INFORMATION BROCHURE

ADMISSION TO PHD PROGRAMME JULY 2024

RESEARCH UNIT

INDIRA GANDHI NATIONAL OPEN UNIVERSITY (IGNOU)

Maidan Garhi,New Delhi-110068

www.ignou.ac.in

For queries, applicants may contact:

researchunit@ignou.ac.in

Monday to Friday

(excluding Gazetted holidays)

DISCLAIMER

The Ph.D. information brochure for July 2024 is a compendium of inputs assembled and collated from various Schools, Disciplines and other related sources.

The Indira Gandhi National Open University (IGNOU) reserves the right to revise, amend or delete any part of this information brochure without prior notice. Any change so made shall be updated on the website of IGNOU. Any change in admission rules after the release of the Ph.D. Information Brochure shall become effective from the date it is uploaded on the IGNOU website, www.ignou.ac.in.

The candidate is responsible for regularly checking the official website of IGNOU for updates, if any, in guidelines, schedules, and admission-related information.

For notifications and updates regarding Ph.D. Admissions, 2024, Kindly visit: www.ignou.ac.in

Note: Last date for filling the PhD online admission form for July 2024 session is extended from 20.11.2024 to 25.11.2024

For filling the PhD online admission form for July 2024 session, kindly use the URL link given below:

https://ignouadm.samarth.edu.in/phd/index.php

A. GENERAL INFORMATION

1. Applications are invited for admission to Ph.D programme for the July 2024 session. The list of disciplines, names of the programme coordinators, discipline wise number of seats (category-wise) available and eligibility criteria are given in **Appendix I**.
2. The Ph.D. programme is offered in compliance with the UGC (Minimum Standards and Procedure for award of Ph.D Degrees) Regulations, 2022 and amendments there to from time to time.
3. IGNOU offers Ph.D programme under two categories: Part time and Full time. Both categories of students will be required to attend course work classes as per the IGNOU PhD Guidelines.
4. The minimum and maximum duration of Ph.D programme is three years and six years respectively. Women candidates and Persons with Disabilities (40% or more / "severe" where percentage is not defined) are given two years extra beyond the maximum duration.
5. The Ph.D. programme involves coursework during the first six months of admission, which will be conducted at IGNOU Campus, New Delhi,only. A student has to attend the coursework on regular basis. At least 80 per cent attendance is compulsory.
6. As of now, IGNOU does not have hostel facilities for students. Students have to make their own arrangements for stay in Delhi.
7. The candidates, who are in employment and wish to pursue part time Ph.D shall obtain NOC from their respective employers in the prescribed format as attached below as **Annexure-IV** which is mandatory for attending the interview (if qualified).

B. SELECTION PROCEEDURE:

1. Admission to the PhD programme shall be done on the basis of the candidate's performance in the UGC NET examination and Interview conducted by the University in the following manner:
   (i) **For Category A Candidates who qualified UGC NET with Fellowship (With JRF)** has to fill the online admission form for Ph.D. He/ She shall be called for interview carrying 100% weightage.
   (ii) **For Category B Candidates who qualified UGC NET without Fellowship (this covers the Category 2 and 3 of UGC NET)** during the year 2024 has to also fill the online admission form for Ph.D. They shall be called for interview based on the merit of their UGC NET score which shall carry a weightage of 70% and 30% weightage shall be given to the interview.
2. Interviews will be conducted by the University at its headquarters, Maidan Garhi, New Delhi only. Eligible candidates shall be called for interview before the **Discipline Specific Admission Committee**. Information in this regard shall be uploaded on the University website.
3. The interview shall have three components comprising Research Methodology(40%)

Subject domain (40%) and Communication Skills (20%).

4. The candidates are required to bring with them an original identity proof such as Aadhar Card, Voter ID Card, Driving License, Passport and ID Card issued by Govt. Agencies at the time of interview.
5. Based on the performance in the Interview, a combined common merit list (list of finally selected candidates) of both the candidates of Category A and B shall be prepared subject to the Reservation Policy of Government of India and availability of vacancies/seats.
6. List of selected candidates will be displayed on IGNOU official website www.ignou.ac.in. No individual intimation regrading selection will be sent. Hence, the applicants are advised to see the University website regularly for updates regarding the list of selected candidates.
7. Selected candidates will be governed by IGNOU Ordinance/IGNOU Regulations/ Ph.D. Guidelines 2022 and amendments there to from time to time for conduct of Ph.D Degree Programmes.
8. Offer letters for admission will be sent to the Selected Candidates, only.

C. GENERAL ELIGIBILITY CRITERIA FOR Ph.D ADMISSION:

The eligibility criteria for admission to Ph.D programme are as follows:

1. Candidates who have completed: 1-year/2-semester master's degree programme after a 4-year/8-semester bachelor's degree programme or a 2-year/4-semester master's degree programme after a 3-year/6 semesters bachelor's degree programme or qualifications declared equivalent to the master's degree by the corresponding statutory regulatory body, with at least 55% marks in aggregate or its equivalent grade in a point scale wherever grading system is followed.

or

equivalent qualification from a foreign educational institution accredited by an assessment and accreditation agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country to assess, accredit or assure quality and standards of the educational institution.

A relaxation of 5% marks or its equivalent grade may be allowed for those belonging to SC/ST/OBC(non-creamylayer)/Differently-Abled, Economically Weaker Section(EWS) and other categories of candidates as per the decision of the Commission from time to time.

Provided that a candidate seeking admission after a 4-year/8-semester bachelor's degree programme should have a minimum of 75% marks in aggregate or its equivalent grade on a point scale wherever the grading system is followed. A relaxation of 5% marks or its equivalent grade may be allowed for those belonging to SC/ST/OBC (non-creamy layer)/Differently-Abled, Economically Weaker Section (EWS) and other categories of candidates as per the decision of the

Commission from time to time.

2. Candidates who have completed the M.Phil. programme with at least 55% marks in aggregate or its equivalent grade in a point scale wherever grading system is followed or equivalent qualification from a foreign educational institution accredited by an assessment and accreditation agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country to assess, accredit or assure quality and standards of educational institutions, shall be eligible for admission to the Ph.D. programme. A relaxation of 5% marks or its equivalent grade may be allowed for those belonging to SC/ST/OBC (non-creamy layer)/Differently-Abled, Economically Weaker Section (EWS) and other categories of candidates as per the decision of the Commission from time to time.

a) See **Appendix I** for further details of discipline wise vacancy and specific eligibility criteria.

Note: Application fees is Rs. 1000/- (Rupees One Thousand Only). The application fees is non refundable.

- A Candidate can apply for one discipline, only.
- The candidates before applying for Ph.D. Programme must ensure their fulfillment of specific eligibility criteria (as mentioned in the Appendix-I against each discipline) before applying.
- In case, a Candidate applies for a particular Discipline without fulfilling the specific eligibility criteria of that Discipline, the University shall not consider such application.
- Admission granted will be canceled at any time, if it is found that the information furnished by the candidate is false or incorrect or if, at a later stage, it is found that the candidate does not fulfill the eligibility criteria prescribed for the programme.
- The candidates are required to download the filled in registration/application form for future reference.
- Candidates are required to apply through online mode,only. No offline/hard-copy of the application form will be accepted.
- Reservation of seats shall be as per Government of India rules.
- For any discipline specific query at any stage, candidates are advised to contact the concerned Programme Coordinator available on the University website. (http://ignou.ac.in//userfiles/List%20of%20Research%20Programme%20Coordinators.pdf)
- Being called for interview does not entitle a candidate to stake claim for admission. The Doctoral Research Committee may not recommend a candidate if the discipline does not have the specialization in which he/she wants to carry out research.
- The University reserves all the rights not to fill up some or all the seats vacant in a Research Degree programme in case suitable candidates are not found at the level of Interview.

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Appendix-I

Discipline wise number of vacancies and their specific Eligibility Criteria

Sl No	Discipline	School	Vacancy of Seats	Specific Eligibility Criteria, if any
1.	Psychology (PHDPC)	SOSS	UR=08 EWS=02 SC=04 ST=01 OBC=06 **Total - 21**	Possesses Master's Degree in Psychology or a related field from a recognized University / Institute
2.	Anthropology (PHDAN)	SOSS	UR=04 EWS=00 SC=00 ST=00 OBC=01 **Total - 05**	Masters in Anthropology (M.Sc. or M.A.)
3.	History (PHDHIS)	SOSS	UR=04 EWS=00 SC=02 ST=01 OBC=03 **Total - 10**	Master's degree in History
4.	Sociology (PHDSOC)	SOSS	UR=03 EWS=01 SC=00 ST=00 OBC=02 **Total - 06**	Master's degree in Sociology
5.	Bio-Chemistry (PHDBC)	SOS	UR=04 EWS=01 SC=01 ST=01 OBC=03 **Total - 10**	Master's Degree from a recognized university or any other qualification recognized as equivalent thereto in Biochemistry/ allied subjects.
6.	Chemistry (PHDCHEM)	SOS	UR=03 EWS=00 SC=00 ST=00 OBC=01 **Total - 04**	M.Sc. Chemistry from a recognized University / Institute or any other qualification recognized as equivalent thereto in such fields of study as are notified for the purpose from time to time by the University.
7.	Geography (PHDGEOG)	SOS	UR=07 EWS=01 SC=02	M.A. / M.Sc. in Geography, Earth Systems Science and Relevant Discipline of Geospatial Technology.

			ST=01 OBC=04 **Total - 15**	
8.	Geology (PHDGY)	SOS	UR=04 EWS=00 SC=01 ST=01 OBC=03 **Total - 9**	Post graduation in Geology or Geological Science or Applied Geology or Marine Geology or Earth Science and resource management or petroleum geosciences or Petroleum Exploration or Geo Chemistry or Geophysics or Hydrogeology or Geomatics or Geoinformatics or Remote Sensing and GIS from any recognized university
9.	Life Sciences (PHDLS)	SOS	UR=08 EWS=02 SC=03 ST=01 OBC=06 **Total - 20**	MPhil degree or Post Graduate degree in Life Sciences
10.	Physics (PHDPH)	SOS	UR=03 EWS=00 SC=00 ST=00 OBC=01 **Total - 04**	Master's Degree in Physics from a University recognized by UGC .
11.	Statistics (PHDSTAT)	SOS	UR=02 EWS=01 SC=02 ST=01 OBC=02 **Total - 08**	Master's degree in Statistics / Applied Statistics
12.	Mathematics (PHDMT)	SOS	UR=01 EWS=01 SC=01 ST=00 OBC=01 **Total - 04**	Master's or MPhil degree in Mathematics
13.	Hindi (PHDHIN)	SOH	UR=01 EWS=01 SC=01 ST=01 OBC=01 **Total - 05**	Master's Degree in Hindi
14.	Sanskrit (PHDSK)	SOH	UR=01 EWS=00 SC=01 ST=01	Master's Degree in Sanskrit or Acharya or equivalent

			OBC=02 **Total - 05**	
15.	Development Studies (PHDDV)	SOEDS	UR=03 EWS=00 SC=01 ST=01 OBC=02 **Total - 07**	Master's Degree in Development Studies, Economics and UGC NET in Economics
16.	Computer Science (PHDCS)	SOCIS	UR=07 EWS=01 SC=02 ST=01 OBC=04 **Total - 15**	Master of Computer Applications (MCA) or M.Sc in Computer Science / IT/ equivalent or ME/MTech in Computer Science/IT/ equivalent
17.	Interdisciplinary & Trans-disciplinary Studies (PHDITS)	SOITS	UR=07 EWS=01 SC=02 ST=01 OBC=05 **Total - 16**	Master's Degree and UGC NET in Economics, Folk Literature, History, Human Resource Management, Management, Philosophy, Political Science, Sociology, Women's Studies.
18.	Environmental Science (PHDEV)	SOITS	UR=08 EWS=02 SC=03 ST=01 OBC=06 **Total - 20**	Master's Degree in Science /Engineering from a University recognized by UGC
19.	Social Work (PHDSW)	SOSW	UR=04 EWS=02 SC=02 ST=01 OBC=03 **Total - 12**	Master's Degree in Social Work.
20.	Nutritional Science (PHDFN)	SOCE	UR=02 EWS=01 SC=01 ST=00 OBC=02 **Total - 06**	Master's Degree (M.Sc.) in Food and Nutrition / Dietetics / Public Health Nutrition from a recognized Institution with UGC-NET in Home Science.
21.	Child Development (PHDCD)	SOCE	UR=09 EWS=02 SC=04 ST=02 OBC=06 **Total - 23**	Master's in Home Science/Community Science (General and Composite) with a specialization in Child Development, Human Development, Human Development and Childhood Studies, or Human Development and Family studies. Master's in Early Childhood development. M.A. in Education (Early Childhood Care and Education) MA in

				Education. M.Ed. in Special Education in any disability area. M.Sc. in Counselling and Family Therapy. Master's in Psychology with UGC NET in Home Science / Psychology / Education
22.	Rural Development (PHDRD)	SOCE	UR=01 EWS=01 SC=00 ST=00 OBC=01 **Total - 03**	Master's Degree and UGC NET in Social Work, Sociology, Women Studies, Economics, Population Studies, Adult Education, Continuing Education, Andragogy, Non formal education, Education
23.	Home Science (PHDHC)	SOCE	UR=03 EWS=01 SC=02 ST=01 OBC=03 **Total - 10**	Master's Degree in Home Science with a specialization in Community Resource Management and Extension / Home Science Extension / Family Resource Management / Development Communication and Extension /Development Extension / Resource Management and Design Applications/ Home Management / Extension / Extension Education and Communication / Master's Degree in Home Science (General).Master's in Home Science (Clothing and Textiles / Textiles and Clothing / Textiles and Apparel Design / Master's degree in Fabric and Apparel Science) or Master's in Fashion and Textiles / Textiles, Clothing and Fashion Studies / Clothing and Textiles Sciences / Fashion Studies / Fashion Design.
24.	Management (PHDMGMT)	SOMS	UR=04 EWS=01 SC=01 ST=01 OBC=03 **Total - 10**	Master's Degree in Management/ or declared equivalent to the Master's degree by the corresponding statutory regulatory body/ or Master's degree in any allied areas related to Management. Candidates with CA /CS/ CMA (ICWA) qualifications are also eligible to apply.
25.	Commerce (PHDCOM)	SOMS	UR=04 EWS=01 SC=02 ST=01 OBC=03 **Total - 11**	Master's Degree in Commerce or Candidates having qualified CA /CS/ICWA
26.	Vocational Education (PHDVE)	SOVET	UR=05 EWS=01 SC=01 ST=01 OBC=02 **Total - 10**	Master's Degree and UGC NET in Economics, Commerce, Management, Environmental Sciences, Education, Adult and Continuing Education/ Andragogy/ Non Formal Education, Labour Welfare / Personnel Management / Industrial Relations / Labour and Social Welfare / Human Resource Management, Computer Science and Application and Tourism Administration Management.
27.	Education (PHDES)	SOE	UR=10 EWS=03 SC=04	MA(Education) or M.Ed.

			ST=02 OBC=07 **Total - 26**	
28.	Fine Arts (PHDPVA)	SOPVA	UR=01 EWS=00 SC=00 ST=00 OBC=01 **Total - 02**	Master Degree in Fine Arts from a university or a recognized institution of higher learning
29.	Theatre Arts (PHDPVA(T))	SOPVA	UR=04 EWS=01 SC=01 ST=00 OBC=02 **Total - 08**	Post Graduate in theatre arts from any recognised University or M. Phil in Theatre Arts from any recognized university with Post Graduate Degree in Theatre Arts from a university or a recognized institution of higher learning
30.	Music (PHDPVA(M))	SOPVA	UR=05 EWS=00 SC=00 ST=00 OBC=01 **Total - 06**	Master Degree in Music from a university or a recognized institution of higher learning
31.	Dance (PHDPVA(D))	SOPVA	UR=03 EWS=00 SC=01 ST=00 OBC=01 **Total - 05**	Master Degree in Dance (All forms of dance inclusive) from a university or a recognized institution of higher learning.
32.	Gender and Development Studies (PHDGDS)	SOGDS	UR=04 EWS=01 SC=01 ST=00 OBC=02 **Total - 08**	Master's Degree in Gender and Development Studies or Women's Studies or Gender Studies Master's degree in other streams with one or two courses in the area of Gender and Development Studies or Women's Studies or Gender Studies and/or with demonstrable evidence of teaching and / or research and publications in the area of Gender and Development Studies or Women's Studies or Gender Studies and UGC NET in Women's Studies
33.	Tourism and Hospitality Service Management (PHDTS)	SOTHSM	UR=03 EWS=01 SC=00 ST=00 OBC=02 **Total - 06**	Master Degree in Tourism/Hospitality/ Hotel Management
34.	Distance Education (PHDDE)	SOE	UR=07 EWS=02 SC=03 ST=01 OBC=06 **Total - 19**	Master's degree and NET in any discipline, Master's preferably in MADE, MA(Education), M.Ed.

- **Note : Discipline wise five percent (5%) seats shall be reserved for Persons With Disabilities (with not less than 40% disability) shall be adjusted against the appropriate category to which they belong (Gen/SC/ST/OBC/EWS).**

Annexure-IV

(No Objection Certificate from Employer must be submitted by the candidates seeking admission to Part Time Ph D Programme in IGNOU, New Delhi. The NOC should be submitted on the letterhead of the Employer).

Date:

NO OBJECTION CERTIFICATE

This is to certify that Mr./Mrs……..S/O, D/O, W/O……

has been working as (designation)…….. in our institute / Organisation (designation) in our Institute / Organization since (date)…….. Our institute/ organization has no objection on his/ her admission in Ph.D. Programme as per the following terms:

i. Mr. / Mrs……... is permitted to pursue the PhD programme on time basis.

ii. His/her official duties shall permit him/her to devote sufficient time for research.

iii. If required, he/she will be relieved from the duty to complete the course work.

Signature,

Name and Seal of the Employer and Organization

Designation

Contact Address

Appendix–II

Syllabus for Interview in various Disciplines

1. Psychology (PHDPC)

Research Methodology (40%)

Constructs and variables, Steps in psychological research Problem and hypothesis, Type 1 and type 2 errors; Types of research: experimental, non experimental, field experiments, field studies, survey research; action research; Research designs; Paradigms of research; Methods of data collection including interview, observation, objective tests, questionnaire; test construction, reliability and validity, standardisation and norms; Areas of psychological testing, Computer based psychological testing; Applications of psychological testing; Sampling and sampling techniques; Qualitative and quantitative research; Methods of data collection and data analysis in qualitative research; Ethics in research; Statistics in psychology; levels of measurement, descriptive and inferential statistics, measures of central tendency and measures of variability; Correlation and Regression; Normal distribution and normal probability curve; Parametric and nonparametric statistics and their techniques; Orientation of Multivariate Statistics; Understanding of different statistical software for analysis; Process and Elements of Report writing

Subject Specific (40%)

Eastern and Western Perspectives in Psychology; Historical development of Psychology in India; Indian Psychology; Human cognition and mental processes, Theories and assessment of Personality, Intelligence and Creativity; Motivation and Emotions, Stress and Stress Management, Coping and Coping styles and Strategies; Nature and Scope of Social Psychology, Social Cognition, Social Influence, Attitude, Prosocial behaviour and Altruism, Group dynamics, Aggression, Applied social psychology; Nature, principles and factors in human development, Theories of human development; Concepts related to disadvantage and deprivation, discrimination and marginalisation, Glass-ceiling and glass- floor effects, Theories of gender development; Conflict resolution; Factors influencing positive health, well-being and quality of life, Character strengths and virtues; Positive psychology interventions; Influence of media on human cognition and behaviour, Digital learning, Cyberbullying, Artificial intelligence.

Introduction to Industrial and Organisational Psychology; Human Resource Management and Human Resource Development; Recruitment and Selection; Training and Training Methods; Performance Appraisal; Leadership; Managing Diversity; Accidents and Industrial safety; Workplace behaviour and ethical issues; Workplace violence and harassment; Managing conflict; Work motivation; Personality and Attitude in the context of organization; Job Satisfaction; Team work and team building; Organisational Behaviour and Organisational development, Organisational Change, Organisational culture and climate; Management by Objectives; Organisational Citizenship Behaviour; Corporate Social Responsibility, Employee counselling.

Introduction to Counselling; Theories of Counselling; Career counselling and guidance; Stages of counselling and counselling relationship; Assessment in Counselling; Counselling Skills and Techniques; Counselling with regard to various developmental stages; Counselling for Special Population; Counselling in diverse settings; Multicultural counselling; Expressive Therapies; Group and Family counselling; Contemporary trends in Counselling; Ethics in Counselling. Counselling in Indian context, Psychotherapies, and Counselling and technology.

Paradigms and perspectives of psychopathology; Classification of mental disorders (DSM 5 and ICD 10); Personality disorders; Schizophrenia; Mood disorders; Feeding and Eating Disorders; Anxiety Disorders; Obsessive Compulsive and Related Disorders, Dissociative Disorders and Somatic Symptom Disorders; Substance use disorders; Sexuality Disorders and Gender Dysphoria, Stress, Trauma and Psychopathology; Developmental disorders in Childhood, Emotional and Behavioural disorders in Childhood, Diagnosis and tools for diagnosis of mental disorders; Psychoanalysis, Psychotherapies, Behaviour therapy, Humanistic and Existential therapy, Person centered therapy, Gestalt therapy, Cognitive therapy, Cognitive Behaviour therapy; Rational Emotive Behaviour Therapy, Solution focused therapy, Narrative therapy; Indigenous therapies; Group and Family therapies; Ethical issues in psychotherapy.

2. Anthropology (PHDAN)

SECTION A: RESEARCH METHODOLOGY

Anthropology and Methods of Research
Introducing Anthropology: Defining Anthropology, Meaning, Scope, history, Branches of Anthropology, Emerging Frontiers in Anthropology Field Work Tradition in Anthropology: Field Work and its Relevance, Ethnography, Techniques, Methods and Methodology, Genealogy and Pedigree Research Design:Review of Literature and Statement of Research Problem, Theory, Research Design Data Collection Techniques: Primary Data, Secondary Data, Biological Methods, Archaeological Methods Statistical Analysis: Collection and Presentation of Data, Measures of Central Tendency and Dispersion, Statistical Distribution, Using SPSS for Data Analysis Contents.

SECTION B: SUBJECT SPECIFIC

Physical Anthropology Introduction to Physical Anthropology: Definition and Scope, Relationship with Other Disciplines, Applied aspects of Physical Anthropology

Human Evolution: Principles of Evolution, Theories of Organic Evolution, Synthetic Theory, Palaeoanthropology
Primate Study: Living Primates, Primate Behaviour.
Biological Diversity: Concept of Race, Characteristic, Criteria of Biological Diversity, Racial Classification
Human Genetics: Human Genetics, Methods in Human Genetics, Population Genetics, Aberrations in Chromosomes
Human Growth and Development: Principles of Growth, Methods and Influencing Factors, Human Constitution and Physique, Reproductive Biology
Ecological Anthropology: Fundamentals of Ecology, Adaptation to Environment, Epidemiological Anthropology

Social Anthropology
Introduction to Social Anthropology: Social Anthropology: Nature and Scope, Philosophical and Historical Foundations of Social Anthropology, Relationship of Social Anthropology with Allied Disciplines

Society and Culture: Concept of Society and Culture, Social Groups, Social Identity and Movements, Social Change in Indian Context
Anthropological Theories: Classical Theories, Functionalism, Structural Functionalism and Neo-Functionalism, Social Organisation and Dynamic Theories of Structure, Culture and Personality, Marxism, Structuralism, Feminism, Post-Modernism and Post-Colonialism Kinship, Marriage and Family: Kinship, Descent and Alliance Theories, Marriage, Family, Kinship, Family and Marriage in India
Religion: Concepts and Approaches to the Study of Religion, Rituals and Symbolism, Religious Specialists
Economic and Political Organisations: Concepts and Definitions, State and Stateless Societies: Political Institutions, Production, Consumption and Exchange, Political Power and Distribution of Resources

Archaeological Anthropology
Introduction to Archaeological Anthropology: Definitions and Scope, History and Development, Interdisciplinary Relations
Tool types and techniques in Archaeology: Space, Tool Families, Tool- Technologies, Household and Decorative Objects Geological Framework: Time and Space, Recent Period, Human Palaeontology
Dating Methods: Relevance of Dating, Relative and Absolute dating
Lithic Cultures: Palaeolithic, Mesolithic and Neolithic. Evidence of palaeolithic culture in India
Indus valley civilization.

3. History (PHDHIS)

Section-A

Research Methodology and Historiography

1. Objectivity and Interpretation
2. Ancient Indian Historiography
3. Medieval Indian Historiography
4. Modern Indian Historiography

Section-B

Ancient India

i. Indus Valley Civilization

ii. Vedic Society

iii. Buddhism and Jainism

iv. Polity in Ancient India

v. Economy in Ancient India Medieval India

vi. Indian Feudalism

vii. Land Revenue

viii. Urbanization

ix. Polity in Medieval India

x. Bhakti & Sufi Movements

xi. 18th Cent. Debate Modern India

xii. Revolt of 1857

xiii. National Movement

xiv. Economic Impact of Colonial Rule

xv. Social and Intellectual Reform Movements

xvi. Gandhi and Gandhian Ideology

4. Sociology (PHDSOC)

Section - A

1. Research Methodology

- **Logic of enquiry in social research**
- **Logic of Theory Building**
- **Issues of epistemology**
- **Positivism and its critique**
- **Comparative Method**
- **Feminist Method**
- **Participatory Method**

2. Research Methods and Research Design

- **Types of Research**
- **Methods of Research**
- **Research Design**
- **Techniques of Data Collections: Sampling, Interview, Case Study, Life History, Observation, Hypothesis, Correlation and regression.**

Section - B

- **Sociological concepts: social groups, social structure, community, association, culture, identity, tradition, modernity, social processes, social Institutions- family, marriage, kinship, state, religion**
- **Sociological Theories: Evolutionary- Functional, Marxian, Structural-Functional, Structural, Symbolic interactionism, Phenomenology, Post-Modernism**
- **Socialstratification-castes, class, race, gender, ethnicity**
- **Types of societies: colonial, post colonial, simple, agrarian, Industrial, post industrial, knowledge society**
- **Social change: Theories of social change, social transformation, social movements, social development**

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5. Biochemistry (PHDBC)

PART A: RESEARCH METHODOLOGY

Objectives of research methods versus Methodology Types of research: Descriptive vs. Analytical; Applied vs. Fundamental; Quantitative vs. Qualitative;
Conceptual vs. Empirical Literature Review: Methods and Importance Research design: Need, Types and Features of research design, Formulating Research Problem Collection and analysis of Data:
Importance and Methods of data collection, Data Analysis with Statistical Packages Ethical issues in Research: Copy right, Intellectual Property Rights; Plagiarism. Basic Principles and Applications of Analytical techniques.

PART-B: Subject specific paper

i. Cell biology Physical structure of model cell membranes in prokaryotes and eukaryotes, lipid bilayer, membrane proteins, other constituents; diffusion, osmosis, active transport, regulation of intracellular transport and electrical properties.
Structural organization and functions of nucleus, mitochondria, Golgi bodies, endoplasmic reticulum, lysosomes, Chloroplast, peroxisomes, vacuoles. Cytoskeletons structure and motility function.
Organization of genome, structure of chromatin and chromosomes, heterochromatin, euchromatin.
Cell division and cell cycle: Mitosis and meiosis, their regulation, Cell cycle and its regulation, apoptosis, necrosis and autophagy.
Cell transformation and cancer, oncogenes and proto-oncogenes, tumor suppressor genes, metastasis. Therapeutic interventions of uncontrolled cell growth.
Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transductionpathways,secondmessengers,regulationofsignalingpathways, bacterial and plant two-componentsystems,lightsignalinginplants,bacterialchemotaxisand quorum ensing.
Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, tight junctions, communicating junctions, extracellular matrix, integrins, neurotrans mission and its regulation. Regulation of hematopoiesis, differentiation and development.

ii. Biomolecules

1. Physical properties of water and the irrolein biology. Concepts of pH, ionic strength and buffers.
2. Laws of thermodynamics. Concepts of ΔG, ΔH and ΔS.
3. Structureandfunctionsofaminoacids,proteins,nucleicacids,carbohydratesand lipids.
4. Forces that stabilize biomolecules such as electrostatic and vander Waal's interaction, hydrogen bonding. Interactions with solvents, Hydrophobic effect. Structural characteristics of protein in α-helix, β-sheet and β-turn. Ramachandran plot. Protein domains and domainarchitecture. Quaternary structure of proteins. General structure of DNA and RNA,
5. Structural characteristics of A, B and Z- DNA. 3D structure of t-RNA, ribozymes and rib switches
6. Introduction to enzymes. Types of enzymatic reaction mechanisms, Michaelis-Menten kinetics.
7. Competitive,Non-competitiveandUn-competitiveinhibition.Bi-substratereaction kinetics.
8. Concepts of order and molecularity of a chemical reaction. Derivation of first and second order rate equation, measurement of rate constants. Concept of activation energy.

9. Structure and biological significance of vitamins and minerals

iii. **Physiology**

1. Photosynthesis- Light harvesting complexes; mechanisms of electron transport; photoprotective mechanism; CO 2 fixation-C 3 , C 4 and CAM pathway. Nitrogen fixation: Historical background, nitrogen cycle in nature, symbiotic nitrogen fixation, nitrogenase system, nitrate reductase.
2. Plant nutrition, water relations, phytochromes, calmodulin, circadian rythms, plant hormones- Biosynthesis, storage, breakdown and transport; physiological effects and mechanisms of action.
3. Blood and circulation- Blood corpuscles, haematopoiesis and formed elements,plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.
4. Cardiovascular System- anatomy of heart structure, myogenic heart, cardiac cycle, heart as a pump,blood pressure, neural and chemical regulation.
5. Respiratory system – transport of gases and exchange of gases, waste elimination.
6. Digestive system–Digestion, absorption, energy balance, BMR.
7. Excretory system- Physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition. Regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.
8. Nervous system- Neurons, action potential, central and peripheral nervous system.
9. Senseorgans-Vision,hearingandtactileresponse.
10. Reproduction- Reproductive processes, gemetogenesis, ovulation.

iv. Molecular biology and Recombinant DNA technology

1. Genes and chromosomes, Operon concept, DNA replication, DNA damage and repair mechanisms, homologous and site-specific recombination.
2. Transcription of various types of RNAs and their processing and modifications. Transcription factors and machinery including RNA polymerases, formation of initiation complex, elongation and termination of transcription. Regulation of transcription: activators (enhancers) and repressors, Locus control regions. Protein synthesis, processing and transport of proteins: Ribosome, mRNA structure, genetic code, aminoacylation of tRNA, aminoacyl tRNA synthetase.
3. Mechanism of translation: Initiation, elongation and termination factors and translational proof-reading.
4. Regulation of Translation- global vs mRNA-specific. Inhibitors of Translation , Posttranslational modifications of proteins. Protein trafficking and transport.Regulation of gene expression in prokaryotes and eukaryotes, role of chromatin, chromatin remodelling and gene silencing, Epigenetic regulation.
5. Enzymes used in Recombinant DNA technology. Isolation and purification of DNA (genomic and plasmid) and RNA. Various methods of separation, characterization of nucleic acids including
6. Southern and Northern hybridizations.

7. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors and their purification. Western
8. blotting.
9. Generation of genomic and cDNA libraries. Plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knock out in bacterial and eukaryotic organisms.
10. Isolation and amplification of specific nucleic acid sequences, PCR, RT PCR and QRT PCR, DNA sequencing methods, strategies for genome sequencing.
11. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques. Analysis of DNA polymorphism: RFLP, RAPD and AFLP techniques.

v. Microbiology and Immunology

Cell structure and components, characterization and classification of microorganisms. Cultivation of Bacteria, nutrition, physiology and growth of microbial cells, reproduction and growth,synchronousgrowth,continuousculture ofmicroorganisms.Pureculturesand their characteristics. Fundamentals of control of microbial growth control by physical and biochemical agents. Production of mutants by chemical and physical agents and their characterizations.

Host microbe interactions, endotoxins, exotoxins, capsular material. Enzymatic and other factors, tissue affinity, resistance and immunity. Viruses of bacteria, plant and animal cells: Structure, classification and life cycle, mycoplasma and viriods, diseases.

Innate and adaptiveimmunesystem:Cellsandmoleculesinvolvedininnateandadaptive immunity, antigens, antigenicity and immunogenicity. Band T cellepitopes, structure and function of antibody molecules. generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen- antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, Toll-like receptors, cell mediated effect or functions, inflammation, hypersensitivity and autoimmunity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immune deficiencies, vaccines.

Host-pathogen interaction- Recognition and entry processes of different pathogens like bacteria, viruses and protozoans into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals and plants, cell-cell fusion in both normal and abnormal cells.

vi. **Tools and Techniques used in Biological research Concepts of precision and accuracy in experimental measurements.**

Concept of signal to noise ratio.

Biostatistics: Measures of Central Tendency. Fundamental ideas of probability and probability distributions: Binomial, Poisson and Gaussian distributions. Concept of the Central Limit Theorem. Hypothesis testing: Use of Student's t and χ 2 tests. Correlation and regression. Basic concepts of design of Experiments. Biochemical Methods: Chromatography: Ion exchange, Gel Filtration and Affinity

chromatography. Electrophoresis: Native and SDS-PAGE. Isoelectric focusing. 2D-PAGE and its applications. UV/Vis spectrophotometry.Beer-Lambert'slawanditsuseindetermination of protein/ nucleic acid concentration. Fluorescence Spectroscopy: Basic concepts of excitation and emission. Quenching, Theory and applications of FRET and fluorescence lifetime measurements. Fundamentals of CD, IR and Raman spectroscopy and their use in the study of biomolecular conformation. Centrifugation: Basic concepts of centrifugation. Density gradient centrifugation. Sedimentation velocity and Sedimentation equilibrium. Separation of sub-cellular components and macromolecules using high speed and ultracentrifugation. Microscopy: Bright field, phase contrast, fluorescence, confocal, and electronmicroscopy. Fundamentals of X-ray, NMR and cryo-electron microscopy for determination of biomolecular structure.

vii. Genetics and Evolution

Chromosomal inheritance: Principles of Mendelian inheritance, codominance, incomplete dominance,geneinteractions,pleiotropy,genomicimprinting,linkageandcross-over, sex-linked inheritance, Population Genetics and Hardy-Weinberg equilibrium. Extra chromosomal inheritance: Maternal inheritance(mitochondria and chloroplast) Gene concept: Allele, multiple alleles, pseudo alleles. Genetic analysis:Linkage maps, mapping with molecular markers, tetrad analysis, gene transfer in bacteria: transformation, conjugation, transduction. Mutation: Spontaneous, induced, lethal, conditional, reversion, mutagenic suppression, germinal and somatic mutation, insertion, deletion, duplication, translocation, transposition, ploidy.
Species concept in archaea, bacteria and eukarya. Phylogenetic analysis and evolutionary relationship among taxa, MLST.

viii. Genomics and Proteomics

Introduction to Genomics: Structure and organization of prokaryotic and eukaryotic genomes - nuclear, mitochondrial and chloroplast genomes; Computational analysis of sequences-finding genes andregulatory regions; Gene annotation; Similarity searches; Pairwise and multiple

alignments; Alignment statistics; Prediction of gene function using homology, context, structures, networks; Genetic variation, polymorphism, deleterious mutation; Phylogenetics; Tools for genome analysis– PCR, RFLP, DNA fingerprinting, RAPD, Automated DNA sequencing; Linkage and pedigree analysis; Construction of genetic maps; Physical maps, FISH to identify chromosome landmarks. Human genome project-landmarks on chromosomes generated by various mapping methods; BAC libraries and shotgun libraries preparation; Physical map-cytogenetic map, contig map, restriction map, DNA sequence; DNA sequencing and sequence assembly; Model organisms and other genome projects; Comparative genomics of relevant organisms such as pathogens and non-pathogens; Evolution of a pathogen. Taxonomic classification of organisms using molecular markers-16SrRNA typing/sequencing. DNA Microarray technology, cDNA and oligonucleotide arrays; Applications: Global gene expression analysis, Comparative transcriptomics, Differential gene expression; Genotyping/SNP detection; Detection technology; Computational analysis of microarray data. Proteomics: Outline of a typical proteomics experiment; Identification and analysis of proteins by 2D analysis; Spot visualization and picking; Tryptic digestion of protein and peptide fingerprinting; Mass spectrometry; ion source

(MALDI, spray sources); analyzer (ToF, quadrupole, quadrupole ion trap) and detector; clinical proteomics and disease biomarkers; Prions; proteins in disease; Protein-protein interactions: Solid phase ELISA, pull-down assays (using GST-tagged protein), far western analysis, by surface plasmon resonance technique, Yeast two hybrid system, Phage display; Protein interaction maps; Protein arrays- definition, applications- diagnostics, expression profiling.

ix. Metabolism

Metabolic concepts: Introduction to metabolic concepts. Gibbs free energy, Laws of thermodynamics, High energy compounds, Phosphoryl transferase, oxidative phosphorylation and generation of ATP, chemiosmotic theory. Carbohydrate metabolism: Pathways involved in carbohydrate metabolism such as Glycolysis, Citric acid cycle, Gluconeo genesis, Cori cycle, HMP shunt pathway, Glycogenesis and Glycogenolysis with reference to their regulation and energetic. Amino acid metabolism: Deamination, transamination, decarboxylation, desulphuration, Ketogenic and glucogenic amino acids. Ureacycle, Regulation of aminoacid biosynthesis Lipid metabolism: Energetics of fatty acid degradation. Fatty acid biosynthesis. Cholesterol metabolism and its regulations. Regulation of blood cholesterol, triglycerides, LDL and HDL. Nuclei Acid Metabolism: Synthesis and degradation of purines and pyrimidines and their regulation. Integration of metabolic pathways, metabolism of Xenobiotics.

x. Clinical biochemistry

Specimen collection and analysis : Concepts of accuracy, precision, reproducibility, reliability, and other factors in quality control. Normal values. Specimen collection and Processing: Collection of blood -venipuncture,skinpuncture,arterialpuncture.Anticoagulants.Collection and analysis of normal and abnormal urine - timed urine specimens, preservatives. Clinical significance of sugars, proteins, ketone bodies, bilirubin and porphyrins. CSF - collection, composition and analysis. Amniotic fluid - Origin, collection, composition.

Disorders of carbohydrate, lipid and protein metabolism: Salient features and managementof disorders related to carbohydrate, lipid and protein metabolism and their diagnostics.

Disorders of carbohydrate metabolism - glucose tolerance test, Glycogen storage diseases.

Disorders of lipid metabolism - fatty liver, obesity, atherosclerosis. Disorders of protein metabolism - Haemoglobinopathies - sickle cell anaemia, thalassemia and erythrocyte enzyme disorders. Inborn errors of metabolism- Phenylketonuria, alkaptonuria. Serum enzyme activities in diseases - Principle and assay of aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, acid phosphatase, streptokinase, asparaginase, a,- hydroxybutyrate dehydrogenase, ceruloplasmin, y - glutamyl transpeptidase, creatine kinaseand lactate dehydrogenase. Enzyme and isoenzyme as diagnostic tool, method for isoenzyme analysis. Organ and organ function tests: Normal structure and functions of liver, diseases of the liver, hepatitis types, cirrhosis, alcoholic liver disease, hepatic tumor and bilary tract diseases, liver function tests, disorders of bilirubin metabolism. Renal function tests and related disorders: Acute and chronic renal failure, urinary tract obstruction and analysis of urinary calculi.

6. Chemistry (PHDCHEM)

PART A

RESEARCH METHODOLOGY

1. Objectives of research
2. Research methods versus Research Methodology
3. Types of research:
   - Descriptive versus Analytical;
   - Applied versus Fundamental;
   - Quantitative versus Qualitative;
   - Conceptual versus Empirical
4. Literature Review: Methods and Importance
5. Research design: Need, Types and Features of research design
6. Formulating Research Problem
7. Collection and analysis of Data: Importance and Methods of data collection,
8. Data Analysis with Statistical Packages
9. Ethical issues in Research: Copyright, Intellectual Property Rights; Plagiarism

PART B

I : Inorganic Chemistry

1. Chemical periodicity
2. Structure and bonding in homo- and heteronuclear molecules, including shapes of molecules (VSEPRTheory).
3. Concepts of acids and bases: Hard-Soft acid base concept, Non-aqueous solvents.
4. Main group elements and their compounds: Allotropy, synthesis, structure and bonding, industrialimportance of the compounds.
5. Transition elements and coordination compounds: structure, bonding theories, spectral and magneticproperties, reaction mechanisms.
6. Inner transition elements: spectral and magnetic properties, redox chemistry, analytical applications.
7. Organometallic compounds: synthesis, bonding and structure, and reactivity. Organometallics inhomogeneous catalysis.
8. Cages and metal clusters.
9. Analytical chemistry- separation, spectroscopic, electro- and thermoanalytical methods.
10. Bioinorganic chemistry: photosystems, porphyrins, metalloenzymes, oxygen transport, electron- transferreactions; nitrogen fixation, metal complexes in medicine.
11. Characterisation of inorganic compounds by IR, Raman, NMR, EPR, Mössbauer, UV-VIS, NQR, MS,electron spectroscopy and microscopic techniques.
12. Nuclear chemistry: nuclear reactions, fission and fusion, radio-analytical techniques and activationanalysis.

II: Physical Chemistry

1. Basic principles of quantum mechanics: Postulates; operator algebra; Model systems: particle-in-a-box, harmonic oscillator; Hydrogen atom, including shapes of atomic orbitals; orbital and spin angular momenta; tunneling.
2. Approximate methods of quantum mechanics: Variation principle; perturbation theory up to second order inenergy; applications.
3. Atomic structure and spectroscopy: term symbols; many-electron systems and antisymmetry principle.
4. Chemical bonding: Elementary aspects of MO and VB theories; Huckel theory for conjugated

π-electron systems.

5. Chemical applications of group theory: symmetry elements; point groups; character tables; selection rules.
6. Molecular spectroscopy: Rotational and vibrational spectra of diatomic molecules; electronic spectra; IR and Raman activities – selection rules; basic principles of magnetic resonance.
7. Chemical thermodynamics: Laws, state and path functions and their applications; thermodynamic description of various types of processes; Maxwell's relations; spontaneity and equilibria; temperature and pressure dependence of thermodynamic quantities; Le Chatelier principle; elementary description of phase transitions; phase equilibria and phase rule; thermodynamics of ideal and non-ideal gases, and solutions.
8. Statistical thermodynamics: Boltzmann distribution; kinetic theory of gases; partition functions and their relation to thermodynamic quantities – calculations for model systems.
9. Electrochemistry: Nernst equation, redox systems, electrochemical cells; DebyeHuckel theory; electrolytic conductance – Kohlrausch's law and its applications; ionic equilibria; conductometric and potentiometric titrations.
10. Chemical kinetics: Empirical rate laws and temperature dependence; complex ; steady state approximation; determination of reaction mechanisms; collision and transition state theories of rate constants; unimolecular reactions; enzyme kinetics; salt effects; homogeneous catalysis; photochemical reactions.
11. Colloids and surfaces: Stability and properties of colloids; isotherms and surface area; heterogeneous catalysis.
12. Solid state: Crystal structures; Bragg's law and applications; band structure of solids.
13. Polymer chemistry: Molar masses; kinetics of polymerization.
14. Data analysis: Mean and standard deviation; absolute and relative errors; linear regression; covariance andcorrelation coefficient.

III. Organic Chemistry

1. IUPAC nomenclature of organic molecules including regio- and stereoisomers.
2. Principles of stereochemistry: Configurational and conformational isomerism in acyclic and cyclic compounds; stereo genicity, stereo selectivity, enantioselectivity, diastereoselectivity and asymmetric induction.
3. Aromaticity: Benzenoid and non-benzenoid compounds – generation and reactions.
4. Organic reactive intermediates: Generation, stability and reactivity of carbocations, carbanions, free radicals, carbenes, benzynes and nitrenes.
5. Organic reaction mechanisms involving addition, elimination and substitution reactions with electrophilic, nucleophilic or radical species. Determination of reaction pathways.
6. Common named reactions and rearrangements – applications in organic synthesis.
7. Organic transformations and reagents: Functional group interconversion including oxidations and reductions; common catalysts and reagents (organic, inorganic, organometallic and enzymatic). Chemo, regioand stereoselective transformations.
8. Concepts in organic synthesis: Retrosynthesis, disconnection, synthons, linear and convergent synthesis, umpolung of reactivity and protecting groups.
9. Asymmetric synthesis: Chiral auxiliaries, methods of asymmetric induction – substrate,

reagent and catalystcontrolled reactions; determination of enantiomeric and diastereomeric excess; enantio-discrimination. Resolution – optical and kinetic.

10. Pericyclic reactions: electrocyclisation, cycloaddition, sigmatropic rearrangements and other related concerted reactions. Principles and applications of photochemical reactions in organic chemistry.
11. Synthesis and reactivity of common heterocyclic compounds containing one or two heteroatoms (O, N, S).
12. Chemistry of natural products: Carbohydrates, proteins and peptides, fatty acids, nucleic acids, terpenes, steroids and alkaloids. Biogenesis of terpenoids and alkaloids.
13. Structure determination of organic compounds by IR, UV-Vis, 1H &13C NMR and Mass spectroscopic techniques.

7. **Geography (PHDGEOG) -** Based on the NET syllabus for Geography

8. **Geology (PHDGY)**

A **RESEARCH METHODOLOGY**
Research Methodology in Geology

B. **DISCIPLINESPECIFIC COURSES**
1. Physical Geology and Geomorphology
2. Structural Geology and Tectonics
3. Stratigraphy and Palaeontology
4. Mineralogy
5. Petrology
6. Georesources and Economic Geology
7. Geochemistry
8. Applied Geology

Research Methodology in Geology

Definition, types, significance, outcome and importance of geological research; Theory and philosophy of research methodology in context to Geology; Processes and stepsinresearch; Criteria of good research; Emerging areas and interdisciplinary research in Geology; Problems encountered by researchers.

Identifyinganddefiningresearchproblem;Techniquesinvolvedindefiningresearchproblem and identifying gaps; Sources of literature; Implications of literature collection and itsreview.

Preparation and planning for fieldwork; Field kit and equipments; Safety measures in field; Field procedures and precautions taken during sampling; Maintenance of field notebook; Uses of topographical maps and satellite images; Selection of traverses; Recognisation of geological features,rocktypesandstratigraphiccontactsinfield;Useofclinometercompass, Measurement of dip and strike of strata; Measurements of geologic sections;UsesofGlobal Positioning System; Recording field observations in field notebook; Geological mapping.

Data collection; Sampling methods; Data collection methods in sedimentology, palaeontology, stratigraphy, structural geology and tectonics, mineralogy, petrology, ore geology and hydrogeology; Classification and presentation of data; Role of statistics and computers in research; Use of computer in data processing; Methods of communicating and displaying analysed data; Applications of Geographic Information System.

Thin section preparation; Petrological and palaeontological microscopes; Ore microscopy; SEM microphotography; Preparation of samples for geochemical and XRD analysis, Heavy mineral separation; Construction of lithologs; Geophysical exploration methods, Remote sensing data.

Writing a research proposal; Intellectual property rights, patents, originality, integrity, plagiarism, copyright and related rights; Ethics in geological research; Professional responsibilities and organizational leadership requisite.

Geology

Physical Geology and Geomorphology: Composition of the crust and Earth as a whole; Basic concepts and significance of geomorphology; Relationship between landforms and geomorphic processes- fluvial, aeolian, glacial, and marine; Soils; Geomorphology of India; Applications of geomorphology; Mountain building; Volcanoes and earthquake; Seismic belts of India.
Structural Geology and Geotectonics: Classification of folds and faults; Mechanism of folding; Concept of stress and strain and their geological significance; Joints and unconformities. Concept of plate tectonics; Palaeomagnetism, polar wandering and reversal of Earth's magnetic field; Sea-floor spreading, Island arcs and mountain chains.
Stratigraphy and Palaeontology: Principles of stratigraphic scales and its divisions; Stratigraphic classifications; Stratigraphic nomenclature; Stratigraphic correlation; Facies concept in stratigraphy; Marine transgression and regression; Ice ages; Broad stratigraphic subdivisions of India. Fossil and modes of fossilization; Application of fossils in age determination; Evolutionary trends and geologic distribution of Brachiopoda, Pelecypoda, Gastropoda, Cephalopoda, Trilobita, Echinoids, Graptolites and Corals; Elementary idea about the origin of major groups of vertebrates; Evolutionary history of Horse, Elephant and Man; Plant life through geologic ages.

Mineralogy: Physical and optical properties of minerals; Classification of minerals; Mineralogy of silicates, Polymorphism, isomorphism and pseudomorphism; Solid solution and exsolution; X-ray crystallography; Concept of symmetry; Crystallographic classification.
Petrology: Generation and evolution of magma; Bowen's reaction series; Textures and classification of igneous rocks; Phase equilibria: single, binary and ternary systems; Silicate systems; Genesis and tectonic setting of different Magma types; Cooling and crystallisation of magma. Sedimentation, lithification and diagenesis; Structures and textures; Classification of sedimentary rocks; Depositional environments; Sedimentation and tectonics; Heavy minerals and their applications in provenance studies. Metamorphism and metamorphic processes; Metamorphic differentiation; Metamorphic facies; Types of metamorphism and metamorphic rocks; Metasomatism and anatexis.
Mineral Resources and Economic Geology: Ore genesis; Ore localisation and ore shoots; Ore dressing and beneficiation; Strategic, critical and essential minerals; National mineral policy; Economic minerals of India; Fossil fuels.
Geochemistry: Cosmic abundances of elements; Geochemical classification and differentiation of the elements; Trace Element Geochemistry; Radio genicandnon-radiogenic isotopes; Concept of

Geochemical and biogeochemical cycles and global climates.
Engineering Geology: Engineering properties of rocks; Geological investigations, seismic parametersand remedial measures related to the construction of dams, bridges, highways and

tunnels; Mass movements with special emphasis on landslides and causes of hill slope instability.
Mineral Exploration: Principles and methodology of geological prospecting for economic minerals and rocks; Sampling methods, Methods for estimating reserve and resources,grade and tonnage calculation of the deposits; Pathfinder elements; Geochemical and geophysical methods; Mining in India.
Hydrogeology: Hydrological cycle; Hydrological properties of rock; Distribution of surface and groundwater in the Earth's crust; ; Global water budget; Movement of groundwater; Aquifers classification and characteristics; Darcy's law; Theis equation; Water table, Flow nets; Groundwater provinces of India Groundwater quality and pollution; Groundwater prospecting; Desalination; Springs and its types.
Environmental Geology: Environment and energy; Non-conventional energy resources; Geoenvironment; Environmental hazards, Instrumentation and analysis; Disposal of municipal, domestic, hospital, solid and nuclear wastes; Oil spills; Environmental Impact Assessment (EIA); Environmental Legislation: National/International standards; Application of remote sensing and GIS in environmental management.
Remote Sensing & GIS: Electromagnetic radiation; Aerial photographs and the irgeometry; Elements of photo and image interpretation; Satellite remote sensing; Global and Indian space missions, Sensor and their characteristics; Digital image processing techniques; Applications of remote sensing in geological interpretation.

9. Life Sciences (PHDLS)

PART-I (RESEARCH METHODOLOGY)

1. Research Methodology: An Introduction: Meaning of Research; Objectives of Research; Motivation in Research; Types of Research; Research Approaches; Significance of Research; Research Methods versus Methodology; Research and Scientific Method; Importance of Knowing How Research is Done; Research Process; Criteria of Good Research; Problems Encountered by Researchers in India.
2. Defining the Research Problem:
   What is Research Problem?; Selecting the Problem; Necessity of Defining the Problem; Technique Involved in Defining a Problem; An Illustration.
3. Research Design:
   Meaning of Research Design; Need for Research Design; Features of a Good Design; Important Concepts Relating to Research Design; Different Research Designs; Basic Principles of Experimental Designs Conclusion.
4. Issues in The Design and Conduct of Selected Research Designs: Descriptive Research–Descriptive Research: Main Steps, Correlation Studies: Basic Issues, Case Study Method; Observational Studies–Issues in the Design of Case-Control Studies, Issues in the Design of Cohort Studies; Experimental Research–Three Characteristics of Experimental Research, Steps Involved in Experimental Research, Design of experimental Study.
5. Sampling Design:
   Census and Sample Survey; Implications of a Sample Design; Steps in Sampling Design;

Criteria of Selecting a Sampling Procedure; Characteristics of aGoodSample Design; Different Types of Sample Designs; How to Select a Random Sample;Random Sample from a Infinite Universe; Complex Random Sampling Designs.

6. Measurement and Scaling Techniques:
   Measurement in Research; Measurement Scales; Sources of Error in Measurement; Tests of Sound Measurement; Technique of Developing Measurement Tools; Scaling; Meaning of Scaling; Scale Classifications Bases; Important Scaling Techniques; Scale Construction Techniques.
7. Methods of Data Collection:
   Collection of Primary Data; Observation Methods; Interview Method; Collection of Data through Questionnaires; Collection of Data through Schedules; Difference between Questionnaires and Schedules; Some Other Methods of Data Collection; Collection of Secondary Data; Selection of Appropriate Method of Data Collection; Case Study Method.
8. Processing and Analysis of Data:
   Processing Operations; Some Problems in Processing; Elements/Types of Analysis; Statistics in Research; Measures of Central Tendency; Measures of Dispersion; Measures of Asymmetry(Skewness); Measures of Relationship; Simple Regression Analysis; Multiple Correlation and Regression; Partial Correlation; Association in Case of Attributes; Other Measures.
9. Sampling Fundamentals:
   Need of Sampling; Some Fundamental Definitions; Important Sampling Distributions; Central LimitTheorem;SamplingTheory;Sandler'sA-test;ConceptofStandardError; Estimation; Estimating the Population Mean (μ); Estimating Population Proportion; Sample Size and its Determination; Determination of Sample Size through the Approach; Based on Precision Rate and Confidence Level; Determination of Sample Size through the Approach; Based on Bayesian Statistics.
10. Testing of Hypotheses-I(Parametric or Standard Tests of Hypotheses):
    What is a Hypothesis?; Basic Concepts Concerning Testing of Hypotheses; Procedure for Hypothesis Testing; Flow Diagram for Hypothesis Testing; Measuring the Power of a Hypothesis Test; Tests of Hypotheses; Important Parametric Tests; Hypothesis Testing of Means; Hypothesis Testing for Differences between Means; Hypothesis Testing for Comparing Two Related Samples; Hypothesis Testing of Proportions; Hypothesis Testing for Difference between Proportions; Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance; Testing the Equality of Variances of Two Normal Populations; Hypothesis Testing of Correlation Coefficients; Limitations of the Tests of Hypotheses.
11. Chi-squareTest:
    Chi-square as a Test for Comparing Variance; Chi-square as a Non-parametric Test; Conditions for the ApplicationofX2Test;StepsInvolvedinApplyingChi-squareTest; Alternative Formula; Yates' Correction; Conversion of X2 into Phi Coefficient; Conversion of X2 into Coefficient by Contingency; Important Characteristics of X2 Test; Caution in Using X2Test.
12. AnalysisofVarianceandCovariance:
    Analysis of Variance (ANOVE) What is ANOVA?; The Basic Principle of ANOVA; ANOVA Technique; Setting up Analysis of Variance Table; Short-cut Method for One-wayANOVA; Coding Method; Two-way ANOVA; ANOVA in Latin-Square Design; Analysis of Co-variance (ANOCOVA); ANOCOVA Technique; Assumptions in ANOCOVA.
13. Testing of Hypotheses-II (Nonparametric or Distribution-free Tests): Important Non parametric or Distribution-free Test; Relationship between Spearman's r's and Kendall's W; Characteristics

of Distribution-free or Non-parametric Tests.

14. Multivariate Analysis Techniques:
    Growth of Multivariate Techniques; Characteristics and Applications; Classification of Multivariate Techniques; Variables in Multivariate Analysis; Important Multivariate Techniques; Important Methods of Factor Analysis; Rotation in Factor Analysis; R-type and Q-type Factor Analyses; Path Analysis.
15. Interpretation and Report Writing:
    Meaning of Interpretation;Why Interpretation?; Technique of Interpretation: Precaution in Interpretation; Significance of Report Writing; Different Steps in Writing Report; Layout of the Research Report; Types of Reports; Oral Presentation; Mechanics of Writing a Research Report; Precautions for Writing Research Reports.
16. The Computer: It's Role in Research:
    Introduction; The Computer and Technology; The Computer System; Important Characteristics; The Binary Number System; Computer Applications; Computers and Researcher.

References

1. Research Methodology: Methods and Techniques–C.R.Kothari.
2. Research Methodology: Methods and Statistical techniques– Santosh Gupta.
3. Statistical Research Methods in the Life Sciences by P.V.Rao.
4. Research Methods–A tool for life by Bernared C.Beins.

PART-II (LIFE SCIENCES)

1. Cell & Molecular Biology

Cell as a unit of life? Schleiden and Schwann cell theory re-examined. Cell separation, sub-cellular fractionation. Properties of intact cells: regulation of cell shape, limitation of cell size, cellular movements, cell adhesion, cell junctions and the extracellular matrix, cell –cell adhesion and communication; cell matrix adhesion, collagen the fibrous protein of the matrix, noncollagen component of the extracellular matrix;, the cytoskeleton, the nature of cytoskeleton,intermediate filaments, microtubules, microfilaments, actin filaments, cilia and centrioles, organization of the cytoskeleton, tissue organisation.

Biological membranes, integral membrane proteins, lipoproteins, phospholipids and trafficking through membrane. Membrane structure, energetic and biosynthesis. Cell growth and division, overview of the cell cycle and its control, the molecular mechanisms for regulating mitotic events, cell cycle control in mammalian cells, checkpoints in cell cycle regulation. The Cell nucleus: Nuclear envelop, Nuclear pore complex, Nucleocytoplasmic transport, Nucleolus, chromosomes, karyotypes, Heterochromatin and euchromatin, lampbrush chromosomes and Polytene chromosomes.

Conformation of nucleic acid- DNA (A, B, Z-DNA), RNA (mRNA, tRNA, rRNA) and micro RNA. DNA replication- General features, DNA Polymerases in prokaryotes and eukaryotes, DNA replication in prokaryotes and eukaryotes. Genetic code: Properties, Wobble hypothesis. Protein Synthesis a) Transcription in prokaryotes and eukaryotes, RNA processing b) Translation: Initiation, elongation and termination of polypeptides, Modification and folding of released polypeptide, Protein translocation across membrane.

Organelles of eukaryotic cells: the lysosomes, peroxisomes, the Golgi apparatus, endoplasmic reticulum. Mitochondria and chloroplast, Structure of the mitochondria and chloroplast, oxidation of glucose and fatty acids, electron transport and oxidative phosphorylation. chloroplast and photosynthesis. Organelle biosynthesis, protein sorting: organelle biogenesis and protein secretion, synthesis and targeting, of mitochondrial chloroplast, peroxisomal proteins and translational modification in the ER. Intracellular traffic, vesicular traffic in the secretary pathway, protein sorting in the Golgi, traffic in the endocytic pathway, exocytosis.

Suggested reading:

1. Molecular Biology of the Cell-Alberts *et al* (5th edn. 2007 or later Recent Edition)
2. The Cell: A molecular approach-Cooper and Hausman
3. Molecular Cell Biology Lodish *et. al*. (6th edn, 2008 or later Recent Edition)
4. Genes IX. Lewin (2008 or later Recent Edition),
5. Molecular Biology of the Gene. Watson *et. al*. (6th edn. 2009)

Cell Biology (Cell & Molecular Biology)- F Sheeler, 6th Edition John Wiley & Sons.

Genetics & Molecular Evolution

What is gene?: Introduction and recapitulation: scope of genetics; DNA as genetic material; basic structure of DNA and RNA; DNA replication: Messelson and Stahl Experiment, Carins Experiment, Okazaki experiment, basic mechanism of DNA replication; cell division and cell cycle: mitosis, meiosis, chromosomal basis of inheritance; basic principles of Mendelian Inheritance: segregation and independent-assortment, alleles and multiple alleles, human pedigrees and inheritance. Gene Interaction: Sex determination and sex-linked inheritance, sex-determination in humans, *Drosophila* and other animals, sex-determination in plants, sex-linked genes and dosage compensation of X-linked genes, human genetics: pedigree analysis.

Linkage analysis and gene mapping in eukaryotes, coupling and repulsion phases; crossing-over and recombination. Benzer's experiment: Fine Structure of gene and gene concept. Chloroplast and Mitochondrial inheritance: yeast, *Chlamydomonas/ Neurospora* and higher plants.

Microbial Genetics: modes of genetic exchange in microbes, transformation, transduction, conjugation, evolutionary significance. Mutations, spontaneous and induced mutations, chromosomal mutation and aberrations, change in chromosome number: trisomy and polyploidy. Evolutionary history of bread wheat, aneuploids –Nullisomics and monosomics, somatic aneuploids, changes in chromosome structure, properties of chromosomes for detection of structural changes, Main type of changes– transitions, transversions and substitutions, deletions, duplications and inversions. Mechanism of chromosome mutations, genetic and cytological features of deletions, duplications, inversions, translocations, somatic vs germinal mutation.

Population genetics: application of Mendel's laws to whole population, calculation of allele frequencies, Hardy -Weinberg principle for calculating recessive gene frequency, calculating frequency of sex –linked alleles.

Genes and genome organisation. Transposons and retrotransposons. Epigenetics. Principles &

applications of genetic engineering; tools and techniques; cloning vectors &expression vectors; Biosafety .

Introduction to molecular evolution: a brief history of the pre DNA era, gene structure, genetic code and mutation. Dynamics of genes in population, random genetic drift, genetic polymorphism, Neo Darwinian theory, evolution of finite and structured population, evolution of dip bit populations. Evolutionary change in nucleotide re-genesis, nucleotide substitution, divergence between DNA sequences. Molecular phylogenetics, methods and examples, molecular clocks, concerted evolution of multigene families, DNA polymorphism. Factors influencing molecular evolution, Role of mutation and selection in molecular evolution.

Genome organization and evolution, evolution of prokaryotic and eukaryotic genomes, C value paradox, tandem repetitive sequences. Cell theory. Evolution& selection, Lamarkism, Darwin's contributions .Pattern of Evolution. Process of evolution: natural & artificial. Constraints & trade offs. Genetic drift and role of chance. Gene flow. Gene flow versus drift Natural selection versus sexual selection. Speciation, allopatry, sympatry, peripatry and parapatry.

Suggested reading:

Genetics

1. Introduction to Genetic Analysis, by Griffiths *et al,* (9th edition.2008 or later edition)

2. Concepts of Genetics, by Klug *et al* (9 th Edition, 2009, or later edition)

3. Principles of Genetics by Snustad *et a*l (2004 Ed. or later edition)

Evolution

1. Evolutionary genetics, John Maynard Smith, Oxford University Press, New York, 1998.

2. Genes and Evolution, A.P. Jha, Mc Graw Hill Publishers, New Delhi, 1993.

3. Molecular Cell Biology 5th Edition, Lodish *et al*., 2004, W.H. Freeman and Company, New York.

4. The World of the Cell Becker, Klein smith and Hardin, 5th Edition, 2004, Pearson Education Pvt. Ltd.

Ecology

Introduction to ecology. Interaction between environment and biota, Evolutionary ecology and molecular ecology, environmental concepts – laws and limiting factors, ecological models. Ecological concept of species: Autecological level (genecology), Synecological level (Ecosystem level). Ecads (Ecophenes), Ecotypes, Ecospecies. Concepts of Ecosystems: Types – Fresh water, marine and terrestrial – Nature and components of ecosystem – Application of laws of thermodynamics, productivity, food chain, food webs, trophic levels, energy flow through ecosystem, resilience of ecosystem, ecosystem management. The biosphere, biomes, ecological pyramids and recycling.

Plant community: Concept. Methods of study of communities–Floristic, Physiogenomic and Phytosociological methods. Classification – Raunkiaer's and Clements systems, individualistic concept of Gleason, Vegetation continuum concept of Whittaker and Curtis, Ecotone, Ecological succession on land and water. Characteristics of population, population size and exponential growth, population dynamics, life history pattern, fertility rate and age structure. Competition and coexistence, intra-specific and inter-specific interactions, scramble and contest competition model, mutualism and commensalisms, prey-predator interactions.

Phytogeography**;** Definition of static and dynamic phytogeography**,** Geological history and evolution of plant and animal life**,** Factors of distribution of plants and animals. Theories concerning present and past distribution – continental drift, glaciations, existence of land bridges and their effect on distribution of species, Phytogeographic

Microbiology

History and Development of Microbiology. Microbial evolution, systematics and taxonomy-evolution of earth and earliest life forms; primitive organisms, their metabolic strategies and molecular coding. Changing concepts in microbiology taxonomy, Bergey's manuals, earlier systems, molecular taxonomy and ribo typing of microorganisms, Jackard's similarities coefficients. Historical development of microbiology, general techniques in microbiology. The microbial cell: general organization of cell, prokaryotes, eukaryotes and Archaea, cell wall organization of prokaryotes, eukaryotes and Archaea, cell surface appendages-pilli, locomotion by flagella chemotactic movement, peptidoglycan synthesis - inhibitors in different steps. Bacterial plasmid and its significance.

Viruses –structure, chemical composition and replication, classification, interferons. General account of Mycoplasma. Growth, recombination, growth kinetics and regulation, effect of environmental factors on growth e.g., pH. temperature, oxygen, nutrient limitations and nutrition: batch and continuous cultures, nutritional classification of microorganisms,nutritional uptake by microorganisms (C.N.P).

Metabolic Pathways: metabolic versatility of microbes, anaerobic carbon metabolism: anaerobic respiration, sulphate respiration, reference to glycolysis, fermentation – diverse fermentation products, putrefaction, methane oxidizing and methanogenic bacteria, aerobic carbon metabolism: TCA cycle, alternative metabolic pathways. Energy Metabolism: chemo autotrophs, hydrogen bacteria, phototrophic bacteria/cyanobacteria.

Advanced Bacterial Metabolism: recent advances in unusual bacterial metabolism pathways. Microbes in extreme environment: The basis of extremophiles and their applications, thermophile and halophiles. Quorum sensing in Bacteria: gram negative bacteria: LUXI LUXR-Type: gram positive bacteria: peptide mediated quorum sensing. Microbial Diseases-disease reservoirs; epidemological terminologies; infectious disease transmission; respiratory infections caused by bacteria and viruses; tuberculosis; Sexually transmitted diseases including;disease transmitted by animals(rabies),insects and ticks (rickettsias, malaria) food and water borne diseases; public health and water quality; pathogenic fungi; Emerging and resurgent infectious diseases.

Host Parasite Relationships-Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host; colonization and factors predisposing to infections; types of toxins (exotoxin, endotoxin and entreotoxin) and their structure; mode of actions. Biochemical, physiological. Genetic aspects of symbionts, Physiology and Molecular Biology of symbiosis; nonspecific and specific defense mechanisms. Mechanism of pathogenesis, host factors influencing resistance to infection. vaccination

Chemotherapy and Antimicrobial agents; Sulfa drugs; Antibiotics; Pencillins and Cephalosporins; Broad-Spectrum antibiotics; Antibiotics from prokaryotes; Antifungal antibiotics; Mode of action; Resistance to

antibiotics. Application of Microbiology in industrial, agriculture and waste water management: symbiotic nitrogen fixation, *Rhizobium, Azotobacter, Cyanobacteria (Anabaena, Azolla etc.), Mycorrhiza* and VAM fungi, Siderophores and other PGRs. Major industrial products from microbes, beverages, antibiotics, secondary metabolites and recombinant products. Biodegradation by microbes, sewage pollution control, control of oil spills, superbugs**.**

Suggested reading:

1. Microbiology, J.G. Cappuccino, N. Sherman, Pearson Education Publications.

2. Essential Microbiology, Stuart Hogg, John Wiley and Sons Limited.

3. Microbiology: A Human Perspective, E.W. Nester, D.G. Anderson, C.E. Roberts, N.N. Pearsall, M. T. Nester Mc Graw Hill Higher Education.

Manual of Environmental Microbiology, C. J. Hurst, R.L.Crawford, G.R.Knudsen, M.J. McInerney, L.D.

4. Stetzenbach,, ASM Press.

5. Microbiology, L.M. Prescott, J. P. Harley, D.A., Klein, Mc Graw Hill International Edition.

6. General Microbiology. H.G. Schlegel, Cambridge University Press.

Dube RC and Maheshwari, D.K. – S. Chandpal

Immunology

Introduction to Immune system – Innate and Acquired Immunity (natural and adaptive immune responses); Natural Immunity: Mechanism of barriers to entry of microbes into human body. Physical barriers (skin, mucous); chemical barrier; cellular barriers; inflammation.
In cellular barrier – Monocyte; macrophages – TLR receptors and PAMPS, signal transduction, opsonization, Eosinophils – parasitic infection and role of eosinophils; Basophils, Mast cell; Neutrophils; NK cell.
Inflation - Inflammatory reaction, migration of neutrophils to the site of infection, prostaglandins, leukotriens. Adaptive Immunity: Lymphocytes- (T. cell, B. cell). Dendritic cells; humoral and cell mediated immunity, clonal selection; lymphoid organs.

Antigens – Structure, properties, types, haptens; Antibodies – Structure, types and their biological functions. Hybridoma technology and monoclonal antibody production, application; Antibody engineering Chimeric antibody, Abzymes (catalytic antibody).

Antibody – antigen interactions/techniques – Complement and lytic reaction, complement fixation test, precipitation, immuno diffustion, agglutination, RIA, ELISA immune fluorescence. MHC genes, MHC complex (organization of H_2 + HLA complex, class I and class II MHC molecules). Antigen presenting cells (APC), Antigen processing and presentation (cytosolic and endocytic pathways)

B Cell receptors, maturation, editing, activation and differentiation. T. Cell receptor (?, ?, γ, δ) thymic selection of T. Cell APC – T. Cell interaction, T. Cell activation, super antigens, role of cytokines. Cytoxictiy – T.Cell mediated cytotoxicity, NK cell mediated cytotoxicity, ADCC (antibody directed ecelluar cytotoxicity)

Transplantation Immunology. Tumor Immunology (Tumor antigen, Tumor escape). Immunological disorder – Hypersensitivity (Type I, II, III, IV) Auto Immunity, Immuno deficiencies.

Suggested reading

1. A Text book of Immunology – P. Madhavee Latha.
2. Text book of Immunology – C.A. Bona and FA Bomlla
3. Basic Immunology by Jacqueline Sharon.
4. Immunology by Ivan Roitt, Janathan Brostoff and David Male.

6. Biochemistry

An overview of Biochemistry, cellular environment and applicability of basic laws of chemistry and thermodynamics. Concept of small and macromolecules, molecular interactions and their importance in understanding cellular processes. Monosaccharides and derivatives of sugars, polysaccharides, glycosaminoglycans, proteoglycans, protein glycosylations and its significance.

Primary characterization of proteins, isolation and chromatographic purification of proteins, ultracentrifugation, sequence determination, mass spectrometry. Structure of amino acids and peptide bonds, Ramachandran Plot, alpha helical and beta pleated structures, structures of fibrous proteins like keratin, fibroin, elastin and collagen. Dynamics of protein structure, protein structure, protein stability, globular proteins and maintenance of specific confirmation, structural motifs commonly found in various proteins and their functional relevance. Basic concepts of protein folding, folding pathways, role of accessory proteins in protein folding. Fatty acids, triacylglycerols, glycerophospholipids, sphingolipids, cholesterol lipid bilayers.

Macromolecules:, proteins, polysaccharides, lipids, glycoproteins, glycolipids, lipoproteins, lipopolysaccharides, protein modifications and their functional implications. Enzyme catalysis, specificity of enzyme action, coenzymes and vitamins. Classification of enzymes, factors affecting enzymes activities, feedback and allosteric inhibition. Chemical kinetics and order of reactions, Michaelis and Menten equation, V max and Michaelis constant double reciprocal plots. Mechanisms of acid base, covalent, metal ion catalysis. Types of inhibitions, reversible (competitive, uncompetitive and non-competitive) and irreversible inhibitions, bisubstrate reaction.

Metabolism: basic concepts, central role of ATP in metabolism, carbon fuel and its oxidation, concept of energy rich compounds and intermediates, common types of reactions involved in metabolism. ATP synthesis and chemiosmotic hypothesis of ATP generation. Glycolysis and gluconeogenesis, energetics and ATP productions. Regulation of glycolysis, glycogen synthase, metabolic flux and its regulation by various metabolic intermediates. Different Metabolic

Pathways: metabolic versatility of microbes, anaerobic carbon metabolism: anaerobic respiration, sulphate respiration, reference to glycolysis, fermentation – diverse fermentation products, putrefaction, methane oxidizing and methanogenic bacteria, aerobic carbon metabolism: TCA cycle alternative metabolic pathways.

Redox reaction, mitochondrial structure and its role in energy metabolism, electron transport system and oxidative phosphorylation. Pentose phosphate pathway and its importance in biosynthetic reactions. Glycogen synthesis, breakdown and its regulation. Fatty acid biosynthesis and degradation. Amino acid metabolism, urea cycle, one carbon reaction, nonprotein amino acids, amines and their role in cell function. Nucleotide biosynthesis and degradation, salvage pathways, its regulation and diseases.

Suggested reading:

1. Biochemistry (5 th Edition) by Jeremy Berg, John Tymoczko and Lubert Stryer.

2. Biochemistry (3 rd Edition) by Donald J. Voet and Judith G. Voet.

3. Lehninger Principles of Biochemistry (4 th Edition) by David L. Nelson and Michael M. Cox.

7. Biophysics

Introduction, interaction in biological systems, feedback mechanism. Elementary quantum mechanics and its application in biological system. Biological membrane, movement of ions across cell membrane, electrochemical equilibrium; genesis of membrane potential; properties of excitable membrane; action potential and its propagation, conduction velocity. Voltage clamp, introduction to patch clamp.

Mechanism of muscle contraction, muscle energetics. Lung mechanics, diffusion of gases, surface tension, role of surfactant. Heart and circulatory system, electrical and mechanical activity of heart, mechanics of blood flow in blood vessels, cardiac work, mechanical efficiency of heart. Geometrical optics of vision, refractive defects of eye and its rectification, mechanism of hearing.

Introduction to radiation biology; non-ionising and ionising radiation, isotopes, radiation measurement; radiation hazards, radiation evaluation; control and regulatory aspects of safety. Physical measurements in biology; surface tension, viscosity, diffusion, sedimentation, electrophoresis, diffraction; microscopic techniques, electron microscopy; introduction to NMR.

Use of computers in biology, systems and application, Software, data acquisition

system and analysis using software.

8. Biostatistics

Introduction to Biostatistics, Biological Data: Brief history; Population, Variables; Sampling: Representative samples, size of sample, Random & non random samples, stratified samples; Introduction to software used in Biostatistics – SPSS; INSTAT; EXCEL.

Types of Data: Primary and Secondary data; Qualitative and Quantitative; Frequency Distributions; Frequency tables; Presentation of Data: Graphical presentation, Frequency Polygon, Histogram, Bar Diagram, Pie Diagram, Pictogram, Cumulative Frequency curves.

Measures of Central Tendency and Variability: Mean: Arithmetic mean grouped and ungrouped data; Weighted mean; Mode: Grouped and ungrouped data; Median: Grouped and ungrouped data; Range, Standard deviation, variance, coefficient of variation, standard. error.

Normal Distribution: Characteristics; Areas under curve; Z – value.

Probability and Binomial Distribution: Probability: Independent events, addition and multiplication rules, conditional probability; Binomial Distribution.

Correlation and Regression: Bivariate data; Scatter plot; Pearsons correlation coefficient (r): determination and interpretation; Linear regression; Regression coefficient; Fitting regression lines.

Hypothesis Testing: Null and Alternate Hypothesis, Type I and II error; Parametric and non parametric tests; Tests of Significance, small samples (t – Test), large samples (Z – Test) degree of freedom; X^2 – Test, contingency tables; $\propto$ – levels, interpretation of test results.

ANOVA: One way; Two way; F – Test.

Application and Practice: HMM; Vital statistics.

Suggested Books for Biostatistics

1. Gould JF and Gould GF, 2001. Biostatistics Basics: A Student Hand Book. W.H. Freeman Co.

2. Campbell RC 1989 – Statistics for Biologists. Cambridge University press.

3. Sokal RR and Rohlf- An Introduction to Biostatistics W.H. Freeman and Co.

4. Bailey NTJ – Statistical Methods in Biology English University Press.

5. Mitchell K & Glover T. Introduction to Biostatistics McGraw Hill Publishing

Co.

6. Zor JH – Biostatistical Analysis Prentice Hall Internal Edition.

7. Gupta SP – Statistics methods, Sultan Chand & Sons.

9. Animal Diversity (Animal Life: Form & Function)

Origin and outline classification of non-chordates and chordates (including Onychophora) along with adaptive radiations. Geological time scale and fossils.
Minor phyla:- concept of significance (Mesozoa, Echiuroidea, Rotifera, Ctenophora, Rhyncocoela), organization and general characters.

Organization of the coelom:- Acoelomates, pseudocoelomates, coelomates (Protostomia and Deuterostomia); Interrelationships of Hemichordata, Urochordata and Cepahalochordata and their relations with other deuterostomes; Life histories of sessile and pelagic *Pyrosoma, Salpa, Doliolium and Oikopleura.*

Integument:- cuticle, chitin, scales, feathers, hair, dermal glands. Exoskeleton and endoskeleton:- jaw formation, gill arches, chondrocranium. Locomotion:- pseudopodia, flagella and ciliary movements in Protozoa; Hydrostatic movements in coelenterates, annelids, and echinoderms. Fins, wings quadripedal and bipedal locomotion.

Nutrition and Digestion in invertebrates and vertebrates:- patterns of feeding and digestion in lower metazoans; filter feeding in polychaetes, molluscs and echinoderms, amphioxus. Alimentary canal and its modification in vertebrates, Digestive glands.

Respiration in invertebrates and vertebrates; surface, cutaneous, gills, book lungs, trachea, lungs, air sacs, swim bladder.

Excretion Organs of excretion-coelom, nephredia, Malphigian tubules; fish to mammals- protonephridia to metanephridia, modifications of the kidney.

Circulation of body fluids invertebrates to vertebrates, open to closed circulation; evolution of heart and aortic arches; portal system.

Nervous system primitive nervous system- coelenterates and echinoderms; advanced nervous system in annelids, insects, crustaceans and cephalopods. Trends in neural evolution (basic plan to cepahlisation). Vertebrates- evolution of brain.

Reproductive system asexual to sexual in invertebrates and vertebrates; oviparous, ovoviviparous and viviparous. Larval forms of free living invertebrates, larvae of

parasites, strategies and evolutionary significance of larval forms.

Suggested Reading Material for Invertebrates

1. Invertebrate Zoology Barnes, RD. W.B.Saunders Co., Philadelphia

2. A Biology of higher invertebrates, Russel-Hunter, WD. McMillan Co. Ltd., London

3. Text book of Zoology. Parker, T.J., Haswell. W.A.Macmillan Co., London.

Suggested Reading Material for Chordates

1. Text book of Zoology. Parker, T.J., Haswell. W.A.Macmillan Co., London.

2. The Biology of Hemichordata and Protochordata. Barrington, E.J.W. Olter and Boyd. Edinborough.

3. Comparative anatomy of vertebrates. Kent. C.G.

4. Chordata morphology. Malcom Jollie. East-West Press Pvt.Ltd., New Delhi.

5. The Chordates. Monielli. A.R.Cambridge University press. London.

6. Life of Vertebrates, Young. J.Z. The Oxford University Press. London.

7. Elements of Chordate Anatomy, Weichert. C.K. and Presch W. McGraw hall Book Co., New York.

8. Chordata structure and function. Waterman. A.J.Macmillan Co. New York.

10. Animal Physiology

Tissue system and their functions: Epithelial tissue, Connective tissue, muscular tissue and Nervous tissue. Principles of physiology: relationship between structure and function, Adaptation, Acclimatization, Acclimation, Homeostasis, Feed-back control systems, Conformity and Regulation. Environmental stress.

Neurophysiology:- ion transport across nerve cell membrane, electrophysiology, conduction of nerve impulse; sensing the environment- photoreceptors, mechanoreceptors, electroreceptor, chemoreceptor, thermoreceptor. Nervous system –CNS and PNS; special senses-eye, ear, smell, taste. Muscle and animal

movement: biochemistry of contraction in skeletal, cardiac and visceral muscles; neuromuscular control.

Respiratory system: respiratory pigments, transport of gases in blood, regulation of body pH, respiratory response to extreme conditions like hypoxia, diving and exercise (effect on enzymes and membranes). Physiology of respiration (mammals) and neural regulation breathing.

Circulatory systems: general plan, electrical and mechanical properties of myogenic and neurogenic hearts. Cardiac cycle; regulation of heart beat and blood pressure and electrocardiogram, Haemodynamics; cardiovascular response to extreme conditions like exercise, diving and hemorrhage. Neural regulation of cardiovascular system; peripheral circulation.

Endocrine system: Glands and Hormones: Secretory mechanisms, Endocrine and Neuroendocrine systems in insects and vertebrates. Molecular mechanism of hormone action. Physiological effects of hormones.

Excretion and Osmoregulation- osmoregulators and osmo conformers, obligatory exchanges of ions and water. Osmoregulation in aquatic and terrestrial environment. Physiology of mammalian and nonmammalian kidneys.

Digestive system: Acquisition of Energy:, Digestion (motility and Secretions), Metabolism, and absorption, Physiology of gastrointestinal system (insects and mammals) including neural and hormonal regulatory mechanisms.

Energetics of metabolism expenditure: Body size and metabolic rate, Energetics of locomotion, body rhythms. Thermoregulation: Temperature dependence of metabolic rate, determinants of body heat and temperature, thermal biology of ectotherms, heterotherms and endotherms; hibernation, torpor, aestivation.

Reproductive system: Gametogenesis and its hormonal control, Fertilization, Capacitation; energetics of reproduction.

Suggested reading:

1. Text Book of Medical Physiology (latest edition) by Guyton

2. Animal Physiology: Adaptations and Environment by Knut.S Nielsen.

3. Principles of anatomy and physiology by Tortora Gabowski (10^{th} edition or latest).

4. Physiology by Shermann.

5. Comparative Physiology by Prosser and Brown (Latest edition).

11. Animal Developmental Biology

Principle of Developmental biology: Question and Approach in developmental biology, Evaluation of developmental patterns, Principles of experimental embryology, Genomic equivalence. Identification of developmental genes, mutant screening, developmental mutations in Drosophila. **Cleavage and gastrulation:** of invertebrates and vertebrates (helminthes, insects, amphibians and mammals) axes and germ layers, cell adhesion.

Phenomenon of organizer: with special reference to amphibians: progressive determination, Regional specificity of induction, Neural tube formation, Cell migration. **General concepts of organogenesis:** Morphogenetic process in epithelia and mesenchyme in organ formation. Morphogenesis of brain, neural crest cells and their accessory organs. Insect imaginal disc – determination of wing and leg imaginal discs, organizing centre in patterning of the wing, butterfly wing development, homeotic selector genes for segmental identity. Development of compound eye, heart and kidney (Ureteric and mesenchymal tubules).

Metamorphosis: Progressive, retrogressive, cyclomorphosis (invertebrate and vertebrate) structural and physiological changes during metamorphosis. **Embryonic Adaptations:** Evolution of cleidoic egg and its structural and physiological adaptations. Development and physiology of extra embryonic membranes in amniotes. Development, types and physiology of mammalian placenta.

Regeneration and differentiation: Types of regeneration – Epimorphic (eg. Salamander limbs), Morphallactic (eg Hydra), Compensatory (eg. Mammalian liver); Morphological and histological processes in amphibian limb regeneration. Origin of cells for regeneration and differentiation. Embryonic stem cells and their applications.

Invertebrate model organisms: *D. melanogaster, C. elegans* – Identification of developmental genes, origin of anterior/posterior and dorsal/ventral patterning, role of maternal genes, zygotic genes, segmentation genes, gap genes – the paired rule genes, homeotic selector genes. **Vertebrate model organisms:** *X. laevis*, chicken, mammals – Patterning vertebrate of limb, signaling in patterning of limb, homeobox genes in patterning.

Growth–cell proliferation, aging, and cancer genes–involved in timing of senescence.

Suggested reading

1. An introduction to Embryology by Boris Ivan Balinsky.
2. Developmental Biology by Scott F Gilbert.
3. Principles of Development by Tickle, Martinez, Arias Worpert.
4. A text book of general embryology. Kellicott and William Erskine.

12. Plant Diversity I: Phycology

Principles of classification (Fritz and Smith).Modern trends in taxonomy of Algae (Lee). Emphasis on Prochlorophyta (Prochloron). Diversity in organism and cell structure, thallus and morphological variations. Reproduction and life cycle patterns (in different group of algae). Diversity distribution and Economic importance of algae in industry, agriculture, medicine and food. Role of algae in bioremediation, and mariculture.

Mycology

Principles and modern trends in taxonomy and classification of Fungi. Structure, reproduction and phylogeny of Oomycota, Zygomycota, Ascomycota and Basidiomycota. Diversity distribution and economic importance of fungi (industry, medicine, agriculture including food). General account of Lichens.

Bryophyta

General characters and systems of classification. Contributions of Indian Bryologists. A general account of morphological and anatomical features, reproduction, life history and phylogeny of Liverwort , Hornwort and Mosses. Origin and evolution of Bryophytes, Fossil bryophytes (Brief mention). Diversity distribution and economic importance of bryophytes.

Pteridophyta

General characters, classification (modern trends) and life cycle of Peteriophytes. Structure and evolutionary trends, stele and spore morphology. Telome concept Pteridophytes. Comparative morphology, structure, reproduction and phylogeny of the following Groups: Psilopsida, Lycopsida,Sphaenopsida,Pteropsida. Fossil Pteridophytes-*Rhynia, Lepidocarpon, Sphaenophyllum, Zygopteris*. Apospory, apogamy and parthenogenesis. Diversity, distribution and economic importance of

pteridophytes.

C. Gymnosperms

General characters, distribution, phylogeny, classification and economic importance of Gymnosperms. Structural details of vegetative and reproductive parts, phylogeny and interrelationships of the following. *Cycadofilicales, Caytoniales, Bennettitales, Pentoxylales, Cycadales, Ginkgoales, Coniferales,Gnetales.* Diversity distribution and economic importance of gymnosperm.

References

Phycology

1. Bold, H.C. Wynne, M.J. 1985. Introduction to the Algae. Prentice Hall of India, New Delhi.

2. Chapman, V.J. Chapman, D.J. 1975. The Algae Macmillan India Ltd., Delhi.

3. Fritsch, F.E.1945. Structure and reproduction of Algae, Cambridge University Press.

4. Kumar, H.D. 1999. Introductory Physiology, Affiliated East West Press Pvt. Ltd. Press. New Delhi.

5. Pandey, B.P.1994. Algae. S. Chand & Company Ltd. New Delhi.

6. Round, F.E. 1984. The Ecology of Algae. Cambridge University Press.

Mycology

1. Ainsworth, G.C., Sparrow. K.E. and Sussman. The Fungi. Academic Press, New York.

2. Alexopoulos, C.J., Mims, C.W. Blackwell, M. 1996. Introductory mycology. John Wiley & Sons., New York.

3. Bilgarmi, K.S. and Verma, R.N. 1994. Physiology of Fungi. Vikas Publishing House Pvt. Ltd. New Delhi.

4. Dube, H.C. An Introduction to Fungi. Vikas Publishing House, New Delhi.

5. Hale, M.E. 1983. Biology of Lichens. Edward Arnold. – D.D. Awasthi

6. Moore, D.et al., 1986. Developmental Biology of higher Fungi

7. Sharma, O.P. Text book of Fungi. Tata McGraw Hill Publishing Co.Ltd.

New Delhi.

8. Webster, J.1975. Introduction to Fungi. Cambridge University Press.

9. Agrawal – Mehrotra.

Bryophyta

1. Cavers, F. 1976. The Inter relationship of the Bryophyta. S.R. Technic (Book House), Ashok Rajpath, Patna.

2. Dyer, A.F. and Duickett, J.G. (Ed.). 1984. The experimental Biology of Bryophytes. Academic Press.

3. Parihar. N.S.1980. An Introduction to Embryophyta Vol. I. Bryophyta. Central Book Depot.

4. Prem Puri, 1981. Bryophytes: Morphology, Growth and differentiation. Atma Ram and Sons, New Delhi.

5. Vashishta, P.C. 1999. Bryophyta. S. Chand & Co. New Delhi.

Pteridophyta

1. Eames, E.J. 1983. Morphology of vascular plants. Standard University Press.

2. Rashid, A. 1999. Pteridophyta, Vikas Publishing House Pvt. Ltd. New Delhi.

3. Sharma, O.P. 1990. Textbook of Pteridophyta. Macmillan India Ltd. Delhi.

4. Sporne, K.R. 1986. The morphology of Pteridophytes. Hutchinson University Press.

5. Sundara Rajan, S. 1999. Introduction to Pteridophyta. New Age International Publishers, New Delhi.

Gymnosperms

1. Biswas, C. and Johri, B.M. 1999. The Gymnosperms. Narosa Publishing House, New Delhi.

2. Chamberlain, C.J. 1955. Gymnosperms. Structure and Evolution.

3. Chamberlain, C.J. 2000. Gymnosperms. C B S Publishers and Distributors, New Delhi.

4. Sporne, K.R.1986. Morphology of Gymnosperms. Hutchinson University Press. Vashishta, P.C. 1999. Gymnosperms, S. Chand & Company Ltd. New

Delhi.

13. Plant Diversity-II - Taxonomy Of Angiosperms

Definition and importance of taxonomy. History of classification, evolutionary systematics and phylogenic systematics. Basic level including merits and demerits of systems of classification by Bentham and Hooker, Hutchinson and Takhtajan and APG Classification. Contents of ICBN – Author citation – Typification and different types. Publication of names – Rules of Priority-Nomina Conservanda and definitions of nomenclatural terms Autonym, Homonym, Basionym, Tautonym and Nomen. Construction of taxonomic keys (indented and bracketed) and their utilization. Floristic studies in India: Botanical garden and herbarium. Modern concepts and trends in Plant taxonomy: Elementary treatment of; (i) Cytotaxonomy (ii) Chemotaxonomy (iii) Numerical Taxonomy (Taximetries) (iv) Molecular Taxonomy (v) Cladistics. Problems in evolutionary taxonomy: the concepts of primitive and advanced, monophyly and polyphyly, parallelism and convergence, homology and analogy.

Taxonomy

1. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants.
2. Davis, P. H. and Heywood. 1963. Principles of Angiosperm Taxonomy, New York
3. Heslop – Harrison, J. 1958. new concepts in Flowering Plant Taxonomy, London.
4. Heywood, V. H. 1968. Modern methods in Plant Taxonomy.
5. Hutchinson, J. Families of Flowering Plants. Cambridge.
6. Jeffrey, C. 1968. An Introduction to Plant Taxonomy, London.
7. Naik, V.N. 1984. Taxonomy of Angiosperms. New Delhi.
8. Radford Albert, E. Fundamentals of Plant Systematics
9. Sivarajan, V.V. 1991. An Introduction to Principles of Taxonomy, London.
10. Sivarajan, V.V. 1999. Principles of Plant Taxonomy Oxford & IBH Publishing Co. Pvt Ltd. New Delhi.

14. Plant Physiology

Water relations: water transport processes (diffusion, bulk flow, osmosis, water potential,

components of water potential); Mechanism of water transport through xylem; (Ascent of sap)Water loss by transpiration, Solute transport by passive and active mechanisms and membrane transport proteins (Lecithin's); Regulation of water supply. Aquaporins and facilitated water transport; Soil plant Atmosphere continuum (SPAC), concept in stomatal physiology; Signal transduction in guard cells. **Transport processes in plants:** Active and passive transport systems, ion channels, driving forces and flow, transport of nutrients across the primary root, transport through sieve element, Regulation and transport of metabolites from the source to the sink, genetic regulation of transport systems in response to nutrients availability and growth status.

Role of micro and macro elements and assimilations of inorganic nutrients: Essential nutrients, deficiencies and plant disorders. Plant microrrhiza association,; sulfur metabolism, phosphate metabolism, calcium metabolism, assimilation of cations, chloride dynamics. **Nitrogen metabolism:** nitrogen metabolism, nitrogen fixation, assimilatory nitrate reduction, ammonia assimilation and synthesis of amino acids. Regulation of 'nif'. Plant mycorrhiza association.

Photosynthesis: Light absorption, emission, energy transfer, Z scheme of photosynthesis, electron transfer, Role of pigment in transformation of radiant energy. Light harvesting complexes, Kok curve, Kautsky curve, ETS, Photophosphorylation photo inhibition O_2 and H_2 evolution, regulation of Calvin cycle, RUBISCO activity. Photorespiration, CAM, C4 Pathway; Environment and its impact on photosynthesis, agricultural aspects. **Respiration**: Aerobic and anaerobic respiration, EMP pathway, TCA cycle, PPP, Glyoxylate cycle, Mitochondrial ETS, Cyanide resistance pathway, Gluconeogenesis, High energy compounds: Synthesis and utilization, ATP synthesis.

Lipid and other natural product metabolism in plants: Fatty acid biosynthesis, Alpha and Beta oxidation, membrane lipid biosynthesis, lipid desaturation, triacylglycerols, complex lipids, cell wall lipids, alkaloids, ceramides.

Plant growth regulators: Introduction and concept, types of growth regulators Auxin: the master growth hormone, distribution in plants, roles, how auxin works? Auxin mutants, auxin perception, auxin binding proteins, signal transduction, auxin responsive gene/ promoters /factors. Model for gene regulation, derepression of early auxin genes, Acid theory, polar auxin transport, A chemoosmotic model, commercial uses of auxin. **Gibberellins:** Foolish seedling disease, functions of GAs, location, and free verses conjugated Gas, signal transduction and mechanism of action of GAs taking amylase as an example, commercial applications. **Cytokinins:** location, functions and mechanism of action, commercial applications Ethylene: discovery, locations and functions, mutants, mechanism of actions, applications Abscisic acid: discovery, location, functions, mutantsVP1, ABA and ABI, mechanism of action; Introduction of other hormones- brassinosteroids, jasmonic acid and salicylic acid.

Sensory Photobiology: structure and function , photochemical and biochemical properties of phytochrome, Phytochrome induced plant responses, molecular mechanism of action of phytochrome in gene expression, Cryptochrome and its role in photomorphogenesis.

The flowering process: Photoperiodism and its significance, initiation of flower primordia, flowering stimulus Vernalization, endogenous clock and its regulation. Seed Germination; metabolic changes during seed germination, flowering initiation, maturity and fruiting, fruit

ripening. **Stress Physiology:** Water deficit and its physiological consequences, drought tolerance mechanisms, salinity stress and plant responses, heat stress and heat shock proteins, metal toxicity, biotic stress, HR and SAR mechanisms.

Plant defenses, role of secondary metabolites: terpenes, phenolic compounds, nitrogen – containing compounds. **Molecular genetics and plant physiology:** Over view, receptors and G. proteins, second messengers, two component sensor regulator systems in bacteria and plants, signal transduction and gene expression.

REFERENCE BOOKS

1. Devline and Witham, 1986. Plant Physiology. CBS Publs and Distributors, New Delhi.

2. Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons Inc., New York, USA.

3. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones. Springer Verlag, New York, USA.

4. Singhal *et al.* 1999. Concepts in Photobiology, Photosynthesis and Phyto-morphognesis, Narosa Pub. House, New Delhi.

5. Taiz and Zeiger, 1998. Plant Physiology Sinauer Associates Inc., Publishers, Sunderland

6. Salisbury and Ross, 4th Ed. Plant Physiology Cengage Learning (paperback)

15. Plant Developmental Biology

Model plants for developmental biology: Introduction of model plants used for development studies in plant system, advantages of each system with special emphasis on model plant *Arabidopsis.* **Terms and tools:** Cell division, planes, cell autonomy, cell polarity, radial a/symmetry, pattern formation, abaxial, adaxial identity, cell lineage vs. cell position, meristem, determinant vs. indeterminant meristem, cell ablation technique, temporal and spatial expression of genes*, in situ* hybridization, interacting genes and their position in respect to signaling pathway, targeted mutagenesis in plants, mutant generation and identification of the gene**.**

Reproduction: Male and female gametophyte development, pollination and fertilization. **Seed formation and germination:** Seed formation, cotyledon, endosperm and seed coat development. Seed dormancy and germination, seedling development, genetic regulation of vernalization.

Embryogenesis: Basic lay out of dicot and monocot embryos, stages of embryo development, embryonic axis, cell division and pattern formation in embryo, cell polarity in embryo. **Shoot development:** Structure and function of shoot apical meristem (SAM), initiation and maintenance of SAM, regulation of meristem size, antagonism between SAM and lateral organs, genetic regulation, axial bud formation, shoot branching.

Leaf development: Emergence of leaf primodium from SAM, abaxial and adaxial identity of leaf cells, leaf margin, trichome, epidermis and stomata development, vascular differentiation. **Root development:** Root apical meristem structure and function, lateral root development, lateral and adventitious root development, root hair development, hormonal regulations in root development. **Flower development:** Transition from vegetative to reproductive stage, role of homeotic gene inflorescence meristem, floral whorls specification, ABC model and beyond, whorl boundary specification, asymmetric flower development, structure and development of monocot flowers.**Use of *in vitro* system for studying development**

Suggested reading:

1. The *Arabidopsis* Book, ASPB publication (available freely at www.aspb.org).
2. Biochemistry and Molecular Biology of plants Ed. Buchanan, Grussem and Jones, ASPB publication.
3. Plant Physiology by Taiz and Zeiger, Sinauer Associate Inc. Publishers.
4. Plant Physiology – Hopkins.

10. **Physics (PHDPH)** - Based on the NET syllabus for Physical Sciences

11. **Statistics (PHDSTAT)**

Part-A: Research Methodology

Meaning of research, Role of research in important areas, Process of research, Types of research, research approach, Significance of research, Research problem: Definition, Selection and necessity of research problem.
Primary and secondary data, Qualitative and quantitative data, Classification of measurement scales, Goodness of measurement scales, Scaling, Scale classification bases, Scaling techniques, Methods of collecting primary data, Merits and demerits of different methods of collecting primary data, Non response, Classification and tabulation of data.
Introduction to sampling, Advantages of sampling over complete enumeration, Probability and non-probability sampling, Sampling and non-sampling errors, Basic concepts of simple random sampling and design of experiments. Measures of central tendency, Measures of dispersion, Probability distributions (Binomial, Poisson, Normal), Simple correlation and regression, Multiple and partial correlation, Testing of hypothesis(z,t,Fandchi-squaretests).

Part-B: Statistics

Sample space, Probability, Conditional probability, independent events, Bayes theorem, Random variables, Distribution functions (Univariate and Bi-variate), Moments and moment generating function, Independent random variables, Marginal and conditional distributions, Characteristic function, Central limit theorem (i.i.d. case). Standard discrete (Rectangular, Geometric, Negative binomial, Hyper-geometric)and continuous distributions (Uniform, Exponential, Beta, Gamma), Bivariate normal distribution, Samplingdistributions (t, F, z, chi-

square). Properties of good estimators (unbiasedness, Consistency, Efficiency, Sufficiency, Complete and minimal Sufficient statistic), Exponential families, Methods of estimation (least square, maximum likelihood, method of moments, minimum chi-square), Mean square error, Minimum variance unbiased estimators, Rao-Blackwell theorem, Lehmann-Scheffe theorem, Cramer-Rao lower bound, Basics of testing of hypothesis, Neyman-Pearson lemma, Most powerful and uniformly most powerful tests, Likelihood ratio tests, Unbiased test, Non-parametric tests for one or more samplesproblems (Sign, Wilcoxon, Mann-Whitney, Kolmogorov Smirnov, Run, Kruskal Wallies test). Gauss-Markov theorem, Estimability of parameters in linear models, BLUE. Markov chainswith finite and countable statespace,Classification of states,Limiting behavior of n-step transition probabilities, Stationary distribution, Poisson process, Birth-and- death process. Multivariate normal and its properties, Distribution of quadratic forms, Canonical correlation, Principle components analysis, Factor analysis, Classification and discriminant analysis. Stratified sampling, Systematic sampling, Probability proportional to sizesampling, Ratio, regression and product methods of estimation, Cluster sampling, Multi Stage sampling, Two- phase sampling, Successive sampling Analysis of variance and covariance, Completely Randomised designs, Randomised block designs, Latin-square designs, Missing plot techniques, Orthogonality, BIBD, 2 k factorial experiments, Confounding. Linear programming problem, Simplex methods, Duality, Assignment, Transportation problems, Queuing theory, Steady-state solutions of Markovian queuing models: M/M/1, M/M/1 with limited waiting space, M/M/C, M/M/C with limited waiting space. Elementary inventory models.

12. **Mathematics (PHDMT)**

- Algebra

  Prerequisites Preliminaries: Logic, Sets and Classes, Functions, Relations and Partitions, Products, The Integers, The Axiom of Choice, Order and Zorn's Lemma. Groups: Semigroups, Monoids and Groups, Homomorphisms and Subgroups, Cyclic Groups, Cosets and Counting, Normality, Quotient Groups, and Homomorphisms, Symmetric, Alternating,and Dihedral Groups,DirectProductsandDirectSums,Free Groups, Free Products, Generators& Relations.

  The Structure of Groups: Free Abelian Groups, Finitely Generated Abelian Groups, The Krull-Schmidt Theorem, The Action of a Group on a Set, The Sylow Theorems, Classification of Finite Groups,Nilpotent and Solvable Groups, Normal and Subnormal Series.

  Rings: Rings and Homomorphisms,Ideals,FactorizationinCommutativeRings,Rings of Quotients and Localization, Rings of Polynomials and Formal Power Series, Factorization in Polynomial Rings.

  FieldsandGaloisTheory:FieldExtensions,theFundamentalTheorem,SplittingFields, Algebraic Closure and Normality, Finite Fields.

  Linear Algebra: Vector Space and Linear Transformations, Matrices and Maps, Rank and Equivalence, Determinants, the Characteristic Polynomial, Eigenvectors and Eigenvalues.

- Real Analysis

  Sequences and series of functions, point wise and uniform convergence, Cauchy criterion for uniform convergence, Weierstrass M-test, Abel's and Dirichlet's tests for uniform convergence, uniform convergence and continuity, uniform convergence and Riemann- Stieltjes integration, uniform convergence and differentiation, Weierstrass approximation theorem, Power series, uniqueness theorem for power series, Abel'sand Tauber's theorems.

  Functions of several variables, linear transformations, Derivatives in anopen subset of Rn, Chain rule, Partial derivatives, interchange of the order of differentiation, Derivatives of higher orders, Taylor's theorem, Inverse function theorem, Implicit function theorem, Jacobians, extremum problems with constraints, Lagrange's multiplier method, Differentiation of integrals, Partitions

of unity, Differential forms, Stoke's theorem.

Lebesgueouter measure.Measurablesets.Regularity.Measurablefunctions.Boreland Lebesgue measurability. Non-measurable sets.

Integration of Non-negative functions. The General integral. Integration of Series. Reimann and Lebesgue Integrals.

Measures and outer measures, Extension of a measure. Uniqueness of Extension. Completion of a measure. Measure spaces. Integration with respect to ameasure.The Lp-spaces. Convex functions, Jensen's inequality. Holder and Minkowskinequalities. Completeness of Lp, Convergence in Measure, Almost uniform convergence.

- Topology

Countable and uncountable sets. Infinite sets and the Axiom of Choice. Cardinal numbers and its arithmetic. Schroeder-Bernstein theorem. Cantor's theorem and the continuum hypothesis. Zorn's lemma Well-ordering theorem.

Definition and examples of topological spaces. Closed sets. Closure. Densesubsets.

Neighbourhoods. Interior, exterior and boundary. Accumulation points and derived sets. Bases and sub-bases. Subspaces and relative to pology.

Continuous functions and homomorphism, compactness. Continuous functions and compact sets. Basic properties of compactness. Compactness and finite intersection property. Sequentially and countably compact sets. Local compact ness and one point compactification. Stone-vech compactification. Compactness in metricspaces.

Equivalence of compactness, countable compactness and sequential compactness inmetric spaces, Connected spaces (Connectedness only for metricspace.)

- Functional Analysis

Normed linear spaces. Banach spaces and examples. Quotientspaceofnormedlinear spacesanditscompleteness,equivalentnorms.RieszLemma,basicpropertiesoffinite dimensional normed linear spaces and compactness. Weak convergence and bounded linear transformation, normed linear spaces of bounded linear transformations, dual spaces with examples. Uniform boundedness theorem and some of its consequences. Open mapping and closed graph theorems. Hahn-Banach theorem for real linear spaces, complex linear spaces and normed linear spaces.

Reflexive space. Weak Sequential Compactness. Compact Operators. Solvability of linear equations in Banach spaces, the closed Range Theorem.

Inner product spaces. Hilbert spaces. Orthonormal Sets. Bessel's inequality. Complete orthonormal sets and Parseval's identity. Structure of Hilbert spaces. Projection theorem. Riesz representation theorem. Adjoint of an operator on a Hilbert space.

Reflexivity of Hibert spaces. Self- adjoint operators, Positive, projection, normal and unitaryoperators.Abstractvariationalboundary-valueproblem.Thegeneralized Lax-Milgram theorem.

- Differential Equations

Preliminaries-initial value problem and the equivalent integral equation, mth order equation in d-dimensions as a first order system, concepts of local existence, existence in the large and uniqueness of solutions with examples.

Linear Differential Equations-Linear Systems, Variation of constants, reduction to smaller systems. Basic inequalities, constant coefficients. Adjoint systems, Higher order equations.

Dependence on initial conditions and parameters; Preliminaries. Continuity. Differentiability. Higher Order Differentiability.

Linear second order equations-Preliminaries. Basic facts. Theorems of Sturm. Sturm- Liouville Boundary Value Problems. Number of zeros. Nonoscillatory equations and principal solutions. Nonoscillation theorems. Use of Implicit function and fixed point theorems-Periodic solutions. Linear equations. Nonlinear problems.

Second order Boundary value problems- Linear problems. Nonlinear problems. Aproribounds, Green's Function.

- Partial Differential Equations

  Examples of PDE. Classification.

  Transport Equation-Initial value Problem. Non-homogeneousEquation. Laplace's Equation - Fundamental Solution, Mean Value Formulas, Properties of Harmonic Functions, Green's Function, Energy Methods.

  Heat Equation-Fundamental Solution, Mean Value Formula, Properties of Solutions, Energy methods. Wave Equation-Solution by spherical Means, Non-homogeneous Equations, Energy Methods.

  NonlinearFirstOrderPDE-CompleteIntegrals,Envelopes,Characteristics, Hamilton-Jacobi Equations (Calculus of Variations, Hamilton's ODE, Legendre Transform).

  Representation of Solutions-Separation of Variables, Similarity Solutions (Plane and Travelling Waves, Solitons, Similarity under Scaling), Fourier and Laplace Transform, A symptotics (Singular Perturbations, Laplace'sMethod), Power Series.

Section B-Research Aptitude

The processes broadly involved in undertaking math research: Ability to generalize and particularise, ability to make 'educated guesses' as conjectures, try to prove /disprove theorems. The objectives are

- To assess the understanding of mathematical research processes.
- To assess the inclination and aptitude for undertaking research in mathematics

13. **Hindi (PHDHIN)**

पीएच.डी (हिंदी) की प्रवेश परीक्षा के लिए पाठ्यचर्या

1. शोध प्रविधि– शोध का उद्देश्य, शोध और आलोचना, शोध के विविध पक्ष और प्रविधियाँ
2. हिंदी साहित्य का इतिहास, परिस्थितियाँ, प्रवृत्तियाँ एवं प्रमुख साहित्यकार
3. आदिकालीन एवं मध्यकालीन कविता
4. आधुनिक हिंदी कविता (छायावाद, प्रगतिवाद, प्रयोगवाद)
5. नाटक एवं अन्य गद्य विधाएँ (स्कंदगुप्त- जयशंकर प्रसाद, आधे- अधूरे – मोहन राकेश, अतीत के चलचित्र- महादेवी वर्मा, किन्नर देश की ओर- राहुल सांकृत्यायन, अदम्य जीवन- रांगेय राघव, अशोक के फूल और अन्य निबंध- हजारी प्रसाद द्विवेदी, जूठन- ओमप्रकाश वाल्मीकि)
6. हिंदी उपन्यास (गोदान, बाणभट्ट की आत्मकथा, मैला आँचल, महाभोज), हिंदी कहानी (प्रेमचंद की कहानियाँ, मानसरोवर खंड-1)
7. भाषा विज्ञान और हिंदी भाषा
8. साहित्य सिद्धांत और समालोचना (काव्य लक्षण, काव्य प्रयोजन, काव्य हेतु, रस सिद्धांत, साधारणीकरण।

प्लेटो, अरस्तू, लांजाइनस, क्रोचे, टी.एस. इलियट, आई.ए. रिचर्ड्स, नयी समीक्षा, मनोविश्लेषणवादी आलोचना, मार्क्सवादी आलोचना, अस्तित्ववाद, आधुनिकतावाद, उत्तर आधुनिकता, दलित साहित्य और चिंतन (डॉ. आम्बेडकर, ज्योतिबा फुले), अस्मितामूलक विमर्श।

नोट : यह प्रश्न पत्र 100 अंकों का होगा।

14.

पीएच.डी. (संस्कृत) प्रवेश परीक्षा का पाठ्यक्रम

1. शोध प्रविधि
2. वैदिक साहित्य
3. दर्शन साहित्य
4. वेदांग
5. भाषा विज्ञान
6. छंदशास्त्र एवं अलंकार
7. काव्य शास्त्र
8. पुराणोतिहास, धर्मशास्त्र
9. अभिलेख शास्त्र
10. भारतीय संस्कृति के तत्व
11. आधुनिक संस्कृत साहित्य

15. **Development Studies (PHDDV)**

COURSE1: DEVELOPMENT STUDIES:ANOVERVIEW(8CREDITS) BLOCK 1: DEVELOPMENT: AN OVERVIEW

Unit 1: Introduction to Development: Why Development? Objectives and Scope of Development; development and growth; Development Ethics: Gandhi, Lebret,Myrdalandother ethical concepts

Unit2:Dimensionsof Development:Economic,Political,Social,Human,Cultural,Genderand Ethical Dimensions

Unit 3: Development Paradigm: Inclusive Development, Sustainable Development, Good Governance, International Relationship, Women Empowerment and Participatory Development Paradigms

Unit 4: Actors of Development: Markets, State and other Heterogeneous Actors such as international organization, and CVOs

BLOCK 2: DEVELOPMENT THEORIES

Unit 1: Classical and Neo-Classical Theories and Marxian theory

Unit2:DevelopmentalistTheories:BalancedandUnbalancedGrowththeories,Rostow's Stages of

Economic Growth, Gunnar Myrdal theory

Unit 3: Heterogeneous Theories: Modernization theory, Human Capital Theory, Neo- Liberal Theory and Dependency Theories

BLOCK 3: EDIFICES OF DEVELOPMENT

Unit 1: Development Governance: meaning and scope of development governance; functions and components; features of good governance; attributes and challenges of good development governance

Unit 2: Development Administration: concept and meaning of development administration, scope of development administration, features of good development administration, and challenges of development administration

Unit 4: Development Management: meaning and concept of development management, aim and scope of development management; development management cycle and requisites of effective development management

BLOCK4:DEVELOPMENTALISSUESANDCHALLENGES-I

Unit 1:Economic Challenges:Poverty, Inequality, InflationandUnemployment, Population and Development

Unit2:SocialChallenges:ConflictandDevelopment,DisplacementandDevelopment,Marginalization, Social Disparities and Inclusion, Education and Health

Unit3:EmergingChallenges:Globalization,Climatechange,SocialClustering,Regional Development

BLOCK 5: DEVELOPMENT ISSUES AND CHALLENGES-II

Unit1:AgricultureandDevelopment:Roleofagriculture,IssuesandChallengesof agriculture, Measures to improve agriculture

Unit 2: Industry and Development: Role ofindustryindevelopment,IssuesandChallengesof industrial Development, Industrial Development measures

Unit3:ServiceSectorandDevelopment:Roleof Service Sector in Development, Issues and challenges of service sector, measures to strengthen service sector.

Unit 4: Informal Sector and Development: role of informal sector in development, measures to formalize the informal sector and challenges of informal sector

BLOCK 6: INDIAN DEVELOPMENT

Unit 1: Urban Development in India: Urbanization, Issues and Challenges of Urbanization, Smart Cities

Unit 2: Rural Development in India: Components of Rural Development, Models of Rural Development, Issues and Challenges ofRural Development,SmartVillage,RuralDevelopment measures

Unit 3: Planning and DevelopmentinIndia:Impactofplanningbeforeandafterliberalization and NITI Ayyog

Unit5:GlobalizationandDevelopmentinIndia:Globalizationanditsimpactonthe development in India

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COURSE 2: RESEARCH METHODOLOGY IN DEVELOPMENT STUDIES(8 CREDITS)

BLOCKS	UNITS
Block-1	**Fundamentalsof Social Science Research**
	1.Social Science Research-An Overview
	2.Component of Social Science Research
	3.Research Designs
	4.Research Project Formulation
Block-2	**Development Research**
	1.Basic of Development Research
	2.Methods of Development Research
	3.Development Research Applications

Block-3

Measurement and Sampling
1. Measurement
2.Scales and Tests
3.Reliability and Validity
4.Sampling

Block-4 **Data Collection andAnalysis-1**
1.Quantitative Data Collection Methods and Devises
2.Qualitative Data Collection Methods and Devises
3.Overview of Statistical Tools

Block -5 **Data Collection andAnalysis-2**
1.Data Sources-Uses and Limitations
2.Data Processing and Analysis Report Writing
3.Report Writing
4.Use of Computer in Data Analysis

16. **Computer Science (PHDCS)**

PART–1(Research Methodology)

Sets, Relations, Functions, Matrices and Determinants, Probability and Statistics, Descriptiveand Inferential Statistics, Probability Distributions Numerical Methods, Finite Differences, Numerical Integration.

PART–2(Computer Science)

Computer System Architecture Digital Logic Circuits and Components: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters, Memory Unit.

Data Representation: Data Types, Number Systems and Conversion, Complements, Fixed Point Representation, Floating Point Representation, Error Detection Codes, Computer Arithmetic - Addition, Subtraction, Multiplication and Division Algorithms.

Register Transfer andMicrooperations:RegisterTransferLanguage,BusandMemoryTransfers, Arithmetic, Logic and Shift Microoperations.

Basic Computer Organization and Design: Stored Program Organization and Instruction Codes, ComputerRegisters,ComputerInstructions,TimingandControl,InstructionCycle,Memory-Reference Instructions, Input-Output, Interrupt.

Programming the Basic Computer: Machine Language, Assembly Language, Assembler, Program Loops, Subroutines, Input-Output Programming.

Micro programmed Control: Control Memory, Address Sequencing, Design of Control Unit. CentralProcessingUnit:GeneralRegisterOrganization,StackOrganization,InstructionFormats, Addressing Modes, RISC Computer, CISC Computer.

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline,

Vector Processing, Array Processors.

Input-OutputOrganization:PeripheralDevices,Input-OutputInterface,AsynchronousDataTransfer, Modes of Transfer, Priority Interrupt, DMA, Serial Communication.

MemoryHierarchy:MainMemory,Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Inter- processor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence, Multi core Processors.

Discrete Structures and Optimization

MathematicalLogic:PropositionalandPredicateLogic,PropositionalEquivalences,Normal Forms, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

SetsandRelations:SetOperations,RepresentationandPropertiesofRelations, Equivalence Relations, Partially Ordering.

Counting Mathematical Induction and Discrete Probability: Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Inclusion Exclusion Principle,Mathematical Induction, Probability, Bayes' Theorem.

Group Theory: Groups, Subgroups, Semi-Groups, Product and Quotients of AlgebraicStructures, Isomorphism, Homomorphism, Automorphism, Rings, Integral Domains, Fields, Applications of Group Theory.

GraphTheory:SimpleGraph,Multigraph,WeightedGraph,PathsandCircuits,ShortestPathsin

Weighted Graphs, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits, Planner graph, Graph Coloring, Bipartite Graphs, Trees and Rooted Trees, Prefix Codes, Tree Traversals, Spanning Trees and Cut-Sets.

Boolean Algebra: Boolean Functions and its Representation, Simplifications of Boolean Functions.

Optimization: Linear Programming - Mathematical Model, Graphical Solution, Simplex andDualSimplexMethod,SensitiveAnalysis;IntegerProgramming,TransportationandAssignment Models.

PERT-CPM: Diagram Representation, Critical Path Calculations, Resource Levelling, Cost Consideration in Project Scheduling.

Programming Languages and Computer Graphics

Language Design and Translation Issues: Programming Language Concepts, Paradigms and Models, Programming Environments, Virtual Computers and Binding Times, Programming Language Syntax, Stages in Translation, Formal Transition Models.

Elementary Data Types: Properties of Types and Objects; Scalar and Composite Data Types. Programming in C: Tokens, Identifiers, Data Types, Sequence Control, Subprogram Control, Arrays, Structures, Union, String, Pointers, Functions, File Handling, Command Line Arguments, Preprocessors.

Object Oriented Programming: Class, Object, Instantiation, Inheritance,Encapsulation,Abstract Class, Polymorphism.

Programming in C++: Tokens, Identifiers, Variables and Constants; Data types, Operators, Control statements, Functions Parameter Passing, Virtual Functions, Class and Objects; Constructors and Destructors; Overloading, Inheritance, Templates, Exception and Event Handling; Streams and Files; Multifile Programs.

WebProgramming:HTML,DHTML,XML,Scripting,Java,Servlets, Applets.

Computer Graphics: Video-Display Devices, Raster-Scan and Random-Scan Systems; Graphics Monitors,

Input Devices, Points and Lines; Line Drawing Algorithms, Mid- Point Circle and Ellipse Algorithms; Scan Line Polygon Fill Algorithm, Boundary-Fill and Flood-Fill.

2-D Geometrical Transforms and Viewing: Translation, Scaling, Rotation, Reflection and Shear Transformations; Matrix Representations and Homogeneous Coordinates; Composite Transforms, Transformations Between Coordinate Systems, Viewing Pipeline, Viewing Coordinate Reference Frame, Window to View Port Coordinate Transformation, Viewing Functions, Line and Polygon Clipping Algorithms. 3-D Object Representation, Geometric Transformations and Viewing: Polygon Surfaces, Quadric Surfaces, Spline Representation, Bezier and B-Spline Curves; Bezier and B-Spline Surfaces; Illumination Models, Polygon Rendering Methods, Viewing Pipeline and Coordinates; General Projection Transforms and Clipping.

Database Management Systems

DatabaseSystemConceptsandArchitecture:DataModels,Schemas,andInstances; Three-Schema Architecture and Data Independence; Database Languages and Interfaces; Centralized and Client/Server Architectures for DBMS.

Data Modeling: Entity-Relationship Diagram, Relational Model - Constraints, Languages, Design, and Programming, Relational Database Schemas, Update Operations and Dealing with ConstraintViolations; RelationalAlgebraandRelationalCalculus;CoddRules.SQL:Data

Definition and Data Types; Constraints, Queries, Insert, Delete, and Update Statements; Views, Stored Procedures and Functions; Database Triggers, SQL Injection. Normalization for Relational Databases: Functional Dependencies and Normalization; Algorithms for Query Processing and Optimization; Transaction Processing, Concurrency Control Techniques, Database Recovery Techniques, Object and Object-Relational Databases; DatabaseSecurityand Authorization.

Enhanced Data Models: Temporal Database Concepts, Multimedia Databases, Deductive Databases, XML and Internet Databases; Mobile Databases, Geographic Information Systems, Genome Data Management, Distributed Databases and Client- Server Architectures. Data Warehousing and Data Mining: Data Modeling for DataWarehouses, Concept Hierarchy,OLAP and OLTP; Association Rules, Classification, Clustering, Regression, Support Vector Machine, K-Nearest Neighbour, Hidden Markov Model, Summarization, Dependency Modeling, Link Analysis, Sequencing Analysis, Social Network Analysis.Big Data Systems: Big Data Characteristics, Types of Big Data, Big Data Architecture, Introduction to Map-Reduce and Hadoop; Distributed File System, HDFS. NOSQL: NOSQL and Query Optimization; Different NO SQL Products, Querying and Managing NOSQL;Indexing and OrderingDataSets;NOSQL in Cloud.

System Software and Operating System

System Software: Machine, Assembly and High-Level Languages; Compilers and Interpreters; Loading, Linking and Relocation; Macros, Debuggers. Basics of Operating Systems: Operating System Structure, Operations and Services; System Calls, Operating-System Design and Implementation; SystemBoot. Process Management:Process Scheduling and Operations; Inter-process Communication, Communication in Client–Server Systems, Process Synchronization,

Critical-Section Problem, Peterson's Solution, Semaphores, Synchronization. Threads: Multicore Programming, Multithreading Models, Thread Libraries, Implicit Threading, Threading Issues.

CPU Scheduling: Scheduling Criteria and Algorithms; Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling.

Deadlocks: Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Avoidance and Detection; Recovery from Deadlock.

Memory Management:Contiguous Memory Allocation, Swapping, Paging,Segmentation, Demand Paging,

Page Replacement, Allocation of Frames, Thrashing, Memory-Mapped Files.

StorageManagement:Mass-StorageStructure,DiskStructure,SchedulingandManagement, RAID Structure.

File and Input/Output Systems: Access Methods, Directory and Disk Structure; File- System Mounting, File Sharing, File-System Structure and Implementation; Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance; Recovery, I/O Hardware, Application I/O Interface, Kernel I/O Sub-system, Transforming I/O Requests to Hardware Operations.

Security: Protection, Access Matrix, Access Control, Revocation of Access Rights, Program Threats, System and Network Threats; Cryptography as a Security Tool, User Authentication, Implementing Security Defenses.

Virtual Machines: Types of Virtual Machines and Implementations; Virtualization. Linux Operating Systems: Design Principles, Kernel Modules, Process Management, Scheduling,

Memory Management, File Systems, Input and Output; Interprocess Communication, Network Structure.

Windows Operating Systems:Design Principles, System Components, Terminal Services and Fast User Switching; File System, Networking.

Distributed Systems:Types of Network based Operating Systems, Network Structure, Communication Structure and Protocols; Robustness, Design Issues, Distributed File Systems.

9. Software Engineering

Software Process Models: Software Process, Generic Process Model–Framework Activity, Task Set and Process Patterns; Process Lifecycle, Prescriptive Process Models, Project Management, ComponentBasedDevelopment,Aspect-OrientedSoftwareDevelopment,FormalMethods, Agile Process Models –Extreme Programming (XP), Adaptive Software Development, Scrum, Dynamic System Development Model, Feature Driven Development, Crystal, Web Engineering. Software Requirements: Functional and Non-Functional Requirements; Eliciting Requirements, Developing Use Cases, Requirement Analysis and Modelling; Requirements Review, Software RequirementandSpecification(SRS)Document.SoftwareDesign:Abstraction,Architecture, Patterns, Separation of Concerns, Modularity, Information Hiding, Functional Independence, Cohesion and Coupling; Object-Oriented Design, Data Design, Architectural Design, User Interface Design, Component Level Design.

Software Quality: McCall's Quality Factors, ISO9126 Quality Factors, Quality Control, Quality Assurance, Risk Management, Risk Mitigation, Monitoring and Management (RMMM); Software Reliability. Estimation and Scheduling of Software Projects: Software Sizing, LOC and FP based Estimations; Estimating Cost and Effort; Estimation Models, Constructive Cost Model (COCOMO), Project Scheduling and Staffing; Time-line Charts. Software Testing: Verification and Validation; Error, Fault, Bug and Failure; Unit and Integration Testing; White-box and Black-box Testing; Basis Path Testing, Control Structure Testing, Deriving Test Cases, Alpha and Beta Testing; Regression Testing, Performance Testing, Stress Testing. Software Configuration Management: Change Control and Version Control; Software Reuse, Software Re-engineering, Reverse Engineering.

10. Data Structures and Algorithms

Data Structures: Arrays and their Applications; Sparse Matrix, Stacks, Queues, Priority Queues, Linked Lists, Trees, Forest, Binary Tree, Threaded Binary Tree, Binary Search Tree, AVLTree, BTree,B+Tree,B*Tree,DataStructureforSets,Graphs,SortingandSearchingAlgorithms; Hashing. Performance Analysis of Algorithms and Recurrences: Time and Space Complexities; Asymptotic Notation, Recurrence Relations. Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound. Lower Bound Theory: Comparison Trees, Lower Bounds through Reductions. Graph Algorithms: Breadth- First Search, Depth-First Search, Shortest Paths,

Maximum Flow, Minimum Spanning Trees. Complexity Theory: P and NP Class Problems; NP-completeness and Reducibility. Selected Topics: Number Theoretic Algorithms, Polynomial Arithmetic, Fast Fourier Transform, String Matching Algorithms. Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

11. Theory of Computation and Compilers

Theory of Computation: Formal Language, Non-Computational Problems, Diagonal Argument, Russel's Paradox.

Regular Language Models: Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis.

Context FreeLanguage:PushdownAutomaton(PDA),Non-DeterministicPushdownAutomaton (NPDA), Context Free Grammar, Chomsky Normal Form, Greibach Normal Form, Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Context Free Grammars; Properties of Context Free Language.

TuringMachines(TM):StandardTuringMachineanditsVariations;UniversalTuringMachines, Models of Computation and Church-Turing Thesis; Recursive and Recursively- Enumerable Languages; Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems.

Unsolvable Problems and Computational Complexity: Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.

Syntax Analysis: Associativity, Precedence, Grammar Transformations, Top Down Parsing, Recursive Descent Predictive Parsing, LL(1) Parsing, Bottom up Parsing, LR Parser, LALR(1)Parser.

Semantic Analysis: Attribute Grammar, Syntax Directed Definitions, Inherited and Synthesized Attributes; Dependency Graph, Evaluation Order, S-attributed and L- attributed Definitions; Type-Checking.

Run Time System: Storage Organization, Activation Tree, Activation Record, Stack Allocation of Activation Records, Parameter Passing Mechanisms, Symbol Table.

Intermediate Code Generation: Intermediate Representations, Translation of Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls.

Code GenerationandCodeOptimization:Control-flow,Data-flowAnalysis,LocalOptimization, Global Optimization, Loop Optimization, Peep-Hole Optimization, Instruction Scheduling**.**

12. Data Communication and Computer Networks

Data Communication: Components of a Data Communication System, Simplex, Half- Duplex and Duplex Modes of Communication; Analog and Digital Signals; Noiseless and Noisy Channels; Bandwidth, Throughput and Latency; Digital and Analog Transmission; Data Encoding and Modulation Techniques; Broadband and Baseband Transmission; Multiplexing, Transmission Media, Transmission Errors, Error Handling Mechanisms.

Computer Networks: Network Topologies, Local Area Networks, Metropolitan Area Networks, Wide Area Network, Wireless Networks, Internet.

Network Models: Layered Architecture, OSI Reference Model and its Protocols; TCP/IP Protocol Suite, Physical, Logical, Port and Specific Addresses; Switching Techniques. Functions of OSI and TCP/IP Layers: Framing, Error Detection and Correction; Flow and Error Control; Sliding Window Protocol, HDLC, Multiple Access – CSMA/CD, CSMA/CA, Reservation, Polling, Token Passing, FDMA, CDMA, TDMA, Network Devices, Backbone Networks, Virtual LANs.

IPv4StructureandAddressSpace;Classful and Classless Addressing; Datagram, Fragmentation

and Checksum; IPv6 Packet Format, Mapping Logical to Physical Address (ARP), Direct and Indirect Network Layer Delivery; Routing Algorithms, TCP, UDP and SCTP Protocols; Flow Control, Error Control and Congestion Control in TCP and SCTP.

World Wide Web (WWW): Uniform Resource Locator(URL),Domain Name Service (DNS), Resolution - Mapping Names to Addresses and Addresses to Names; Electronic Mail Architecture, SMTP, POP and IMAP; TELNET and FTP. Network Security: Malwares, Cryptography and Steganography; Secret-Key Algorithms, Public-Key Algorithms, Digital Signature, Virtual Private Networks, Firewalls.

Mobile Technology: GSM and CDMA; Services and Architecture of GSM and Mobile Computing; Middleware and Gateway for Mobile Computing; Mobile IP and Mobile Communication Protocol; Communication Satellites, Wireless Networks and Topologies; Cellular Topology, Mobile Adhoc Networks, Wireless Transmission and Wireless LANs; Wireless Geolocation Systems, GPRS and SMS. Cloud Computing and IoT: SaaS, PaaS, IaaS, Public and Private Cloud; Virtualization, Virtual Server, Cloud Storage, Database Storage, Resource Management, Service Level Agreement, Basics **of IoT.**

13. Artificial Intelligence (AI)

Approaches to AI: Turing Test and Rational Agent Approaches; State Space Representation ofProblems,HeuristicSearchTechniques,GamePlaying,Min-MaxSearch,AlphaBetaCutoff Procedures.KnowledgeRepresentation:Logic,SemanticNetworks,Frames,Rules,Scripts, Conceptual Dependency and Ontologies; Expert Systems, Handling Uncertainty in Knowledge. Planning: Components of a Planning System,Linear and Non Linear Planning; Goal Stack Planning, Hierarchical Planning, STRIPS, Partial Order Planning.

Natural Language Processing: Grammar and Language; Parsing Techniques, Semantic Analysis and Prgamatics.

Multi Agent Systems: Agents and Objects; Agents and Expert Systems; Generic Structure of Multiagent System, Semantic Web, Agent Communication, Knowledge Sharing using Ontologies, Agent Development Tools.

Fuzzy Sets: Notion of Fuzziness, Membership Functions, Fuzzification and Defuzzification; Operations on Fuzzy Sets, Fuzzy Functions and Linguistic Variables; Fuzzy Relations, Fuzzy Rules and Fuzzy Inference; Fuzzy Control System and Fuzzy Rule Based Systems.

Genetic Algorithms (GA): Encoding Strategies, Genetic Operators, Fitness Functions and GA Cycle; Problem Solving using GA.

Artificial Neural Networks(ANN):Supervised, Unsupervised and Reinforcement Learning; Single Perceptron, Multi Layer Perception.

17. **Interdisciplinary and Trans-disciplinary Studies (PHDITS)**

RITS001:IntroductiontoInterdisciplinary and Trans-disciplinary

Studies 1.Knowledge Production and Emergence of Disciplines

2.Disciplinary Approaches: Challenges and

Opportunities3.Interdisciplinary Studies:

Nature and Scope

4. Areas of Interdisciplinary Inquiry (Environment, Culture and Civilization, Women and Gender studies, disability, migration and diaspora, labour studies,globalization, sustainable development)

5. Emerging Issues and Challenges

6. Areas of Interdisciplinary Inquiry: The candidate has to select anyone of the specialization area in consultation with supervisor. This course so proposed by research guide shall be approved by the Doctoral Committee and then assigned to the student.

References:

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Choudry, Aziz (2011) On Knowledge Production, Learning and Research in Struggle, Uniting Struggles : Critical Social Research in Critical Times, http://www.alternateroutes.ca/index.php/ar/article/viewFile/15862/15764

Frodeman,Robertet.al.(2017)TheOxofordHandbookofInterdisciplinarity,OxfordUniversityPressGi

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Klein,J.T.&Newell,W.H.(1987),AdvancingInterdisciplinaryStudies,inJerryGraff&Jame sRatcliff,H andbookoftheUndergraduateCurriculum,SanFrancisco:Jossey-Bass,pp. 393-394

Kuhn,Thomas(1970)TheStructureofScientificRevolution,Chicago:TheUniversityofChicago

Merton, R.K (2002), Science, Technology and Society in Seventeenth Century, England, Fertig, HowardPublisher,ISBN0865274347

Miser, H.J.(1992),Craftinoperationsresearch, OperationalResearch40(4), pp.633-639 Müller-Merbach,H

Weingart,Peter(2017)AShortHistoryofknowledgeformations,inFrodeman,Robertet.al.(2017) The OxofordHandbook of Interdisciplinarity, Oxford University Press

Garrett-Jones,Sam (2007)*TransdisciplinarityandDisciplinarityInTheUniversityofTheFuture,*UnityofKnowledge (In Transdisciplinary Research For Sustainability)– Vol.

RITS002: Research Methods and Techniques

1. IntroductiontoSocialScienceResearch
2. TypesofResearch
3. Sources ofData
4. Techniques ofDataCollection
5. Ethnography

6. Sampling
7. ResearchDesign
8. AnalysisandInterpretationofData
9. QuantitativeMethods
10. Ethics in Research

References:

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Simon, Julian Lincoln. 2003. *Basic research methods in social science: The art of empirical investigation*. New Brunswick, NJ: Transaction Publishers. [Reprint of previous 2nd edition, 1978, entitled Basic research methods in social sciences:Theartofempiricalinvestigation.]558p.
Yin, Robert K. 2008. *Case study research: Design and methods.* Applied Social Research Methods Series 5.4thed.City, ST:Sage Publications.240 p

18. Environmental Science (PHDEV)

RESEARCH METHODOLOGY: Meaning of Research in Environmental Sciences, Characteristics and Types of Research, Hypotheses, Methods of Research, Major emerging areas in environmental sector and interdisciplinary research, problems encountered by researchers in India in the field of Environmental Science. Basic concepts of Techniques of defining research problem; literature review, types of data collection. Basic concepts in analytical techniques of chromatography & spectroscopic methods. Ethical, legal, social and scientific issues in Environmental Science Research. Basic concepts in writing research papers, reports and research proposals. Role of IPR in Research and Development.

Subject areas: Environmental Chemistry, Environmental Biotechnology, Environmental Geomicrobiology, Environmental management, Natural resource management, Climate change, Sustainability science

19. SOCIAL WORK (PHDSW)

Part A- Research Methodology

1. Introduction to Social Work Research - Philosophical foundation, Approaches, Process and Methods in social science research
2. Relevance and importance of review of Literature, formulation of research problem, objectives, hypothesis and preparing research proposal
3. Research Design - Descriptive, Exploratory, Diagnostic, Evaluation, Action Research and Experimental
4. Sampling and Data collection
5. Research Tools: Questionnaires, Rating Scales, Attitudinal Scales and Tests
6. Data Processing, Analysis and Reporting of Research
7. Qualitative Approaches, Research Methods, Tools, Techniques and Data analysis.
8. Analysis of qualitative data
9. Plagiarism, Publication ethics, Referencing styles, Process of ethical clearance, and Ethics in social

work research

10. Application of statistics in research work- Need and importance of statistics, Types of data, Measures of central tendency and variability; Descriptive and Inferential Statistics; Parametric and Non-parametric tests

Part B- Theory and Practice of Social Work

11. Social Work Profession in changing contexts: Micro, Meso and Macro level.
12. Social work in Indian and International Context.
13. Theories of Social Work
14. Values, Principles, Ethics in social work and Code of Ethics for social workers
15. Models of Social Work
16. Constitutional provisions and rights, Social development and Social Justice.
17. Contemporary Social Movements: Indian and western Models. Philosophy and Methods.
18. Social Policy and Advocacy
19. Social Work Education and practice, Challenges of professional Social Work
20. Role of professional social work association
21. Advanced/ critical social work practice
22. Social Work practice in various groups/areas
23. Draft a Research Proposal

20. Nutritional Science (PHDFN)

Course: Advance Nutrition

The course would cover the following concepts/topics:

- Nutrition: Basic concepts and physiological requirements,
- Recommended Dietary Allowances, Estimated Average Requirements,Tolerableupper limit, AMDR: Basic Concepts
- Nutrient Requirements for Indians: Energy Requirements, ProteinandAminoAcidRequirement, Fat and Fatty Acid Requirements, Fat- Soluble Vitamins and Water- Soluble Vitamins, Mineral requirements etc.
- Nutritional needs during the life cycle:Pregnancy/lactation,Infancy,Preschool,School Age, Adolescent, Adulthood and Old Age
- Diet planning during the life cycle
- Nutrition needs for sports person,
- NutritionduringSpecialConditions–Emergency,Highaltitude,SpaceMission etc..

Course:ClinicalandTherapeuticNutrition

The course would cover the following concepts/topics:

- IntroductiontoDiettherapy,TherapeuticNutrition,
- Adaptations of Therapeutic Diets,
- Nutritional managementofFevers (Typhoid, Tuberculosis etc.)and infections (HIV/AIDS),

- NutritionalmanagementofpatientwithBurns,Trauma,SepsisandSurgery,
- NutritionalmanagementofFood AllergiesandFood Intolerance,
- Nutrition, Diet and Cancer,
- NutritioncareforWeightManagement(Underweight,Overweight, Obesity),
- Nutritional management of Cardiovascular Diseases (Dysipidemia, Hypertension etc.),
- Nutritional management of Metabolic Diseases – Diabetes, Gout etc.
- NutritionalmanagementofGastrointestinalTractDisorders(PepticUlcer,Ulcerative colitis, Dyspepsia, Malabsorption Syndrome etc.)
- Nutritional management in Pancreatic, Gall bladder and Liver Diseases,
- Nutritional management of Renal Disease,
- Nutritional management of Neurological Disorders (Ketogenic Diet etc.),
- Paediatric and Geriatric Nutrition.

Course: Public Health Nutrition

The course would cover the following concepts/topics:

- Concept of Public Health Nutrition, Public Nutrition: Multidisciplinary Concept,
- Nutritional Problems of Public Health Importance – VAD, PEM,Anaemia, Iodine Deficiency Disorders, Zinc deficiency and Vitamin D deficiency,

-BasicConcept,Etiology,Consequences

-Strategies to Combating Public Nutrition Problems,

-National programmes/policies related to prevention of deficiency disorders

-Programme Management and Evaluation

- Health Economics and Economics of Malnutrition,
- Food and Nutrition Security,
- Assessment of Nutritional Status in Community Settings: Methods and Techniques,
- Nutrition Monitoring and Surveillance,
- National Nutrition Policy and Nutrition Programmes (Operational details):

-Supplementary feeding programmes,

-Nutrient Deficiency Control programmes,

-Food Security programmes etc.

- Programme Management and Administration,
- Infrastructure Systems for delivery of the nutrition and health services in India
- Conceptualization and the Process of Nutrition Education, Behaviour Change communication (BCC);
- Nutrition Education Programmes – Formulation, Implementation, Evaluation.

Course: Food Service Management

The course would cover the following concepts/topics:

- History and Development of Food Service System;
- Planning/Setting Up a Food Service Unit;

- Entrepreneurship and Food Service Management;
- Menu Planning
- FoodManagement:MenuPlanning,PurchaseandStorage,FoodProduction,Delivery and Service: Goals, Styles and Different Systems; Records and Controls;
- Personnel management

-Leadership

-StaffPlanningandManagement(Approaches,Issues,employmentprocess,staff recruitment and selection

-StaffTraining(Need,Trainingprocess,EvaluationandAppraisal etc.)

-WorkProductivity;

- Plantand Equipment Maintenance, Sanitation and Safety,
- IssuesinWorkerSafetyandSecurity(PersonalHygieneandSanitary Practices);
- Food hazards, Food borne diseases and their prevention
- Factors influencing growth of microorganisms
- Food Laws, Food Regulations, Standards and Quality control;
- Food Adulteration, Additives, Contaminants.

Course: Research Methods and Biostatistics

The course would cover the following concepts/topics:

- Basic Concepts; Formulation of Research Problem and Objectives;
- Designing research proposal and study
- DesignStrategiesinResearch–DescriptiveStudies,AnalyticStudies,Experimental studies, Intervention trials etc.,
- Methods of Sampling,

- DataCollectionToolsandTechniques,
- Presentation and Summarization of Data,
- Graphical presentation of quantitative data,
- Measures of Disease Frequency and Association,
- Reference Values,
- HealthIndicatorsandValidityofDiagnosticTests,
- MeasuresofCentralTendency:mean,medium, mode,
- MeasuresofVariability:StandardDeviation,Variance,
- Measures of Relationship – Correlation,
- HypothesisTesting–parametricandnon-parametrictests,
- Proportions, Relative risk, Odds ratio.
- EthicsandScientificWritingfor Research
- Computer Applications

21. **Child Development (PHDCD)**

The syllabus for interview is based on the syllabus of the M.Sc. Home Science specialization' Child Development' as well as the relevant components in the UGC-NET syllabus pertaining to the component 'Research Methodology' and the specialization component' Child Development'. (The specialization 'Child Development' could be referred to by different names in various universities such as HumanDevelopment/ Human Development and Childhood Studies /Human Development and Family Studies).

The outline of the syllabus is as follows:

Paper1:Research Methodology(50%)

1. Purpose and characteristics of research.
2. Research approaches: quantitative, qualitative and mixed.
3. Positivism and post-positivistic approach to research; nomothetic and idiographic approaches.
4. Steps of research-the research cycle.
5. Research design, sampling and methods of data collection in quantitative, qualitative and mixed methods research.
6. Reliability and validity.
7. Values, Social Responsibility and Ethics in Research.
8. Sources, acquisition, and classification of data.
9. Basic principles and concepts in statistics; Descriptive Statistics; Probability and normal distribution.
10. Statistical tests-parametric and non-parametric tests of association and difference, regression; interpretation of tests
11. Data analysis and interpretation-quantitative and qualitative data.
12. Graphical representation(bar-chart,histograms,pie-chart,table-chart,andline-chart)and mapping of data.
13. Application of ICT in research

Paper 2: Subject specific: Child Development(50%)

1. Principles of growth and development.
2. Pregnancy and child birth.
3. Development through the lifespan in variousdomains (including physical-motor; cognitive, language, socio-emotional development).
4. Theoriesofchild/humandevelopmentandbehavior;culturalcontextofhumandevelopment.
5. Early childhood care and education–curriculum, pedagogy and materials; activities to promote holistic development.
6. Influence of family, peers, school, community and culture on development.

7. Children and persons with disabilities-care and support, early intervention, special education, prevention of disabilities, rehabilitation.

8. Children at risk-child labour, street children, orphaned, abandoned and destitute children, child abuse and trafficking.

9. Adolescenceandyouth:developmentalchangesandchallenges;programmesto promote optimal development.

10. Adulthood-characteristics, changing roles and responsibilitiesinearlyandmiddleadulthood.

11. Aging-physical and psychological changes; care ,health and psychological needs.

12. Diversity, Disadvantage, Rights and Equity: Policies, Legislation, Strategies and Programmes for Intervention and Inclusion

13. Parenting and Society; Counseling for optimal child development.

14. Research Methods in Child Development

22. **Rural Development (PHDRD)**

Paper - 1

Research Methodology

1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition,Variablesandits types, Review of Literature, philosophy of research.

2. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis –Qualities of a good Hypothesis – Null Hypothesis & Alternative Hypothesis.Hypothesis Testing – Logic & Importance

3. ResearchDesign:ConceptandImportanceinResearch–Featuresofagoodresearchdesign – Exploratory Research Design – Concept,TypesandUses,DescriptiveResearchDesigns– Concept, Types and Uses.Experimental Design: Historical Research.

4. Qualitative and Quantitative Research: Qualitative Research – Quantitative Research – Concept of measurement, causality, generalization, replication.Mixed Methods.

5. Measurement: Concept of measurement- Problems in measurement in research – Validity and Reliability.Levels of measurement – Nominal, Ordinal, Interval, Ratio.

6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size.Characteristics of a good sample. Probability and nonprobability sampling, Determining size of the sample – Practical considerations in sampling and sample size, methods of data collection.

7. Data Analysis: Univariate analysis (frequency tables, bar charts, pie charts, percentages), measures of central tendency, Dispersion, correlation, T-test, Chi-square Test, content analysis, narrative analysis, thematic analysis, grounded theory.

8. StepsofwritingResearchProposal,writingaResearchReport.

Paper - 2

Rural Development

1. Rural Development in India – Rural society and economy, concepts & strategies ofrural development, agrarian issues, community development, rural development administration, land reforms Panchayati Raj, cooperatives, rural credit and banking, dynamics of change in rural India, Indian experiments of rural development (Mahatma Gandhi, Nanaji Deshmukh, Anna Hazare).
2. Rural Development Programmes – Poverty alleviation, wage and self employment programmes, rural basic services and infrastructure, natural resources management and environment.Mahatama Gandhi National Rural Employment Guarantee Act.

3. Rural Development Planning and Management – Planning process, multi-level planning, district planning and grass roots level planning; issues in management of rural development project, project appraisal-financial feasibility, economic feasibility and technical feasibility, monitoring and evaluation of projects.Voluntary action – voluntary efforts in rural development, voluntary agency administration social action, formation and strengthening of voluntary organisation.

5. Rural Social Development –DevelopmentofRuralWomen–ruralwomen–statusand strategies, education and training, health and nutrition, empowerment, Development of Rural Children – rural children – situation, health and nutrition, education, Developmentof Scheduled Castes, Scheduled Tribes and Other Under Privileged Groups – developmentof SCs, STs, bonded labourers, artisans and landless labourers, policies and social legislations on children, women, SCs and STs and disadvantaged.

23. **Home Science (PHDHC)**

Community Resource Management and Extension Communication for Development (C4D) ICTforDevelopmentGenderandDevelopment Corporate Social Responsibility Capacity Building – Training, Advocacy and Development Entrepreneurship and Innovations Programme Management and Development Consumer Studies Sustainable Development – Policies and Programmes Resource Management Extension Education Ergonomics and Design Learningoutcomes:

· Building systematic, methodological and comprehensive gain in knowledge inthefield of Community Resource Management and Extension. · Enhancing research skills in the areas of: participatory and innovation communication strategies, resource management, product development; extension management and sustainable development of communities. · Preparing a cadre of professionals for planning and implementing various programmes in the development sector

Fabric and Apparel Science (8 Credits)

1. **Recent Advancements in Textiles and Apparel**
   - Types of Novelty yarns,
   - New generation of fibres (Specialty rayons (high wet modulus rayon, polynosics, etc); high tenacity polyester; microdenier polyester; aromatic polyester/co-polyester; speciality nylons and

nylon-6 T; poly-aramid fibres (Nomex and Kevlar). Bicomponent / Multicomponent / Conjugate Fibres: Nanofibres; hollow fibres; microfibres; glass, ceramic and other inorganic fibres. Poly-blend fibres, elastomeric fibres and biodegradable synthetic fibres. Super absorbent fibres etc).

2. **Fabric Construction**
    - Advance woven fabric such as welt and piques, bed ford cord, backed cloths, double cloth, gauze and leno fabrics, Turkish toweling, plied fabric, lapped and swivel fabric.
    - Advancement in knitted and nonwoven fabrics, introduction of advance looms and weaving techniques
3. **Technical Textiles**
    - Agrotech (Agro-textiles),
    - Geotech (Geo-textiles) ,
    - Meditech/Medtex (Medical textiles),
    - Mobiltech (Textiles used in transport, Oeko tex,
    - Smart textiles.

    (Production of Technical Textiles: Coating, lamination, manufacturing polymer /resin based fibre reinforced composite products, functional finishing, and uses of smart polymers for manufacture of specialty products of different technical textiles.)
4. **Sustainable Textile**
    - Eco friendly textiles, banned dyes and eco parameters.
    - Environmental impact of Textile Industries, Pollution control and treatment of effluents, advanced Textile Production,
    - Sustainability and Renewable Products, Circular Economy/ Certificates
    - Eco Labels, Eco mark
    - Sustainable textiles finishes
    - Green Practices in textiles processing (dyeing, printing, finishing)
5. **Quality Assurance in textiles and Apparel industry**
    - Concept of Quality, Inspection and its significance in textiles and Apparel industry.
    - Introduction of defects: fabric, yarn, weaving, dyeing, printing and finishing**.** Textile testing, Standards follow in textiles industry.
    - Apparel Testing: strength, dimensional changes in apparel due to laundering, dry cleaning, steaming pressing and color fastness, drapability & crease recovery,
    - Standards: Benefits of standards, Levels of standards, Sources of standards, ISO 9000 Series Standards. Introduction to AATCC, ASTM, ISO, BIS, INDA
    - Consumer Behaviors towards quality of products
6. **Functional Clothing**
    - Clothing for special need
    - Protective and functional clothing
    - Medical function clothing
    - Sports Clothing
    - Cross function clothing

7. **CAD – Textiles and Apparel**
    - Identification of recent software's used for textiles and apparel design
    - Benefits of software's at textiles and apparel industry
8. **Visual merchandising**
    - Recent advancement in Visual Merchandising
    - Inage building and Brand portfolio
9. **Entrepreneurship in textiles and apparel field**
    - Business opportunities in the field of textiles and Apparel
    - Government policies for new business
    - Strategies to plan new enterprises

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B. Compulsory Course: Research Methodology (8 Credits) Introduction to Research Ethics in Research Research Methods and Approaches Conceptualization and Research Theory building Research Design – Qualitative and Quantitative Designing Research Proposal Methods of Sampling, Techniques of Data Collection Tool Construction – Reliability, Validity and Standardisation Statistical Methods (including Hypothesis Testing – parametric and non-parametric tests) Data Analysis, Interpretation and Report Writing Scientific Writing and Publishing Learning outcomes: · Developing research competencies in the field of Home Science. · Enhancing analytical abilities and strengthening research through research on community mobilization, participatory development, development communication extension and resource management. · Raising standards of the profession of Home Science through quality research andatthe same time promoting responsible citizenship.

24**. Management (PHDMGMT)**
The question paper will havethe following two parts:

a. Research Methodology
b. Management(Financial Management,HumanResource Management, Marketing Management, Operations Management and General Management)

Part1-Research Methodology

1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method–Understanding the language of research–Concept, Construct, Definition, Variable.

Research Process

2. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis–Null Hypothesis & Alternative Hypothesis. Hypothesis Testing–Logic & Importance

3. Research Design: Concept andImportanceinResearch–Featuresofagoodresearchdesign – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables

4. Qualitative and QuantitativeResearch: Qualitative research – Quantitative research–Concept of measurement, causality, generalization, replication. Merging the two approaches.

5. Measurement: Concept of measurement–what is measured? Problems in measurement in research– Validity and Reliability. Levels of measurement–Nominal, Ordinal, Interval, Ratio.

6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristicsofagoodsample.ProbabilitySample–Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.

7. Data Analysis: Data Preparation–Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bi-variate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

8. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

9. UseofEncyclopedias,ResearchGuides,Handbooketc., Academic Databases for Computer Science Discipline.

10. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/ Mendeley, Softwareforpaperformattinglike LaTeX/ MSOffice, Software for detection ofPlagiarism

Part 2
Management(FinancialManagement,HumanResourceManagement,Marketing Management,Operations Management and General Management)

I Managerial Economics – Demand Analysis Production Function Cost–Output Relations Market Structures Pricing Theories Advertising Macro – Economics National Income Concepts Infrastructure – Management and Policy Business Environment Capital Budgeting

II The concept and significance of organizational behaviour – Skills and Roles in an organisation – Classical,Neo–ClassicalandModernTheoriesofOrganisationalStructure– Organisational Design – Understanding and Managing individual behavior personality – Perception – Values – Attitudes – Learning – Motivation.UnderstandingandManagingGroupBehaviour,Processes–Inter– personal and group dynamics – Communication – Leadership – Managing change–Managing conflicts. Organisational Development.

III Concepts and perspectives in HRM;HRMinchangingenvironment.HumanResource Plarming– Objectives, Process andTechniques.

Job analysis – Job Description. Selecting Human Resources. Induction, Training and Development. Exit policy and Implications. Performance Appraisal and Evaluation. Potential Assessment. Job Evaluation. Wage Determination. Industrial Relations and Trade Unions. Dispute Resolution and

Grievance Management. LabourWelfare and SocialSecurity Measures.

IV Financial Management – Nature and Scope. Valuation Concepts and Valuation of Securities. Capital Budgeting Decisions – Risk Analysis. Capital Structure and Cost of Capital. Dividend Policy–Determinants. Long– Term and Short–Term Financing Instruments. Mergers and Acquisitions.

V Marketing Environment and Environment Scanning; Marketing Information Systems and Marketing Research; Understanding Consumer and Industrial Markets; Demand Measurement and Forecasting; Market Segmentation– Targeting and Positioning;

ProductDecisions,Productmix,ProductLifeCycle;NewProductDevelopment;Branding and Packaging; Pricing Methods and Strategies.

Promotion Decisions– Promotionmix; Advertising; Personal Selling; Channel Management; Vertical Marketing Systems; Evaluation and Control of Marketing Effort; Marketing of Services; Customer Relation Management; Uses of Internet as a Marketing Medium–Otherrelatedissueslike branding, market development, Advertising and retailing on the net. New issues in Marketing.

VI Role and Scope of Production Management; Facility Location; Layout Planning and Analysis; Production Planning and Control – Production Process Analysis; Demand Forecasting for Operations; Determinants of Productmix; Production Scheduling; Work measurement; Time and Motion Study; Statistical Quality Control. Supply Chain Management and Materials Management

Role and Scope of Operations Research; Linear Programming; Sensitivity Analysis; Duality; Transportation Model; Inventory Control; Queueing Theory; Decision Theory; Markov Analysis; PERT/CPM.

VII ProbabilityTheory;Probabilitydistributions–Binomial,Poisson,NormalandExponential; Correlation and Regression analysis; Sampling theory; Sampling distributions; Tests of Hypothesis; Large and small samples; tz, F, Chi–square tests.

Use of Computers in Managerial applications; Technology issues and Data processing in organizations; Information systems; MIS and Decision making; System analysis and design; Trends in Information Technology; Internet and Internet–based applications.

VIII Concept of Corporate Strategy; Components of Strategy Formulation; Ansoffs Growth Vector; BCG Model; Porter's Generic Strategies; Competitor Analysis; Strategic Dimensions and Group Mapping; Industry Analysis; Strategies in Industry Evolution, Fragmentation, Maturity, and decline.

Competitive strategy and Corporate Strategy; Transnationalization of World Economy; Managing Cultural Diversity; Global Entry Strategies; Globalisation of Financial System and Services; Managing International Business; Competitive Advantage of Nations; RTP and WTO.

IX Concepts–Types,Characteristics;Motivation;Competenciesanditsdevelopment;Innovation and Entrepreneurship; Small business–Concepts Government policy for promotion of small and tiny enterprises; Process of Business Opportunity Identification; Detailed business plan preparation; Managing small enterprises; Planning for growth; Sickness in Small Enterprises; Rehabilitation of Sick Enterprises; Intrapreneurship (Organisational Entrepreneurship).

X EthicsandManagementSystem;EthicalissuesandAnalysisinManagement;Valuebased organisations; Personal framework for ethical choices; Ethical pressure on individual in organisations; Gender issues; Ecological consciousness; Environmental ethics; Social responsibilities of business;

Corporate governance and ethics.

25. Commerce (PHDCOM)

Course1:Research

Methodology

Theory of Research :Meaning and Definition of Research, Types of Research, Research Approached(Scientific, Historical, Descriptive, Comparative, Institutional), Criteria of Good Research, Research and Business Decisions, Research Applications in Functional Areas of Business.

1. **Research Process :** Problem Selection and Research Design-Selecting a Topic for Research Study ,Formulation of Hypothesis, Research Design (Concepts relating to Research Design, Major stops preparing a Research Design, Factors affecting Research Design.)

   Technique of Collecting Qualitative Data (PRA-ParticipatoryRuralAppraisal,RRA-Rapid Rural Appraisal Case Study), Tools of Collecting Qualitative Data (Social Mapping Resource Mapping, Wealth Ranking of the Households, Preference Ranking, FocusGroup Discussion etc.),Formatting and Processing of Qualitative Data Sampling Techniques and Sample Design (Methods, Selectionof Appropriate Methods and Sampling Criteria),SamplingTests(Ztest,Ttest,Ftest).Editing,Coding,ClassificationandTabulation Diagrammatic and Graphic Presentation

2. **Analysis of Data (Statistical Application in Research)**

   Statistics and Business Research Probability Theory Probability DistributionsPercentages and Ratios Measures of Central Tendency Measures of Variability Correlation and Regression Measurement of Trend Association of Attributes Construction of Indices Hypothesis Testing Scaling Technique

RCO – 002: SPECIALIZATION COURSE (In the selected area of research interest) FOR Ph.D

Area–

1:Accounting&TaxationACCOUNTING

Contents

1. **Accounting: Information for Decision Making**
   Accounting Information: A Means to an End User's Perspective-Types of Accounting Information
   Accounting Information Forms:-DeterminingInformationNeeds-

TheCostofProducing Accounting Information, Users of Accounting Information - Objectives of ExternalFinancial Reporting – CharacteristicofExternallyReportedInformation-Characteristicsand Objectives of Management Accounting Information

IntegrityofAccountingInformation:InstitutionalFeatures-ProfessionalOrganizations-Competence, Judgment, and Ethical Behavior

Accounting Systems: Basic Functions of an Accounting System-Designing andInstallation Accounting Systems.

Careers in Accounting:Public Accounting- Management Accounting-Governmental Accounting -Education

2. **Presentation and Reporting of Accounting Information**

Reporting the Results of Operations: Developing Predictive Information - Reporting IrregularItemsContinuingOperations– DiscontinuedOperations,Extraordinary Items-Changes in Accounting Principles -Earnings per Share (EPS)-Basis and Diluted Earnings per Share

3. **Statement of Cash Flows**

Statement of Cash Flows: Purpose of thestatement -Example of a Statement of Cash Flows-Classification of Cash Flows-The Approach to Preparing a Statement of Cash Flows

Managing Cash Flows: Budgeting (The Primary Cash Management Tool-What Priority Should Managers give to Increasing Net Cash Flows? –Some Strategies for Permanent Improvements in Cash Flow

4. **Financial Statement Analysis**

Techniques of financial statement Analysis: Common Size Financial Statements-FinancialStatementAnalysisUsingCommonRatios-ProfitabilityRatios,Efficiency Ratios, and Solvency Ratios

ToolsofAnalysis:TrendPercentages,ComponentPercentages,Ratios,Standardsof Comparison, Quality of Earnings, Quality of Assets, and the Relative Amount of Debt

Measures of Liquidity and Credit Risk: A classified Balance Sheet - Working Capital – Current Ratio, Quick Ratio, Debt Ratio-Evaluating Financial Ratios– Liquidity, Credit Risk, and the Law

5. **Accounting Standards**

Introduction – Accounting Standards in India – Importance of the AccountingStandards– Disclosure of Accounting Policies – Regulations for Valuation of Inventories – Rules for Cash Flow Statement – Norms for Events after Balance Sheet Date – RulesforProvisions and Contingencies – Norms for Net Income andChangesinAccountingPolicies–RegulationsforDepreciationAccounting– NormsforReven ueRecognition – Accounting for Fixed Assets – Accounting for Taxes on Income – Accounting for Intangible Assets – Norms for Consolidated Financial Statements – Need forNotestoAccounts–OtherAccountingStandards– ComputerizationofAccounts–

Indian Companies Providing their Accounts as per US GAAP and IFRS

6. **Global Business and Accounting**

Environmental Forces Shaping Globalization- Political and Legal Systems, Economic Systems, Culture, Technology and Infrastructure Harmonization of Financial Reporting Standards

Foreign Currencies and Exchange Rates: Exchange Rates - Accounting forTransactions with Foreign Companies - Currency Fluctuations – Who Wins and Who Loses? - Consolidated Financial Statements That Include Foreign Subsidiaries

7. **Management Accounting**

An overview –Conceptsanduses-ManagementAccountingDecisionMakingAuthority– Management Accounting's Role in Decision Making - Management Accounting's Role in Performance Evaluation and Rewards

8. **Costing System and Analysis**

Activity Based Costing System: Introduction - TraditionalmanufacturingCostingSystem- Activity Based Costing (ABC) and Activity Based Management (ABM) System - Cost of Resource Capacity - ABC for Marketing, Selling and Distribution Expenses-ABC for Service Companies

Cost variance Analysis: Introduction – Material Variances–LabourVariances– Overhead Variances –Standard Cost Accounting

Revenue and Profit Variance Analysis*:* Introduction - Sales Variances - ProfitVariances- Actual Profit and Budgeted: Reconciliation –Variance Reporting-Disposition of Variances

9. **Responsibility Accounting**

Introduction–MeaningandObjectives–TypesofResponsibilityCentres

Reference text books:

1. Williams, Haka, Bettner (2005) Financial & ManagerialAccounting,thebasisforbusiness decisions, Tata McGraw- Hill, New Delhi.
2. M.Y.Khan,P.K.Jain(2007)ManagementAccounting,Text,ProblemsandCases,TheMcG raw-Hi ll, New Delhi.
3. Asish K .Bhattacharyya(2006) Financial Accounting for Business Managers, Printice-Hall of India Pvt. Ltd., New Delhi.
4. Robert N Anthony, David F. Hawkins, Kenneth A Merchant (2007) Accounting Text and Cases, TataMcGraw-Hill, New Delhi.
5. N.Ramachandran,RamKumarKakani(2008),FinancialAccountingforManagement,Tat aMcG raw-Hill,NewDelhi.
6. ShashiK.Gupta(2002),ContemporaryIssuesinAccounting,KalyaniPublishers,NewDelhi.
7. Aggarwal,M.P.(1981),AnalysisofFinancialStatements,NationalPublishingHouse,New Delhi.
8. S.N.Maheshwari(2004),Management Accounting and Financial Control, Sultan Chandand Sons, New Delhi.
9. S.N.Maheshwari, S.K.Maheshwari(2006),CorporateAccounting,VikasPublishingHouse Pvt. Ltd. NewDelhi.

Taxation

DirectTaxation–LawandPractice

1. ***General Frame work of Direct Taxation in India:*** Different direct tax laws and their inter-relationship; Importance of Income Tax Act and Annual Finance Bill Relevant Constitutional provisions; harmonization of tax regime.
2. ***Tax Planning:*** Concept of tax planning; Tax planning with reference to setting upanew business; locational aspects; nature of business; tax holiday, etc. - Tax planning with regard to specific management decisions such as mergers and takeovers; location of undertaking; introduction of voluntaryretirement;taxplanningwithreferencetofinancial management decisions such as borrowing or investment decision; reorganization or restructuring of capital decisions - Tax planning with respect tocorporatereorganization; tax planning with reference to employees' remuneration - Tax Planning vis-à-vis important provisions of wealth-tax including court rulings and legislative amendments.
3. ***Tax Management:*** Return and procedure for assessment; special procedure forassessment of search cases, e-commerce transactions, liability in specialcases;collection and recovery of tax; refunds, appeals and revisions ;penalties imposable ,offences and prosecution.

IndirectTaxation–LawandPractice

4. ***Indirect Taxes:*** Specialfeaturesofindirecttaxlevies– allpervasivenature,contributionto Government revenues; constitutional provisions authorizing the levy and collection of duties of central excise, customs, service tax, central sales tax and VAT.
5. ***Central Excise:*** Basis of chargeability of duties of central excise –goods, manufacture, classification and valuation of excisable goods, assessment procedure, exemption, payment, recovery and refunds of duties. Clearance of excisable goods; Central Excise Bonds; maintenance of accounts and records and filing of returns. CENVAT; Duties payable by small scale units. Set-off of duties – concept, meaning and scheme; Central Excise Concessions on exports; search, seizure and investigation; offences and penalty.
6. ***Custom:*** Levy of and exemption from, customs duties – specific issues and casestudies; assessment and payment duties; recovery and refund of customs duties; drawback of duties; Confiscation of goods and conveyances and imposition of penalties; search,seizure and arrest, offence and prosecution provisions - Adjudication, Appeal and Revision; Settlement of Cases.
7. ***Service Tax:*** Introduction; Genesis of service tax in India; Constitutional Provisions; Definition of service; Education Cess and Secondary and Higher Education Cess
8. ***Tax Planning and Management:*** Tax Planning, TaxManagement,TaxAvoidanceandTax Evasion

Reference text books:

1. Dr.VinodKumarSinghania&Dr.MonicaSinghania,(2014),DirectTaxesPlann ingand Management,Taxmann,NewDelhi
2. Dr.VinodKumarSinghania&Dr.MonicaSinghania,(2014), Income Tax including Central Sales Tax,Taxmann, NewDelhi
3. R.K.Jain,(2014),IncomeTaxPlanning&Management,SahityaBhawan,Agra
4. Dr.P.K.Jain&R.KTyagi,(2014),IncomeTaxlaw&accounts,SanjaySahityaBhawan,Agra
5. R.K.Jain (2014) Excise Customs and Service Tax CaseReferences,JainBookDepot,New Delhi.

Area 2–International Business

1. **BasicsofInternationalBusinessEnvironment**–Social,Cultural,Economic, Political, Demographic, Ecological and Legal Environment.

2. **Balance of Payments** – Concept, Balance of Payments Accounting, DeficitandSurplus, Factors affecting Balance of Payments andEquilibriumandDisequilibriumofBalanceof Payments. India's Balance of Payments.

3. **GovernmentInfluenceonTrade**–Rationalefor government intervention, Tariff and Non tariff barriers.Impact of tariff and non tariff barriers on international trade.

4. **CrossCulturalManagement**–HofstedeandotherstudiesrelatedtoCrossCultural Management

5. **Introduction to Globalization**–Concept, Major forces, Effects of Globalization on the world economy and developing countries, Globalization strategies of Indian Companies, Cross border Mergers and Acquisitions
6. **International Investment**– Concept, Types of International Investment, FDI and Developing Countries, Determinants of FDI, Recent Trends in FDI flows, Trade Related Investment Measures, Multilateral Investment Agreements.

7. **Transnational Corporations**–Features of Transnational Corporations, RecentTrends in Transnational Corporations, Issues And Controversies Of Transnational Corporations. TNCs and Developing Countries.

8. **Technology Transfer** – Rationale of Transfer of Technology, Recent Trends andCurrent Issues, Non Equity Forms of Technology Transfer, IntellectualPropertyRights,Indiaand Transfer of Technology –strategies and challenges.

9. **World Trade**–Recent Trends –composition and direction, Problems of Developing Countries.

10. **International Trade in Services**–Role of Trade in Services in Economic Development, Composition and Direction ofInternationalTradeinServices,ChallengesofInternational Trade in Services.

11. **Multilateral Trading System** – Functions and Structure of WTO, Multilateral Trade Agreement and Plurilataral Trade Agreement, India and WTO. Recent issues related to Multilateral Agreements. Impact of Multilateral Trading System on World Trade.

12. **Regional EconomicGroupings**–FormsofRegionalGroupings,RationaleandImpactof Regional Economic Groupings, Major Regional Economic Groupings - European Union (EU), North American Free Trade Agreement(NAFTA), Association of South etc. East Asian Nations (ASEAN), South Asian Association for Regional Corporation(SAARC)

13. **International Product Planning** – Product Decision, International Product Life Cycle, New Product Development. Product diffusion.

14. **InternationalBrandingandPackaging**–ObjectivesandAdvantages,BrandFamiliarity Levels, Branding Strategies , Local Brand VsGlobalBrand,ImpactofBrandsonBuying Behaviour, Scope for Indian Brands, Functions and Importance of Packaging, Factors Influencing Packaging Decision, Special Considerations in International Marketing.

15. **International Pricing** – Objectives and factors affecting Pricing Decisions, Pricing Methods and Practices in International Marketing, Transfer Pricing, Counter Trade and Pricing Issues.

16. **International Distribution**–International Channel System, Types of Intermediaries, Factors affecting Channel Choice, Selecting Overseas Agents.

17. **International Marketing Communication** – Promotion Mix, Objectives and Role of International Marketing Communication, Key Issues in International Marketing Communication, Major Marketing Promotion Tools.

18. **International Advertising** – Rationale for International Advertising, Adaptation Vs Standardization, Advertising Appeals and Product Characteristics, Impact of Advertising on buying decisions, Global Media Decisions, Selecting Advertising Agencies, Advertising Regulations, Sales Promotion Tools.

19. **International Retailing** – International Store Operations andSupplyChainManagement ofLeading International Retailers. International Retail Formats, International Retail Marketing Strategy.

20. **Emerging Trends and Issues in International Marketing** – E-Marketing, Green Marketing, Digital Marketing, Multi level Marketing (MLM),Web-based Marketing, and Network Marketing etc.

Further Readings

-WTOReport
-UNCTADReport
-WorldInvestmentReport
-WorldEconomicSurvey,etc.

Area3–BankingandFinance

1. **Commercial Banks:** Overview of Commercial Banking in India; Role and Functions of Commercial Banks; Indian Banking in Pre, Nationalization and Post, nationalization Phases.
2. **Banking Sectoral Reforms:** Banking Sector Reforms and their Implications on Indian Banking Sector; Changing Role of Indian Banks; Reforms and Restructuring of Banks; Management of Private Sector Banks and Public Sector Banks; ManagementofBanksin Rural Areas.
3. **Basic Banking Services:** Opening of accounts for companies, trusts, societies, government and public bodies; Importance of AML.
4. **Credit concepts:** Principles of lending; Various credit Products/ Facilities - working capital and term loans; Credit Appraisal Techniques; Approaches to lending; Credit Management, credit monitoring ,NPA Management; Credit Risk Analysis Framework.
5. **Documentation:** Different types of documents; Documentation Procedures; Stamping of documents Securities; Types of collaterals and their characteristics; Priority Sector Lending - Sectors, Targets and Issues/Problems.
6. **RecentDevelopments:**Agriculture/SMEs/SHGs/SSI/TinySector;FinancingNewProducts& Services:Factoring,Securitization,bancassurance,MutualFunds,MerchantBanking,HirePur chase,Securitization,VentureCapital,LeasingandDepository,CreditCards/HomeLoans/Pers onalLoans/ConsumerLoans;ITApplicationinBanking.
7. **Credit Rating in India:**Conceptandreasonsofcreditrating;Creditratinginstitutionsin India, Limitation of Credit Rating.
8. **Reforms in Banking and Finance:** Reports of the committees; Chakravarty committee, Narsimham Committee I&II :FDI In Banking Sector.
9. **International Banking:** An Overview; Rationale and Scope of International Banking Regulation; Capital Adequacy, loan loss provisioning and other Regulatory Controls.
10. **International Financial System:** An overview; Foreign Exchange Markets; Exchange rate determination; International party theory and Fisher effect; Foreign Exchange Risk Management.
11. **Financial Institutions:** Role of FDI, NBFCs and other International Financial Institutions
12. **FinancialMarkets:**Structure;InstitutionsandOperationMechanism;MoneyMarketinIndia;I mportance; Feature and Instruments; Capital Market in India, New Issues Market and Secondary Market(Stock Exchanges);salient features and operation, changing scenarioof Indian Stock Market.
13. **Valuation of Securities:** Equity shares and Bonds valuation models; CAPM, Arbitrary pricing theory.
14. **Corporate Valuation:** Approaches to Corporate Valuation; Restructuring; merger, acquisition and disinvestment leveraged buy-outs.

References

Chandra, Prasanna, Financial Management Theory and Practice, Tata McGraw-Hill Publishing CompanyLtd.,New Delhi,2007

- Shapiro AlanC., Multinational Financial Management,Prentice Hall of India Ltd.,NewDelhi
- Khan,M.Y.andJain,P.K.,FinancialManagementText,CasesandProblems,Tata McGraw-Hill Publishing CompanyLtd.,NewDelhi,2007
- Kishore,RaviM.:FinancialManagement,Tax,Delhi.
- VanHorne,JamesC.,FinancialManagementandPolicy,PrenticeHallofIndiaLtd.,New Delhi

  Damodaran onValuation:Security Analysis for Investment and Corporate Finance (WileyFinance)
- NeelamCGulati(2011)BankingandInsurance:Principles&Practices,3rdedition,ExcelBooks, DaryaganjNewDelhi
- Gomez Clifford (2011) Banking and Finance: Theory, Law and Practice, 3rdedition, PHI, Daryaganj NewDelhi
- IndianInstituteofBanking&Finance(2012):PrinciplesandPracticesofBanking, 2ndedition, McMillan, Daryaganj, NewDelhi.
- Indian Institute of Banking & Finance (2012):Legal and RegulatoryAspectofBanking 2nd edition, McMillan, Daryaganj NewDelhi.
- NK Sinha (2009): Money Banking and Finance 5thedition,BscPublisherco,Daryaganj, NewDelhi.

Area4: MARKETING MANAGEMNT

1. **Defining Marketing for the 21stcentury The new marketing realities:** Marketingin21stcentury,Markerts:ConsumerandOrganisationalmarkets,Strategicplanning&themarketingenvironment,Currentissuesinmarketing,Marketingresearch,Buyerbehaviour, Segmentation,targetingandpositioning,Valuecapture,Valuecreation,Valuedelivery, Value communication, Major Societal Forces, NewConsumerCapabilities,NewCompany Capabilities, Integrated Marketing, Internal Marketing, Performance Marketing, Connecting with Customers, Shaping the Market Offerings.

   The Demographic Environment and its implication in marketing management: Economic Environment, Social- Cultural Environment, Natural Environment, Technological Environment, Political-Legal Environment.

   CreatingCustomerValue: SatisfactionandLoyalty,CustomerPerceivedValue(CPV),

Total Customer Satisfaction, Monitoring Satisfaction, Maximizing Customer Lifetime Value (CLV), Cultivating Customer Relationships.

Analyzing Consumer Markets: What Influences Consumer Behaviour? CulturalFactors Social Factors, Personal Factors, Key Psychological Processes.

Analyzing Business Markets: Organizational Buying, The Business Market Versus the Consumer Market, Delivering Superior Customer Value, Managing Business-to-Business Customer Relationships, Business Relationships: Risks and Opportunism, Segment Marketing, Niche Marketing, Local Marketing, Balancing Customer and Competitor Orientations. Creating Brand Equity, Building brand equity, Measuring brand equity, Devising a branding strategy, crafting brand positioning.

2. Marketing Decisions

ProductDecisions: SettingProductStrategy,Differentiation,Productandbrandrelationship, The Product Hierarchy, Product Systems and Mixes, Product-Line Analysis Product-Line Length, Packaging, Labeling,Warranties, and Guarantees.

Designing and Managing Services: The Nature of Services, Categore is of ServiceMix Distinctive Characteristics of Services, Service Experience , Service Innovation, Service Delivery, Service Quality, service recovery and its implications on business. Managing Service Brands, Developing Brand Strategies for Services, Developing Service Offers for Rural Areas, Manageing Product-Support Services, Identifying and Satisfying Customer Needs, Post sale Service Strategy.

Pricing Decisions: Developing Pricing Strategies and Programs, Consumer Psychology and Pricing**,** Setting the Price, Adapting the Price, Geographical Pricing (Cash, Countertrade, Barter),Price Discounts and Allowances, Promotional Pricing,Differentiated Pricing, Pricing for Rural Markets, Initiating and Responding to Price Changes, Responding to Comptitiors's Price Changes

Distribution Decisions(logistics decisions): Designing and Managing Integrated Marketing Channel, Marketing Channels and Value Networks, Channel Integration and Systems,VerticalMarketingSystems,The Importance of Channel Stewards, Horizontal Marketing Systems, Integrating Multichannel Marketing Systems, Conflict, Cooperation, and Competition, Channel Conflict andCompetition,ManagingChannelConflict,Dilution and Cannibalization, Legal and Ethical Issues in Channel Relations, Managing Retailing, Wholesaling, and Logistics.

Promotion Decisions:Communicating Value, Designing and Managing Integrated Marketing Communications, The Changing Marketing Communication Environment, Marketing Communications, Brand Equity, and Sales, The Communications Process Models, Developing Effective Communications, Celebrity Endorsements as a Strategy, Selecting the Communications Channels, Establishing the Total Marketing Communications Budget,Deciding on theMarketing Communications Mix, Managing the

Integrated Marketing Communications Process, Implementing IMC, Managing Mass Communications: Advertising, Sales Promotions, Events and Experiences, and Public Relations, Developing and Managing anAdvertising Program, Communicating to the Rural Audience, Deciding on Media and Measuring Effectiveness, Sales Promotion in Indian market, Events and Experiences, Public Relations, Managing Personal Communications: Direct and Interactive Marketing, Word of Mouth, and PersonalSelling, Direct Marketing, Public and Ethical Issues in Direct Marketing, Interactive Marketing, Placing Ads and Promotions Online, Word of Mouth, Buzz andViralMarketing,Creating successful long term growth.

3. **Marketing research**
   Introduction to Marketing Research, Qualitative and quantitative research methods, Sampling methods, Questionnaire design, reliability and validity. Online survey method, Data preparation and data presentation (graphing), AnalysisofVariance (ANOVA)and Analysis of Covariance(ANCOVA),Cluster Analysis, Factor analysis, Presenting research information

4. **EmergingTrendsinmarketing:**RuralMarketing,Greenmarketing,Experientialmarketing,DigitalMarketing,ebusiness,Onlinemarketing,Onlineretailing,Neuroscienceandconsumer,SportsMarketing ,Media marketing and advertising, Brand Management, Innovation and marketing

ReferenceBooks

- Marketing Management by Arum Kumar and N Meenakshi
- The Rural Marketing Book by Kashyap Raut
- MarketingManagementasouthAsianPerspectivebyPhilipKotler,KevinLanekeler,AbrahamkoshiandMithileshwarJha,PearsonPrenticeHall,2009
- ResearchMethodology,ConceptsandcasesbyDeepakChawlaandNeenaSondhi,VikasPublishinghouseprivatelimited
- MarketingmanagementRanjanSaxena,TataMcGrawHillPublishingCompany limited
- Marketingmanagement,CasesandConcepts,NikihileshDholakia,RakeshKhurana, Labdhi Bhandari, AbhinandanKjain, MacmilanIndia

Area5:EntrepreneurshipandSmallBusinessManagement

1. **Entrepreneurshipandeconomicdevelopment**
   Entrepreneurship theory and literature: Entrepreneurship in India and abroad, Entrepreneurial motivation(socio-economicfactorsinentrepreneurshipdevelopment,basic skills in entrepreneurship),Entrepreneurial environment, Entrepreneurship development Programmes, Entrepreneurial functions, Analysis of barriers in entrepreneurship development, Analysis of success factors of entrepreneurship development.

   Entrepreneurship'sImportance:Economicimpactofentrepreneurialfirms,

Entrepreneurial Firms' impact on society, Entrepreneurial Firms' impact on larger firms, Entrepreneurial Firms' impact on overall economic development of a nation Entrepreneurship development.

2. **CreativityandInnovationinbusiness**
   Encouraging creativity at the firm level, protecting ideas from being lost or stolen, IPR, Creation of effective innovation, Market dynamics and new technology, Diffusion and adoption of innovations,Marketingandsalesoftechnologybasedproductsandservices.

3. **Enterprise creation**
   Screening of ideas, opportunity identification and selection, moving from an idea to an entrepreneurial firm, New enterprise creation: Conceptual and analytical tools to understand, analyze and manage critical aspects of new enterprise, Buisness plan preparation and Analysis, feasibility analysis of business (product/ service feasibility, industry/market feasibility,organizationalfeasibilityandFinancialfeasibilityanalysis,Industry and competitoranalysis),Businesscrisis,Familybusinessmanagement,Smallandmedium enterprises(threats and opportunities),
   Developing an effective Business models: The importance of business models, How buisness models emerge, potential fatal flaws of business models.

4. **Enterprise Management Small and medium enterprise (managing and growing entrepreneurial firm): Essentials of management principles, its application on enterprise management, planning, importance and application of planning in an organisation, strategic planning and its application.**
   Human resource Management: recruitment, selection and induction of key employees, training and development, performance appraisals, application of exit interviews etc.,Board of directors, Professional advisers, lenders and investors, other professionals.
   OrganisationBehaviour: Motivationandbehavior,designingMotivatingjobs,perception, personality,Stressandbehavior,Groupbehavior,Intergrouprelations,conflictanditsimpactonor ganization,Leadershipinorganisation,followership,transactionanalysis,analysisandapplicatio n of leadership styles, Organisation structure and design, Organisational change and development, organizational culture and climate.
   Controlling (PERT, CPM and other emerging methods to establish control in an organization. Managinghuman resources and organization development and dynamics, Personnel and Industrial relations, Sources of capital and capitalization process, Venture capitals, Angel investors etc, Intrapreneurship.

5. **Microbusiness development**
   What are micro businesses, Role of Government in micro business development, Importance of micro businesses in an economy, Microfinance, Self help groups, Direct funding from financial institutions.

6. **New Age entrepreneurship**
   Agri-entrepreneurship,Edu-preneurship(education/academicentrepreneurship),Techno-preneurs (nanotechonology, biotechnology)

7. Social Entrepreneurship

Socialentrepreneurship,socialentrepreneursaschangeagents,financialsustainability Social entrepreneurship in India and abroad

8. Women Entrepreneurship

StateofwomenEntrepreneurshipinIndia.BarrierstowomenEntrepreneurship development.

9. Business ethics

Corporate Social responsibility Corporate governance

10. Succession Planning

BusinessgrowthandneedofsuccessionPlanninginIndia.Itsroleandimportancein expansion management.

Reference Books:

- SmallBusiness Management and Entrepreneurship by DavidStokes, NicholasWilson
- Think and Grow Rich by Napoleon Hillane -book
- Entrepreneurship and small business management by Norman MSc or borough
- EntrepreneurialDevelopmentByVasantDesai
- Entrepreneruship and entrepreneurial Development by M. Gangadhar Rao
- OrganisationalBehaviourByJitSChandan,VikaspublishinghousePrivateLimited

26. Vocational Educational (PHDVE)

Part-A:Research Methodology

Introduction to research: meaning of research, role research in behavioral sciences, process of research, types of research, research approach and significance of research.

Formulation of a Research Problem: Research problem: definition, selection and necessity of research problem.

Data Collection Methods: Primary and secondary data, methods of collecting primary data, merits and demerits of different methods of collecting primary data, non-response.

DataCollectionTechniques:Designingaquestionnaire,pretestingaquestionnaire,editing of primary data, technique ofinterview,collectionofsecondarydata,scrutinyofsecondary data, scale of measurements.

Sampling Techniques: Introduction to sampling, advantage of sampling over census, probability and non-probability sampling and non-sampling error,basicsofsimplerandom sampling, stratified random sampling, systematic sampling, and multistage sampling.

Presentation of Data: Classification and tabulation of data diagrammatic and graphical presentation of data.

Statistical Methods: Measure of Central tendency, measures of dispersion, simple correlation and regression, testing of hypothesis(z,t,Fandchi-squaretests),Interpretation of data.

Report writing: Formation of Report, Presentation of a report

Part B: Vocational Education and Training

Vocational Education (for Human Recourse Development for National Development, for Knowledge Economy, for Development of Marginalized Sections of the Society, for Persons with Special Needs, Personal/Family Actualisation and Happiness).

International Experiences:Review of International Reports (UNESCO's Report of the International Commission on Education for the Twenty-First Century "Learning: The Treasure Within, Second

International Congress on Technical and Vocational Education, Report on Knowledge Acquisition and Skill Development (UNESCO)), International Experiences in Vocational Education (Germany, China, Korea, Japan, Switzerland, Australia, New Zealand).
Growth and Development in India: Historical Background of Vocational Education in India (Pre-Independence Period, Post-Independence Period), Impact of Globalization and Liberalization on Vocational Education. Recent Government of India initiatives on Vocational education, NSOF, VET programmes through formal non-formal modes.
Initiatives by Different Sectors of India: Education Sector (CBSE, State Boards, NIOS and State Open Schools, Community Polytechnics, Jan Shikshan Sansthans, Community Colleges, Degree Colleges and Universities, Open Universities, NCERT and PSSCIVE), Industrial Sector (Craftsman Training Scheme, Apprenticeship Training Scheme, Skill Development Initiative),Health and Paramedical Sector, AgricultureSector,Businessand CommerceSector,InformationandCommunicationSector,RoleandWorkofNon-Governmental Organizations.

Models of Vocational Education and Training: School Based Model (Introduction of VEP in Schools, Thrust Areas Identified by NPE (1986) for VEP, Centrally Sponsored Scheme of Vocationalisation of Education,Programme of Action (POA, 1992), Industry Based Model (Vocational Training Programmes), Community Colleges Scheme, Apprenticeship.
Issues in Vocational Educational and Training: Social Acceptability, Access, Terminal Nature of Courses, Employability, Multi-Skilling, Managing a Small Enterprise,Remunerative Structure (wages and earnings) of Vocationally trained person
Relevance, Untrained Vocational Teachers, On the Job Training, Apprenticeship Training Assessment and Certification of Prior Learning, Connectivity among Vocational programmes at All Levels, Lateral and Vertical Mobility.
EnvironmentalconsciousnessandSustainableDevelopment:UnderstandingEnvironment, Environmental Concerns, Environmental Problems and Issues, Major Environmental Problems, Global Environmental Issues (Global Warming, Acid Rain, Ozone Layer Depletion), Environmental Resources (Forest Resources, Land Resources, Water Resources, Animal Resources).

27. Education (PHDES)

(A) Methodology of Educational Research

Sources of acquiring Knowledge, Meaning and Scope of Educational Research, Meaning and steps of Scientific Method, Characteristics of Scientific Method (Replicability, Precision, Falsifiability andParsimony), Types of Scientific Method (Exploratory, Explanatory and Descriptive), Aims of research as a scientific activity: Problem-solving, Theory Building and Prediction, Types ofresearch(Fundamental,AppliedandActionresearch),Ethicalconsiderations in Research

Criteria and sources of identifying the research problem, Survey, review and importance of related literature, Selection, definition and evaluation of research problem, WritingObjectives

Hypotheses-Concept, Sources, Types(Research, Directional, Non directional, Null),Formulating Hypothesis, Characteristics of a good hypothesis, Concept of Universe and Sample, Characteristics of a good Sample,

Techniques of Sampling (Probability and Non-probability Sampling), Tools of Research - Validity, Reliability and Standardisationof a Tool, Types of Tools (Rating scale,Attitude scale, Questionnaire, Aptitude test and Achievement Test, Inventory), Techniques of Research (Observation, Interview and Projective Techniques)

Variables:MeaningofConcepts,Constructsand Variables, Types of Variables (Independent, Dependent, Extraneous, Intervening and Moderator)
Toolsandtechniquesofdatacollection-CharacteristicsofagoodresearchtoolTypesofresearch tools and techniques and their use
MajorApproachestoEducationalResearch-QuantitativeResearch,QualitativeResearch and Mixed Methods Research

MethodsofEducationalResearch-Historicalresearch,Descriptiveresearch,Experimentalresearch, Expost facto research

Statistical Analysis of Data:Types of Measurement Scale (Nominal,Ordinal,Interval and Ratio),Quantitative Data Analysis - Descriptive data analysis (Measures of central tendency, variability, fiduciary limits and graphical presentation of data), Testing of Hypothesis (Type I and Type II Errors), Levels of Significance, Power of a statistical test and effect size,ParametricTechniques,Non-ParametricTechniques, Inferential data analysis, Use and Interpretationofstatisticaltechniques:Correlation,t-test,z-test,ANOVA,ANCOVA, Chi-square (Equal Probability and Normal Probability Hypothesis). Qualitative Data Analysis- Data Reduction and Classification, Analytical Induction and Constant Comparison, Concept of Triangulation
WritingResearchReport-Meaningandscope,Formatofresearchreports,Presentation Dissemination

(A) Subject Specific Areas:

(i) Philosophical and Sociological Foundations of Education

Relationship of Education and Philosophy, Indian and Western Schools of Philosophy and their educational implications; ContributionsofVivekananda,Tagore,GandhiandAurobindotoIndian Education; National values as enshrined in the Indian Constitution, and their educational implications; Philosophical Inquiry in Education, Nature and Scope, Steps, Philosophicalinquiry of current educational issues.

Education as a social sub-system-specific characteristics: Education and its relationship with modernization and democracy; Education and its relationship with the home, community; Socialization of the child; Meaning and nature of social change: Education as related to social equity and equality of educational opportunities;ConstraintsonsocialchangeinIndia;Education of the socially and economically disadvantaged sections of the society including students with special needs. Social mobility.

(ii) Learner,LearningProcessandAssessment

Growth and Development: Concept and principles, Social,emotionalandcognitivedevelopment. Individual differences. Personality - Definitions and theories (Freud, Carl Rogers, GordonAllport, Max Wertheimer, Kurt Koffka), learning styles and their implications on individual in succeeding in his/her learning; Motivation - concept; determinants and types, implications of motivation on learning; Group dynamics and role of teacher in developing positive class room climate. Mental health and mental hygiene.

Approaches to Intelligence from Unitary to Multiple: Concepts of Social intelligence, multiple intelligence,

emotionalintelligenceTheoriesofIntelligencebySternberg,Gardner,Assessmentof Intelligence, Concepts of Problem Solving, Critical thinking, Meta cognition and Creativity.

Principles and Theories of learning: Behaviouristic, Cognitive and Constructivist theories of learning, Factors affecting learning, learning environment, Concept of social cognition, understanding social relationship and socialization goals.

Assessment–Meaning,nature,perspectives(assessmentforLearning,assessmentoflearningandAssess ment as Learning) - Types of Assessment - Placement, diagnostic, formative, summative, Criterion-referenced and Norm-referenced. Relation between objectives and outcomes, Assessment of Cognitive(Anderson and Krathwohl), Affective (Krathwohl) and Psychomotor domains (R.H. Dave) of learning.; Issues in Assessment and Evaluation.

Assessment in pedagogy of education – feedback devices, meaning, types, and criteria. Assessment of Portfolios, Reflective Journal, Field Engagement using Rubrics, Competency Based Evaluation, Assessment of Teacher Prepared ICT Resources, performance-based assessment, issues in assessment and evaluation.

(iii) Curriculum Studies

ConceptandPrinciplesofCurriculum,StrategiesofCurriculumDevelopment,Stagesinthe Process of Curriculum development, Foundations of Curriculum Planning-Philosophical Bases (National, democratic), Sociological basis (socio cultural reconstruction), Psychological Bases (learner's needs and interests), Bench marking and Role of National level Statutory Bodies - UGC, NCTE and University in Curriculum Development

ModelsofCurriculumDesign:TraditionalandContemporaryModels(Academic/Discipline Based Model, Competency Based Model, Social Functions/Activities Model (social reconstruction), Individual Needs and Interests Model, Outcome Based Integrative Model, Intervention Model, Context, Input, Process, Product Model(CIPP Model).
Instructional System, Instructional Media, Instructional Techniques and Material in enhancing curriculum Transaction, Approaches to Evaluation of Curriculum: Approaches to Curriculum and Instruction(Academic and Competency Based Approaches), Models of CurriculumEvaluation:Tyler'sModel,Stakes'Model,Scriven'sModel,Kirkpatrick'sModel
MeaningandtypesofCurriculumchange,Factorsaffectingcurriculumchange,Approaches tocurriculumchange,Roleofstudents,teachersandeducationaladministratorsincurriculum change and improvement, Scope of curriculum research and Types of Researchin Curriculum Studies.

(iv) Educational Management, Administration and Leadership

Educational Management and Administration – Meaning, Principles, Functions and importance, Institutional building, POSDCORB, CPM, PERT, Management as a system, SWOT analysis, Taylorism, Administration as a process, Administration as a bureaucracy, Human relations approach to Administration, Organisational compliance, Organisational development, Organisational climate
Leadership inEducationalAdministration:MeaningandNature,Approachestoleadership: Trait, Transformational, Transactional, Value based, Cultural, Psychodynamic and Charismatic, Models of Leadership (Blake and Mouton's Managerial Grid, Fiedler's ContingencyModel,Tri-dimensionalModel,HerseyandBlanchard'sModel, Leader-Member Exchange Theory.

Concept of Quality and Quality in Education: Indian and International perspective, Evolution of Quality:

Inspection, Quality Control, Quality Assurance, Total Quality Management (TQM), Six sigma, Quality Gurus: Walter Shewart, Edward Deming, C.KPralhad

Change Management: Meaning, Need for Planned change, Three-Step Model of Change (Unfreezing, Moving, Refreezing), The Japanese Models of Change: Just-in-Time, Poka yoke, Cost of Quality: Appraisal Costs, Failure costs and Preven table costs, Cost Benefit Analysis, Cost Effective Analysis, Indian and International Quality Assurance Agencies: Objectives, Functions, Roles and Initiatives (National Assessment and AccreditationCouncil [NAAC], Performance Indicators, Quality Council of India (QCI), International Network for Quality Assurance Agencies in Higher Education(INQAAHE).

(v) Educational Technology and ICT

Concept of Educational Technology (ET)as a Discipline:(Information Technology, Communication Technology, Information and Communication Technology (ICT) and Instructional Technology, Application of Educational Technology in formal, non-formal (Open and Distance Learning), informal and inclusive education systems, Overview of Behaviourist, Cognitive and Constructivist Theories and their implications to Instructional Design (Skinner, Piaget, Ausubel, Bruner, Vygotsky), Relationship between Learning Theories and Instructional Strategies (for large and small groups, formal and nonformal groups)
Systems Approach to Instructional Design, Models of Development of InstructionalDesign (ADDIE,ASSURE,DickandCareyModelMason's),Gagne'sNineEventsofInstructionand FiveE'sofConstructivism,NineElementsofConstructivistInstructionalDesign,Application of ComputersinEducation:CAI,CAL,CBT,CML,Concept,ProcessofpreparingODLM,Concept of elearning, Approaches toe-learning (Offline, Online, Synchronous, Asynchronous, Blended learning, mobile learning)

EmergingTrendsine-learning:Sociallearning(concept,useofweb2.0toolsforlearning,socialnetw orking sites, blogs, chats, video conferencing, discussionforum),OpenEducationResources (Creative Common, Massive Open Online Courses; Concept and application), e-Inclusion - Conceptofe-Inclusion,ApplicationofAssistivetechnologyinElearning,Qualityofe-Learning – Measuring quality of system: Information, System, Service, User Satisfaction andNetBenefits(D&MISSuccessModel,2003),EthicalIssuesfore-Learnerand e-Teacher-Teaching, Learning and Research.
UseofICTinEvaluation,AdministrationandResearch:Eportfolios,ICTfor Research-Online Repositories and Online Libraries, Online and Offline assessment tools(Online survey tool sortest generators) –Concept and Development.

(vi) Inclusive Education
Inclusive Education: Concept, Principles, Scope and Target Groups (Diverse learners; Including MarginalizedgroupandLearnerswithDisabilities),EvolutionofthePhilosophyof Inclusive Education: Special, Integrated, Inclusive Education, LegalProvisions:Policiesand Legislations (National Policy of Education (1986), Programme of Action of Action (1992), Persons with Disabilities Act (1995), National Policy of Disabilities (2006), National Curriculum Framework (2005), Concession and Facilities to Diverse Learners (Academicand Financial), Rehabilitation Council of India Act (1992), Inclusive Education underSarva Shiksha Abhiyan (SSA), Features of UNCRPD(UnitedNationsConventionontheRightsof Persons with Disabilities) and its Implication

ConceptofImpairment,DisabilityandHandicap,ClassificationofDisabilitiesbasedonICFModel,R eadiness of School and Models of Inclusion, Prevalence, Types, Characteristics and Educational Needs of Diverse learners' Intellectual, Physical and Multiple Disabilities, Causesandpreventionofdisabilities,IdentificationofDiverseLearnersforInclusion,

Educational Evaluation Methods,Techniques and Tools

Planning and Management of Inclusive Classrooms: Infrastructure, Human Resource and Instructional Practices, Curriculum and Curricular Adaptations for Diverse Learners, Assistive and Adaptive Technology or Diverse learners: Product (Aids and Appliances) and Process (Individualized Education Plan, Remedial Teaching), Parent- Professional Partnership: Role of Parents, Peers, Professionals, Teachers, School

Barriers and Facilitators in Inclusive Education: Attitude, Social and Educational, Current Status and Ethical Issues of inclusive education in India, Research Trends of Inclusive Education in India

(vii) Educational Guidance and Counselling

Understanding Guidance - Meaning and Definitions, Misconceptions about guidance, Need for guidance, Purpose of guidance:self-understanding,self-discovery,self-reliance,self-direction,self-actualization,Scope ofguidanceprogramme,PlanningGuidanceProgrmmes

Types of Guidance and Group Guidance: Types of Guidance-Educational, Vocational/Career and Personal, Individual guidance and group guidance; advantages of group guidance, Group guidance techniques-class talk, career talk, orientation talk, group discussion, career conference, career corner, bulletin board, role play.

Understanding Counselling - Meaning and nature of counselling, Misconceptions about Counselling, Scope of counselling, Goals of counselling:resolutionofproblems,modification of behaviour, promotion ofmental health. Relationship between guidance and counselling: place of counselling in the total guidance programme

Counselling Process and Counselling Relationship-Stages of the counseling process, Counselling Techniques - personcentred and groupcentred, cognitive interventions,behavioural interventions, and systematic interventions strategies. Theories of Counselling, Skills and qualities of an effective counsellor, Professional ethics

Types and Areas of Counselling - Uses of group process in counselling, Process of group counselling, Areas of counselling: family counselling, parental counselling,adolescent counselling, counseling of girls, counselling of children belonging to special groups, Peer counselling: Its concept and the relevance to the Indian situation, Steps and skills in group counseling process.

(viii) Teacher Education

DevelopmentofTeacherEducationinIndia,NCTECurricularFrameworksforTeacherEducation;Ob jectives and organization of curriculum of teacher education at various levels; Agencies involved in Pre-service and In-service teachereducation;TeachereducationthroughOpenand DistanceEducation;QualityassuranceinTeacherEducationProgramme.Meaning,Nature

and Scope of Teacher Education; Types of Teacher Education Programmes, The Structure of Teacher Education Curriculum and itsVisioninCurriculumDocumentsofNCERTandNCTE atElementary,SecondaryandHigherSecondaryLevels,OrganizationofComponentsof Pre-service Teacher Education Transactional Approaches (for foundation courses) Expository, Collaborative and Experiential learning.

Understanding Knowledge base of Teacher Education from theviewpointofSchulman,Deng and Luke and

Habermas, Meaning of Reflective Teaching and Strategies for Promoting Reflective Teaching, Models ofTeacherEducation-Behaviouristic,Competency-basedandInquiryOrientedTeacherEducationM odels

Concept, Need, Purpose and Scope of In-service Teacher Education, Organization and Modes ofIn-service Teacher Education, Agencies andInstitutionsofIn-serviceTeacherEducationat District, State and National Levels (SSA, RMSA, SCERT, NCERT, NCTE and UGC), Preliminary Consideration in Planning in-service teacher education programme (Purpose, Duration, Resources and Budget)

Concept of Profession and Professionalism, Teaching as a Profession, Professional Ethics of Teachers, Personal and Contextual factors affecting Teacher Development, ICT Integration, Quality Enhancement for Professionalization of Teacher Education, Innovation in Teacher Education.

(ix) Adult Education

AdultEducation–Basicconceptsandmeaning.AdultandContinuingEducation--PreandPostIndepe ndent India, Extension Education and Services in India -- Phases and Movements, Adult Education Perspectives: Asian, Latin American, European and American perspectives Need, concept ,typesandcharacteristicsofLifelongLearningprogrammesinIndia,Opportunitiesfor Lifelong Learning and Extension, Agencies in Lifelong Learning in and outside India, Comparative Studies in Adult Education: Parameters, Trends and Analysis

Theoretical and Functional bases of Adult Education -- Liberal, Behaviouristic, Progressive, Humanistic, Radical and Analytical approaches of Adult Education, Social and educational perspectives of Tagore,Gandhi,Vivekananda,Radhakrishnan,AmbedkarandotherIndianthinkers

Androgogy and Pedagogy—Issues of marginalization and pedagogy of women, tribals, minorities, transgender, aged and persons with disability, Attributes anddistinctivefeaturesof adult learninganddevelopment,IndividualVs.GrouplearningapproachesinAdultEducation, Experiences and learning from agriculture, home science, community health and technology, Learning needs of diverse group of adult learners, Recognition of prior learning –Resolvingthedilemmas of institutional and non-institutional learning, Theories of adult learning, Professionalization of adult education

Policy Planning and Implementation of Adult Education in India–Five Year Plans, Implementing Agencies – Role of Government Departments,Role of Universities, Collegesand Students, Role of NGOs, Role of Local Bodies, Community and individuals, Understanding

Networking inAdultLearning,NationalLiteracyMission;Objectives,strategies,TotalLiteracy Campaigns, Post-Literacy Campaigns and Continuing Education programmes, Operationalization of the concept of vocational education in adult, continuing education and Lifelong Learning through state supported structures like JanShikshanSansthan(JSS)andnon state supported structures of Industrial and Bussiness houses, Population Education: Concept and paradigm shift Development and its indicators, Millennium Development Goals (MDGs), Sustainable Development Goals(SDGs),Building learning communities—Towards a learning society.

28. Fine Arts (PHDPVA(F))

Research Methodology in Fine Arts

1. Research and its meaning
2. Objectives of Research
3. Motivation in Research
4. Types of Research
5. Research and its approaches
6. Significance of Research
7. Research Methods Vs Methodology
8. Research and Scientific Methods
9. ResearchProcess:ResearchProblem,Reviewoftheliterature,Hypothesis,research design, Data collection, Analysis, Interpretation, Report.
10. Tools and Techniques
11. Field Methods
12. Qualities of good research
13. Problems and issues in research
14. Research Ethics

Indian Art History Sculpture:

Formal and stylistic aspects of sculpture in Indus Valley, Mauryan, Sunga, Satvahana, Kushana (Mathura and Gandhara), Gupta (Buddhist, Brahamancical and Jain), Chalukya, Gurjara Pratihara, Pallava, Chola, Rashrakuta, Hoysala, Kakatiya, Pala-Sena, Orissan, Solanki and Paramara periods.

Architecture:

Formal and stylistic aspects of architecture in Indus Valley of stupas (Bharhut, Sanchi, Amaravati, Sarnath) of cave temples, (Bhaja, Karle, Ajanta, Nasik, Lomas Rishi,Kanheri,etc.), Gupta (Udaygiri, Deogarh, nachna, etc.) Chalukya (Badami, Aihole, Pattadakal, etc.), Pallava (Mahabalipuram, Kanchipuram, etc.) Rashtrakuta (Ellora), GurjaraPratihara, Saindhava – Maitraka, Chandela (Khajuraho), Orissa (Bhubaneshwar, Konaraka), Chola (Tanjore and GangaikondaCholapuram, Darasuram, etc.), Hoysala (Belur, Halibid, etc.) Paramara, Nayukaand Vijayanagar (HampiLepakshi). Islamic architecture; Sultanate and Mughal; Mandu, Delhi, Agra, Fatehpur Sikri.

Painting:

Formal and stylistic aspects of pre-historic, Ajanta, Bagh and later mural tradition. Manuscript painting (Eastern Indian and Western Indian), Sultanate (Mandu) Chourapanchaskika style and other pre-Mughal schools, Mughal (Akbar to Shahjahan), Rajasthani (Mewar, Bundi, Kotah, Bikaneer, Jaipur, Kishangarh, etc.) Malwa, Pahari (Basholi, Guler, Kangra) and Decacani (Ahmednagar, Bijapur and Golkonda) schools.

Modern Indian Art:

Company School, Bazar Painting, British Art Schools, Kalighat Painting, Raja Ravi Verma and followers.Neo-BengalSchool('Revivalism'andearlymodernists):AbanindranathTagoreand

disciples, Nandalal Bose, Benode Behari Mukherjee, RamkinkarBaij, Rabindranath Tagore, Gaganendranath Tagore, Jamini Roy and others. Role of Santiniketan in art education. Academic/Professional sculptors and painters; Mahatre, Talim, D.P. RoyChoudhuri,Dhurandar. Heman Majumdar, Thakur Singh, etc. Early modernists: Amrita Shergil, Karmarkar. Geroge Keyt. Art in 1940's and 50's : Bengal famine and artists (Somnath Hore, Chittaprasad, Zainul Abedin, Gobardhan Ash. Sudhir Khastgir), Progressive art movements in Calcutta, Madras, Bombay and Delhi. International Modernism and artists : F.N.Souza,PradoshDasgupta,K.C.S. Panikkar, B.C. Sanyal, Dinkar Kaushik, Nirode Majumdar, Paritosh Sen, M.F. Hussain, Akbar Padamsee, Ramkumar and others. Independent Artists : N.S. Bendre, K. K. Hebbar, Shankho Choudhuri, Krishan Reddy, Dhanraj Bhagat, Y. K. Shukla, PilooPoochkhanwala, V.S.Gaitonde, Santhanraj, Davierwala and other.

Art in 1960's and 70's Indigenist trends in painting, sculpture, mural and print-making; K. G. Subramanyam, K.C.S. Panikkar (Cholamandal artists village), Reddappa Naidu, S.B. Palsikar, JanakiRam,MeeraMukherjee,JyotiBhatt,J.Swaminathan,Neo-Tantricart,etc. Figurative-Narrativetrendsince1960'sBikashBhattacharjee,GaneshPyne.A.Ramachandran,
R.B. Bhaskaran, Lakshma Goud, JoganChoudhuri, Bhupen Khakhar, Anjole Ela Menon, Arpita Singh, Gogi Saroj Pal, Arpana Kaur, Vivan Sundaram and others.
TrendofAbstractionsince1960's:raghavKaneria,JairamPatel,P.Barwe,Ramkumar,L. Munnuswamy, P.V. Kolte, Jagmohan Chopra, Balbir Singh Katt, Nagji Patel.
DevelopmentofInstallation,Multimedia,Performative,HappeningArt:naliniMalani,Ved Nayar, VivanSundaram and others.
Tribal,FolkandPopularArt(IncludingDesignandFunctionalArt)
African,Oceanic,North-WestCoastAmerican,Mexican,Indian,South-EastAsianArt.
Aesthetics and Art Critical History:
General principles of Indian art, art and beauty, principlies of image making (iconometry and other canons), six limbs of Indian painting (shadanga) and six Chinese canons of paintings, theories of Rasa, Dhvani, Aankara, Auchitya and Riti, and their relevance in understanding art making and viewing. Interrelationship of visual and performing art. Classificationofpaintingin Chitrasutra. Concepts of Kshyavridhi. Guna-dosha, Sadrishya, Vartana, Nimnonata, etc. Visible and invisible aspects of art (Drishyam/Adrishyam), Rekha (Line) and Linear rhythm (Chanda) compositional aspects of art,perspective,formandcontent.Textualsources(Vishnudharmottara, Brihatasmhita and otherSilpasastra texts. Kashmiri aestheticians. Distinctions and overlap between the scope of Art History, Art Criticism, and Aesthetic theories. Inter relationship between Art History, Anthroplogy, Arhaelogy, Cultural History and Philology, Development of Art History as a discipline. Connoiseur ship and catalogue raissone. Development of formalism (Wolffin, Reigl, Roger Fry, Greenberg), Iconology (Gombrich and Panofsky), Visual perception (Rudolf Arnheim) and NewArtHistory(Bryson,HalFoster).AnandacoomaraswamyandStella Kramrisch and their relevance in the India Art Historical Studies.Westernapproachestoartand aesthetcs : Plato, Aristotle, Alberti, Vasari, Bellori, Reynolds, Diderot, Wincklemann, Croce, Tolstoy,etc.Writingbyartistsandmanifestorsofmodernartmovements.TheoryofAvant-Garde.ImplicaitonoftheoriesofSemiotics,Structuralism,Post-strcuturalism, Post-modernism and Feminism on Art thinking and writing.

Fundamental and Principles of Painting:
Knowledge of principal elements, perspective values, fundamentals of paintings. Visual principles, Form, space, illusion, image. Chronology of the developmentofideas.Visualreality, conceptual reality.Traditionandthegradualdevelopmentoftheartofcombiningtheelementsof ideas of different visual arts specialization. Media and material and their use, sketching and drawing. Application of materials, oil painting-All a Prima and old masterprocess,glazingand scumbling, priming of canvas, different types of oil, brushing etc. Tempera and Gocache and their uses in painting in both traditional andnon-traditionalart.Washmethodonpaperandsilk, Acrylic, pastel, mixed media,watercolourmuralandmuraltechniques-FrescoseccoandBuono fresco, Ajanta and different modern media relief and mixed media in mural. Collage, Encaustic Wax SupportsinPainting(Canvas,paper,wood,silk,etc.)Typesofpaintings,openairpaintings, portrait paintings, study of head and full length figures, male and female. Landscape paintings, patronized art, paintings under different art movements, still life, thematic, abstract , etc. Principles of compositions, reflection of artists personalviews,developmentofconcept.Process of creative paintings. Expression of ideas under some aesthetical and philosophical views. Artistic expression during different social and structural changes. Art and Changes. Application of techniques, colours and colour theory and the application of colour theory in art activities. Colour harmony, traditional application of colour and the application of colour with reasoning. Colour preparation, tecture, technical aspect of pigment.

Sculpture:
DetailknowledgeofPrincipleelementofSculptureincludingHistoricalbackgrounds, developments and the modern approach about all Sculpture methods.

- Stone Carving
- wood Carving
- Metal Casting
- Terracotta(Lowrelief/Highrelief)
- Other-ClayMakingProcess,PlasterofParis,MetalFabricationlikeWelding,Metal Scrap, waste Material, Installation.
- HistoryofSculpture–IndianandWestern:Manifestationandinventionofdifferent Sculpture technique Artist and their Contributions.

Graphics (Print making):
DetailknowledgeofPrincipleelementofPrintmakingincludingHistoricalbackgrounds, developments and the modern approach about all Printmaking methods.

- Relief method
- Intaglio Method
- Planography Method
- Serigraphy Method
- Other-ComputerGraphics,Papermaking,DimensionalPrintlike Blind print, Embossing, colography, Unique Print / Mono prints.
- ConceptStudyofTools,Techniques,Processing and developing Block preparation & Printing
- HistoryofPrintmaking–AsiaandEurope:ManifestationandinventionofdifferentPrint making Methods Artist and their Contributions.

- HistoryofIndianPrintmaking–Manifestation,inventionanddevelopmentofdifferentPrintmaking Methods Artist and their Contributions.

Applied Arts:

- Introduction to Advertising, History of Advertising, truth and fundamentals of Advertising,ethics in Advertising. Media of Advertising.
- TechnicaltermsofAdvertising.
- Principlesof Design.Elements ofdesign, its roleand effectin Advertising layouts.
- Typographyanditsbasicrules.Calligraphyandits History.
- Illustration, History and famous Illustrator.
- Printing:itshistoryanddevelopment,introductionofmainprintingprocessessuchas Letterpress, Lithography, Gravure, Offset, Silk-screen, latest techniques of printings.
- TrendsanddevelopmentsofModernAdvertising,TypesofAdvertising,Justificationof advertising for expenditure and growth.
- Advertising for Nation-Building and Social welfare. Concept Planning and Creative Research.
- Advertising Agency, its structure and different departments. Function of different departments.RoleofartstudiointheAgency.FamousAd.AgencyandAd,gurus.
- DifferentMediaofAdvertising–PrintMedia,Indoor,outdoor,Directmail,POP,Social Media, TV, Radio, Internet, electronic media, new media of advertising etc.
- CampaignPlanning,appeal:Useofappealincampaignplanning,objectives,continuity. Differentkinds ofCampaigns :Social, Product,Movie, Event,Educational, Political etc.
- Corporate Image, and Corporate Identity.
- TypesofcopyandDesignapproachof campaigning.
- Communication and its type. Barriers in good communication.
- DifferentfunctionsofAdvertisingBusiness.ResearchandMotivationalResearch– present and future action.

- Future of Advertising – Career options in Internet Advertising, web designing and Animation.
- Introductiontomarketing.4P'sof marketing.
- Market Research & Analysis.
- Importance of Marketing and Consumer Behaviour in Advertising.
- Advertising Effectiveness.
- TestingofAdvertising.

29. Theatre Arts (PHDPVA (T))

Research Methodology

1. Research and its meaning
2. Objectives of Research
3. Motivation in Research
4. Types of Research
5. Research and its approaches
6. Significance of Research
7. Research Methods Vs Methodology
8. Research and Scientific Methods
9. Research Process: Research Problem, Review of the literature, Hypothesis, research design, Data collection, Analysis, Interpretation, Report.
10. Tools and Techniques
11. Field Methods
12. Qualities of good research
13. Problems and issues in research
14. Research Ethics

Subject Specific

1. History and origins of Western and Indian Theatre /drama
2. Elements of Theatre and Drama (Western and Indian)
3. Bharata's Natyasastra and Aristotle Poetics.
4. Origin and development of Traditional Theatre and Folk theatrical Forms of India
5. History and Development of Modern Western Drama and Theatre
6. History and development of Modern Indian Drama and Theatre
7. Makers of Modern Theatre (Indian and Western)
8. Major acting theories
9. Technical Aspects of Theatre (design, direction, set design, costume design, lighting, stage craft, theatre music, Play production Process)
10. Theatre Aesthetics(Western and Indian)
11. Indigenous Theatre Practices (Indian context)
12. Theatre- in- education, Children theatre, creative drama, applied theatre, political theatre, street theatre.
13. Theatre management and Theatre festivals.
14. Post modern theories of theatre(Theatre Semiotics, Feminist Theatre, Intercultural Theatre, Phenomenology, Historiography, Post-Dramatic theories etc)
15. Theatre Pedagogies and Theatre Education (Universities and Institutions)

30. Music (PHDPVA (M))
Hindustani Music (Vocal/ Instrumental)

Research Methodology
1. Importance of Literature Survey in research
2. Importance of content analysis in research
3. Qualitative and quantitative research in music
4. Methods to be applied in historical research in Music
5. Sources for collection of Data for research in Music
6. Various approaches for research in Music
7. Ethical issue in research
8. Principles of Research Ethics
9. Process of Data analysis in research
10. Presentation of Research findings
1. Technical-Terminology.
Nada, Shruti, Swara, Grama-Moorchana, Jati, Thata (Mela), Raga, Tana, Gamak, Gandharva,Gaan, Margi-Deshi, Giti, Nibaddha, Anibaddha, Varna, Alankar, Melody, Harmony, SwarSanwad, Musical Scales, Musical Intervals, Western and South Indian terminology and their explanation,Alpatva-Bahutva,Avirbhav-Tirobhav,Laya,Tala,Matra,Avartan,Vibhag, Theka, Kriti, Kirtana,Ragmalika, Tillana, Javeli, Maseetkhani and Rajakhani Gat.
2. Applied theory.
DetailedandcriticalstudyofRagas,classificationofRagas,i.e.GramaRagavargikaran, MelaRagaVargikaran, Raga-RaginiVargikaran, Thata Raga Vargikaran, and RagangaVargikaran, Time-theory of Ragas, Application of melody and harmony in Indian Music,
PlacementofShuddhaandVikritSwarasonShrutiesinancient,medievalandmodern period.
DetailedknowledgeofprevalenttalasofHindustanimusic,knowledgeoftalaDashpranas and Margi and Deshitalas of ancient period.
3. Compositional forms and their Evolution.
Prabandha, Dhrupad, Dhamar, Sadra, Khyal, Thumri, Tappa, Tarana, Chaturang, Trivat, Vrindagana, VrindaVadan.
4. Gharanasand Gayaki.
Origin, development and contribution of Gharanas in preserving and promoting Hindustani classical music (Vocal-Instrumental).
5. Contribution of Scholars to Indian Music and the study of Important Granthas (treatises).
Natya-Shastra, Brihaddeshi, Dattilam, Sangeet-Makarand, Geet-Govinda, SangeetRatnakar, Rag-Tarangini, Swara-Mela-Kalanidhi, Sadraga-Chandrodaya, Sangeet Raj, Sangeet-Parijat, HridyaPrakash,ChaturdandiPrakashika,Rag-Tatva-Vivodh,Raga-Darpan,Nagmat-e-Asaphi, BhatkhandeSangeetShastra (Vol. 1-4), Rag-Vigyan, Sangeetanjali, SangeetChintamani etc.
6. Historical Perspective of Music.
AstudyofthehistoricaldevelopmentofHindustanimusic(Vocal,Instrumental).
Contribution of Western Scholars to Indian Music.
7. Aesthetics.

Itsorigin,expressionandappreciation:PrincipleofaestheticsandIts,relationtoIndianMusic.
Rasa theory and its application to Indian Music.
RelationshipofMusicalaestheticsandRasatoHindustaniMusic(Vocal,Instrumental).
Inter-relationshipofFineArtswithspecialreferencetoRag-
RaginiPaintings;DhyanofRagas and others.
8. Instruments.
Origin,development,materialusedandstructureofvariousinstrumentsandtheirwell-known exponents of Hindustani Music (Vocal, Instrumental).
ClassificationofInstrumentsofHindustaniMusic.
9. Folk Music.
GeneralstudyofthefolkmusicofvariousregionsofIndialikeUttarPradesh,Rajasthan, Haryana,Punjab, Maharashtra, Bengal and South India.
10. Music Teaching and Research Methodology.
The methodologies of music research, preparing synopsis, data collection, field work, writing project reports, finding bibliography, Footnotes, reference material etc. with reference to Hindustani music.

31. Dance (PHDPVA (D))
Paper- 1: Research Methodology
I. Introduction to Research- Its definition, role of research in dance, process, types, significance
II. Research approaches in dance
III. Formulation of research problem
IV. Research design
V. Sources of Data
VI. Data collection- primary and secondary data, methods of collection and techniques
VII. Analysis and Interpretation
VIII. Ethics in research
2. Paper- 2: Dance
I. Aesthetics: Rasasutra of Bharata, Bhava and its constituents, Abhinaya- Its types
II. Historical study: References from literature, paintings, sculptures
III. Study of Treatises:Technical concepts and classification of dance,features, significance of dance, study of Abhinayadarpana, Nayaka-Nayika prakarana as in texts, study of Natyashastra, Dasarupaka, Sangeetha Rathnavali
IV. Indian classical and other dance forms including traditional dance theatre: History, development, Technique, costumes, Music, instruments, Gurus
V. Dance in Modern India: Role of revivalists,institutions, Works of modern and contemporary dancers/ choreographers
VI. World dances: History and development of Ballet, Emergence of Modern dance in the west, overview of dances from East Asia, South-east Asia.

32. **Gender and Development Studies (PHDGDS)**
1. Concepts and Theories
Goals and Praxis of Gender and Development, History of Feminists Movement and Formation of Patriarchy, Emergence of Gender and Development Studies in India, Gender Sensitive Planning and Policy Making, Gender Mainstreaming, Gender Analysis, Gender Auditing and Gender Budgeting, Gender and Democracy, Gender Justice, Gender Equality and Equity.

2. The Development Debate
Changing Notions of Development, Development and Post Development Theories, Critique of Development theories from a Gender Perspective, Development and Underdevelopment (Dependency Theory and its Critiques); WAD/WID/GAD, Power and Decision Making, Gender and Empowerment, Gender and Poverty, HDI, GDI, GEM -Approaches and Indicators.
3. Gender and Livelihoods
Issues in Gender and Environment, Climate Change, Sustainable Environment, Green Politics, Food Security; Land Rights, Right to Forest Resources, Gender, Water and Sanitation, Security of land tenure, Sustainable Development, Ecological Security.
4. Gender and Work
Theories of Feminist Economics; Debates on Women's Labour, Gender Based Division of Labour in Pre-Industrial and Industrial Society, Gender Segregation in the Labour Force, Labour Force Participation of Women in National Economy, Productive and Unproductive Work, Domestic Labour, Female Headed Households, Women and issues of Poverty, Visibility of Women in Statistics and Indicators, Gender Concerns in Formal and Informal Sectors, Social Security and Decent Work, Women's Contribution to National Wealth.
5. Demographic, Nutrition and Health Dimensions
Demographic Characteristics (Sex ratio, Population distribution, Census Enumeration and the debates on Indian Census), Gender Based Violence, Migration, Gender and Health (Nutritional Needs, Occupational Health) Poverty and Food Security, Basic Needs and Development Goals
6. Gender and Culture
Debates in Gender and Culture, Construction of Gender, Formation of Patriarchy, Nature of Indian Patriarchy, Variations in the Theories of Femininity and Masculinity: Cross- Cultural Perspectives, Gender Roles, Gender Ideology, Issues of Ethnicity and Multiculturalism; Communitarianism, Recent debates in Gender and Literature: Post-structuralism; Post-colonialism; Post-feminism; Feminist Futures; Eco Feminisn and Environmental Humanisms, Communication, Media and Gender Debates, Changing Gender Roles and Identities: Sexualities and Queer issues; Recent debates on Gender, Education and Social Development, Social Equity and Distributional Aspects of Development in Education and Health.
7. Case Studies and Selected Readings
Research Methodology in Gender and Development Studies
Researching Gender- I
Debates in the difference between Social and Natural Science, Positivism, Empiricism, Rationalism, Realism, Post Empiricism, Feminist Critique of Positivism, Feminist Epistemology, Stand Point Theory; Gendered Ontology and Changing terms of Societal Inquiry: Liberalism, Marxism, Hermeneutics, Feminism, Post- Modernism, Post- Colonialism and Post-structuralism, Gender and Ethnographic Cultural Studies, Life Histories and Narratology, Gender and Discourse Analysis
1. Researching Gender- II
Quantitative and Qualitative Research, Feminist Paradigms, Feminist Research Methods and Ethics, Situating Differences, Interdisciplinary Methods in Feminist Research.
Processes of Gendering and the Institutionalizing Gender and Gender Relations, Building Alternative Knowledge Base and Feminist World View (Weltanchauung): State, Society, Industry and Market.
2. Research Design, Types and Strategies
Research Design, Exploratory Studies, Surveys, Historical, Experimental, Ethnographic and Case Studies; Types of Research- Fundamental, Applied Research, Action Research, Experimental, Ex-Post Facto Research, Descriptive, Correlational Research, Participatory

Research, Special Approaches for Studying Gender- Sensitive Problem- Centred, Policy Relevant and Action Oriented Research, Linking Policy and Research as Strategies for Advocacy

3. Sampling

Definition of Population, Sample, Merits and Demerits of Sampling; Probability Sampling: Random Sampling, Multi-stage Sampling, Cluster Sampling, Non- Probability Sampling, Purposive Sampling, Convenience Sampling, Quota Sampling; Sampling Designs for Various Types of Research; Critical Review of Sampling Design of Different Research Studies.

4. Tools and Techniques of Research

Questionnaire, Interview (Media and Internet), Scaling, Measurement, Focus Group Discussions, Observation, Narration, Gender Analysis Matrix and Impact Flow Chart

5. Selected Studies in Gender and Development\

Factors Determining and Influencing Gender and Development; Gender Division of Labour, Time use Survey and Management; Women's Status and Challenges; Household allocation of Resources; Access to Natural Resources; Time Scale for Rural Households; Value Added Analysis for Households: Production/Goods/Resources, Household Decision Making.

6. Data Analysis

Quantitative Data Analysis; Parametric Tests used for Quantitative Data Analysis; Qualitative Data Analysis, Non-Parametric Tests used for Analysis of Qualitative Data; Presentation of Data (Tables, Graphs etc.); Interpretation of Data.

7. Preparing and Presenting Research Reports

Evaluation Research; Report Writing/Paper Presentation, Bibliography/References/Citations; Research Ethics; Research Proposals Seeking Grants; Research Funding Sources.

33. **Tourism and Hospitality Services Management Studies (PHDTS)**

PART I: RESEARCH METHODOLOGY

1. Theory of Research :Meaning and Definition of Research, Types of Research, Research Approaches, Criteria of Good Research, Research Applications
2. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues–Hypothesis–Qualities of a good Hypothesis–Null Hypothesis & Alternative Hypothesis. Hypothesis Testing–Logic & Importance
3. Research Design: Concept and Importance in Research–Features of a good research design–Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables
4. Qualitative and Quantitative Research: Qualitative research –Quantitative research – Concept of measurement, causality, generalization and replication.
5. Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement–Nominal, Ordinal, Interval, Ratio.
6. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability and Non Probability samples. Determining size of the sample–Practical considerations in sampling and sample size. Sampling Tests
7. Data Analysis: Percentages and Ratios, Measures of Central Tendency, Frequency Distribution,MeasuresofVariability,CorrelationandRegression, Measurement of Trend, Data Preparation – Univariate analysis(frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis.
8. Interpretation of Data and Paper Writing
9. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software, Software for detection of Plagiarism

PARTII: Subject Specific (Tourism and Hospitality)

Unit 1

Tourist/Visitors/Travelers/Excursionist- Definition and Differentiation, Tourism recreation and Leisure inter-relationship. Tourism components, Types and Typologies of Tourism Emerging Concept: Eco/Rural/Agri/Farm/Green/Wildness/Countryside/ Special interest tourism

Tourism Trends: Growth and development over the year and factors responsible there in. Changing market destination pattern, traffic flows. Receipt trends. Travel motivator and deterrents. Pull and push forces in tourism.

Linkage and Channels of distribution in tourism

Tourism organization /institutions: Origin Organization and functionofWTO,PATA,IATA, ICAO, FHRAI,TAAI, IATO and UFTAA

Unit-2

Conceptofresource,Attractionandproductintourism,TourismProducts:Typologyand unique feature

Natural tourism resources in India: Existing use pattern vis-à-vis potential with relation to varied and form (Mountain, deserts, beaches, coastal areas and island), water bodies and biotic wealth (flora-fauna)

Popular Tourist destination for land based (soft/hard trekking, ice skiing, mountaineering, desert,safaris,carralliesetc),WaterBased(rafting,kayaking,canoeing,surfing,waterskiing, scuba/scuba diving) and air based (Para-sailing,Para-gliding,ballooning,handglidingandmicrolighteningetc),Touristactivities,Wi ldlife-Tourism a conservation related issues-Occurrence and distributions of popular wild life species in India. National Parks, Wildlife Sanctuaries and Biosphere Reserve (case of Dachigham, Corbett/ Dudhva/Kaxiranga/kanha/Gir/Ranthumbore/Mudumalai/Sunderbun/Shivpuri/Manas/NandaD evi/Valley of flower Reserve)

Tourism andnatureconservation-conflict,symbiosisandSynergyCulturalTourismresources in India: Indian cultureandSocietyIndianHistory-Ancient,MedievalandModernTradition, Customs and costumes, Life Style and settlementspatterns,Foodhabitsandcuisines,Music, Musical instruments and Dance Form; Drawing and Painting, Craftsmanship Religion/ Religious observances and important pilgrim destination ArchitecturalHeritage-Forts/palace etc.

Unit-3

Accommodation: Concepts, types and typologies, Linkage and Significance with relation to tourismEmergingdimensionsofaccommodationindustry-Heritagehotels,Motelsandresort properties, Time share establishments

Hotel-Origin,Growthanddiversification,Classification,registration and gradation of hotels,

OrganizationalStructure,FunctionsandResponsibilitiesofthevariousdepartmentsofa standard hotel/other catering outlets, bars, restaurants etc.

Fiscalandnon-fiscalincentivesavailabletohotelindustryinIndia,Ethical,legaland regulatory aspects

Unit–4

Transportation: Dynamically changing needs and means Landmarks in the development of transport sector and the consequent socioeconomic, cultural and environmental implication, Tourism transport system.

Airlines Transportation: The Airlines Industry-Origin and Growth. Organization of Air Transport Industry; Scheduled and Non Scheduled Airlines services; Role of IATA, ICAO, and other agencies, Bermuda convention.

Air Transports Industry in India- DGCAandotherkeyplayers;Regulatoryframework,Acts, Indian Cariers-Opertaions Management and Performance, Marketing Strategies of Air India.

SignificanceofRoadTransportinTourism:Growthanddevelopmentofroadtransport system in India, State of

existing infrastructure, Public and Private Sector involvementRole ofRegionalTransportAuthority,ApprovedTravelAgencies,Tour/TransportOperators, RentalCompaniesRailTransportNetwork-MajorRailwaysystemofworld-BritishRail, Euro Rail and Amtrak TypeofSpecialPackageofferedbyIndianRailwaystotourists-IndrailpassesPalaceon wheel and Royal Orient WaterTransportsysteminIndia-Historyofwatertransport,Cruiseships,Ferries, Hovercraft, River and canal boats, Fly cruise, Future prospects etc.

Unit-5

Travel Agencies and Tour OperatorsBusiness:Origin,GrowthandDevelopment,Definition, Differentiation and linkage, Organization and functions, Travel information counseling, Itinerary preparation, reservation, costing/pricing, Marketing of tour package, Incomesources

Airlines Ticketing: Operational perspective of ticketing-ABC codes Flight Scheduling,Flying time, and MPM/TPM calculation, TIM (Travel Information Manual), Consultation, Routine and itinerary preparation, Types of fare, fare calculation and rounding up,Currency conversion and payment modes, issuance of ticket

Cargo handling: Baggage allowance, Free Access Baggage, Weigh and Piece Concept, Accountabilityoflostbaggage,Dangerousgoods,Cargoratesandvaluationcharges, Automation and airport procedures

RequirementsforsettingupTravelAgencyandTourOperation business

Approval from organization andinstitutionconcerned,IncentivesavailableinIndiancontext, constraint and limitations

Unit-6

Marketing : Core concepts in marketing, Needs, Wants, Demands, Product market,Marketing Management Philosophies -Production,Selling,Marketingandsocialperspective, economic importance of marketing

Tourism Marketing: Service characteristicsoftourism,uniquefeaturesoftouristdemandand tourist product, Tourism marketing mix

Analysis and selection of market: Measuring and forecasting tourism demand, Forecasting method, Managing capacity and demand, Market segmentation and positioning

Developing marketing environment, consumer buying behavior, competitive differentiation and competitive marketing strategies, new product development, product life cycle,Customer satisfaction and related strategies in internal and external marketing, interactiveand relationship marketing

Planning marketing programmes: Product and product strategies, Product line, Product mix, Branding and packaging, Pricing Consideration, Approaches and strategies, Distribution channels and strategies

Marketing of Tourism Services: Marketing of Airlines, Hotels, Resort, Travel Agencies and other tourism related services-challenges and strategies

Marketing Skill for Tourism: Creativity-communication-Self motivation-team building, personality development

Unit7

Tourism Planning: Origin, concept and approaches, Level and types of tourism planning, Product life cycle theories and their applicability in tourism planning, Urban and Rural tourism planning

Tourismplanningandpolicyperspective,planningatnational,stateandregionallevels, India's tourism policies

Tourism Planning process: Objectives, Setting, Background analysis, detailed research and analysis, Synthesis, goal setting and plan formulation, Evaluation of tourism project-Project feasibility study, Plan implementation, Development and monitoring tourism master plan

Tourism impacts and need for sustainable tourism planning: Socio-Cultural, Economic andPhysical Impacts, Tourism Carrying Capacity and Environmental Impact Analysis(EIA)

Business ethics and laws-their relevanceandapplicabilityintravelandtourismindustryLaw and legislation relating to tourist entry, stay, departure, Passport, Visa and Health

Tourist safety and security, Preservation and conservation of heritage, Archaeological sitesand wildlife.

Unit-8
Management:Concept,Nature,ProcessandFunctions,Managementlevels,Managerialskills and roles, the external environment, Social responsibilities and ethics
Planning:
Nature,Purpose,typesandprocess,Managementbyobjectives,strategies,andpolicies, Decision making process, Tools and techniques, Decision making models
Organizing: Concept of organizing and organization, Line and Staff, Authority and responsibility, Span of control, Delegation, Decentralization, conflict and Coordination,
organizationalstructureanddesign,Managementofchangeinnovationandorganizational

development
Directing: Communication-process, Types, Barriers and principles of effective communication, Motivation-Theories and practices, Leadership-Concept theories and styles Controlling: Process, Methods and techniques, managing international business
Information systems: Automation of manual system, DataProcessingstages,Evolutionfrom EDP to MIS: Introduction, Definition, Status
Computer networking: ApplicationofCRS(computerizedreservationSystem)intraveltrade and hospitality sector

34. Distance Education (PHDDE)

SECTIONA– Research Methodology Conceptual

Framework of Research:

Meaning of research; Sources of acquiring Knowledge; what is research problem.

Types and characteristics of distance education research; areas of distance education research; technique involved in defining a problem; selecting the problem; necessity of defining the problem; steps and formulation of research problems;operational definition.

Identify key theories, concepts and ideas around the topic; distinguish between what is known and what is unknown; the significant controversies around the topic; theoretical emphasis of epistemological and ontological ground on which problem has been selected.

Objectives of research; research design in selecting a topic for research study; researchquestions; hypothesis; research approaches (scientific, historical, descriptive, comparative).

Major steps preparing involved in a research design; factors affecting research design; aims of research as a scientific activity:problem-solving; theory building and prediction; types ofresearch (fundamental,applied and action research);

Research ethics and ethical considerations in researchcriteria; and, sources of identifying the research problem.

ResearchReview:

Meaning and definition of reviewofliterature;importanceofrelatedliterature;criteriaofreview selection; purpose of the review;

Types of reviews (Narrative Review, Realistic Review, Meta Review, Qualitative Review, Systematic Review, Transparent Review);

Sources of information for review selection (Primary source, secondary source, tertiarysource); and, process of selecting and reading journals.

ResearchMethodsandDataAnalysis:

Researchdesign;toolsofresearch-validity,reliabilityandstandardizationofatool.

Types of tools (rating scale, attitude scale, questionnaire,aptitude test and achievement test, inventory); techniques of research (observation, interview, projective techniques).

Variables- meaning of concepts, constructs and variables; types of variables(independent, dependent,extraneous, intervening and moderator).

Methods of educational research - qualitative, quantitative and mixed methods of research;types of research.
Sampling,characteristicsofagoodsample;techniquesofsampling(probabilityandnon-probability sampling); sampling (types of sampling, sampling error).

Methods of data collection.
Data processing and analysis strategies - data analysis with statistical packagesand sample.

Report Writing:

Significanceofreport writing; different steps in writing report; types of research reports; format of research report writing; referencing techniques.

Precautions for writing research reports; methods to avoidplagiarism; and, using software for plagiarism detection.

Evaluation of research report.

SECTION B– Distance Education

Policy, Growth and Development of Distance Education:

Scenario of higher education in India; basic issues of open and distanceeducation;philosophical foundation of open and distance education; genesis, growth of distance education in Indiaand global spheres; its socio-economic relevance;theories of distance education and their implications; issues

concerning distance education; nature, scope and characteristics of distance education;distance education as a system as well as a discipline of study, structure and governance of distance education/ODL institutions in ODL; policies, regulations, national education policies and reform; quality assurance and accreditation mechanism.

Pedagogy of Distance Education:

Concept of learning and instruction; theories of learning - Behaviouristic School of Thought (Pavlov;Skinner,Guthrie,Watson,Thorndike, Gagne,Social learning theory);Cognitivist School of Thought (Piaget, Bruner, Ausubel, humanistic perspective, Maslow, Carl Roger;Constructivist School of Thought(discovery learning, Vygotsky's zone of proximal development, scaffolding, cognitive apprenticeship coaching, contractual learning, problem based learning);Implications and application of learning theories in instructional design for distance education. Instructional design theories (Component display theory, elaboration theory, cognitive load theory, theory of multiple intelligence); instructional design models (ADDIE, ASSURE); educational implications on designing and developing course materialsthrough print, multimedia and other technology in distance education.

Design and Development of Course Material for Distance Education:

Design and Development of Curriculum and Course Materials – (Basic concepts, Nature, types, Characteristics, Approaches, Planning, ImplementationStrategies,IssuesandTrendsin DistanceEducation); Development of Self Learning Materials – (Concept Mapping, Access devices, WritingLearning Objectives/Learning Outcomes, Developing Content, Incorporation of Assessment Tools,Referencing Styles); Editing ofCurriculumandCourseMaterials–(Language, Content, Format, Proofreading, Copy write and Plagiarism Issues); Production, Distribution and Revision of Course Materials –
(Printing, Dispatching, Maintenance, Procedures, Framework and Strategies for Revision);Design andDevelopment of e-Resources- (OER, MOOCs, Integration of Multiple Media, Universal Design Principlesand Accessibility Issues)

Learner Supportin ODL:

Some Basic Issues (Nature, Significance, Need, Types, LSS at various Stages,Components of LSS, Evolution, Factors, Institutional Arrangements and Models, Relationshipbetween LSS and other Components of ODL System, Self-directed Learning);Development of Skills (Cognitive Skills; Study Skills; Reading Skills; Writing Skills and Problem SolvingSkills);Counseling and Tutoring Services (Importance, Nature, Forms of Counseling, Qualities and Skills, Roleand Attributes of Idol Tutor, Media and Technology);Assessment and Evaluation Support(Assessment in ODL, Types, Marking, Grading, Reliability, Validity of Assessment, Tutor Comments, Tutoring Through Correspondence and Supplemental Interaction);Management of Learner Support (Learners Expectations, Learners' Satisfaction, Monitoring Learner); Progress, Data Management, Quality Assurance in Learner Support, Learners' Attrition (types, factorsand measures to reduce attrition), Library and Information Services.

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ज्ञान-विज्ञान विमुक्तये
आचार्य मनिष र. जोशी
सचिव
Prof. Manish R. Joshi
Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

विश्वविद्यालय अनुदान आयोग
University Grants Commission
(शिक्षा मंत्रालय, भारत सरकार)
(Ministry of Education, Govt. of India)

No.F.4-1(UGC-NET Review Committee)/2024(NET)/140648 28th March, 2024/8 चैत्र, 1946

Sub: National Eligibility Test (NET) as an Entrance Test for Admission to Ph.D.

Dear Madam/Sir,

As you are aware, the University Grants Commission (Minimum Standards and Procedure for Award of Ph.D. Degree) Regulations, 2022 provides for the admission of students to Ph.D., who qualify for fellowship/scholarship in UGC-NET/UGC- CSIR NET/GATE/CEED and similar National level tests, based on interview.

In addition, Higher Education Institutions (HEIs) conduct their entrance tests for admission to Ph.D. programmes, requiring the students to write multiple entrance tests.

To help the students with one national entrance test for admission to Ph.D. as a part of the implementation of National Education Policy (NEP) 2020, the Commission in its 578th Meeting held on 13th March, 2024, decided that from the academic session 2024-25 onwards, the NET score can be used for admission to Ph.D. programmes in place of entrance tests conducted by the different universities/HEIs.

A Public Notice issued by the UGC on 27th March, 2024 in this regard is enclosed.

In view of the above, the HEIs are requested to utilize the NET score for admission to Ph.D. programmes instead of conducting their entrance tests from the forthcoming academic session 2024-2025.

In case any clarification is required, the HEIs may write to net-bureau@ugc.gov.in

With kind regards,

Yours sincerely,

(Manish Joshi)

Encl.: As stated above

To

The Vice Chancellors
Central / State / Deemed / Private Universities

ज्ञान-विज्ञान विमुक्तये
आचार्य मनिष र. जोशी
सचिव
Prof. Manish R. Joshi
Secretary

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

विश्वविद्यालय अनुदान आयोग
University Grants Commission
(शिक्षा मंत्रालय, भारत सरकार)
(Ministry of Education, Govt. of India)

No.F.4-1(UGC-NET Review Committee)/2024(NET)/140648 **March 27, 2024/7 चैत्र 1946**

PUBLIC NOTICE

National Eligibility Test (NET) as an Entrance Test for Admission to Ph.D.

The University Grants Commission conducts the National Eligibility Test (NET) through the National Testing Agency (NTA). The NET is conducted twice a year, in June and December. Currently, the NET scores are used (a) to award Junior Research Fellowship (JRF) and (b) as eligibility for appointment as Assistant Professor for those with a Master's degree.

Many universities conduct their entrance tests for admission to their Ph.D. programmes, requiring the students to write multiple Ph.D. entrance tests. To help the students with one national entrance test for Ph.D. admissions as a part of implementing the National Education Policy 2020, the UGC constituted an expert committee to review the provisions of the National Eligibility Test (NET).

Based on the expert committee's recommendations, in its 578th Meeting held on 13 March 2024, the UGC has decided that from the academic session 2024-25, the NET score can be used for admission to Ph.D. programmes in place of entrance tests conducted by the different universities/HEIs.

From June 2024 onwards, therefore, the NET candidates will be declared eligible in three categories:

Category-1: Eligible for (i) admission to Ph.D. with JRF and (ii) appointment as Assistant Professor.

Category-2: Eligible for (i) admission to Ph.D. without JRF and (ii) appointment as Assistant Professor.

Category-3: Eligible for admission to Ph.D. programme only and not for the award of JRF or appointment as Assistant Professor.

Contd...

The determination of the eligibility of NET for different categories is summarized below:

Qualified for	Eligible for		
	JRF	Assistant Professor	Ph.D. Admission
Category-1: Award of JRF and appointment as Assistant Professor	Yes	Yes	Yes
Category-2: Appointment as Assistant Professor and admission to Ph.D.	No	Yes	Yes
Category-3: Admission to Ph.D. only	No	No	Yes

The result of NET will be declared in percentile along with the marks obtained by a candidate to utilize the marks for admission to Ph.D.

The JRF-qualified students are admitted into the Ph.D. programme based on an interview as per the University Grants Commission (Minimum Standards and Procedures for Award of Ph.D. Degree) Regulations, 2022.

For students who qualify in Categories 2 and 3, 70% weightage will be given for test scores and 30% weightage for the interview for admission to Ph.D. programmes. The Ph.D. admission will be based on the combined merit of NET marks and the marks obtained in the interview/viva voce.

The marks obtained in the NET by the candidates in Categories 2 and 3 will be valid for a period of one year for admission to Ph.D.

The notification and Bulletin of Information for the NET June 2024 will be issued by the National Testing Agency shortly at https://ugcnet.nta.nic.in.

(Manish Joshi)