से प्रत्येक प्रश्न का उत्तर परीक्षार्थी को अधिकतम 20–25 शब्दों में अपेक्षित होगा।

द्वितीय खण्ड 20 अंकों का होगा। इस खण्ड में 05 अंकों के 04 अनिवार्य प्रश्न होंगे, जिनमें से प्रत्येक का उत्तर 150 शब्दों में अपेक्षित होगा।

तृतीय खण्ड 60 अंकों का होगा। इस खण्ड में तीन भाग होंगे। जिनमें प्रत्येक में 20 अंको के दो निबंधात्मक प्रश्न होंगे। परीक्षार्थी से प्रत्येक खण्ड में से एक प्रश्न का उत्तर अपेक्षित होगा। प्रत्येक खण्ड से एक प्रश्न का चयन करते हुए कुल 03 प्रश्नों का उत्तर अपेक्षित होगा।

General Scheme of Question Papers

Each question paper shall be of three hours duration and of 100 marks.

Each question paper shall consist of three parts. Part I shall carry 20 marks and shall consist of 10 compulsory questions of 2 marks each to be answered in 20-25 words each.

Part II shall carry 20 marks and shall consist of 4 compulsory questions of 5 marks each to be answered in 150 words each.

Part III of the question paper shall carry 60 marks. This part shall be divided into 3 sections each comprising of 2 cssay-type questions of 20 marks each. Candidates will be required to attempt one question from each section (3 questions in all, one from each section)

एम.ए. पूर्वार्द्ध परीक्षा

अग्रांकित चार अनिवार्य प्रश्न–पत्र होंगे

I पाश्चात्य राजनीतिक चिन्तन
II भारतीय राजनीतिक चिन्तन
III अन्तर्राष्ट्रीय राजनीति
IV लोक प्रशासन के सिद्धान्त एवं व्यवहार

There shall be following four compulsory papers:

I Western Political Thought
II Indian Political Thought
III International Politics
IV Theory and Practice of Public Administration

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M.A./M. Sc. Geography (Annual Scheme)

(Regular/Non-Collegiate Candidates)

SCHEME OF EXAMINATION

Each Theory Paper	3 Hrs. Duration	100 Marks
Dissertation if offered in lieu of an elective paper		100 Marks
Practical		100 Marks

N.B. Non-Collegiate candidate are not eligible to offer dissertation as per provisions of O. 170-A.

1. The number of papers and the maximum marks for each paper/practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in practical part (wherever prescribed) of a subject/paper separately. Each theory paper will have a teaching of three hrs per week
2. A candidate for passing at each of the Previous and the Final Examination shall be required to obtain:

(i) Atleast 36% marks in the aggregate of all the papers prescribed for the examination, and

(ii) Atleast 36% marks in practical(s) wherever prescribed at the examination, provided that if a candidate fails to secure atleast 25% marks in each individual paper at the examination and also in the dissertation/survey report/field work, wherever prescribed, he shall be deemed to have failed at the examination notwithstanding his having obtained the minimum percentage of marks required in the aggregate for that examination. No division will be awarded at the Previous and the Final Examination. Division shall be awarded at the end of the Finai Examination on the combined marks obtained at the Previous and the Final Examinations taken together, as noted below:

First Division	60%	of the aggregate marks taken together of the Previous and the Final Examination.
Second Division	48%	

All the rest will be declared to have passed the examination.

3. If a candidate clears any Paper(s) Practical(s)/Dissertation prescribed at the Previous and/or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper(s)/Practical(s)/Dissertation are cleared after the expiry of the aforesaid period of three years, provided that in case where a candidate requires more than 25% marks in order to reach the minimum aggregate as many marks in out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.
4. The Thesis/Dissertation/Survey Report/Field Work shall be type written and submitted in triplicate so as to reach the office of the Registrar atleast 3 weeks before the commencement of the theory examinations. Only such candidates shall be permitted to offer Dissertation/Field Work/Survey Report/Thesis (if provided in the

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scheme of examination) in lieu of a paper as have secured atleast 55% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme I and II semester examination taken together in the case of semester scheme irrespective of the number of papers in which a candidate actually appeared at the examination.

5. The Students are permitted to use simple calculator, Log Table & map stencils in the Examinations if needed.
6. Non-collegiate candidates both in previous and final year are required to attend a practical training camp of forty eight hours at the Department of Geography, University of Rajasthan, Jaipur on payment of fee fixed by the University from time to time. The candidate should contact the Head, Department of Geography, University of Rajasthan, Jaipur for practical camps immediately after the filling the examination forms. Head, Department of Geography will issue a Certificate to each of the non-collegiate candidate for successful completion of the training camp. The candidate have to submit the Certificate at the time of practical examination.

M.A./M.SC. Geography

There will be four theory papers and a practical each in Previous and Final Examination. Each of the theory papers will be 100 marks. Each theory paper will be of three hours duration. Candidate will be required to pass both in theory and practicals separately.

PREVIOUS

Paper –I Evolution of Geographical Thought

Paper –II Physical Basis of Geography

Paper –III Principles and Theory of Economic Geography

Paper –IV Any one of the following:

(a) Advanced Geography of Monsoon Asia
(b) Geography of Rural Development
(c) Comparative Geography of U.S.A. and Russia
(d) Geography of South Asian Countries (Bangladesh, Nepal, Pakistan, Srilanka)
(e) Advanced Regional Geography of West Europe.
(f) Man and Natural Environment.
(g) Quantitative Techniques in Geography.

Practicals

FINAL

Paper –V Advanced Geography of India

Paper –VI Any one of the following:

(a) Population Geography
(b) Agricultural Geography (Elements & Applied)
(c) Industrial Geography

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M.A./M.Sc.(Previous) Mathematics Examination

Scheme of Examination : Annual Scheme
Note: Papers I to V are compulsory

Paper – I: Advanced Abstract Algebra
Teaching : 6 Hours per Week
Examination : Common for Regular/Non-collegiate Candidates

3 Hrs. duration **Theory Paper** **Max. Marks 100**

Note : This paper is divided into FIVE Units. TWO questions will be set from each Unit. Candidates are required to attempt FIVE questions in all taking ONE question from each Unit. All questions carry equal marks.

Unit 1: Direct product of groups (External and Internal). Isomorphism theorems – Diamond isomorphism theorem, Butterfly Lemma, Conjugate classes (Excluding p-groups), Commutators, Derived subgroups, Normal series and Solvable groups, Composition series, Refinement theorem and Jordan-Holder theorem for infinite groups.

Unit 2: Sylow's theorems (without proof), Cauchy's theorem for finite abelian groups. Euclidean rings. Polynomial rings and irreducibility criteria. Linear transformation of vector spaces, Dual spaces, Dual basis and their properties, Dual maps, Annihilator.

Unit 3: Field theory – Extension fields, Algebraic and Transcendental extensions, Separable and inseparable extensions, Normal extensions. Splitting fields.
Galois theory – the elements of Galois theory, Automorphism of extensions, Fundamental theorem of Galois theory, Solutions of polynomial equations by radicals and Insolvability of general equation of degree five by radicals.

Unit 4: Matrices of a linear maps, Matrices of composition maps, Matrices of dual map, Eigen values, Eigen vectors, Rank and Nullity of linear maps and matrices, Invertible matrices, Similar matrices, Determinants of matrices and its computations, Characteristic polynomial, minimal polynomial and eigen values.

Unit 5: Real inner product space, Schwartzs inequality, Orthogonality, Bessel's inequality, Adjoint, Self adjoint linear transformations and matrices, Orthogonal linear transformation and matrices, Principal Axis Theorem.

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M.Sc. Botany
Scheme of Examination

M.Sc. (Prev.)

There will be six papers in theory, each of three hours duration, 100 marks each and two practicals carrying 150 marks each (10%) marks are reserved for viva and 15% records in each examination). Each practical examination will be of 6 hours duration to be completed in one day.

Each paper will have 9 questions, out of which a student has to attempt 5 questions including the question No.1 which will be compulsory. The question No.1 will carry 20 marks and will be of short answer type questions with a limit of 20 words.

M.Sc. (Final)

There will be six papers, four compulsory and two elective, in theory of 3 hours duration carrying 100 marks each and two practicals each as follows :

(i) Practical for compulsory papers of 200 marks of 8 hours duration to be completed in two days.

(ii) Practical for elective papers - 100 marks of 4 hours duration to be completed in one day.

Each paper will have 9 questions, out of which a student has to attempt 5 questions including the question No.1 which will be compulsory. The question No.1 will carry 20 marks and will be of short answer type questions with a limit of 20 words.

M.Sc. Previous

Paper-I	**: Cell and Molecular Biology of Plants**
Paper-II	**: Cytology, Genetics and Cytogenetics**
Paper-III	**: Biology and Diversity of Lower Plants : Cryptogams**
Paper-IV	**: Taxonomy and Diversity of Seed Plants**
Paper-V	**: Plant Physiology and Metabolism**
Paper-VI	**: Microbiology and Plant Pathology**

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Physics

NOTICE

The Ordinance governing the examinations in the Faculties of Arts, Fine Arts, Social Sciences, Science, Commerce and Law are contained in a separate booklet. The students are advised to refer to the same

2 Changes in Statutes/Ordinances/Rules/Regulations/ Syllabi and Books may, from time to time, be made by amendment or re-making and a candidate shall, except in so far as the University determines otherwise comply with any change that applies to years he has not completed at the time of change.

3 All court cases shall be subject to the jurisdiction of the Rajasthan University head quarter at Jaipur only and not any other place.

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for University of Rajasthan
Printed by Harish Printers, Jaipur

SCHEME OF EXAMINATION

(Annual Scheme)

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Dissertation / Thesis/ Survey Report/Field Work, if any.		100 Marks

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Second Division	48%	

All the rest will be declared to have passed the examination.

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4. If a candidate Clears any Paper (s) / Practical (s) / Dissertation prescribed at the Previous and or Final examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper (s) / Practical (s) / Dissertation as are cleared after the expiry of the aforesaid period of three years : provided that in case where a candidate requires more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secure by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.

5. The Thesis/ Dissertation/ Survey Report/ Field Work shall typewritten and submitted in triplicate so as to reach the office of the Registrar atleast 3 weeks before the commencement of the theory examination. Only such candidates shall be permitted to offer Dissertation/ Field Work/ Survey Report/ Thesis (If provided in the scheme of Examination) in lieu of a paper as have secured atleast 55% marks in the aggregate of all the paper prescribed for the previous examination in the case of annual scheme irrespective of the number of paper in which a candidate actually appeared at the examination.

N.B.—Non-Collegiate candidates are not eligible to offer dissertation as per provisions of O.170-A.

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M. Sc PHYSICS PREVIOUS

Paper-I	:	Clasical Mechanics and Mathematica. Method in Physics	Max. Marks 100 Time 3 hrs.
Paper-II	:	Classical Electrodynamics	Max. Marks 100 Time 3 hrs.
Paper-III	:	Quanum Mechanics, Atomic and Molecular Physics	Max. Marks 100 Time 3 hrs.
Paper-IV	:	Electronics, Numerical Methods and Computer Programming	Max. Marks 100 Time 3 hrs.

PAPER - I : CLASSICAL MECHANICS AND MATHEMATICAL METHODS IN PHYSICS

Max. Marks 100 Duration 3 hrs.

Note : In all Ten questions are to be set, Five from each section. Candidates are required to attempt five questions in all, taking at least two questions from each section.

Section A

1. Holonomic and nonholonomic constraints: D-Alembert's Principle. Generalized coordinates, Lagrangian, lagrange's equation and its applications. Velocity dependant potential in Lagaragian formulation. Generalized momentum, Legendre transformation, Hamiltonian, Hamilton's Canonical equation.

2. Calculus of variations and its application to simple problems. Hamilton's variational principle, Derivation of Lagrange's and Hamilton. Canonical equation from Hamilton's variational principle. Extension of Hamilton's Principle for nonconservative and nonholonomic systems, Method of Lagrange's multipliers. Conservation Principle and Noether's theorem. Conservation of energy, linear momentum and angular momentum as a consequence of homogenicity of time and scope and isotropy of space respectively.

3. Canonical transformation, integral in variants of poincare Lagrange's and Poisson brackets as canonical invariants. Equation of motion in Poisson bracket formulation, Infinitesimal connect transformation and generators of symmetry, Liouville's theorem, Hamilton Jacobi equation and its applications.

4. Action angle, variable adiabatic invariance of action variable : The Kepler problem in action angle variables, [illegible]

UNIVERSITY OF RAJASTHAN

UGC CURRICULUM FOR POSTGRADUATES

M.Sc. Zoology Previous (Annual Scheme)

Paper –I	Biosystematics and Taxonomy
Paper –II	Structure & Function of Invertebrates
Paper –III	Molecular Biology and Biotechnology
Paper – IV	General Physiology
Paper – V	Biochemistry
Paper – VI	Biostatistis and Population Genetics

Note:- In M. Sc. Zoology Previous Examination the theory papers will have the following pattern.

Question papers will have 5 (five) questions in all having equal marks

(i) Question number 1 will be compulsory and will have 20 very short answer question of 1 mark each.

(ii) Question numbers2and 3 will consist ofonly short answer type questions with 4subdivisions of 5 marks each. There will be internal choice in these questions.

(iii) Question numbers 4 and 5 will be long answer type questions with internal choice.

PAPER I: BIOSYSTEMATICS AND TAXONOMY

3 Hours duration Max. Marks: 100 Periods : 80

1. Definition and basic concepts ofbiosystematics and taxonomy 10
   - 1.1 Historical resume of systematics.
   - 1.2 Importance and applications of biosystematics in biology.
   - 1.3 Manual basis of histo-systematics-different- attributes.
2. Trends in biosystematics: Concepts of different conventional and newer aspects 14
   - 2.1 Behavioural Taxonomy
   - 2.2 Chemotaxonomy
   - 2.3 Cytotaxonomy
   - 2.4 Molecular taxonomy
   - 2.5 Numerical taxonomy
3. Molecular perspective on the conservation of diversity 6
   - 3.1 Diversity and ecosystem process:Theory, achievements and future directions.
4. Dimensions of speciation and taxonomic characters 20

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4.1 Dimensions of speciation – Typesof lineage changes;Production of additional lineage.

4.2 Mechanisms of speciation,Speciation in panmictic and apomictic species.

4.3 Species concepts and species category, Different species concepts: Subspecies and other infra-specific categories.

4.4 Theories of biological classification: Hierarchy of categories.

4.5 Taxonomic characters of different kinds, origin of reproductive isolation and biological mechanism of genetic incompatibility.

5. Procedure keys in taxonomy 20

5.1 Taxonomic procedures: Taxonomic collections, preservation, correct process of identification.

5.2 Taxonomic keys: Different kinds of taxonomic keys, their merits and demerits.

5.3 Systematic publications and different kinds of publications.

5.4 Process of Zoological types.

5.5 International Code of Zoological Nomenclature (ICZN) and its operativeprinciples, interpretation and application of important rules. Zoologicalnomenclature; formation of scientific names of various taxa.

6. Evaluation of biodiversity indices 10

6.1 Shannon-Weinner index, dominance index.

6.2 Similarity and dissimilarity index

6.3 Association index

Recommended Books (All latest editions)

1. Avise, J.C., Molecular Markers, Natural History and Evolution.Chapman Hall, New York.
2. Kato, M.,The Biology of Biodiversity, Springer.
3. Mayer, E., Principles of Systematic Zoology, McGraw Hill Book Company, New York.
4. Simpson, G.G., Principle of Animal Taxonomy. Oxford, IBH Publishing Company.
5. Tikadar, B.K., Threatened Animals of India, ZSI Publication, Calcutta.
6. Wilson, E. O.,The Diversity of Life. W.W. Northern & Company.
7. Wilson, E.O., Biodiversity. Academic Press, Washington.

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Paper II: STRUCTURE & FUNCTION OF INVERTEBRATES

3 Hours duration | Max. Marks: 100 | Periods : 80

1. Organization of Coelom — 6
   - 1.1 Acoelomates
   - 1.2 Pseudocoelomates
   - 1.3 Coelomates:Protostomia and Deuterostomia.
2. Locomotion — 14
   - 2.1 Flagellar and ciliary movement in Protozoa.
   - 2.2 Hydrostatic movement in Coelenterata, Annelida andEchinodermata.
3. Nutrition and Digestion — 10
   - 3.1 Patterns of feeding and digestion in lower Metazoa.
   - 3.2 Filter feeding in Polychaeta. Mollusca and Echinodermata.
4. Respiration — 10
   - 4.1 Organs of respiration: Gills, lungs and trachea.
   - 4.2 Respiratory pigments.
   - 4.3 Mechanism of respiration.
5. Excretion — 8
   - 5.1 Organs of excretion: Coelom, Coelomoducts, Nephridia and Malpighian tubules.
   - 5.2 Mechanisms of excretion.
   - 5.3 Excretion and osmoregulation.
6. Nervous system — 12
   - 6.1 Primitive nervous system: Coelenterata and Echinodermata.
   - 6.2 Advanced Nervous system: Annelida, Arthropoda(Crustacea and Insecta) and Mollusca (Cephalopoda)
   - 6.3 Trends in neural evolution
7. Invertebrate larvae — 10
   - 7.1 Larval forms of free-living invertebrates
   - 7.2 Larval forms of parasites
   - 7.3 Strategies and evolutionary significance of larval forms
8. Minor Phyla — 10
   - 8.1 Concept and significance (Mesozoa, Ctenophora, Rhynococoela, Protostomes, Deuterostomes)
   - 8.2 Organization and general characters.

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Recommended Books

1. Hyman, L.H., The Invertebrates, Vol. 1, Protozoa through Clenophora, Mc.Graw Hill Company, New York.
2. Hyman, L.H., The Invertebrates, Vol. 2, Mc.Graw Hill Company, New York.
3. Hyman, L.H., The Invertebrates, Smaller Coelomate Groups, Vol. 5, Mc.Graw Hill Company, New York.
4. Hyman, L.H., The Invertebrates, Vol. 8, Mc.Graw Hill Company, New York.
5. Barington, E.J.W., Invertebrate Structure and Function. Thomas Nelson and Sons Ltd., London.
6. Branes, R.D., Invertebrate Zoology, W.B., Saunders Co., Philadelphia.
7. Russel-Hunter, W.D., A Biology of Higher Invertebrates. McMillan Company Ltd., London.
8. Cad, G.P., Animal Parasitism, Prentice Hall Inc., New Jersey.
9. Sedwick, A., Student Text Book of Zoology, Vol. I, II, and III, Central Book Depot, Allahabad.
10. Parker, T.J., Haswell, W.A., Text Book of Zoology, MacMillan Co., London.

PAPER III: MOLECULAR BIOLOGY & BIOTECHNOLOGY

Duration: 3 Hours | Max. Marks: 100 | Periods : 80

1. DNA — 6
   - 1.1 Equivalence rule
   - 1.2 DNA structure: Primary & Secondary, Unusual secondary structures (slipped & cruciform ,triple helix, tetraplex and G-quadriplex).
   - 1.3 Packaging of DNA: Nucleosome, solenoid & scaffold
2. DNA replication — 12
   - 2.1 Prokaryotic and eurokaryotic DNA replication
   - 2.2 Mechanics of DNA replication
   - 2.3 Enzymes and accessory proteins involved in DNA replication
3. Transcription — 10
   - 3.1 Prokaryotic transcription
   - 3.2 Eukaryotic transcription
   - 3.3 RNA polymerases
   - 3.4 General and specific transcription factors
   - 3.5 Regulatory elements and mechanisms of transcription regulation
   - 3.6 Transcription termination
   - 3.7 Transcriptional and post-transcriptional gene splicing

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4. Post-transcriptioial modifications in RNA 10

4.1 Cap formation

4.2 End processing and polyadenylation

4.3 Splicing, editing

4.4 Nuclear export of mRNA.

4.5 RNA stability

5. Translation

5.1 Genetic code

5.2 Prokaryotic and eukaryotic translation

5.3 Translation machinery

5.4 Mechanisms of initiation, elongation and termination

5.5 Regulation of translation

5.6 Co-and post-translation modifications of proteins.

6. Recombination and repair

6.1 Holliday junction, gene targeting, gene dissruption

6.2 FLP/FRT and Crelox recombination

6.3 RecA and other recombinases

6.4 DNA repair mechanisms (Radiation damage, Direct reversal, Oxidative damage, Alkylasion, Base excision repair, Nucleotide excision repair, Mismateh repair, ds break repair, SOS response, Translesion DNA system

7. Molecular mapping of genome 10

7.1 Genetic and physical maps

7.2 Physical mapping and mapbased cloning

7.3 Southern and fluorescence, *in-situ* hybridization for genome analysis

7.4 Molecular markers in genome analysis, RFLP, RAPD, AFLP,DNA finger prenting, single nucleotide polymorphism (SNPs), Sequence tagged site (STS)

7.5 Application of RFLP and forensic disease prognosis, genetic counselling, pedigree varietal etc. Analysis, Animal tracking and poaching, germplasm maintenance and taxonomy.

8. Human Genome project, flap map project , the encode project 10

8.1 Production Recent Technologies of transgenic animals and Knock out and its applications

8.2 Embryonic stem cellsand its applications

8.3 Care and breeding of experimental animals including bioethics

9. Embryo technology 10

9.1 Superovulation, cryopreservation of spermatazoa.

9.2 *In Vitro* fertilization and embryo transfer.

9.3 Embryo sexing and cloning

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9.4 Chimera formation.

9.5 Gene transfer through embryo transgenesis.

9.6 Surrogacy and ethics.

9.7 Assisted Reproductive Technologies-ICSO, GIFT, ZIFT, TET

9.8 Prenatal diagnosis and genetic counselling.

Recommended Books

1. Albert, B., Bray, D.D., Lewis, J., RafifM., Roberts, K, Walson, J.D., Molecular Biology of the. Cell. Garland Publishing Company, Inc., New York.
2. Benjamin, Lewin, Gene VIII, Oxford University Press, U.K
3. Brown, T.A. (Ed.), Molecular Biology Labfax, Vol. 1, Bio Scientific Publishers Ltd, Oxford.
4. Dabre, P.D., Introduction to Practical Molecular Biology, John Wiley & Sons Ltd., New York.
5. Darnell, J., Lodish, H. and Baltimore, D.; Molecular Cell Biology, Scientific American Books, Inc., USA.
6. Karp, G Cell and Molecular Biology, Concepts and Experiments, John Wiley & Sons, Inc., New York.
7. Meyers, R.A. (ed.), Molecular Biology and Biotechnology. A Comprehensive Desk Reference. VCH Publishers, inc, New York.
8. Sambrook, J., Fristsch, E.F. and Maniatis, T Molecular Cloning: A Laboratory Manual. Cold Spring HarborLaboratory Press, New York.
9. Watson, J.D., Hopkins, N.H., Roberts, J.W., Steiz, J.A., Weinef, A.M.; Molecular Biology of Gene. The Benjamin Cummings Pub. Co., Inc., California.

PAPER IV: GENERAL PHYSIOLOGY

Duration: 3 Hours | Max. Marks: 100 | Periods :-80

1. Thermoregulation and Cold Tolerance — 8
   - 1.1 Basic principles of metabolism
   - 1.2 Heat balance and exchange
   - 1.3 Endotherms Vs Ectotherms
   - 1.4 Counter-current heat exchanger
   - 1.5 Torpor, hibernation and aestivation
   - 1.6 Adaptationsto very cold environments
2. Ionic andOsmotic Balance — 8
   - 2.1 Osmoregulation vs. Osmoconfirming

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2.2 Osmoregulation in aquatic and terrestrial environments

2.3 Kidney function and diversity

2.4 Other osmoregulatory organs

2.5 Nitrogenous waste excretion

3. Gas Exchange and Acid-base Balance 8

3.1 Oxygen and carbon dioxide transport in blood

3.2 Role of haemoglobin

3.3 Responses to attitude and hypoxia

3.4 Swim bladder inflation in fish

3.5 Regulation of body pH

3.6 Gas transfer in air and water, gas exchanger design and function

4. Muscle Function and Movement 8

4.1 Anatomy of muscle

4.2 Regulation of contraction

4.3 Excitation-contraction coupling

4.4 Molecular theory of muscle contraction

5. Nervous System 8

5.1 Anatomy of nervous system

5.2 Neurons and membrane excitation

5.3 Electrochemical potentials

5.4 Action potentials

5.5 Transmission between neurons

5.6 Synapses and neurotransmitters

5.7 Memory an learning

6. Sensory Transduction 10

6.1 Sensing the environment

6.2 Auditory receptors

6.3 Chemoreceptors, Taste and smell, homing in Salmon

6.4 Mechanoreceptors: Tactile systems and escape responses

6.5 Vision and photoreception

6.6 Thermoreception and infrared detection: Prey detection in snakes.

6.7 Echolocation and bats

7. Digestion and Metabolism 5

7.1 Nutritional uptake and distribution

7.2 Effects of starvation

8. Stress Biology 10

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8.1 Basic concept of environmental stress and strain:concept of elastic and plastic strain; stress resistance, stress avoidance and stress tolerance.

8.2 Adaptation, acclimation and acclimatization

8.3 Concept of homeostasis

8.4 Physiological response to oxygen deficient stress

8.5 Physiological response to body exercise

8.6 Meditation, yoga and their effects

9. Endocrinology 15

9.1 Aims and scope of endocrinology

9.1.1 Discovery of hormones.

9.1.2 Hormones as messengers.

9.1.3 Classification of hormones

9.2 Phylogeny of endocrine glands (Pituitary, pancreas, adrenal, thyroid, testis, ovary)

9.3 Ontogeny of endocrine glands.

9.4 Neuroendocrine system and neurosecretion

9.5 General principles, structure and hormone action

9.6 Hormones, growth and development.

9.7 Hormones and reproduction.

Recommended Books

1. Barrington, E.J.W., General and Comparative Endocrinology Claredon Press, Oxford.
2. Dejours, P.L., Bolis, L. Taylor, C.R., Weibel, E.R. (eds.); Comparative Physiology: Life in Water or Land, Liviana Press, Podova, Italy.
3. Eckert, R.W.H.; Animal Physiology, Mechanisms and Adaptations, Freeman and Company, New York.
4. Fochachka, P.W. and Somero, G.N.; Biochemical Adaptation,Princeton, New Jersey.
5. Gorbman, A., Dickhoff, W.W., Vigna, S.R., Clark, H.B., Ralpls, C.L.; Comparative Endocrinology, Wiley-Interscience Publication, New York.
6. Hill, R.W., Wyse, G.A., Anderson, M.; Animal Physiology, Sinauer Associates, Inc, Publishers, Sunderland, USA.
7. Hoar, W.S.; General and Comparative Animal Physiology, Prentice Hall of India.
8. Johnson, I.A., Bennett, A.F. (eds.); Animal and Temperature, Phenotypic and Evolutionary Adaptations, Cambridge University Press, Cambridge, U.K.
9. Louw, G.N.; Physiological Animal Ecology, Harloss, U.K.
10. Martin, C.R., Endocrine Physiology, Oxford University Press.
11. Newell, R.C. (ed); Adaptation to Environment: Essays on the Physiology of Marine Animals. Butter Worths, London, U.K.
12. Prosser,C.L.; Environmental and Metabolic Animal Physiology, Wiley-Liss, Inc, New York.

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13. Schemadt Nelsen; Animal Physiology: Adaptation and Environment. Cambridge University Press.

14. Strand, F.L.; Physiology: A Regulatory Systems Approach, Macmillan Publishing Co., New York.

15. Townsend, C.R. and Cawlow. P.; Physological Ecology: An Evolutionary Approach to Resource Use, Blackwell, Sci. Publication, Oxford, U.K.

16. Vander, A.J., Shermen, J.H., Luciano, D.S.; Human Physiology, McGraw-Hill Publishing Company, New York.

17. Williams, R.H., Text Book of Endocrinology, W.B. Saunders.

18. Willmer, Stone, P.G and Johnson, I.; Environmental Physiology, Blackwell Sci. Publication,Oxford, U.K.

PAPER V: BIOCHEMISTRY

Duration: 3 Hours | Max. Marks: 100 | Periods : 80

1. Covalent properties of Proteins — 6
   - 1.1 Structure and chemistry of amino acids
   - 1.2 Protein sequencing
   - 1.3 Peptide synthesis
   - 1.4 Covalent modifications
   - 1.5 Protein size and composition
   - 1.6 Protein splicing
2. Protein secondary and tertiary structure — 6
   - 2.1 Protein tertiary structure and folding patterns.
   - 2.2 Common tertiary structural motifs.
   - 2.3 Role of packing constraints in tertiary structure patterns.
   - 2.4 Divergent vs. convergent evolution of similarstructure.
3. Globular and fibrous proteins. — 5
   - 3.1 Water and the hydrophobic effect.
   - 3.2 Tertiary and quaternary effect.
   - 3.3 Motifs in globular proteins.
   - 3.4 Properties of protein interiors and surfaces.
   - 3.5 Fibrous proteins.
   - 3.6 Structure of bone.
4. Protein folding and thermodynamics — 5
   - 4.1 Protein folding and dynamics.

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4.2 Folding overview:Levinthal paradox.

4.3 Condensation and molten globules.

4.4 Ramchandaran plots and amino acid propensities.

4.5 Catalysis and assistance.

4.6 Amino acid sequence variation and membrane proteinfolding.

4.7 Chaperonin-assisted protein folding.

5. Allostery(Hemoglobin), Myglobin structure and oxygen binding 3

5.1 Hemoglobin subunits co-operativity, Hill coefficient.

5.2 Quarternarystructure changes and Sickle cell and other molecular diseases.

6. Fats 10

6.1 Fatty acids: structure, nomenclature, acyl glycerols, phospholipids, sphingolipids, glycolipids, lipoproteins.

6.2 Terpenoids and sterols: structure, properties and functions.

6.3 Function of lipids.

6.4 Signal transducing molecules.

7. Vitamins 10

7.1 Classification, occurrence offar soluble vitamins.

7.2 Classification, occurrence and biological functions of thiamine, riboflavin, folicacidand B_{12}.

7.3 Phenolics and alkaloids: Structure, biological properties and functions.

8. Covalent properties of nucleic acids 5

8.1 Modified nucleosides.

8.2 Properties of polynucleotides.

8.3 Secondary and tertiary structure.

9. Nucleic acid structure 5

9.1 Duplex stability.

9.2 Hybridization.

9.3 RNA structure.

9.4 Hairpin and pseudoknot structures, tRNA.

10. Nucleic acids 5

10.1 DNA and RNA helical geometrics (A-Z), banding, deformation.

11. Nucleic acid analysis: DNA and RNA sequencing, determination of modified nucleotides. 4

12. RNA catalysis 3

12.1 Chemistry and structure of ribozymes.

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12.2 Evolutionary implications.

13. Enzyme mechanisms 8

13.1 Principles of enzyme catalysis.

13.2 Proteases and polymerases, other examples.

13.3 Coenzymes and Cofactors.

14. Inborn errors of metabolism 5

Recommended Books

1. Alberts R.H., Frey P.A. and Jencks W.P. Biochemistry Jones. & Bartlett Publisher, Boston/London. 1992.
2. Champe, P.C., Harvey, R.A.; Lippincott's Illustrated Reviews Biochemistry, Lippincott Williams & Wilkins, Philadelphia.
3. Deb A.C. Fundamentals of Biochemistry, New Bcok Agency Pvt. Ltd. Calcutta, 2006.
4. Elliott, W.H. and Elliott, D.C., Biochemistry and Molecular Biology, Oxford University Press, Oxford. 2001.
5. Harper's Biochemistry by Murray R.K., Granner D.K., Mays P.A., Rodwell V.W., McGraw Hill Publication, 2000.
6. Horton, H.R., Morsan, L.A., Scrimgeour, K.G., Perry, M.D., Rawn, J.D., Principles of Biochemistry, Pearson Educations, International, 2006.
7. Mathews, C.K., Van Holde, K.E., Ahern, KG., Biochemistry, Pearson Education Pvt. Ltd., Delhi, India, 2003.
8. McKee, T., McKee J.R., Biochemistry (The Molecular Basis of Life) McGraw Hill Company, Inc.
9. Nelson D.L. and Cox M.M. Lehninger Principles ofBiochemistry, MacMillan/Worth Publishers, 2001.
10. StryerL. Biochemistry. W.H.Freeman and Co. New York, 2001.
11. Voet D. VoetJ.G. and Pratt C.W. Fundamentals of Biochemistry, Johan Wiley and Sons Inc., New York, 1999.
12. Wilson K. and Walker J. Principles and Techniques of Practical Biochemistry Cambridge University Press, Cambridge, 1994.
13. ZubayG.L., Parson,V.W. and Vence D.E. Principles of Biochemistry. Wm.C. Brown Publishers, Oxford, England, 1995.

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PAPER VI: BIOSTATISTICS AND POPULATION GENETICS

Duration: 3 Hours | Max. Marks: 100 | Periods : 80

Biostatistics

Unit I:

1. Definition Scope and applications of biostatistics
2. Collection, organization and representation of data (graphical- Bar, Histogram, Frequency polygon, line diagram& diagrammatic).
3. Basic statistics-Arithmetic mean, Harmonic mean, Geometric mean, Median, Mode, Mean deviation. (Direct, short- cut and step –deviation for all)

Unit II

1. Statistics of dispersion, Coefficient of variation.
2. Standard error; Confidence limits.
3. Probability distributions (Binomial, Poisson and Normal).
4. Testing of Hypothesis, level of significance; Type I and II errors.
5. Tests of statistical significance (Student's t –test, Z - test, Chi-square test).
6. Correlation and regression.
7. Analysis of Variance (One way and two way ANOVA)

Population Genetics

Unit III

1. Concepts of evolution and theories oforganic evolutionwith an emphasis on Drawinism. 5
2. Neo-Darwinism 10
   - 2.1 Hardy-Weinberg's law of genetic equilibrium.
   - 2.2 Detailed account of destabilizing forces-
     - (i) Natural selection
     - (ii) Mutation
     - (iii) Genetic drift
     - (iv) Migration
     - (v) Meiotic drive
   - 2.3 Genetic structure of natural populations.
   - 2.4 Variations –including transgressive variations
   - 2.5 Models explaining changes in genetic structure of populations.
   - 2.6 Factors affecting human disease frequency.
3. Molecular population genetics 5

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3.1 Patterns of change in nucleotideand amino acid sequences.

3.2 Ecological significance of molecular variations.

3.3 Emergence of Non-Darwinism-Neutral hypothesis.

4. Genetics of Quantitative traits in populations 10

4.1 Analysis of quantitative traits.

4.2 Quantitativetraits and natural selection.

4.3 Estimation of heritability.

4.4 Genotype-environment interactions.

4.5 Inbreeding depression and heterosis.

4.6 Molecular analysis of quantitative traits.

4.7 Phenotypic plasticity.

Unit IV

1. Genetics of speciations 10

1.1 Phylogenetic and biological concept of species.

1.2 Patterns and mechanisms of reproductive isolation.

1.3 Modes of speciation (allopatric, sympatric, parpatric&peripatric).

2 Molecular Evolution 10

2.1 Gene evolution.

2.2 Evolution of gene families, molecular drive.

2.3 Assessment of molecular drive.

2.4 Micro-and macro-evolution.

3. Molecular phylogenetics 12

3. 1 Construction of phylogenetic trees.

3.2 Phylogenetic inference-distance methods, parismony methods, maximum likelihood method.

3.3 Immunological techniques.

3.4 Amino acid sequence and phylogeny.

3.5 Nucleic acid phylogeny-DNA-DNA hybridizations, restriction enzyme sites, nucleotide sequence comparisons and homologies.

3.6 Molecular clocks.

Recommended Books

1. Batschelet, E.; Introduction to Mathematics for Life Scientists Springer, Verlag, Berlin.
2. Dobhzhamsky, T., Alaya, F.J., Stebbins, G.L., Valentine, J.M., Genetics and Origin of Species, Surjeet Publication, Delhi.

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M.Sc. (Zoology) FINAL

3 Hours Duration — 100 Marks (each paper)

Paper I	Biology of Chordates
Paper II	Environmental Biology and Ethology
Paper III	Genes and Differentiation
Paper IV	Tools and techniques in Biology
Paper V	Special Paper
Paper VI	Special Paper
	Laboratory Exercises
	Demonstration and Tutorials
	SEMINAR

Note: The theory paper of M.Sc. Final (Zoology) will have the following pattern.

Question paper will have 5 (five) questions in all having equal marks.

(i) Question number 1 will be compulsory and will have 10 very short answer question of 2 mark each.

(ii) Question numbers 2 and 3 will consist of only short answer type questions with 4 subdivisions of 5 marks each. There will be internal choice, in these questions.

(iii) Question numbers 4 and 5 will be long answer type questions with internal choice.

PAPER I : BIOLOGY OF CHORDATES

Duration : 3 Hours **Max. Marks – 100** **Periods : 70**

1.	Origin and outline classification of the chordates.	3
2.	Interrelationships of Hemichordata, Urochordata and Cephalochordata and their relations with other deuterostomes.	5
3.	Life histories of sessile and pelagic tunicates, *Ascidia*, *Herdmania*, *Pyrosoma*, *Salpa*, *Doliolum* and *Oikopleura*.	8
4.	Neoteny	4
5.	Origin, evolution and adaptive radiation of Chordates.	20
	5.1 Geological time-scale and fossils.	

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5.2 Origin, evolution and general characters of Agnatha (Ostracoderm and Cyclostomes).

5.3 The early Gnathostomes (Placoderms).

5.4 A general account of the Elasmobranchii, Holocephali, Dipnoi and Crosspterygii.

5.5 Adaptive radiation in bony fishes.

5.6 Origin, evolution and adaptive radiation of Amphibia.

5.7 Origin and evolution of Reptiles. The conquest of land; Seymouria and related forms; Cotylosauria, basic types and outline classification of reptiles.

5.8 Dinosaurs.

5.9 Living Reptiles: a brief account of Rhynchocephalia. Chelonia, Crocodilia and Squamata.

5.10 Origin and evolution of Birds.

5.11 Origin of flight: Flight adaptations.

5.12 Origin of Mammals.

5.13 Primitive Mammals (Prototheria and Metatheria).

5.14 A general survey of the main radiations in eutherian, excluding detailed reference to individual orders.

5.15 Evolution of man: Relationship of man with other primates, fossil record of man's ancestry.

6. Organogenesis 10

6.1 Morphogenetic processes in epithelia and mesenchyme, organ formation.

6.2 Morphogenesis of the brain; neural crest cells and their accessory organs.

6.3 Development of the eye, heart and alimentary canal with accessory organs.

7. Embryonic adaptations 10

7.1 Evolution of the cleidoic egg, its structural and physiological adaptations.

7.2 Development and physiology of extra-embryonic membranes in amniotes.

7.3 Evolution of viviparity.

7.4 Development, types and physiology of the mammalian placenta.

8. Metamorphosis in Amphibia 5

8.1 Structural and physiological changes during metamorphosis.

8.2 Endocrine control of metamorphosis.

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9. Regeneration

9.1 Types of regeneration (physiological, reparative and compensatory hypertrophy) regenerative ability in chordates.

9.2 Morphological and histological process in amphibian limb regeneration.

9.3 Origin of cells for regenerations and differentiation.

Recommended Books

1. Alexander, R.M. : The chordata, Cambridge University Press, London.
2. Andrevos, S.M., Miles, R.S., Walker, A.D. : Problems in Vertebrate Evolution, academic Press, New York.
3. Andrew, S.M. : Problems in. Vertebrate Evolution, Academic Press, New York.
4. Barbiur T. Hongton : Reptiles and Amphibians : Their Habitats and Adaptations, Miffin Co, New York.
5. Barrington, E.J.W. ; The Biology of Hemichordata and Protochordata, Olter and Boyd, Edinbourgh.
6. Bourne, G.H. : The Structure Functions of Nervous Tissues Academic Press; New York.
7. Carter, G.S.: Structure and Habit in Vertebrate Evolution Sedwick and Jackron, London.
8. Clark, W.K., History of Primates, University of Chicago Press, Chicago.
9. Colbert, E.H. : Evolution of the Vertebrates, John Wiley & Sons, Inc., New York.
10. DeVeer, S.G. : Embryos and Ancestors, Claredon Press, Oxford.
11. Eccles, J.C.: The understanding of the Brain, McGraw Hill Company, New York.
12. Joysey, K.A. and Kemp, T.S. : Evolution, Oliver and Boyd, Edinbourgh.
13. Kent, C.G. Comparative Anatomy of Vertebrates.
14. Kingsley, J.S.: Outlines of Comparative Anatomy of Vertebrates Central Book Depot, Allahabad.
15. Lovtrup, S. : The Phylogeny of Vertibrate, John Wiley &. Sons, London.
16. Malcom Jollie: Chordata Morphology, East-West Press Pvt. Ltd., New Delhi.
17. Messers H.M An Intrductin of Vertebrate Anatomy.

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18. Milton, H. : Analysis of Vertebrate Structure, John Wiley and Sons Inc., New York.
19. Monielli, A.R.: The chordates, Cambridge University Press, London.
20. Montagna, W. : Comparative Anatomy, John Wiley & Sons, Inc., New York.
21. Romer, A.S. : Vertebrate Body, W.B. Saunders Company, Philadelphia.
22. Romer, A.S. : Vertebrate Palentology, University of Chicago Press, Chicago.
23. Sedgwick, A.A.: Text Book of Zoology, Vol.-II.
24. Smith, H.S.: Evolution of Chordata Structure, Hold Rinehart and Winstoin, Inc., New York.
25. Tansley, K.: Vision in Vertebrate, Chapman and Hall Ltd., London.
26. Torrey, T.W.: Morphogenesis of Vertebrates, John Wiley & Sons, New York.
27. Walters, H.E. and Sayles, L.D.: Biology of Vertebrates, Macmillan and Co., New York.
28. Waterman, A.J. : Chordata Structure and Function, MacMillan Co., New York.
29. Weichert, C.K. and Presch, W. Elements of Cordate Anatomy, MacGraw Hill Book Company, New York.
30. Young J.Z. : Life of Vertebrates, The Oxford University Press, London.

M.Sc. FINAL (ZOOLOGY)
PAPER II : ENVIRONMENTAL BIOLOGY AND ETHOLOGY

Duration : 3 Hours **Max. Marks – 100** **Periods : 70**

Unit I - Environmental Biology

1. Interactions between environment and biota 5

1.1 Concept of habitat and ecological niches

1.2 Limiting factors.

1.3 Energy flow, food chain, food web and trophic levels, eco logical pyramids.

1.4 Biotic community: Concept, structure, dominance, fluctuation and succession.

1.5 Various nutrient cycles in nature.

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2. Ecosystem dynamics and management 6

   2.1 Complexity, stability and homeostasis of ecosystems.

   2.2 Functional aspects and productivity concept.

   2.3 Niche, ecotone and overlapping of niches.

   2.4 Character displacement, speciation and extinction.

3. Environmental impact assessment 5

   3.1 Environmental pollution.

   3.2 Population and impact of urbanization.

4. Principles of conservation: Conservations strategies 5

   4.1 Various natural resources.

   4.2 Present status and future needs.

   4.3 Management.

   4.4 Biodiversity of India and Rajasthan and their management.

5. Prospects and strategies for sustainable communities. 2

6. Organisation and dynamics of ecological communities 7

   6.1 The habitat approach.

   6.2 A detailed knowledge of communities of fresh water, marine, terrestrial and esturine areas with respect to

      6.2.1 Extent

      6.2.2 Zonation

      6.2.3 Environment

      6.2.4 Biota

      6.2.5 Adaptations

7. The ecological outlook 5

   7.1 Applied human ecology

   7.2 Radiation (electromagnetic and ionizing) and environment

   7.3 Climatic changes (*El Nino* and *La Nina*)

   7.4 Space ecology

   7.5 Human future

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Unit II: Ethology

1. Introduction to Ethology

1.1 Branches and significance of Ethology: Ethophysiology, Ethoendocrinology, Neuroethoiogy, Human ethology, Behavioural genetics, sociobiology.

1.2 Milestones of Ethology : Konrad Lorenz, Niko Tinbergen, Karl Von Frisch, BF Skinner, HF Harlow.

1.3 Proximate and ultimate mechanisms of ethology.

2. Concepts of Ethology :

2.1 Motivation and Innate behaviour (Fixed action pattern).

2.2 Sign stimulus, super normal stimulus.

2.3 Action specific energy and Innate releasing mechanism.

2.4 Difference between learned and Innate behaviours.

3. Nervous system and Behaviour

3.1 Mammalian brain structure and behaviour.

3.2 Hypothalamus and Innate behaviour.

3.3 Behavioural endocrinology including effect of drugs.

3.4 Orientation - taxis and kinesis, bird migration and navigation

3.5 Biological clocks, Chronobiology.

4. Learning and Imprinting

4.1 Introduction and definitions.

4.2 Habituation; Conditioning.

4.3 Trial and error; Imprinting .

4.4 Neural mechanism of learning .

4.5 Birds song learning behavior in the context of Tinbergen's 4 aims.

5. Sociobiology

5.1 Introduction- definition, WO Wilson, Richard Dawkins, WD Hamilton.

5.2 Units of sociobiology,

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5.3 Hamilton's theory and Altruism, cooperation, reciprocation and Eusociality,

5.4 Properties, advantages of a social group, Social organisation in primates.

6. Social Behaviour

6.1 Parental care- Types , Parent offspring conflict.

6.2 Courtship and mating.

6.3 Aggression and territory

6.4 Evolution of social systems.

7. Communication in animals

7.1 Auditory, Echolocation, Infra- and ultra- sounds.

7.2 Tactile, Visual ,

7.3 Pheromones- vertebrates and invertebrates

7.4 Language of honey bees-circle and waggle dance.

8. Human Behaviour-

8.1 Desmond Morris, Sarah Hrdy.

8.2 Sign stimulus, Imprinting.

8.3 Kinship , Aggression.

8.4 Pheromones.

Recommended Books (Environmental Biology)

1. Begon, M. Harper, J.I. and Townsend, C.R.: Ecology, Individuals, Populations and Communities. Blackwell Science, Oxford University Press, Oxford.
2. Cherrett, J.M.: Ecological Concepts, Blackwell Scientific Publication, Oxford, U.K.
3. Elseth, B.D. and Baumgartner, K.M.: Population Biology, Van Nostrand Col, New York.
4. Iorgension, S.E.: Fundamentals of Ecological Modeling, Elsevies.
5. Krebs, C.J.: Ecological Methodology, Harper and Row, New York.
6. Krebs, C.J.: Ecology, Harper and Row, New York.

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7. Ludwig, J .A. and Reynolds, J.F.: Statistiaal Ecology, Johnwiley & Sons, New York.
8. Pianka, E.R. : Evolutionary Ecology, Harper and Row, New York.
9. Recklefs, R.E. and Miller, G. Ecology, W.H. Freeman and Company, New York.
10. Swartzmen, G.L. and Kaluzny, S.P.: Ecological Stimulation Primer, Macmillan, New York.

Ethology

1. Alcock, J. : Animal Behaviour: An Evolutionary Approach, Sinauer Assoc. Sunderland Mass, USA.
2. Bradbury, J.W. and Vehren camp. S.L.: Principles of Animal communications, Sinauer Assoc., Sunderland Mass, USA.
3. Clutton-Brock, T.H.: The Evolution of Parental Care Princeton Univ. Press, Princetorn, USA.
4. Eobi-Eibesfeldt, Holt, I: Ethology, the Biology of Behaviour, Rinehart and Winston, New York.
5. Gould. J.L. : Mechanism of Evolution of Behaviour.
6. Hauser, M. : The Evolution of Communication, MIT Press, Cambridge, Mass, USA.
7. Hinde R.A. : Animal Behaviour: A Synthesis of Ethology and Comparative Psychology, McGraw Hill Company, New York.
8. Krebs, J.R. and Davis, N.N. : Behavioural Ecology, Blackwell Oxford, U.K.
9. Rof, D.A. : The Evolution of Life Histories, Chapman and Hall, London, U.K.
10. Wilson, E.O. : Sociobiology : The New Synthesis, Harward University Press, Cambridge, Mass, USA.

PAPER III: GENES AND DIFFERENTIATION

Duration : 3 Hours **Max. Marks – 100** **Periods : 70**

1. Introduction to animal development. 7

1.1 Problems of developmental biology.

1.2 Developmental patterns in metazoans.

1.3 Development in unicellular eukaryotes.

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2. Creating multicellularity 5

2.1 Cleavage types.

2.2 Comparative account of gastrulation.

3. Early Vertebrate development 6

3.1 Neurulation and ectoderm.

3.2 Mesoderm and endoderm.

4. Cytoplasmic determinants and autonomous cell specification 8

4.1 Cell commitment and differentiation.

4.2 Cell specifications, in nematodes.

4.3 Germ cell determinants.

4.4 Germ cell migration.

4.5 Progressive cell–cell interaction and cell specification fate.

5. Body Axes 5

5.1 Establishment of body axes in mammals and birds.

5.2 Proximate tissue interactions.

5.3 Genetics of axis specifications in drosophila.

6. Homeobox concept in different phylogenetic groups. 4

7. Tetrapod limb development. 3

8. Hormones as mediators of development. 6

8.1 Amphibian metamorphosis.

8.2 Insect metamorphosis.

8.3 Ovarian luteinization and mammary gland differentiation.

9. Environmental evolution and animal development 8

9.1 Environmental cues and effects.

9.2 Malformations and disruptions.

9.3 Changing evolution through development modularity.

9.4 Developmental constraints.

9.5 Creating new cell types-basic evolutionary mystery.

10. Biology of sex determination 6

10.1 Chromosomal sex determination - Mammals and Drosophila.

10.2 Testis determination genes.

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10.3 Ovarian development.

10.4 Secondary sex determination in mammals.

10.5 Environmental sex determination.

11. Cell diversification in early embryo 6

11.1 *Xenopus* blastomeres.

11.2 Morphogen gradients.

11.3 Totipotency & Pleuripotency.

11.4 Embroyonic stem cells.

11.5 Renewal by stem cells-epiderms.

11.6 Skeletal muscle regeneration.

11.7 Connective tissue cell family.

12. Hemopoietic stern cells 6

12.1 Stern cell disorders.

12.2 Blood cell formation.

12.3 Bone marrow transplants.

12.4 Gene therapy.

Recommended Books

1. Development Biology S.F. Gilbert, Sinauer Associates Inc., Massachusetts.
2. Ethyan Bier, The Cold Spring: Cold Spring Harbour Laboratory Press, New York.

PAPER IV : TOOLS AND TECHNIQUES IN BIOLOGY

Duration : 3 Hours **Max. Marks – 100** **Periods : 70**

Section A : Tools

1. Principles and application of 10

1.1 Light Microscopy and micrometery.

1.2 Phase contrast microscopy.

1.3 Interference microscopy.

1.4 Polarized microscopy.

1.5 Fluoresence & epifluorescence microscopy.

1.6 Transmission electron microscopy.

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1.7 Scanning electron microscopy.

1.8 Confocal scanning and deconvolution microscopy.

1.9 Atomic Force Microscopy.

2. Principles and application of 10

2.1 Ultracentrifugation: Differential and density gradient.

2.2 Electrophoresis: Various media for electrophoresis and various types such as paper, agarose, PAGE, submerged DNA electrophoresis, Pulse Chase electrophoresis, iso-electrofocussing points and capillary electrophoresis.

2.3 Chromatography: Various types such as paper, TLC, GLC, HPLC, Ion-exchange and Affinity chromatography.

2.4 Freeze techniques; freeze-drying, freeze substitution, freeze fracture and freeze itch.

2.5 X-Diffraction.

2.6 Lambert-Beers Law and colorimeter & spectrophotometer -fluorescence, U.V., N.M.R., O.R.D./CD, ESR, IR, Atomic absorption and plasma emission.

2.7 Flow cytometer / Fluorescence activated cell sorter.

3. Principles and application of radiation techniques in Biology 10

3.1 Radiation dosimetry.

3.2 Radioisotopes and half life of isotypes.

3.3 Tracer techniques in biology.

3.4 Cerenkov radiation.

3.5 Liquid scintillation counter.

3.6 G.M. Counter

3.7 Autoradiography.

Section B : Techniques

1. Assay 2

1.1 Definition and criteria of reliability.

1.2 Chemical assays.

1.3 Biological assays *in vivo* and *in vitro* assays.

2. Principles of cytological and cytochemical techniques 5

2.1 Fixation, chemical basis of fixation by formaldehyde, gluteraldehyde, chrormium salts, mercury salts, osmium salts, alcohol and acetone.

2.2 Chemical basis of staining of carbohydrates, proteins, lipids and nucleic acids.

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3. Principles and techniques of 8

3.1 Nucleic acid hybridization and cot curve.

3.2 Sequencing of proteins and nucleic acids.

3.3 Blotting techniques (Southern, Northern and Western).

3.4 Dot and Slot blots.

3.5 Biotinylated DNA probe.

3.6 Polymerase chain reaction (PCR).

3.7 Screening of genomic and cDNA libraries.

4. Principles and techniques of genetic engineering. 8

4.1 Basic techniques.

4.2 Cutting and joining of DNA molecules.

4.3 Changing genes: Site directed mutagenesis.

4.4 Analysis of DNA sequences.

4.5 Cloning strategies gene library and cDNA

4.6 DNA transformation techniques and their application in agriculture, health, medicine and industry.

4.7 Introducing genes in animal cells.

4.8 Application of recombinant DNA technology.

(a) Recombination, selection and screening.

(b) Nucleic acid probes and their application.

(c) Impact of recombinant technology.

4.9 Hybridoma technology.

5. Cell Culture techniques 4

5.1 Design and functioning of tissue culture laboratory.

5.2 Cell proliferation measurements.

5.3 Cell viability testing.

5.4 Culture media preparation and cell harvesting methods.

6. Cryotechniques 3

6.1 Cyropreservations for microscopy.

6.2 Cyrotechniques for microscopy.

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4.3 Complexity & connectedness

4.4 Resilience & diversity

4.5 Community structure

4.6 Edges and boundaries

5. Communities in transition

5.1 Ecological succession

5.2 Introduced species and community change

6. Restoration Ecology

6.1 Natural

6.2 Restoring keystone species and ecological process

6.3 Mitigation and replacement

6.4 Creating an artificial ecosystem

7. Conservation of biodiversity

7.1 Concept of biodiversity

7.2 Causes of loss of biodiversity

7.3 Productivity and diversity

7.4 Conversion methods *In-situ* and *Ex-situ*

7.5 Biodiversity conversion methods: Gene bank, intellectual property right and bio-safety protocol

8. Population dynamics

8.1 Dynamics of population growth

8.1.1 Exponential growth & doubling times

8.1.2 Biotic potential

8.1.3 Catastrophic declines and population oscillation

8.1.4 Growth to a stable population

8.1.5 Strategies of population growth

8.2 Factors that increase or decrease population

8.2.1 Natality, fecundity & fertility

8.2.2 Immigration

8.2.3 Mortality and survivorship

8.2.4 Age structure

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8.2.5 Emigration

8.3 Factors: Regulate population growth

8.3.1 Density independent factors

8.2.3 Density dependent factors

9. Methods of population estimations of animal

9.1 Census

9.2 Sampling

9.3 Indices, manipulation of indices

9.4 Transect estimates

9.5 Arial Survey

9.6 Belt transect estimate

9.7 Line Transect estimate

9.8 Mark recapture estimates

10. Restoration of wildlife populations by reintroduction

10.1 Captive breeding

10.2 Soft and hard release

10.3 Management of endangered species-reasons to preserve them

10.4 Human factors leading to extermination/extinction of species, characteristics of endangered species.

11. Habitat analysis and evaluation

11.1 Reconnaissance type evaluation of habitat

11.2 Permanent condition trend transects vegetative analysis

11.3 Forest range evaluation

11.4 Wetland evaluation

11.5 Wildlife evaluation

12. Environmental monitoring

12.1 Physicochemical and biological monitoring

12.2 Biological indicators of environmental changes

12.3 Physiological adaptations of animals to their environment, effects of temperature, current, pressure

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12.4 Osmoregulation, aestivation, mimicry, camouflage, bioluminescence, parasitism, eco-location, migration, pheromones

13. Environmental degradation, role of men in changing the environment

14. Environmental awareness and education regarding conservation of wildlife.

14.1 Wildlife protection legislation acts and laws in India

14.2 Environmental conservation ethics.

15. Impact of tourism related activities on environment.

15.1 Basic principles of ecotourism

15.2 Ecological and conservation aspects of tourism

15.3 Island ecology and tourism

15.4 Effect of tourism related developments on ecology

15.5 Pollution related to tourism

15.6 Disposal of solid and liquid waste from tourist destination

16. Wildlife techniques-radiometry, photographic identification of animals etc.

17. Wildlife of India-reserves, management, diversity, special protection programmes.

6. ENVIRONMENTAL BIOLOGY

PAPER-VI: ECOTOXICOLOGY, ENVIRONMENTAL MICROBIOLOGY AND BIOTECHNOLOGY

Duration : 3 Hours **Max. Marks – 100** **Periods : 90**

1. Environmental Health and Toxicology

A. Types of Environmental Hazards

1. Infectious organisms
2. Chemicals (Pesticides, metals, solvents)
3. Radiation

B. Movement, distribution and fate of toxins

1. Bioaccumulation
2. Biomagnifications
3. Biotransformation (metabolic degradation and excretion)

C. Carcinogenesis, genetic toxicology, developmental toxicology and wildlife toxicology

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2. Measuring toxicity
   A. Animal testing:
      (a) Acute, sub chronic and
      (b) Chronic
      (c) GLP
   B. Environmental impact assessment with special reference to biotic environment
   C. Risk assessment
   D. Statistical analysis of data
3. Pollution
   A. Air
      - Natural sources of air pollution
      - Human caused air pollution
      - Acid rain
      - Climate: Topography and atmospheric process
      - Global warming: The green house effect, green house gases, potential effect of global warming
      - Control of air pollution
      - Ozone depletion

   B. Water
      - Types and effects of water pollution
      - Infectious agents
      - O_2 demanding waters
      - Plant nutrients and cultural eutrophication
      - Toxic inorganic and organic materials
      - Human waste disposal
      - Waste water treatment
4. Biogeochemical cycling
   - Carbon cycle
   - Nitrogen cycle
   - Sulfur cycle

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- Phosphorus cycle
- Iron & other element

5. Biodeterioration Control and Soil, Waste, and Water Management
   - Control of biodeterioration
   - Management of agricultural soils
   - Treatment of solid waste
   - Treatment of liquid waste
6. Microbial Interaction with Xenobiotic and Inorganic Pollutants
   - Persistence and biomagnifications of xenobiotic molecules
   - Polychlorinated biphenyls and dioxins
   - Synthetic polymers
   - Microbial interaction interactions with some inorganic
   - Acid mine drainage
   - Microbial conversions of nitrate
   - Microbial methylations
   - Microbial accumulation of heavy metals and radio nuclides
7. Biodegradability testing and monitoring the bioremediation of xenobiotic pollutants.
   - Biodegradability and ecological side effect testing
   - Biosensor detection of pollutants
   - Bioremediation
   - Environmental modification for bioremediation
   - Microbial seeding and bioengineering approaches to the bio remediation of pollutants
   - Bioremediation of marine oil pollutant
   - Bioremediation of air pollutants
8. Microorganisms in Mineral and Energy Recovery and Fuel and Biomass Production
   - Recovery of metals
   - Recovery of petroleum
   - Production of fuels

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5. ENTOMOLOGY

PAPER-V: MORPHOLOGY AND PHYSIOLOGY

Duration : 3 Hours **Max. Marks – 100** **Periods : 90**

1. Integument: Structure, composition and functions, biochemistry of sclerotization.
2. Functional morphology of head, thorax and abdomen including head segmentation and appendages.
3. Muscular system.
4. Digestive system: Alimentary canal and physiology of digestion.
5. Circulatory system: Morphology and physiology including composition of haemolymph.
6. Respiratory system: Structure of respiratory organs and physiology. Adaptations for aquatic respiration.
7. Excretory system: Structure of excretory organs and physiology of excretion.
8. Nervous system: Morphology and physiology.
9. Neuroendocrine system: Morphology and physiology.
10. Sense organs: Mechanoreceptors, Chemoreceptors auditory organs, sound and light producing organs, visual organs and physiology of vision.
11. Reproductive systems: Structure and physiology.
12. Embryology: Structure of egg, embryonic and postembryonic development, types of larvae, pupae and metamorphosis, role of endocrine in growth and development, diapause, viviparity and parthenogenesis.

5. ENTOMOLOGY

PAPER-VI: SYSTEMATICS, ECOLOGY AND APPLIED ENTOMOLOGY

Duration : 3 Hours **Max. Marks – 100** **Periods : 90**

1. Classification of insects up to orders and suborders, basis and short history of classification. Introduction to primitive insects.
2. Detailed classification of important and selected super families, and families of the following orders- Orthoptera, Isoptera, Hemiptera, Coleoptera, Lepidoptera, Diptera and Hymenoptera.
3. Social tire in Isoptera and Hymenoptera.
4. Life cycle of Locusts and Aphids.

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5. Origin and Evolution of insects with special reference to fossil insects; causes of success of insects.

6. Ecology of insects

   (a) Effect of physical factors.

   (b) Intra and inter- specific relations.

   (c) Population dynamics.

   (d) Host-plant insect interactions.

   (e) Biochemical adaptations of environmental stress (Metamorphosis; Diapause, Polymorphism etc.)

7. Concept of pest. How and why insects have become pests?

8. Life history, damage caused and control of major pests of

   (a) Cash crop, e.g. sugarcane, tobacco, and mustard.

   (b) Cereal crop e.g. wheat, paddy, millet, maize, sorghum, pulses.

   (c) Pests of vegetables, fruits and oil seed crops.

   (d) Cash fibre crops e.g. cotton, sun hemp etc.

   (e) Pests of medical and veterinary importance with reference to role of WHO and UNICEF. Insect borne diseases (A preliminary idea).

   (f) Storage pests (Stored grains and milled products) with an elementary idea of different types of storage.

9. Inset Control: Basic idea.

10. Various methods of insect control

    (a) Prophylactic and cultural method, Quarantine regulation.

    (b) Physical control.

    (c) Chemical control.

    (d) Biological control

    (e) Insect pest management, its strategies and tools in IPM. Its relevance in insect pest control.

11. Chemistry and mode of action of insecticides

    (a) Inorganic insecticides.

    (b) Organochlorine insecticides

    (c) Organophosphorus compounds and carbonates.

    (d) Insecticides of plant origin.

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(e) Synthetic pyrethroids.

(f) Insect growth regulatory compounds.

(g) Microbial insecticides.

(h) Chemosterilant, repellents, antifeedants.

(i) Fumigants and fumigation.

12. Concept I, II and III generation of insecticides

12.1 A brief idea of appliances used for application of insecticides, hazards involved and safe handling of insecticides

12.2 Development of resistance in insects to insecticides.

12.3 Insecticide synergists and antagonists.

12.4 Insecticide formulations and application technology.

12.5 Dynamics of environmental pollution.

12.6 Pesticides: Impact on wildlife and human health (bioaccumulation, biomagnification, biodegradation)

12.7 Microbial and environmental degradation of pesticides.

13. Forensic entomology with special reference to man and wildlife.

14. Beneficial insects: Silk worm, honeybee and lac insect and industries related to them.

15. Role of genetics in vector control.

16. Social insects, social organization, caste differentiation.

Special Paper – I
Entomology

List of Practicals:-

1. Field trips for collection and preservation of insects of various orders.
2. Museum study for identification of insects of different orders.
3. Dissection

(a) Cockroach: Digestive, nervous, circulatory, reproductive systems and neuroendocrine complex.

(b) Grasshopper

(c) Honeybee: Digestive and nervous system.

(d) White grubs: Nervous system.

(e) Housefly.

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4. Permanent preparations
   (a) Different types of mouthparts, antennae, legs and wings.
   (b) Sting apparatus of honeybee.
   (c) Pollen basket of honeybee.
   (d) Tympanum and spiracle of grasshopper.
   (e) Whole mounts (wm.) of various small insects.
5. Familiarity with techniques of appliances used for the application of insecticides
   (a) Sprayers including hand sprayers.
   (b) Dusters.
6. Knowledge of rearing insects and maintaining insectary
   (a) *Tribolium* Sp.,
   (b) *Rhizopertha* Sp.,
   (c) *Heliothis* Sp.,
   (d) *Corcyra* Sp.,
   (e) *Callosobruchus* Sp.,
   (f) *Lasioderme serricorne*, mosquito species.
7. Testing of insecticides: bioassay methods.
8. Study of prepared slides
   (a) Whole mounts of insects.
   (b) Histology.
   (c) Leg types.
   (d) Antennae types.
   (e) Types of mouthparts.
   (f) Wing types.
9. Microtomy (Internal organs of insects).
10. Study of seasonal abundance of crop-pest in nearby area.
11. Live demonstration of biological control using *Coccinella* or *Chrysopa*
12. Role of hormones in metamorphosis (ligature experiment with Housefly larvae).
13. To study antennal grooming in cockroach.
14. To study the blood cells in insects.
15. To study meiosis and polytene chromosomes in insects.

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16. To study the insects infestation in the grains.
17. To study the food preference of *Tribolium* or any other insect.

SCHEME OF ENTOMOLOGY PRACTICAL EXAMINATION

Duration : 6 Hours **Max. Marks – 100**

1.	Major dissection.	15 (12+3)
2.	Minor dissection / Permanent preparation.	5 (4+1)
3.	Identification of four insects (A to D) using taxonomic keys	16
4.	Exercise on Ecology/Physiology/Behaviour/Bioassay	10
5.	Microtomy +submission of slides prepared	10 (7+3)
6.	Comment on spots 1 to 8.	24
7.	Viva	10
8.	Record / Field work	10
		Total = 100

Recommended Books:

1. Borror. D.J. and Delong, D.M.: An Introduction to the Study of Insects. Constable and co. London/Holt. Rinehart and Winston. New York. 1954.
2. Chapman R.F. The Insects: Structure and Functions, Cambridge Low Price, Edition, 1998.
3. Dhaliwal, G.S. and Arora, Ramesh. Principles of insect. Pest management National Agricultural Technology Information, Ludhiana, 1976.
4. Essig. E.Q. College Entomology: MacMillan Co. New York, 1942.
5. Fox, R.M. and Fox, J.W.: Introduction to comparative Entomology, Reivehold Puse, Corp. New York, 1964 (Indian Reprint: Affliated East West Press Pvt. Ltd., New Delhi.
6. Frost, S.W. Insert Life and Insert Natural History dover Puse. Inc. New York, 1969.

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Zool.

Note:

1. **Submission of slides from the above exercises.**
2. **With reference of whole mounts and museum specimens the animal types may be substituted with diagrams/photographs/models etc.**
3. **It should be ensured that animals used in the practical exercise are not covered under the wild life act 1972 and amendments made subsequently.**

SCHEME OF PRACTICAL EXAMINATION

Duration : 6 Hrs. **Max. Marks : 100**

1.	Dissection of male and female reproductive organs surgical procedures.	12
2.	Monitoring of exocrine and endocrine functions of gonads.	10
3.	Biochemical investigations of marker parameters.	12
4.	Microtomy	12
5.	Hormonal bioassay Pregnancy test, in vitro fertilization (GIFT, ZIFT, TET, ICSI)	10
6.	Spots (1-8)	24
7.	Record & submission of slides	5+5
8.	Viva-voce	10
		Total 100

Recommended Books

1. A Text Book of comparative Endocrinology. Gorbman, A and Bern, H. A. John Wiley and Sons Inc., New York, 1962. (Indian reprint, Wiley Eastern Pvt. Ltd., New Delhi, 1974).
2. An Introduction to General and Comparative Endocrinology by Barrington: E. J. W. Clarenden Press, Oxford, 1963
3. Andrology Male Reproductive Health and Dysfunction. Nieschlag F. and Behre H.M Springer-Verlag, Berlin-2001
4. Biology of Gestation. Assali, N. S. (ed.) Vol. I and II Academic Press, New York.
5. Biology of Human Reproduction. Pinon, Jr. R. University Science Books, California, 2002.
6. Biology of ovarian follicles in Mammals. Guraya, S. S., Springer Verlag, Berlin.
7. Comparative Reproductive Biology Reviewed. Ali Honaramooz, Blackwell Publishing House, Ames, Iowa, USA, 2007.
8. Comparative Vertebrate Endocrinology, Benttey P.
9. Delayed Implantation Enders, N.C. University of Chicago Press, Chicago, 1963.
10. Encyclopedia of Reproduction. Vol. I to IV. Knobil E. and Neill J.D. Academic Press, New York, 1998.
11. Essential Reproduction. M. H. Johnson, Barry J. Everitt Blackwell publishing ,USA 2007.
12. General Endocrinology. Turner, C.D., W B. Saunders and Co., Philadelphia (Tappan International. Edition, Tappan Co. (Singapore) Pvt. Ltd., New Delhi, 1974).
13. Hormones. Norman AW. and Litwack G. Academic Press, New-York, 1997.
14. Human Physiology (Vol. II), C.C. Chatterjee.
15. Knobil and Neill's physiology of reproduction, Vol. I and II, Ernst Knobil, Jimmy D. Neill Academic Press, 2006.
16. Marshall's Physiology of Reproduction Parkes. A. S. Vols. 1; Part 1 (1956) and 2 (1960) 3 (1952) and 4 (1966) Longmans, Green and Co., London. .

17. Molecular Mechanisms in spermatogenesis, Volume 636. C. Yan Cheng, Springer, USA 2008.
18. Reproductive Physiology. Nalbandov. A. S, W H. Freeman and Co., New York, 1964. (Indian Reprint), D. B. Taraporevala, Sons and Co. Ltd., Bombay, 1970.
19. Sex and Internal Secretions Vols. I and II., Young, W. C.: Baltimore, Williams & Wilkins, 1961.
20. The Mammary gland and its Secretion Vol. I and II by S. K. Kon and A. T. Cowie. Academic Press, New York.
21. Vertebrate Endocrinology, Norris D.O.
22. Williams Textbook of Endocrinology. Shlomo Melmed, Kenneth Polonsky and P. Reed Larsen ed., SAUNDERS,2007
23. Yen & Jaffe's Reproductive Endocrinology Jerome Strauss and Robert Barbieri Elsevier 2009.

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M.Sc. (CHEMISTRY)
(Annual Scheme)

SCHEME OF EXAMINATION

Each Theory Paper: 3 Hrs. Duration
Dissertation/Thesis Survey Report Field Work, if any.

1. The number of papers and the maximum marks for each paper practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in practical part (wherever prescribed) of a subject/paper separately.

2. A candidate for a pass at each of the Previous and the Final Examinations shall be required to obtain:
   1) Atleast 36% marks in the aggregate of all the papers prescribed for the examination, and
   2) Atleast 36% marks in practical(s) wherever prescribed at the examination, provided that if a candidate fails to secure atleast 25% marks in each individual paper at the examination and also in the dissertation/Survey report/field work, wherever prescribed, he shall be deemed to have failed at the examination notwithstanding his having obtained the minimum percentage of marks required in the aggregate for that examination. No division will be awarded at the Previous and the Final Examination. Division shall be awarded as the end of the Final Examination on the combined marks obtained at the Previous and the Final Examination taken together, as noted below:

First Division	60%	of the aggregate marks taken together of the
Second Division	48%	Previous and the Final Examination.

   All the rest will be declared to have passed the examination.

3. If a candidate clears any Paper(s)/ Practical(s)/ Dissertation prescribed at the Previous and/or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper(s)/ Practical(s)/ Dissertation as are cleared after the expiry of the aforesaid period of three years: provided that in case where a candidate required more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum, aggregate.

4. The Thesis/Dissertation/Survey Report/Field Work shall be typewritten and submitted in triplicate so as to reach the office of the Registrar atleast 3 weeks before the commencement of the theory examinations Only such candidates shall be permitted to offer Dissertation/ Field Work/Survey Report/Thesis (if provided in the scheme of examination) in lieu of a paper as have secured atleast 55% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme irrespective of the number of papers in which a candidate actually appeared at the examination.

N. B. None-collegiate candidates are not eligible to the dissertation as per provisions of O. 170-A.

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M.Sc. Chemistry
(Two Year Course)

Note: In each question paper 10 questions will be set (two from each unit). Candidates have to answer any 5 questions selecting at least one question from each unit.

M.Sc. I Year (Previous)

Paper	Course Code	Course Title	Exam Duration	Maximum Marks	Minimum Marks
Paper-I	CH-401	Inorganic Chemistry	3 Hrs.	100	36
Paper-II	CH-402	Organic Chemistry	3 Hrs.	100	36
Paper-III	CH-403	Physical Chemistry	3 Hrs.	100	36
Paper-IV	CH-404	Spectroscopy and Diffraction Methods	3 Hrs.	50	18
Paper-V	CH-405	Green and Sustainable Chemistry	3 Hrs.	50	18
Paper-VI	CH-406	Analytical Techniques	3 Hrs.	50	18
Practical			14 Hrs.	200	72
			Total Marks	**650**	

M.Sc. II Year (Final)

Paper	Course Code	Course Title	Exam Duration	Maximum Marks	Minimum Marks
Paper-I	CH-501	Applications of Spectroscopy, Photochemistry and Solid-State Chemistry	3 Hrs.	100	36
Paper-II	CH-502	Bioinorganic Chemistry, Bioorganic Chemistry and Biophysical Chemistry	3 Hrs.	75	27
Paper-III	CH-503	Environmental Chemistry	3 Hrs.	50	18
Paper-IV	CH-504	Elective Paper-I	3 Hrs.	50	18
Paper-V	CH-505	Elective Paper-II	3 Hrs.	50	18
Paper-VI	CH-506	Elective Paper-III	3 Hrs.	50	18
Paper-VII	CH-507	Elective Paper-IV	3 Hrs.	50	18
Seminar (Internal)				25	9
Practical			14 Hrs.	200	72
			Total Marks	**650**	
M.Sc. (Previous) & M.Sc. (Final) - Grand Total				**1300**	

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M.Com. EAFM Syllabus

Annual Scheme

Each Theory Paper — 3 Hrs. duration — 100 Marks

1. The number of papers and the maximum marks for each paper/practical shall be shown in the syllabus for the subject concerned. It will be necessary for a candidate to pass in the theory part as well as in practical part (wherever prescribed) of a subject/paper separately.
2. A candidate for a pass at each of the Previous and the Final Examinations shall be required to obtain
   (i) At least 36% marks in the aggregate of all the papers prescribed for the examination, and
   (ii) At least 36% marks in practical(s) wherever prescribed at the examination, provided that if a candidate fails to secure at least 25% marks in each individual paper at the examination and also in the dissertation/Survey report/ Field work, wherever prescribed, he shall be deemed to have failed at the examination notwithstanding his having obtained the minimum percentage of marks required in the aggregate for that examination. No division will be awarded at the Previous and the Final Examination. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the previous and the Final Examination taken together, as noted below:

First Division	60%	of the aggregate marks taken together of the Previous and the Final Examinations
Second Division	48%	

All the rest will be declared to have passed the examination.

3. If a candidate clears any Paper(s)Practical(s)/Dissertation prescribed at the previous and/or Final Examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper(s)/Practical(s)/ Dissertation are cleared after the expiry of the aforesaid period of thiee years; provided that in case where a candidate requires more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.
4. The Dissertation shall be typewritten and submitted in triplicate so as to reach the office of the Registrar at least 3 weeks before the commencement of the theory examinations. Only such candidates shall be permitted to offer Dissertation/ Field Work/ Survey Report/ Thesis (if provided in the scheme of examination) in lieu of a paper as have secured at least 55% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme irrespective of the number of papers in which a candidate actually appeared at the examination.
5. The dissertation shall carry 50 marks and there shall be a viva-voce based on dissertation of 50 marks. The viva-voce shall be conducted in the college/institution concern by the external examiner appointed by the university on the recommendation of the BOS concerned.
6. The external examiner for conducting the practical examination and viva-voce shall be appointed by the University through BOS.

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The candidate shall be permitted to use battery operated pocket calculator that should not have more than 12 digits, 6 functions and 2 memories and should be noiseless and cordless.

Non-collegiate candidates are not eligible to offer dissertation as per provisions of O.170-A

Scheme and Distribution of Paper

There will be 9 papers in all. Of these 9 papers 5 will be compulsory and 4 optionals. A candidate will be required to offer two compulsory and two optional papers in previous out of the list of papers meant for previous and the remaining three compulsory and two optional papers in the final examination out of the list of papers meant for M.Com (Final). Dissertation in lieu of the paper can be offered at the Final Examination provided that a candidate secures at least 55% marks in the aggregate of the previous examination, subject to the approval of topic of survey work and a candidate being adjusted suitable for undertaking such work. Maximum marks for each theory paper shall be 100 marks and each paper duration shall be three hours.

There will be five questions in all. The candidates are required to attempt all the question. There will be one question from each unit with an internal choice (either/or).

M.COM (PREVIOUS)

Compulsory Papers:

EAFM-101	Economic Analysis
EAFM-102	Financial Management & Control

Optional Papers (Any Two) Economic Administration Group

EA-103	Public Enterprises
EA-104	Industrial Economics
EA-105	Project Management
EA-106	India's Foreign Trade
EA-107	Quantitative Techniques

Optional Paper (Any Two) : Financial Management Group

FM-103	Business Budgeting
FM-104	Public Finance
FM-105	Security Analysis
FM-106	Portfolio and Investment Management
FM-107	Quantitative Techniques

Optional Paper (Any Two) : Cooperation Group

CO-103	Cooperative Project Planning
CO-104	Cooperative Movement in Rajasthan
CO-105	Co-operative Movement in India
CO-106	Financing Co-operative Projects
CO-107	Quantitative Techniques

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SCHEME OF EXAMINATION

M.Com (ABST)

(Annual Scheme)

Each Theory Paper Duration: 3 Hrs. 100 Marks
Dissertation/Thesis/Survey Report/Field Work, if any. 100 Marks

1. The number of paper and the maximum marks for each paper/practical shall be shown in the syllabus for the subject concerned. It will necessary for a candidate to pass in the theory part as well in practical part (Where prescribed) of a subject/paper separately.
2. A candidate for a pass at each of the Previous and the Final Examination shall be required to obtain

   (i)At least 36% marks in the aggregate of all the papers prescribed for the examination and

   (ii) At least 36% marks in practical (s) wherever prescribed at the examination, provided that if a candidate fails to secure at least 25% marks in each individual paper at the examination and also in the Dissertation/Survey Report/Field work, wherever prescribed, he shall be deemed to have failed at the examination notwithstanding his having obtained the minimum percentage of marks required in the aggregate for the examination. No division will be awarded at the previous and the Final Examination. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the Previous and the Final Examination taken together, as noted below:

First division	60%	of the aggregate marks taken together of the Previous and the Final Examination
Second Division	48%	

   All the rest will be declared to have passed the examination.
3. If a candidate clears any paper(s) Practical (S)/Dissertation prescribed at the previous and/ or Final examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz 25% (36% in the case of practical) shall be taken into account in respect of such paper(s)/Practical(s)/Dissertation are cleared after the expiry of the aforesaid period of three years: Provided that in case where a candidate required more than

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25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate.

4. The Thesis/Dissertation/Survey Report/Field Work shall be type written and submitted in triplicate so as to reach the office of the Registrar at least 3 weeks before the commencement of the theory examination. Only such candidate shall be permitted to offer Dissertation/Field Work //Survey Report/Thesis (if provide at least 55% marks in the aggregate of all the papers prescribed for the previous examination in the case of annual scheme irrespective of the number of papers in which a candidate actually appeared at the examination.
5. The Dissertation shall carry 50 marks and there shall be a viva-voce based on dissertation of 50 marks. The Viva-Voce shall be conducted in the college/institution concern by the external examiner appointed by the university.
6. The dissertation shall be evaluated by two examiners independently and the average of the two awards shall be taken into consideration. However, if the difference between two awards exceeds 20% of the Maximum marks, the dissertation shall be evaluated by third examiner and the average of the two nearest awards shall be taken into consideration.

   Note: Non-collegiate candidates are not eligible to offer dissertation as per provisions of O 170-A.
7. The external examiner for conducting the practical examination shall be appointed by the university through BOS.
8. There will 9 papers in all. Out of these 9 Papers, 6 will be compulsory and three optional. A candidate will be required to appear in three compulsory papers and one optional paper in the previous Examination and the three compulsory papers and two optional papers in the Final Examination. Dissertation in lieu of one optional paper can be offered by a collegiate/regular student secured at least 55% marks in the aggregate of the previous Examination.
9. There will be five question in all. The candidate will require to attempt all question selecting one question from each unit with an internal choice (either/or).
10. The candidate shall be permitted to use battery operated pocket calculator that should not have more 12 digits, 6 functions and 2 memories and should be noiseless and cordless.

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SCHEME OF EXAMINATION
M.Com Business Administration
(Annual Scheme)

Each Theory Paper	Duration: 3 Hrs.	100 Marks
Dissertation/Thesis/Survey Report/Field Work, if any.		100 Marks

1. The number of paper and the maximum marks for each paper/practical shall be shown in the syllabus for the subject concerned. It will necessary for a candidate to pass in the theory part as well in practical part (where prescribed) of a subject/paper separately.
2. A candidate for a pass at each of the Previous and the Final Examination shall be required to obtain:
   i) At least 36% marks in the aggregate of all the papers prescribed for the examination, and
   ii) At least 36% marks in practical(s) wherever prescribed at the examination, provided that if a candidate fails to secure at least 25% marks in each individual paper at the examination and also in the Dissertation/Survey Report/Field work, wherever prescribed, he shall be deemed to have failed at the examination notwithstanding his having obtained the minimum percentage of marks required in the aggregate for the examination. No division will be awarded at the Previous and the Final Examination. Division shall be awarded at the end of the Final Examination on the combined marks obtained at the Previous and the Final Examination taken together, as noted below:

First division	60%	of the aggregate marks taken together of the Previous and the Final Examination
Second Division	48%	

   All the rest will be declared to have passed the examination.
3. If a candidate clears any paper(s) Practical(s)/Dissertation prescribed at the Previous and/or Final examination after a continuous period of three years, then for the purpose of working out his division the minimum pass marks only viz. 25% (36% in the case of practical) shall be taken into account in respect of such Paper(s)/Practical(s)/Dissertation are cleared after the expiry of the aforesaid period of three years: Provided that in case where a candidate required more than 25% marks in order to reach the minimum aggregate as many marks out of those actually secured by him will be taken into account as would enable him to make up the deficiency in the requisite minimum aggregate
4. The Thesis/Dissertation/Survey Report/Field Work shall be type written and submitted in triplicate to reach the office of the Registrar at least [illegible] before the commencement of the theory examination. Only such candidates will be permitted to [illegible] Field Work [illegible]

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5. The Dissertation shall carry 50 marks and there shall be a viva-voce based on dissertation of 50 marks. The Viva-voce shall be conducted in the college/institution concern by the external examiner appointed by the university.
6. The dissertation shall be evaluated by two examiners independently and the average of the two awards shall be taken into consideration. However if the difference between two awards exceeds 20% of the Maximum marks, the dissertation shall be evaluated by third examiner and the average of the two nearest awards shall be taken into consideration.
   Note: Non-Collegiate candidates are not eligible to offer dissertation as per provisions of O.170-A.
7. The external examiner for conducting the practical examination shall be appointed by the university through BOS.
8. There will be 9 papers in all. Out of these 9 papers, 6 will be compulsory and three optional. A candidate will be required to appear in three compulsory papers and one optional paper in the Previous Examination and the three compulsory papers and two optional papers in the Final Examination. Dissertation in lieu of one optional paper can be offered by a collegiate/regular student secured at least 55% marks in the aggregate of the Previous Examination.
9. There will be five questions in all. The candidate will require to attempt all the questions selecting one question from each unit with an internal choice (either/or).
10. The candidate shall be permitted to use battery operated pocket calculator that should not have more than 12 digits, 6 functions and 2 memories and should be noiseless and cordless.

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B.Sc - II
(4)

Practical 2 (6 hrs.) 50marks

Scheme of Examination (Common for all theory papers)

Midterm/Continuous assessment (20% weightage)
(End of Semester Examination) EoSE (80% weightage)
Each theory paper shall have two parts A & B.

Part A: 20 marks

Part A will be compulsory having 10 or 20 very short answer type questions (with a limit of 20 words) of two or one marks respectively.

Part B: 60 marks

Part B of question paper shall be divided into four units comprising question numbers 2-5. There will be two questions from each unit with internal choice. Each question will carry 15 marks.

Paper I- Cell Biology, Genetics and Plant breeding

Objectives

- To understand the structural organization of cells.
- To understand structure and functions of different organelles in the cell.
- To understand the concept of cell division, mutations and chromosomal aberrations.
- To understand basic laws of inheritance and variations.
- To understand various gene interactions.
- To understand basics of plant breeding methods and other crop improvement strategies.

Course Outcomes:

At the completion of the course, the student would be able to:

	BOT H01
Cognitive level	Course outcomes

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B.Sc – I st

(2)

Syllabus: UG0803-B.Sc.
I-Semester- Physics
(2023-2024)

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (Midterm + EoSE)	Minimum Marks (Midterm + EoSE)
Theory	UG0803-PHY-51T-101-Mechanics& Oscillations	1 Hrs-MT 3 Hrs-EoSE	20 Marks-MT 80 Marks-EoSE	8 Marks-MT 32 Marks-EoSE
Practical	UG0803-PHY-51P-102-Physics Lab-I	2 Hrs-MT 4 Hrs-EoSE	10 Marks-MT 40 Marks-EoSE	4 Marks-MT 16 Marks-EoSE

Semester	Code of the Course	Title of the Course/Paper	NHEQF Level	Credits
I	UG0803-PHY-51T-101	Mechanics& Oscillations	5	4
Level of Course	Type of the Course	Delivery Type of the Course		
Introductory	Major/Minor	Lecture, Sixty Lectures including diagnostic and formative assessments during lecture hours.		
Prerequisites	Physics and Mathematics courses of Central Board of Secondary Education or equivalent.			
Objectives of the Course:	Objectives of the Course in Mechanics: The objective of the course is to provide students with a comprehensive understanding of classical mechanics, including the laws of motion, frames of reference, forces, motion of particles and rigid bodies, oscillations, and central forces. The course aims to develop their knowledge and skills in analyzing and solving problems related to these topics, using appropriate mathematical formalism and physical concepts.			

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B.SC - I

(3)

Name of University	University of Rajasthan, Jaipur
Name of Faculty	Science
Name of Programme	UG0803-Three/Four Year Bachelor of Science (Maths Group)
Name of Discipline	Mathematics

PROGRAMME PREREQUISITES
Mathematics course of XIIth std. of Central Board of Secondary Education or equivalent.
PROGRAMME OUTCOMES (PO)
The program would enable students to take on advanced courses in Mathematics with global needs and to serve as a formidable skill-force in research, academia, industry, government, and other sectors where Mathematics is reckoned as a strong devising and design tool with diverse interdisciplinary applications.

Scheme of Examination-

1 credit = 25 marks for examination/evaluation

Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous Assessment (CA) (20% weightage) and End of Semester Examination (EoSE) (80% weightage).

1. Continuous Assessment will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study.
2. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration. Each question will carry equal marks and have two parts as -
   - Part-A of the question paper shall consist first question with 08 short answer type questions of 3 marks each, two from each of the units. The first question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
   - The Part-B of the question paper shall consist four questions of 24 marks each, one from each unit. Each Question will have four parts. A Candidate is required to attempt all four units by taking any two parts from each question.
3. 75% Attendance is mandatory for appearing in EoSE.
4. To appear in the EoSE examination of a course/subject student must appear in the Continuous Assessment (CA) and obtain at least a "C" grade in the course/subject.
5. Credit points in a Course/Subject will be assigned only if, the student obtains at least a C grade in CA and EoSE examination of a Course/Subject

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B.Sc - I st

SEMESTER-WISE PAPER TITLES WITH DETAILS

UG0802/03 – Four Year Bachelor of Science (B.Sc. Pass Course) Subject/Discipline - Chemistry						
Credit Framework for Four Year Bachelor of Science under NEP – 2020						
Academic Session 2023-2024						
S. No.	Semester	Course Code	Course Title	Credits		Marks
				L	P	
1.	I	CHM-51T-101	Structure-bonding, Mathematical concept and States of matter	4	0	100
2.	I	CHM-51P-102	Chemistry Lab-I	0	2	50
3.	II	CHM-52T-103	Reaction mechanism, Stereochemistry, Aromatic hydrocarbon and Chemical kinetics.	4	0	100
4.	II	CHM-52P-104	Chemistry Lab-II	0	2	50

Scheme of Examination:

1 credit = 25 marks for examination/evaluation

Notes:

Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous assessment (20% weightage) and (End of Semester Examination) EoSE (80% weightage).

1. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study.
2. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration.
   - **Part-A** of the paper shall have multiple questions of equal marks. This first question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
   - **Part B** of the paper shall consist of 4 questions with an internal choice of each. The four questions will be set with one from each of the units with internal choice. Third to fourth questions shall be based on applications of the topics/texts covered in the syllabus (60% weightage) and shall involve solving Problems (40% weightage) if applicable.
3. 75% Attendance is mandatory for appearing in EoSE.
4. To appear in the EoSE examination of a course/subject student must appear in the mid-semester examination and obtain at least a C grade in the course/subject.

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B.SC-I

Pass Course

University of Rajasthan

UG0802 Four- Year Bachelor of Science (B.Sc.)

Subject/Discipline-Zoology

Syllabus: B.Sc. Semester I

(2023-2024)

ZOO- 51T-101	: 3 Hrs duration	20+80 Marks	8+32 Marks
ZOO- 51P-102	: 4 Hrs. duration	10+40 Marks	4+16 Marks

Code of the Course	Title of the Course	Level of the Course	Credits of the Course
ZOO- 51T-101	Animal Diversity	5	4
Type of Course		Delivery Type of the Course	
Major		Lectures: 60 lectures including diagnostic and informative assessments during lecture hours	
Prerequisites	Biology courses of Central Board of Secondary Education or equivalent		
Objectives of the Course	The main purpose of introducing this course is to teach the students the Morpho-taxonomy, and evolutionary relationships among and between non-chordates and chordates along with creating awareness and concern towards importance of animal diversity for human survival and its socioeconomic significance. In addition to this, the course is aimed at nurturing skills of conducting scientific inquiry and experimentation in the field of animal diversity to acquire knowledge of fundamental concepts and theories of animal diversity.		

Syllabus

Animal Diversity

Section – A

LOWER INVERTEBRATES

Unit 1: Protista/Protozoa: General Characteristics and Classification up to classes; Locomotory Organelles and locomotion in Protozoa. 3 hrs

Unit 2: Porifera : General characteristics and Classification up to classes; Canal system in Porifera. 3 hrs

Unit 3: Coelenterata (Cnidaria): General characteristics and Classification up to classes; Polymorphism in Hydrozoa. 3 hrs

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18. Economics

B.A. Part-II

Scheme:	Min. Pass Marks	Max. Marks
Arts	72	200
Science	54	150

Each paper shall be of three hour duration and of 100 marks for Arts students and of 75 marks for Science students.

Paper – I Introductory Macro Economics

Paper – II (a) Elements of Statistics and Mathematics
(b) History of Economic Thought

Note: There will be two papers of Economics. Each paper shall consist of three parts. Part A shall contain question No I consisting of very short type X (Ten) questions. The candidate is required to answer each question in 20 words. Part B shall contain question No 2 consisting of V (five) question. The candidate is required to answer each question in 100 words. Part C shall contain three essay type questions (one from each section) with internal choice.

A candidate will be required to attempt five questions in all. All questions of Part A and Part B are compulsory while rest 3 questions are to be attempted from parts C selecting one question from each section. All questions carry equal marks. Each question will carry 20 marks for Arts students and 15 marks for Science students.

Paper-I

Introductory Macro Economics

Section- A

Macroeconomics, Meaning, Subject matter and Importance. Basic tenets of Classical, Keynesian, New-Classical and New –Keynesian economics, Macrocosmic variables, Circular flow of Income, National Income: Basic concepts, Measurement, Sectoral Accounts, Nominal and Real Aggregates.

Money function. Demand and Supply Quantity Theory of Money Transaction Approach. Cash Balance Approach. Keynes reformulation of the Quantity Theory of Money inflation Meaning and Impact. Theories of Inflation- Demand Pull (Keynesian and modern), Demand Push. Structural Theories of Inflation.

Section-B

Income and Employment Determination : Classical Modal and Keynesian Model, Consumption Function: Psychological Law of Consumption, Determinants of Consumption, Paradox of, Thrift, Investment Function: Determinants of investment, Marginal Efficiency of Capital and Marginal Efficiency of Investment, Concept of Multiplier and Accelerator.

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13. Home Science

Examination Scheme :

- Each Theory paper will contain nine questions having three questions from each unit. Candidates are required to attempt five questions in all selecting at least one question from each unit. Each question will be of 10 marks.

BA Home Science Part II

Paper	Subjects	Duration of exam	Maximum marks	Minimum marks	No. of hrs/wk
Theory Paper III	Human Development	3hrs	50	18	4
Practical III	Human Development	3hrs	50	18	2
Theory Paper IV	Textiles and Clothing	3hrs	50	18	4
Practical IV	Textiles and Clothing	3hrs	50	18	2
		Total	200	72	12

B.A. PART-II

HUMAN DEVELOPMENT (THEORY PAPER III)

Maximum Marks: 50

Minimum marks: 18

Teaching workload: 4 hrs /week

Total teaching workload: 96

Human Development and Family Studies is concerned with the study of the human lifespan from conception and onwards. In this program students would study various stages of life; prenatal, Infancy childhood, adolescence, adulthood and ageing. There is a special reference to ECCE, developmental disorders, family relationships and its dynamics. This program covers the biological and environmental, psychological and social factors that are understood to explain patterns of human behavior over the lifespan.

The program helps in understanding how people develop throughout their lives, and how Heredity and Environment can influence possibilities for individuals. This is important and useful knowledge for everyone.

Basic knowledge of Human Development is an important background for those wishing to go into professions such as social work, nursing and teaching. There is a need for more research in the context of family and lifespan development in our country, and we are looking for students

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B.A. Part – II

11 DRAWING & PAINTING

SCHEME :

Theory Paper I	Duration	M.M.	Min. Pass Marks
History of Indian Painting and Sculpture	3 hrs.	90	32 1/2
Practical Paper II			
Part A- Study from Bust (Portrait)	3 hrs.	45	32 1/2
Part B-Creative Portrait (Rendering)	3 hrs.	45	
Submission of Practical Works(A & B)		20	07
	Total	200	72

Paper I : History of Indian Painting and Sculpture

Note : The paper consist of two parts :-
Part –I: Carries 30 marks and consist of 15 short type questions of 2 marks each.
Part –II: Carries 60 marks divided into three sections 4 questions of 15 marks each with internal choice. Candidates are required to attempt four questions selecting one question from each section. Each answer should be limited in 700-800 words.

Section – A

Prehistoric Rock Paintings, Art of Indus Valley Civilization, Jogimara, Ajanta, Bagh, Sigiriya Cave Paintings.
Pal and Apbhransh Painting.
Rajasthani School – Mewar, Kishangarh, Jaipur and Bundi style of painting.
Pahari School – Basohli and Kangra style of Painting.

Section – B

Company School
Raja Ravi Varma, Bengal School Abnindranath Tagore, Nandlal Bose
Other Indian Artist – Yamini Roy, Rabindranath Tagore and Amrita Shergil

Section –C

History of Indian Sculpture – Maurya Period – Ashoka Pillars, Yakshni of Didarganj and Yaksh Murtishilp.
Sunga Period – Sanchi
Kushan Period, Gandhara and Mathura Sculpture.
Sculptures of Gupta Period.

Books Recommended:

1. Studies in Indian Art - V.S. Agarwal, Varansi, 1965
2. History of Fine Arts in India & Ceylon - Vincent A. Smith (edited by K. Khomalalwala), Bombay, 1930
3. History of Indian and Indonesian Art - A.K. Coomaraswamy, London, 1927
4. Indian Painting - Percy Brown. Calcutta, 1918.
5. Survey of Indian Sculpture - S.K. Saraswati, Calcutta, 1657
6. Kala Vilas - Dr. R.A. Agarwal. D.S.A. Books international, Meerut, 2015
7. Fundamental of Indian Arts - S. Das Gupta.
8. भारतीय चित्रकला का संक्षिप्त इतिहास – शर्मा, लोकेश चन्द्र, कृष्ण। प्रकाशन मीडिया (प्रा.लि.)
9. भारतीय मूर्तिकला – राय कृष्ण दास, नागरी प्रचारिणि सभा, काशी
10. भारतीय चित्रकला का संक्षिप्त इतिहास – अविनाश बहादुर वर्मा, प्रकाश बुक डिपो, बरेली,1968
11. भारतीय चित्रकला – राय कृष्ण दास, भारती भोमदार लीडर प्रेस, इलाहाबाद, 2023 ए.डी.
12. भारतीय चित्रकला – वाचस्पति गैरोला, मित्र प्रकाशन प्राइवेट राय कृष्ण दास, नागरी प्रचारिणि सभा, काशी

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B.A - IInd

7. : HISTORY

The scheme of examination will be as follows:

Scheme:

Maximum Marks 200		Minimum Pass Marks 72
Paper I	3 hrs. Duration	Marks 100
Paper II	3 hrs. Duration	Marks 100

Note: There shall be two papers in all in the subject of History, and each paper shall be of three hours duration and of 100 marks.

Each paper shall consist of two parts. Part I shall carry 40 marks and shall consist of two compulsory questions. The first compulsory question will be of 20 marks, comprising of 10 very short answer type questions of two marks each. The answer to each question should not exceed 20 words.

The second compulsory question will be of 20 marks. It will comprise of 10 short answer type questions of 04 marks each, the candidate will be required to answer any 05 questions. The answer to each question should not exceed 50 words.

The second part of the question paper shall be divided into three sections comprising of 06 essay type questions, containing 02 questions from each section, of 20 marks each. Candidate will be required to answer 03 questions, selecting one question from each section. This part of the question paper shall be of 60 marks.

परीक्षा योजना :

अधिकतम अंक 200		न्यूनतम उत्तीर्णांक 72
प्रथम प्रश्नपत्र	समय 3 घंटे	अंक 100
द्वितीय प्रश्नपत्र	समय 3 घंटे	अंक 100

नोट : इतिहास विषय के कुल दो प्रश्नपत्र होंगे, प्रत्येक प्रश्नपत्र तीन घंटे की अवधि का एवं 100 अंकों का होगा।

प्रत्येक प्रश्नपत्र के दो भाग होंगे। प्रथम भाग 40 अंको का होगा एवं इस भाग में दो अनिवार्य प्रश्न होंगे। 20 अंकों के प्रथम अनिवार्य प्रश्न में, दो–दो अंक के 10 अनिवार्य अतिलघुउत्तरात्मक प्रश्न होंगे। प्रत्येक उत्तर की शब्द सीमा 20 शब्द।

20 अंकों के द्वितीय अनिवार्य प्रश्न में, चार–चार अंकों के 10 लघुउत्तरात्मक प्रश्न होंगे जिनमें से 05 प्रश्न करने होंगे। प्रत्येक उत्तर की शब्द सीमा 50 शब्द।

प्रश्नपत्र के द्वितीय भाग में, पाठ्यक्रम के तीन खण्डों में से, प्रत्येक खण्ड से दो–दो प्रश्नों का चयन करते हुए, कुल 06 निबन्धात्मक प्रश्न होंगे। प्रत्येक प्रश्न 20 अंको का होगा। परीक्षार्थियों को प्रत्येक खण्ड में से कम से कम एक प्रश्न का चयन करते हुए कुल 03 प्रश्न हल करने होंगे। प्रश्नपत्र का यह भाग 60 अंको का होगा।

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B.A/B.SC- IIIrd

B. Geography.

Scheme of Examination

Faculty	Min. Pass Mars	Max. Marks
Arts/Social Science	72	200
Science	54	150
Paper I	World Regional Geography	Arts 75 Science 50
Paper II	Geography of India	Arts 75 Science 50
Practical	18	Arts 50 Science 50

Notes

1. Students are permitted to use the stencils, simple calculator and log tables wherever needed in both theory and practical examinations.
2. There will be a common paper for Arts and Science.
3. Q.1 will be compulsory and will cover the entire course of the paper.

   Q.No. 1 of 20% marks of the maximum marks be set in two parts.

   (a) Part (a) will have ten items for locating on a map (to be supplied by examination centre) carrying 10% marks of the maximum marks and candidates shall attempt any five items.

   (b) Part (b) will have 10 short answer questions carrying 10% marks of the maximum marks and candidates shall attempt any five items.
4. Remaining 9 questions carrying equal marks will be set with three questions from each section of the syllabus.
5. Candidate will attempt 5 questions in all including question No. 1 selecting at least one question from each section.
6. Practical examination will be conducted by the board of examiners.
7. The candidate will have to pass in theory and practical separately.
8. The non-collegiate candidates will have to attend a practical training camp of 48 hours at a college affiliated to the University of Rajasthan, Jaipur notified by the University from time to time in which Geography subject is taught on payment of fee fixed by the University The candidates appearing at examination from any examination centre located in Jaipur City will attend the practical camp at the University Post Graduate Department on payment of fee fixed by the University. The candidate will procure Certificate of successful completion of practical training camp from the College/Department of Geography and produce the same at the time of practical examinations

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6. MATHEMATICS

B.Sc. Part III

Teaching : 3 Hours per Week per Theory Paper.

Examination Scheme :

	Min.Pass Marks		Max. Marks
	Science – 54		150
	Arts – 72		200
		Duration	Max.Marks
Paper – I	Algebra	3 hrs.	40 (Science) 53 (Arts)
Paper – II	Complex Analysis	3 hrs.	40 (Science) 53 (Arts)
Paper – III	Mechanics	3 hrs.	40 (Science) 54 (Arts)
Practical		2 hrs.	30 (Science) 40 (Arts)

Note:

1. Common paper will be set for both the Faculties of Social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.
2. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/Head, Department of Mathematics in the college.
3. An Internal/external examiner can conduct Practical Examination of not more than 100 (Hundred) Candidates (20 Candidates in one batch).
4. Each candidate has to pass in Theory and Practical examinations separately.

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Jaipur

BOTANY
B. Sc. Part III (Pass Course Syllabus)

Scheme

Min. Pass Marks : 36		**Max Marks: 100**
Paper I	3 hrs. duration	**Max. Marks 33**
Paper II	3 hrs. duration	**Max. Marks 33**
Paper III	3 hrs. duration	**Max. Marks34**
Practical Min.Marks: 18	4 hrs, duration	**Max. Marks 50**
		3 hours
		4 hours

Duration of examination of each theory paper-
Duration of examination of practicals-

Note:

1. There will be 5 questions in each paper. Allquestions are compulsory. Candidate has to answer all questions in the main answer book only.
2. Q.No. will have 20 very short answer type Questions(not more than 20 words) of half marks each covering entire syllabus.
3. Each paper is divided into four units. There will be one questionfrom each unit. These Q.No. 2 to 5 will have internal choice.

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University of Rajasthan

Syllabus: B.Sc. Part-III (Pass Course)

Zoology

(2022-2023)

Scheme:
Max. Marks: 100 Min. Pass Marks: 36

Paper I	**: 3 Hrs duration**	**33 Marks**
Paper II	: 3 Hrs duration	33 Marks
Paper III	: 3 Hrs duration	34 Marks
Practicals	: 4 Hrs. duration	50 Marks

NOTE:

1. There will be two parts of every theory question paper with total duration of 3 hours. First part of question paper will comprise question No. 1 containing 9 (Paper I & II) or 10 (Paper III) very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus.
   Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section out of which candidate will be required to attempt any 4 question selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

PAPER –I: Z-301
STRUCTURE AND FUNCTIONS OF CHORDATE TYPES

NOTE:

1. There will be two parts of this theory question paper with total duration of 3 hours. First part of question paper will comprise question No. 1 containing 9 very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus.
   Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part i.e. three from each unit /section, out of which candidate will be required to attempt any 4 question selecting at least one question from each unit/section. Each question will carry 6 marks
2. The candidate has to answer all questions in the main answer book only.

Section – A

Chordates

1. Comparison of habit, external features and anatomy of *Herdmania* and *Branchiostoma* (excluding development).
2. Ascidian tadpole larva and its metamorphosis.
3. Affinities of Hemichordata, Urochordata and Cephlochordata
4. Habit, habitat and salient features of *Petromyzon*, Ammocoete larva.

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B. SC – III

2. CHEMISTRY
Scheme

Max Marks: 150

	Duration (hrs)	Max. Marks	Min. Pass Marks
Paper I	3	33	
Paper-II	3	33	36
Paper-III	3	34	
Practical	5	50	18

Note: Ten (10) questions are to be set taking two (02) questions from each unit. Candidates have to answer any 5 questions selecting at least one question from each unit.

CH-301 Paper-I : Inorganic Chemistry
(2 hrs or 3 periods/ week)

Unit-I

Hard and Soft Acids and Bases (HSAB):
Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

Unit-II

Metal-ligand bonding in Transition Metal complexes:
Limitations of valence bond theory, an elementary idea of crystal-field theory, crystal-field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

Magnetic properties of Transition Metal Complexes:
Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of μ_s, and μ_{eff} values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

Unit-III

Electron spectra of Transition Metal Complexes:
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel energy level diagram for d^1 and d^9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

Thermodynamic and Kinetic Aspects of Metal Complexes:
A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes.

Unit-IV

Organometallic Chemistry:
Definition, nomenclature and classification of organometallic compounds. Preparation,

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B.Sc- III 2nd

PHYSICS

Scheme			
Paper I	Exam: 3 hours duration	Min Pass marks: 12	Max. Marks : 33
Paper II	Exam: 3 hours duration	Min Pass marks: 12	Max. Marks : 33
Paper III	Exam: 3 hours duration	Min Pass marks: 12	Max. Marks : 34
Practical	Exam: 4 hours duration	Min Pass marks: 18	Max. Marks : 50

Paper I: Quantum Mechanics and Spectroscopy

Work Load: Two hours Lecture per week

Scheme of Examination: First question will be of nine marks comprising of six short answer type parts each with answer not exceeding half a page. Remaining four questions will be set with one question from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying three marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

Unit – I : Evolution of quantum physics

1. Difficulties of classical mechanics to explain: the black-body emission spectrum, specific heat of solids. Plank quanta concept and radiation law, Photo electric effect and Einstein's explanations. Compton effect, De-Broglie hypothesis, diffraction and interference experiments of particle (Davisson-Germer experiment).

2. Uncertainty principle: position and momentum, angle and angular momentum, energy and time. Application of uncertainty principle: (i) Ground state energy of hydrogen atom, (ii) ground state energy of simple harmonic oscillator, (iii) Natural width of spectral lines, (iv) Non-existence of electron in nucleus.

3. Operators: linear operators, product of two operators, commuting and non-commuting operators, simultaneous eigen functions and eigen values, orthogonal wavefunctions. Herminian operators, their eigenvalues, Hermitian adjoint operators.

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B.A/B.SC IInd

B. Geography

Scheme of Examination

Faculty	Min. Pass Marks	Max. Marks
Arts/Social Science	72	200
Science	54	150
Paper I	Resources Geography	Arts 75 Science 50
Paper II	Human Geography	Arts 75 Science 50
Practical	18	Arts 50 Science 50

Notes

1. Students are permitted to use the stencils, simple calculator and log tables wherever needed in both theory and practical examinations.
2. There will be a common paper for Arts and Science.
3. Q.1 will be compulsory and will cover the entire course of the paper.

   Q No. 1 of 20% marks of the maximum marks be set in two parts

   (a) Part (a) will have ten items for locating on a map (to be supplied by examination centre) carrying 10% marks of the maximum marks and candidates shall attempt any five items.

   (b) Part (b) will have 10 short answer questions carrying 10% marks of the maximum marks and candidates shall attempt any five items.
4. Remaining 9 questions carrying equal marks will be set with three questions from each section of the syllabus.
5. Candidate will attempt 5 questions in all including question No. 1 selecting at least one question from each section.
6. Practical examination will be conducted by the board of examiners.
7. The candidate will have to pass in theory and practical separately.
8. The non-collegiate candidates will have to attend a practical training camp of 48 hours at a college affiliated to the University of Rajasthan, Jaipur notified by the University from time to time in which Geography subject is taught on payment of fee fixed by the University. The candidates appearing at examination from any examination centre located in Jaipur City will attend the practical camp at the University Post Graduate Department on payment of fee fixed by the University. The candidate will procure Certificate of successful completion of practical training camp from the College/Department of Geography and produce the same at the time of practical examinations.

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6. MATHEMATICS

B.Sc. Part-II 2020

Teaching : 3 Hours per Week per Theory Paper.
2 Hours per Week per Batch for Practical

Examination Scheme:

	Min.Pass Marks		Max. Marks
	Science – 54		150
	Arts – 72		200
		Duration	Max. Marks
Paper – I	Real Analysis	3 hrs.	40 (Science) 53 (Arts)
Paper – II	Differential Equations	3 hrs.	40 (Science) 53 (Arts)
Paper – III	Numerical Analysis	3 hrs.	40 (Science) 54 (Arts)
Practical		2 hrs.	30 (Science) 40 (Arts)

Note:

1. Common paper will be set for both the Faculties of Social Science and Science. However, the marks obtained by the candidate in the case of Faculty of Social Science will be converted according to the ratio of the maximum marks of the papers in the two Faculties.
2. Each candidate is required to appear in the Practical examination to be conducted by internal and external examiners. External examiner will be appointed by the University and internal examiner will be appointed by the Principal in consultation with Local Head/Head, Department of Mathematics in the college.
3. An Internal/external examiner can conduct Practical Examination of not more than **100 (Hundred)** Candidates.
4. Each candidate has to pass in Theory and Practical examinations separately.

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BOTANY
B.Sc. Part II (Pass Course Syllabus)

Scheme

Min. Pass Marks: 36		**Max Marks: 100**
Paper I	3 hrs. duration	**Max. Marks 33**
Paper II	3 hrs. duration	**Max. Marks 33**
Paper III	3 hrs. duration	**Max. Marks34**
Practical Min.Marks: 18	4 hrs, duration	**Max. Marks 50**

Duration of examination of each theory paper- **3 hours**
Duration of examination of practicals- **4 hours**

Note:

1. There will be 5 questions in each paper. Allquestions are compulsory. Candidate has to answer all questions in the main answer book only.
2. Q.No. 1 will have 18 very short answer type Questions(not more than 20 words) of half marks each covering entire syllabus.
3. Each paper is divided into four units. There will be one questionfrom each unit.These Q.No. 2 to 5 will have internal choice.

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University of Rajasthan

Syllabus B. Sc. Part II (Pass Course)

Zoology

(2022-2023)

Scheme:
Max. Marks: 100 Min. Marks: 36

Paper I	**: 3 Hrs duration**	**33 Marks**
Paper II	**: 3 Hrs duration**	**33 Marks**
Paper III	**: 3 Hrs duration**	**34 Marks**
Practical	**: 4 Hrs duration**	**50 Marks**

NOTE:

1. There will be two parts of every theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 (Paper I & II) or 10 (Paper III) very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus.
   Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.,* three from each unit /section out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

PAPER – I: Z-201
STRUCTURE AND FUNCTION OF INVERTEBRATE TYPES

NOTE:

1. There will be two parts of this theory question paper with a total duration of 3 hours. First part of question paper will comprise of question No. 1 containing 9 very short answer (Maximum 25 words) type questions, each of 1 mark. This part is compulsory to attempt. Questions should be evenly distributed covering entire syllabus.
   Second part of question paper will be of long answer type questions having three sections. There will be total 9 questions (Q. No. 2 to 10) in this part, *i.e.*, three from each unit /section, out of which candidate will be required to attempt any 4 questions selecting at least one question from each unit/section. Each question will carry 6 marks.
2. The candidate has to answer all questions in the main answer book only.

Section – A

Habit, Habitat,Morphology,Structure, Organs and Systems (Locomotion, Digestive, Circulatory, Respiratory, Excretory, Nervous &Reproductive), Life Cycle,*Affinities and *Adaptations.

Note :* indicates whenever required.

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B.Sc – IInd

2. CHEMISTRY

Scheme:
Max Marks: 150

	Duration (hrs.)	Max. Marks	Min. Pass Marks
Paper-I	3	33	
Paper-II	3	33	36
Paper-III	3	34	
Practical	5	50	18

Note: Ten (10) questions are to be set taking two (02) questions from each unit. Candidates have to answer any 5 questions selecting at least one question from each unit.

CH-201 Paper-I: Inorganic Chemistry
(2 hrs or 3 periods/week)

Unit-I

Chemistry of Elements of First Transition Series:
Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation-states, coordination number and geometry.

Chemistry of Elements of Second and Third Transition Series:
General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

Unit-II

Coordination Compounds:
Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

Unit-III

Chemistry of Lanthanide and Actinide Elements:
Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.
General features of chemistry of separation of Np, Pu and Am from U, electronic configuration, oxidation states, magnetic properties, coordination behavior, comparison of Lanthanides and Actinides with d-block elements.

Unit IV

Oxidation and Reduction:
Redox Potential, Potential data, analysis of redox stability in water, Frost, Latimer and Pourbaix diagrams, Application of redox principles, extraction of elements.

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University of Rajasthan, Jaipur

B.Sc. Pt.-II

I. PHYSICS

Scheme : Max. Marks: 100

Min. Pass Marks: 36

Paper I	3 hrs. duration	Max. Marks: 33	Min. Pass marks 12
Paper II	3 hrs. duration	Max. Marks: 33	Min. Pass marks 12
Paper III	3 hrs. duration	Max. Marks: 34	Min. Pass marks 12
Practical	5 hrs. duration	Max. Marks: 50	Min. Pass marks 18

Paper-I : Thermodynamics and Statistical Physics

Work Load: 2 hrs. Lecture /week

Examination Duration: 3 Hrs.

Scheme of Examination: First question will be of nine marks comprising of six parts of short answer type with answer not exceeding half a page. Remaining four questions will be set with one from each of the unit and will be of six marks each. Second to fifth question will have two parts namely (A) and (B) each carrying 3 marks. Part (A) of second to fifth question shall be compulsory and Part (B) of these questions will have internal choice.

Unit-1

Thermal and adiabatic interactions: Thermal interaction; Zeroth law of thermodynamics; System in thermal contact with a heat reservoir (canonical distribution); Energy fluctuations; Entropy of a system in a heat bath; Helmholtz free energy; Adiabatic interaction and enthalpy; General interaction and first law of thermodynamics; Infinitesimal general interaction; Gibb's free energy; Phase transitions, Clausius Clapeyron equation; Vapour pressure curve; Heat engine and efficiency of engine, Carnot's Cycle; Thermodynamic scale as an absolute scale; Maxwell relations and their applications.

Unit-2

Production of law temperatures and applications: Joule Thomson expansion and J T coefficients for ideal as well as Vander Waal's gas, porous plug experiment, temperature inversion, Regenerative cooling, Cooling by adiabatic expansion and demagnetization; Liquid Helium, He I and He II superfludity, Refrigeration through Helium dilution, Quest for absolute zero, Nernst heat theorem

The distribution of molecular velocities: Distribution law of molecular velocities, most probable, average and r m s velocities; Energy distribution function; effusion and molecular beam, Experimental verification of the Maxwell velocity distribution; The principle of equi-partition of energy

Transport phenomena: Mean free path, distribution of free paths, coefficients of viscosity, thermal conductivity, diffusion and their interaction.

Unit-3

Classical Statistics: Validity of Classical approximation; Phase space micro and macro states; Thermodynamic probability, relation between entropy and thermodynamic probability, Monoatomic ideal gas, Barometric equation; Specific heat capacity of diatomic gas, Heat capacity of solids

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B.A. Part-II Examination

(Under 10+2+3 Pattern)

R.11 (2)

The number of papers and the maximum marks for each paper together with the minimum marks required for a pass are shown in the scheme of Examination on against each subject separately. It will be necessary for a candidate to pass in the theory part as well as the practical part of a subject/ paper, wherever prescribed, separately classification of successful candidates shall be as follows :

First Division 60%
Second Division 48%
} of the aggregate marks obtained at the Part I, II, & III Examination, taken together

All the rest will be declared to have passed the Examination if they obtain the minimum pass marks in each subjects, viz. 36%No division shall be awarded at the Part-I and Part-II examination.

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UG SYLLABUS

B.COM (PASS COURSE) Part – II

EXAMINATION

Economic Administration and Financial Management

Scheme of Examination

The number of papers and the maximum marks for each paper together with the minimum marks required for a pass are shown against each subject separately. It will be necessary for a candidate to pass in the theory part as well as practical part of a subject/paper, wherever prescribed, separately, classification of successful candidates shall be as follows:

First Division	60%	of the aggregate marks prescribed at (a) Part I Examination, (b) Part II Examination, (c) Part III Examination taken together
Second Division	48%	

All the rest will be declared to have passed the examination if they obtain the minimum pass mark in each subject viz. 36%. No division shall be awarded at the Part I and the Part II Examination.

There will be five questions in all. The candidate will require to attempt all the questions selecting one question from each unit with an internal choice (either/or).

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B.Com. (Pass) Course – III rd

SCHEME OF EXAMINATION

The number of papers and the maximum for each paper together with the minimum marks required for a pass are shown against each subject separately. It will be necessary for a candidate to pass in the theory part as well as the practical part of a subject paper, wherever prescribed, separately classification of successful candidates shall be as follows :

First Division 60%
Second Division 48%

} Of the aggregate marks prescribed at (a) Part-I Examination, (b) Part-II Examination (c) Part-III Examination, taken together

All the rest shall be declared to have passed the examination if they obtain the minimum pass marks in each subject, viz., 36% No division shall be awarded at the Part-I and Part-II examination.

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UNIVERSITY OF RAJASTHAN, JAIPUR

Four Year Undergraduate Programme

Faculty of Commerce

Programme Name:

UG0202 – Four Year Bachelor of Commerce

B. Com.

Subject/Discipline - ABST

(Syllabus as per NEP – 2020 and Choice Based Credit System)

Medium of instruction: Hindi/English

w.e.f. Academic Session 2023-24

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Scheme of Examination-

1 credit = 25 marks for examination/evaluation

Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous Assessment (20% weightage) and (End of Semester Examination) EoSE (80% weightage).

1. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study.
2. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration. The question paper will have three parts as: -
   - Part-A of the paper shall have 10 very short answer type questions of 02 marks each.
   - Part-B of the paper shall consist of 04 short answer type questions selecting one question from each unit of 10 marks. The student shall attempt any two questions.
   - Part-C of the paper shall consist of 04 questions. The 04 questions will be set with one from each of the units with internal choice. Each question carries 20 marks.
3. 75% Attendance is mandatory for appearing in EoSE.
4. To appear in the EoSE examination of a course/subject student must appear in the mid-semester examination and obtain at least a "C" grade in the course/subject.
5. Credit points in a Course/Subject will be assigned only if, the student obtains at least a C grade in midterm and EoSE examination of a Course/Subject.

Contact Hours:15 Weeks per Semester

L – Lecture	(1 Credit = 1 Hour/Week)
T – Tutorial	(1 Credit = 1 Hour/Week)
S – Seminar	(1 Credit = 2 Hours/Week)
P – Practical	(1 Credit = 2 Hours/Week)
F – Field Practice/Projects	(1 Credit = 2 Hours/Week)
SA – Studio Activities	(1 Credit = 2 Hours/Week)
I – Internship	(1 Credit = 2 Hours/Week)
C – Community Engagement and Service	(1 Credit = 2 Hours/Week)

Exit and Entrance Policy

1. Students who opt to exit after completion of the first year and have secured 48 credits will be awarded a **UG Certificate** if, in addition, they complete one internship of 4 credits during the summer vacation of the first year. These students are allowed to re-enter the degree programme within three years and complete the degree programme within the stipulated maximum period of seven years.
2. Students who opt to exit after completion of the second year and have secured 96 credits will be awarded the UG diploma if, in addition, they complete one internship of 4 credits during the summer vacation of the second year. These students are allowed to re-enter within a period of three years and complete the degree programme within the maximum period of seven years.
3. Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 150 credits and satisfying the minimum credit requirement.
4. A four-year UG Honours degree in the major discipline will be awarded to those who complete a four-year degree programme with 200 credits and have satisfied the minimum credit requirements.
5. Students who secure 75% marks and above in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the

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University/College. The research project/dissertation will be in the major discipline. The students who secure 200 credits, including 12 credits from a research project/dissertation, are awarded UG Degree (Honours with Research).

Letter Grades and Grade Points

Letter Grade	Grade Point	Marks Range (%)
O (outstanding)	10	91 - 100
A+ (Excellent)	9	81 - 90
A (Very good)	8	71 - 80
B+ (Good)	7	61 - 70
B (Above average)	6	51 - 60
C (Average)	5	40 - 50
P (Pass)	4	
F (Fail)	0	
Ab (Absent)	0	

Semester wise Paper Titles

Programme Name: UG0202 - Four Year Bachelor of Commerce								
				UG0202-B.Com.	Credits			
S. N.	Level	Semester	Type	Title	L	T	P	Total
1	5	I	MJR	UG0202-ABS-51T-101-Financial Accounting	6	0	0	6
2	5	II	MJR	UG0202-ABS-52T-107-Business Statistics	6	0	0	6
3	6	III	MJR	UG0202-ABS-63T-201-Cost Accounting	6	0	0	6
4	6	IV	MJR	UG0202-ABS-64T-209-Income Tax Law & Practice	6	0	0	6
5	7	V	MJR	UG0202-ABS-75T-301-Auditing	6	0	0	6
6	7	VI	MJR	UG0202-ABS-76T-307-Goods and Services Tax (GST)	6	0	0	6
7	8	VII	MJR	UG0202-ABS-87T-401-Research Methodology-I	6	0	0	6
8	8	VIII	MJR	UG0202-ABS-88T-407- Research Methodology-II	6	0	0	6

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SYLLABUS

(Three/Four Year Under Graduate Programme in Social Science)

I & II Semester

Examination-2023-24

As per NEP - 2020

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SCHEME OF EXAMINATION FOR UNDERGRADUATE PROGRAMME AS PER UGC FRAMEWORK FOR THE SESSION 2023-24

Subject: Political Science

1. 1 Credit =25 marks for examination/evaluation. Continuous assessment in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous Assessment (20% weightage) and End of Semester Examination (EoSE) (80% weightage).
2. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of the study.
3. Each paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration.
4. 'Part A' of the paper shall have 10 multiple short answer questions of 2 marks each. This question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
5. 'Part B' of the paper shall consist of 4 questions, each taken from different unit and the student shall attempt any 2 questions that carries 10 marks each.
6. 'Part C' of the paper shall consist of 8 descriptive questions with 2 questions having internal choices, taken from each unit. Question shall be drawn from each unit and also the corresponding internal choice from the same unit. Student shall attempt 1 question from each unit. Each question shall be of 20 marks.
7. 75% attendance is mandatory for appearing in EoSE.
8. To appear in the EoSE of a course/subject, the student must appear in the mid-semester examination and obtain at least C grade in the course/subject.
9. Credit points in a course/subject will be assigned only if, the student obtains at least C grade in midterm and EoSE examination of a course/subject.

RJ Jain
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UNIVERSITY OF RAJASTHAN

Programme Name: UG -9101-THREE/FOUR YEAR BACHELOR OF ARTS
DISCIPLINE: - PUBLIC ADMINISTRATION

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SCHEME OF EXAMINATION FOR UNDERGRADUATE PROGRAMME AS PER UGC FRAMEWORK FOR SESSION 2023-24.

1 Credit =25 marks for examination/evaluation

Continuous assessment in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous Assessment (20% Weightage) and (End of Semester Examination) EoSE (80% Weightage).

1. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of the study.

2. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration.

- Part A of the paper shall have 10 multiple short answer questions of 2 marks each. This first question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
- Part B of the paper shall consist of 4 questions and the student shall attempt only 2 questions that carries 10 marks each.
- Part C of the paper shall consist of 4 units carrying 2 descriptive questions with internal choice from each unit of the syllabus. Question shall be drawn from each unit specifically to the corresponding internal choice. Student shall attempt 1 question from each unit. Each question carries 20 marks.
- 75% attendance is mandatory for appearing in EoSE.
- To appear in the EoSE of a course/subject must appear in the mid-semester examination and obtain at least a C grade in the course/subject.
- Credit points in a course/subject will be assigned only if, the student obtains at least a C grade in mid-term and EoSE examination of a course/subject.

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	UG9112 Three/Four Year Bachelor of Arts Subject/ Discipline- Sociology							
					Credits			
	Level	Semester	Type	Title	L	T	P	TOTAL
1.	5	I	MJR	Exploring Sociology	6			6
2.	5	II	MJR	Basic concepts in Sociology	6			6
3.	6	III	MJR	Sociology of Indian Society	6			6
4.	6	IV	MJR	Social Research and Sociological Enquiry	4	2		6
5.	7	V	MJR	Classical Sociological Traditions	6			6
6.	7	VI	MJR	Indian Sociological Thought	6			6

Scheme of Examination

CA: 20% and EOSE- 80 %

SOC 1-6: 6 credits= 150 marks (30 CA and 120 EOSE)

Continuous assessment- Compulsory to appear in mid-semester exam and obtain at least C grade

Sessional work: Class test/ Mid-semester examination/ homework assignment to be decided by BOS

EOSE: Duration 3 hours; 2 parts

Part A: One question with two parts each carrying 20 marks. The first part will have 20 Multiple choice questions of one mark each and the second part will have 10 short answer type questions carrying 2 marks each.

Part B: 04 questions to be set from each unit with one from each unit with internal choice. Third and Fourth question shall be based on application of topics/texts covered in syllabus (60%) and shall involve solving problems (40% weightage)

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SYLLABUS

(Three/Four Year Under Graduate Programme)

B.A. – Economics

I & II Semester

Examination-2023-24

As per NEP - 2020

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Programme Outcomes (POs):

- Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- Provides a firm basis for much of the advanced thinking in the Economics discipline. It provides the student with a logical paradigm for modelling and interpreting the behaviour and interactions of houscholds, firms, and government institutions.
- Understand the basic economic issues and problems of real world.
- Learn the mathematical and statistical techniques necessary for a proper understanding of the discipline, get trained to collect primary data and gain an understanding of proper policy responses to economic problems.
- Learn to use scientific empirical methods to arrive at conclusions about the validity of economic theories.
- Providing students the flexibility to prepare for careers in academia, law, management, journalism, government, and many other fields.

Scheme of Examination for the Session 2023-2024

Scheme of the Examination for Practical subjects:

1 Credit = 25 marks for examination/evaluation

Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous assessment (20% Weightage) and (End of Semester Examination) EoSE (80% Weightage).

1. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study.

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2. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration.
   - Part-A of the paper shall have multiple questions of equal marks. This first question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
   - Part-B of the paper shall consist of 4 questions with an internal choice of each. The four questions will be set with one from each of the units with internal choice. Third to fourth questions shall be based on applications of the topics/texts covered in the syllabus (60% Weightage) and shall involve solving Problems (40% Weightage) if applicable.
3. 75% Attendance is mandatory for appearing in EoSE.
4. To appear in the EoSE examination of a course/subject student must appear in the mid-semester examination and obtain at least a "C" grade in the course/subject.
5. Credit points in a Course/Subject will be assigned only if, the student obtains at least a C grade in midterm and EoSE examination of a Course/Subject.

Scheme of the Examination for Non-practical subjects:

1 Credit = 25 marks for examination/evaluation

Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous assessment (20% weightage) and (End of Semester Examination) EoSE (80% weightage).

6. Sessional work will consist of class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study.
7. Each Paper of EoSE shall carry 80% of the total marks of the course/subject. The EoSE will be of 3 hours duration.
   - Part-A of the paper shall have multiple questions of equal marks. This first question shall be based on knowledge, understanding and applications of the topics/texts covered in the syllabus.
   - Part B of the paper shall consist of 2 questions with an internal choice of each. The questions will be set with one from each of the units.

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UNIVERISTY OF RAJASTHAN
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SYLLABUS
Three/Four Year Undergraduate Programme in English

I & II Semester
Examination 2023-24

As per NEP 2020

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B.A. Literature (English Literature Syllabus

B.A. English Literature Part I 2023-24

Semester Scheme

B.A. English Literature Part I

SEMESTER I
Paper I - Applied Language Skills and Literary Analysis

The Syllabus aims at achieving the following objectives:

- Introduce various literary devices, different genres and forms of literature
- Critically analyze prose pieces and write
- Appreciate poetry
- Practice Journalistic report writing and know how it is different from other forms of prose writing
- Write advertisement copy, to be able to write catchy, precise advertisement copies
- Develop writing skills by practicing theme writing

Maximum Marks:150 **Min. Marks: 40**

Duration: 3 hrs **Internal Marks: 30**

Candidates will be required to answer five questions in all with at least one from eachUnit.

UNIT I

Analysis of a literary text (prose and poetry) in terms of imagery, diction, structure,tone, point of view, referential and connotative meaning. **40 marks**

UNIT II

Journalistic Report Writing, Writing an Editorial **20 marks**

UNIT III

Theme writing, One out of Three Topics. **30 marks**

UNIT IV

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Summary Writing — 30 marks
Tutorials : *Quiz, Seminar, Group Discussion, Presentation, Project*

Recommended Reading:

Vandana R. Singh: *The Written Word (O.U.P.)*
K.M. Shrivastava: *News Reporting and Editing, Sterling Publication*
Parthasarathy, Raagaswami: *Basic Journalism, Macmillan India.* **John Seely:** *Oxford Guide to Writing and Speaking*
A.K. Sinha: *A Students Companion to English Poetry*

Paper II: English Literature: Elizabethan Age and Metaphysicals

The Syllabus aims at achieving the following objectives:

- To build an understanding of the age of Renaissance and Reformation in Europe. Its impact on England in the field of literature, culture, politics and economy
- To create an understanding of the times of Queen Elizabeth I, the rise of New Learning and the factors that contributed to the popularity of drama
- To trace the arrival of blank verse and the sonnet form to England and their extensive use at the hands of well-known sonneteers
- To explore the popularity of the lyric and its use at the hands of great poets like Edmund Spenser
- To understand metaphysical poetry and its characteristics
- To comprehend the importance and cultural setting of a wedding song with reference to Epithalamion
- To look at the impact of Reformation by analyzing the religious poetry of the age

Maximum Marks: 150 — **Min. Marks: 40**
Duration: 3 hrs — **Internal Marks: 30**

Part A - References to Context

Candidate will be required to explain **four (4)** passages of Reference to Context with 5 marks each with a total of **20 Marks.**

Knowledge of Literary Terms and Poetry Appreciation and usages of drama is required.

Part B - The student will be required to attempt 2 questions out of 4. Each question will carry 10 marks each to a total of **20 marks.**

Part C -The other 4 questions will be Essay-type questions of **20 marks** each, one from each unit with internal choice.

UNIT I

The following poems from *The Metaphysical Poets*, ed. Helen Gardner.

John Donne: (i) Sweet Love

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- Sweets- jalebi, sandesh, laddu, coconut barfi, gujiya, fruit stew (apple and pear), pudding, cupcake, brownie 5

Meal planning (with additional emphasis on nutritional problems) for: 25

- Exchange Lists
- Adult man/woman
- Pregnant Woman
- Lactating Woman
- Packed lunch for school going child
- Elderly

2. **Scheme of Examination –**
   - Practical exam (total 50 marks)
   - Internal and record: 10 marks
   - Planning of two recipes: 20 marks
   - Preparation of two recipes: 20 marks

3. **Suggested books and reference including links to e-resources –**
   - Khanna K, Gupta S, Seth R, Mahna R, Rekhi T (2004). The Art and Science of Cooking: A Practical Manual, Revised Edition. Elite Publishing House Pvt Ltd.
   - Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S (2010). Basic Food Preparation:A Complete Manual, Fourth Edition. Orient Black Swan Ltd.
   - http://ecoursesonline.iasri.res.in/course/view.php?id=184
   - http://ecoursesonline.iasri.res.in/mod/page/view.php?id=19593
   - http://ecoursesonline.iasri.res.in/mod/page/view.php?id=19575

Learning Outcomes-

- The learners will be able to prepare various recipes from different food groups based on principles and methods of cooking.
- The learners will be able to plan appropriate meals for people from different stages of life.

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Details of AECC/SEC/ Generic Elective Courses

For Fresher's who will be admitted in the session 2023-24

Name of University: UNIVERSITY OF RAJASTHAN, JAIPUR
Name of Faculty: Fine Arts

Name of Discipline/ Subject: **Drawing and Painting**

List of Ability Enhancement Compulsory Courses (AECC)								
					Credits			
#	Level	Sem.	Sub. Code	Title	L	T	P	Total
1	5	I	DRP-51T-101	Fundamental of Fine Arts (Theory)	2	-	-	2
2	5	I	DRP-51P-102	Study from object (Still Life)	-	-	4	4
								2 +4=6
3	5	II	DRP-52T-103	Fundamental of Fine Arts (Theory)	2	-	-	2
4	5	II	DRP-52P-104	Creative Design	-	-	4	4
								2 +4=6

1 Credit= 1 Hour Theory Lecture (L) per week
1 Credit= 2 Hours Practical (P) per week

SYLLABUS

B.A. SEMESTER-I & II 2023-24

EXAMINATION SCHEME :

SEMESTER-I

Name of Paper	Duration of Exam	EoSE Max. Marks	EoSE Min. Marks	Internal (CA) Max. Marks	Internal (CA) Min. Marks	Max marks	Min. Marks
Fundamentals of Fine Arts (Theory)	3 hrs.	40	16	10	04	50	20
Study from object (Still life) (Practical)	3 hrs.	80	32	20	08	100	40

Note:-Minimum 40% required in CA/Internal Exam to appear in EoSE(End of Semester Exam)

SEMESTER-II

Name of Paper	Duration of Exam	EoSE Max. Marks	EoSE Min. Marks	Internal (CA) Max. Marks	Internal (CA) Min. Marks	Max marks	Min. Marks
Fundamentals of Fine Arts (Theory)	3 hrs.	40	16	10	04	50	20
Creative Design (Practical)	3 hrs.	80	32	20	08	100	40

Note:-Minimum 40% required in CA/Internal Exam to appear in EoSE (End of Semester Exam)

EXAMINATION SCHEME OF THEORY PAPER :

Note : The theory paper consist of three parts :-
Part –I: Carries 10 marks and consist of 10 short type questions of 1 marks each.
Part –II: Attempt any four questions of 10 marks ($2^{1/2}$ marks of each question) with internal choice.
Candidates are required to write each answer with the limit of 50-60 words.
Part –III: Attempt any two questions of 20 marks (10 marks of each question) with internal choice.
Candidates are required to write each answer with the limit of 500-600 words.

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