

FEDERAL PUBLIC SERVICE COMMISSION
(Curriculum & Research Wing)

Schemes and Syllabi for Screening/Professional Tests as well as Descriptive Examination
Relating to Posts Advertised under Consolidated Advertisement No. 13/2022

S. No	Case No. F.4-	Particulars of Post(s)	Qualifications/Experience for the Posts	Test Specification	Topics of Syllabi
1.	202/2022	Inspector (BS-16), Airports Security Force, Ministry of Aviation.	Bachelor's degree. PHYSICAL STANDARD OF FITNESS: (i) Minimum Height: For male 5'-6" or 168 cm and for female 5'-2" or 157 cm. (ii) Minimum Weight: For male 106 Lbs or 48.1 Kg and for female 45 Kg or 99.2 Lbs. (iii) Minimum Chest Measurement: For male 32¾" or 83 cm, Expanded 34¾" or 88 cm.	Objective Type Test (MCQ) Part-I English = 20 marks Part-II General Intelligence/ Professional Test = 80 marks	Part-I Grammar Usage, Sentence Structuring. Part-II <ul style="list-style-type: none"> • Basic Arithmetic <ul style="list-style-type: none"> – Algebra – Ratios – Percentages – Arithmetic Means • Current Affairs. <ul style="list-style-type: none"> – Developments at National and International Levels in the last 2 years • Pakistan Affairs & Islamic Studies <ul style="list-style-type: none"> – Basic Level knowledge • Basic Knowledge of ASF Act – 1975 Note : (Equal weightage for each topic at Part-II)
2.	207/2022	Law Officer (BS-16), (Railway Board), Ministry of Railways.	i) Second Class or Grade 'C' LLB degree from a University/ Institute recognized by HEC. ii) Computer literate in Microsoft Word, Excel and Spreadsheet.	Objective Type Test (MCQ) Part-I English =20 marks Part-II Professional Test=80 marks	Part-I Grammar Usage, Sentence Structuring. Part-II <ul style="list-style-type: none"> • Core courses of LL.B. Programme • Steps involved in Processing of Legal Cases • Basic Knowledge of Microsoft Office. • Important principles established in case law.

Schemes and Syllabi for Written Examination (Descriptive) for All Posts in BS-18 & BS-19 included in Consolidated Advertisement No. 13/2022

PAPER-I: ENGLISH

Max Marks: 100

Time Allowed: 3 Hours

- (i) **English Essay-50 Marks:** Candidates will be required to write an Essay in English comprising **1500 words** from a set of **six given topics**. Candidates are expected to reflect comprehensive and research based knowledge on a selected topic. Candidate's articulation, expression and technical approach to the style of English Essay writing will be examined.
- (ii) **English (Composition and Précis)-50 Marks:**
The examination will test the candidate's abilities to handle Précis Writing, Reading Comprehension, Sentence Structuring, Translation, Grammar and Vocabulary, etc.
- Précis Writing (10 marks):** A selected passage with an orientation of generic understanding and enough flexibility for compression shall be given for précising and suggesting an appropriate title.
- Reading Comprehension (10 marks):** A selected passage that is rich in substance but not very technical or discipline-specific shall be given, followed by five questions, each carrying 2 marks.
- Grammar and Vocabulary (10 marks):** Correct usage of Tense, Articles, Prepositions, Conjunctions, Punctuation, Phrasal Verbs, Synonyms and Antonyms etc.
- Sentence Correction (5 marks):** Ten sentences shall be given each having a clear structural flaw in terms of grammar or punctuation. The candidates shall be asked to rewrite them with really needed correction only, without marking unnecessary alterations. No two or more sentences should have exactly the same problem, and 2-3 sentences shall be based on correction of punctuation marks.
- Grouping of Words (5 marks):** A random list of ten words of moderate standard (neither very easy nor utterly unfamiliar) shall be given, to be grouped by the candidates in pairs of those having similar or opposite meaning, as may be clearly directed in the question.
- Pairs of Words (5 marks):** Five pairs shall be given of seemingly similar words with different meanings, generally confused in communication, for bringing out the difference in meaning of any five of them by first explaining them in parenthesis and then using them in sentences.
- Translation (5 marks):** Ten short Urdu sentences involving structural composition, significant terms and figurative/idiomatic expressions shall be given, to be accurately translated in English.

SUGGESTED READINGS

Sr. No.	Title	Author
1.	English Grammar in Use	Raymond Murphy
2.	Practical English Usage	M. Swan
3.	Practical English Grammar and Composition	S.C. Gupta
4.	Improve your Punctuation & Grammar	Marion Field
5.	The Little, Brown Handbook	H. Ramsey Flower & Jane Aaron
6.	A University English Grammar	R. Quirk & S. Greenbaum
7.	Write Better, Speak Better	Readers Digest Association
8.	Modern English in Action	Henry Christ
9.	Exploring the World of English	Syed Saadat Ali Shah

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-203/2022-R
Particulars of post	Deputy Engineering Adviser (Power)/ Government Inspector of Electricity (BS-19), Office of the Chief Engineering Adviser/ Chairman Federal Flood Commission, Ministry of Water Resources.
Minimum Qualification & Experience:	i. Bachelor's Degree in Electrical Engineering or an equivalent qualification from a recognized University/ Institution. ii. Twelve (12) years post qualification experience in Planning, Design or operation of Hydroelectric or Thermal Power Stations or High Voltage Transmission Systems, or distribution systems in BS-17 and above or equivalent in a Government/ semi-Government/ reputable private organization.

Part-I: 25 Marks (MCQ)

- 25 MCQ Questions on Part-II.

Part-II (Engineering) (Subjective) : 75 Marks**I. Electricity & Electronics:**

Electricity & Magnetism; Electrical potential, Resistance, Laws of resistance, Conductance, Conductivity, Impedance, Ohm law, Resistance in series and in parallel, practical resistors, work, power, Energy, Joule's law of electric field intensity, Gauss's Theorem, Capacitor, Capacitance, Capacitors in parallel and series. Force on a conductor in a magnetic field, electrical and magnetic circuits, leakage flux, Relation between magnetism and electricity, Induced emf, induced current and directions, Faraday's laws of electromagnetic inductions, Lenz's law, dynamically induced emf, Self inductance, mutual inductance and inductance in series/parallel, magnetic hysteresis, Energy stored in magnetic field, Generation of alternating currents and voltages.

II. Electrical Machines:

DC Motors: Shunt, Series and Compound Motors, Speed and Torque Relations. Transformers: Principle, Construction, Voltage transformation ratio, Step-up/stepdown transformers, Copper & Iron Losses, Transformer connections; delta and star.

AC Motors: Induction motor, Synchronous motor, Performance, Efficiency. Single phase and three phase Motors.

Generators: Principle, Construction, Different components of generators. AC Generators, DC Generators.

III. Power Systems:

Power network analysis, Polyphase circuits, Transients, Transmission Lines, Losses, Selection of hydropower sites, General Arrangement of components of a typical RoR plant: Type of turbines, Pelton, Francis, Kaplan and Bulb turbines and their performance characteristics, Selection of turbines and their specific speed, Turbine setting

IV. Costing, Accounting and Budgeting:

Net present value, Net future value, cash flows, auditing, income statement, balance sheet, taxation, financial risk management, cost analysis.

V. Project Management:

Project Management Techniques, Time lines, milestones, resources allocation, dependency, Gant Charts,

VI. Inventory Management:

FIFO models, LIFO models, Identification Schemes, Inventory management systems.

VII. Quality Management Systems:

QA models. Deming, Juran Crosby, Quality circles, management responsibility, quality planning, purchasing, design process and design validation, quality audit, corrective and preventive measures.

VIII. National policies on Water and Power

- Power Generation Policy 2015
- National Electricity Policy 2021
- National Water Policy 2018

IX. Indus Waters Treaty 1960 and its implementation

Historical background of Indus Water Treaty, 1960, Transitional Arrangements, Functions of Permanent Indus Commission, Challenges in implementation of the Treaty, Implications and limitations, Disputes resolution mechanism, Current water issues/disputes with India, Benefits or otherwise of the Treaty for Pakistan and India.

X. Global Warming and Climate Change

The emerging scenario of global warming and its impact on riverain systems, aquifer and agricultural eco-systems (including cropping pattern)

XI. Water Accord, 1991

Salient features of Water Accord, 1991 between the provinces of Pakistan, functioning of IRSA, Impact of IRSA on the water distribution for irrigation purposes and current water distribution issues.

SUGGESTED READINGS

S. No.	Title	Author
1.	Electrical Technology	B.L. Tharaja
2.	Electronic Devices and Circuits.	Bogart
3.	DC Machines	P.C. Sen
4.	Handbook of Engineering Management	Dennis Lock.
5.	Total Quality Management	Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Gesterfield-Sacre
6.	Conflict and cooperation on South Asia's International Rivers: A Legal Perspective	M.A. Salman
7.	Indus Water Treaty: Political and Legal Dimensions	Ijaz Hussain
8.	Pakistan's Water: in the line of Action for Global Warming	Dr. Raja Rizwan Hussain, Engr. Raazia Attique
9.	Irrigation and Hydraulic Structures, Theory, Design and Practice	Iqbal, A,
10.	Environmental Science: Earth as a living Planet	Botkin, D . Keller, E.

PAPER-II: PROFESSIONALMax Marks: 100Time Allowed: 3 Hours

Case No.	F.4-204/2022-R
Particulars of post	General Staff Officer, Grade-II (Bio Medical Tech) (Radio Pharmacist/ Radio Chemist) (BS-18), Armed Forces Institute of Radiology and Imaging, Ministry of Defence.
Minimum Qualification & Experience:	i. Second Class or Grade 'C' Master's Degree in Pharmacy or equivalent qualification from a University recognized by HEC/PCP. ii. Five (5) years post qualification working experience at PET-CT radiopharmaceutical production lab at any renowned functional PET-CT setup.

Part-I: 25 Marks (MCQ)

- 25 MCQ Questions on Part-II.

Part-II (Professional) (Subjective) : 75 Marks**I. Introduction to Nuclear Pharmacy**

Nuclear Pharmacy, Nuclear Medicine, Nuclear Pharmacist / Chemist, Specialty Certification of Nuclear Pharmacist, Radiopharmaceuticals, Radioisotopes, Concept of Dosage form in Nuclear Medicine, Radiation dose, Radiation & Radioactive decay, Principal forms of radiation, Units of activity, Half-life.

II. Facility Layout

Administrative area, Dispensing area, Reception area, Decontamination kit, Dedicated sink, Chemical Spill Kit & Waste Disposal.

III. Radiopharmaceuticals

Sterile & Nonsterile radiopharmaceuticals, Radiation safety considerations, Radiation Contamination Control, Kit, Aseptic Preparation of Radiopharmaceuticals, Classified area, Buffer area, Compounding, Dispensing, Expiration date, Garb, High efficiency particulate air (HEPA) filtration, Hot lab, Hot Cell, ISO Class, Primary engineering control (PEC), Pyrogen, Quality Control, Quality Assurance, Primary engineering control (PEC), Restricted area, Repackaging.

IV. Operational Levels of Nuclear Pharmacy

Operation level 1a, Operation level 1b, Operation level 2a, Operation level 2b, Operation level 3a, Operation level 3b, Operation level 3c

V. Methods of Radiolabelling of Radiopharmaceuticals

Ideal Characteristics of radiopharmaceuticals, General Consideration to design new radiopharmaceuticals, Factors influencing the design of new radiopharmaceuticals, Methods of radiolabelling (Isotope exchange, Introduction of foreign label, labelling with bifunctional chelating agent, biosynthesis, recoil labelling, excitation labelling), Important factors in labelling of radiopharmaceuticals, General Properties & Chemistry of technetium-99m.

VI. Concept on PET/CT Radiopharmaceuticals (FDG)

FDG Production, Equipment's used in synthesis & Quality Control of FDG, Microbiological testing equipment's, Quality Control of final product & its Quality Assurance, Basics of the safe transport of FDG,

SUGGESTED READINGS

Sr. No.	Title	Author
1.	Radiopharmaceuticals in Nuclear Pharmacy & Nuclear Medicine	Richard J. Kowalsky Steven W. Falen
2.	Operational Guidance On Hospital Radiopharmacy	International Atomic Energy Agency Vienna,
3.	Radiopharmaceuticals – Preparation, Compounding, Dispensing & Repackaging	USP General Chapter on radiopharmaceuticals
4.	Competency Based Hospital Radiopharmacy Training	International Atomic Energy Commission, Training Course 39, Vienna
5.	Fundamentals of Nuclear Pharmacy	Gopal B. Saha Sixth Edition
6.	Cyclotron Produced Radionuclides: Guidance on Facility Design and Production of [18F] Fluorodeoxyglucose (FDG)	IAEA Radioisotopes & Radiopharmaceuticals Series No. 3

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-205/2022-R
Particulars of post	Superintending Engineer (Floods) (BS-19), Office of the Chief Engineering Adviser/ Chairman Federal Flood Commission, Ministry of Water Resources.
Minimum Qualification & Experience:	i. Bachelor's Degree in Civil Engineering or an equivalent qualification from a recognized University/ Institution. ii. Twelve (12) years post qualification experience in Planning, Design or construction or operation of Dams, Irrigation or Hydraulic Works in BS-17 and above or equivalent in a Government / Semi-Government / reputable private organization.

Part-I: 25 Marks (MCQ)

- 25 MCQ Questions on Part-II.

Part-II (Engineering) (Subjective) : 75 Marks**I. Civil Engineering Fundamentals:**

Structures; stress, strain, shearing force and bending moment concepts, beams, columns, footing. Simply supported and Cantilever beams, Pulleys and gears.

II. Environmental Engineering:

Environmental impacts on water resources projects, transportation engineering projects, waste water treatment and management, water supply and distribution.

III. Hydraulic Engineering:

Properties of fluid mechanics, pressure measuring devices, flow measuring devices, losses in pipelines, open channels, barrages and dams. Prediction of sediment distribution; Estimation of life of a reservoir. Operation and Maintenance of small dams: Maintenance of spillways, outlet pipes, earth embankments and foundation, storage dams, diversion dams, flood detention reservoirs; emergency preparedness plan, periodic examination and evaluation, reservoirs problem, silting seepage control, toxic algae, reservoir safety, marine life, Spillways, undersluices.

IV. Hydraulic Structures

- Canal Falls, flumes, canal outlets
- Cross drainage works: types and functions

V. National policies on Water and Power

- Power Generation Policy 2015
- National Electricity Policy 2021
- National Water Policy 2018

VI. Indus Waters Treaty 1960 and its implementation

Historical background of Indus Water Treaty, 1960, Transitional Arrangements, Functions of Permanent Indus Commission, Challenges in implementation of the Treaty, Implications and limitations, Disputes resolution mechanism, Current water issues/disputes with India, Benefits or otherwise of the Treaty for Pakistan and India.

VII. Global Warming and Climate Change

The emerging scenario of global warming and its impact on riverain systems, aquifer and agricultural eco-systems (including cropping pattern)

VIII. Water Accord, 1991

Salient features of Water Accord, 1991 between the provinces of Pakistan, functioning of IRSA, Impact of IRSA on the water distribution for irrigation purposes and current water distribution issues.

IX. Project Management:

Project Management Techniques, Time lines, milestones, resources allocation, dependency, Gant Charts,

X. Inventory Management:

FIFO models, LIFI models, Identification Schemes, Inventory management systems.

XI. Quality Management Systems:

QA models. Deming, Juran Crosby, Quality circles, management responsibility, quality planning, purchasing, design process and design validation, quality audit, corrective and preventive measures.

SUGGESTED READINGS

S.No.	Title	Author
1.	Properties of Concrete	A.M. Neville.
2.	Plain and reinforced concrete	Nilson.
3.	Strength of material	Andrew Pytel and Singer.
4.	Transportation Engineering, Planning and design	Paul Wright.
5.	Civil Engineer's Reference Book	LS Blake
6.	Surveying and Leveling	T.P Kanetaker.
7.	Public Health Engineering	STEEL.
8.	Fluid mechanics with engineering applications	Finnemore/ Franzini.
9.	Handbook of Engineering Management	Dennis Lock.
10.	Conflict and cooperation on South Asia's International Rivers: A Legal Perspective	M.A. Salman
11.	Indus Water Treaty: Political and Legal Dimensions	Ijaz Hussain
12.	Pakistan's Water: in the line of Action for Global Warming	Dr. Raja Rizwan Hussain, Engr. Raazia Attique
13.	Irrigation and Hydraulic Structures, Theory, Design and Practice	Iqbal, A,
14.	Environmental Science: Earth as a living Planet	Botkin, D . Keller, E.
15.	Total Quality Management	Dale H. Besterfield, Carol Besterfield-Michna, Glen H. Besterfield, Mary Gesterfield-Sacre

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-206/2022-R
Particulars of post	Assistant Chief (BS-18), Food and Agriculture Section, Ministry of Planning, Development and Special Initiatives.
Minimum Qualification & Experience:	<p>i) Second Class or Grade 'C' Master's Degree or equivalent qualifications in Agriculture Economics OR Bachelor's Degree or equivalent qualifications in Agriculture/ Forestry/ Veterinary Science/ Animal Husbandry/ Agricultural Engineering.</p> <p>ii) Three (3) years post qualification experience of work and/or research relating to food and agriculture or agricultural planning or development.</p>

Part-I: 25 Marks (MCQ)

- 25 MCQ Questions on Part-II & Part-III.

Part-II (Research and Planning) (Subjective) : 25 Marks**i. Communication Skills, Technical Writing and Presentation Skills**

Paragraph writing, Essay writing, CV and job application, Translation skills, Study skills, Academic skills, Academic writing, Technical Report writing, Progress report writing, Presentation skills

ii. Planning and Management**a) Project Management**

Project Management, Processes Integration Management, Project Plan Development, Project Plan Execution and Overall Change Control, PERT, Gantt Chart, CPM

b) Scope Management

Initiation, Scope Planning, Scope Definition, Scope Verification and Scope Change Control.

c) Communications Management

Communications Planning, Information Distribution, Performance Reporting and Administrative Closure.

d) Risk Management

Risk Identification, Risk Quantification, Risk Response Development and Risk Response Control.

e) Statistical Techniques

All statistical techniques related to Planning & Research

Part-III (Professional) (Subjective) : 50 Marks

- I. Concept of Integrated Agriculture:** Components of natural resources as bases for agriculture production (Land, Water, biological, Environmental, Solar, Energy)
- II. Challenges in Pakistan's Agriculture:** Present scenario and future prospects. Analytical overview: issues and strategies for improvement of crop management, livestock management, fisheries, cottage industry, resource management and rural development. Institutions and policies: issues and options.

- III. Elements of Climate and their Relationship with Crop Growth:** Farming Systems, biological nitrogen fixation, soil profile, structure and texture, soil fertility, soil erosion and conservation, water logging and salinity
- IV. Genetic Improvement for Crop Production:** GMO crops, Seed production technology.
- V. Horticulture:** Floriculture, landscaping, pests and diseases of agriculture crops and their control, integrated pest management.
- VI. Rainfed and Irrigated Agriculture:** Agriculture mechanization, land tenure and land reforms, role of agriculture in national economy.

SUGGESTED READINGS

S. No.	Titles	Author
1.	Practical English Grammar	A.J. Thomson and A.V. Martinet.
2.	Writing. Upper-Intermediate	Rob Nolasco.
3.	Study Skills	Riachard Yoriky
4.	Writing. Advanced	Ron White.
5.	College Writing Skills	John Langan.
6.	Project Management Body of Knowledge,	Project Management Institute (PMI) standards committee
7.	Participatory Rural Development in Pakistan	Khan, M. H
8.	Agriculture in Pakistan	Khan M. H.
9.	Manual of Plant Production	Abdul Manan.
10.	Principles of Field Crop Production	Martin., J.H. & Leonard, W.H.
11.	Diseases of Field Crops	Dickson, J.G
12.	Irrigation Principles & Practices	Isrealson, O.W. Vaughn, E. Hansen.
13.	A Text Book of Plant Pathology	A.V.S.S. Sambamurti
14.	The Principles of Agronomy.	Harris, Franklin Stewart

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-208/2022-R
Particulars of post	Quality Management Representative (BS-18), AFIC / NIHD, Ministry of Defence.
Minimum Qualification & Experience:	i) Second Class or Grade 'C' Master's Degree in Health Administration/ Quality Management from a University recognized by HEC. ii) Five (5) years post qualification experience of working in hospital management system.

Part-I: 25 Marks (MCQ)

- 25 MCQ Questions on Part-II.

Part-II (Professional) (Subjective) : 75 Marks**I. Hospital Based Healthcare & Its Changing Scenario**

Concept of Modern Hospital & Privatization in Health Sector, Public Sector Hospitals and Level of care / offered facilities, Effects of Globalization in Health care, Concept of Corporate Hospital in developing countries, Infrastructure and lay out of an ideal corporate hospital, Functioning of modern hospitals & changing need of patients, Hospitality in Hospital Care, Invasive and non-invasive diagnostic facilities in modern hospital, Care offered in Specialty and Super specialty Hospitals

II. Basic Information Technology

Basic concepts about computer Hardware & Software, Working knowledge of commonly used hospital software, Application of Computer in hospitals, Computer programme and operating system, Data Based Concept (ER diagram), Microsoft Office, SQL, V.B., ERP system with all modules, Importance of effective Health Information system, Digital maintenance of Medical Records

III. Principles of Management

History and growth of management science, Traditional management vs. modern health care management , Evolution of management theory, Healthcare management as a profession, Evaluation of Management Concepts, Management components i.e. Planning, Organizing, Staffing, Motivating, Leading, Co-ordination and Controlling, Modern Management concept and its implication in health sector

IV. Quality Management

Quality Management Programme, ISO clauses, quality manual, quality of clinical services, Critical Pathways, Medical Audits, NABL, NABH, JCI, BIS, Performance review – Assessment / Methods , Quality Management of diagnostic facilities, Quality of assurance procedures, Deming's Principles, Juran Trilogy, Kaizen, Philip Crosby's Principles, Management of Social Services. Assessment of Client satisfaction

V. Health Policy and Management

Introduction to Health Management, Strategic Management, Planning, Organization, Monitoring, Evaluation, Pakistan Health Policy 2009, Health Financing, Stewardship, History of Health Policy in Pakistan, Determinants of health policy

SUGGESTED READINGS

S. No.	Title	Author
1.	Guide to Quality Management Systems for the Food Industry	Early, R. 1995.
2.	Training manual on health manpower management	Gourlay R.
3.	Health Care Management	Shortell SM, Kaluzny AD.
4.	Health planning for effective management	ReinkeWA
5.	Understanding primary health care management: from theory to practical reality	Chanawongse K.
6.	Hospital Administration	Tabish
7.	Introduction to Computers	C. Xavier
8.	Computers today	S. K. Basandra
9.	Principles of Management	L. M. Prasad, S. Chand
10.	Management	Peter Drucker
11.	Quality Management	Barnett

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-209/2022-R
Particulars of post	Assistant Professor (Mathematics) (BS-18), Military College Jhelum, Ministry of Defence.
Minimum Qualification & Experience:	Ph.D Degree in the relevant subject and one (1) year post qualification teaching experience at College/ University level. OR M.Phil Degree in the relevant subject with three (3) years post qualification teaching experience at College/ University level. OR Second Class or Grade 'C' Master's Degree in the relevant subject from a University recognized by HEC with five (5) years post qualification teaching experience at College/ University level.

Part-I: 25 Marks (MCQ)

- 25 MCQ Questions on Part-II & Part-III.

Part-II (Mathematics) (Subjective) : 50 Marks**I. Vector Calculus**

Vector algebra; scalar and vector products of vectors; gradient divergence and curl of a vector; line, surface and volume integrals; Green's, Stokes' and Gauss theorems.

II. Statics

Composition and resolution of forces; parallel forces and couples; equilibrium of a system of coplanar forces; centre of mass of a system of particles and rigid bodies; equilibrium of forces in three dimensions.

III. Dynamics

- Motion in a straight line with constant and variable acceleration; simple harmonic motion; conservative forces and principles of energy.
- Tangential, normal, radial and transverse components of velocity and acceleration; motion under central forces; planetary orbits; Kepler laws;

IV. Ordinary differential equations

- Equations of first order; separable equations, exact equations; first order linear equations; orthogonal trajectories; nonlinear equations reducible to linear equations, Bernoulli and Riccati equations.
- Equations with constant coefficients; homogeneous and inhomogeneous equations; Cauchy-Euler equations; variation of parameters.
- Ordinary and singular points of a differential equation; solution in series; Bessel and Legendre equations; properties of the Bessel functions and Legendre polynomials.

V. Numerical Methods

- Solution of nonlinear equations by bisection, secant and Newton-Raphson methods; the fixed- point iterative method; order of convergence of a method.
- Solution of a system of linear equations; diagonally dominant systems; the Jacobi and Gauss-Seidel methods.
- Numerical solution of an ordinary differential equation; Euler and modified Euler methods; Runge- Kutta methods.

Part-III (Professional) (Subjective) : 25 Marks

- I. Development of Curriculum and Instructional Material**
- Elements of Curriculum.
 - Curriculum Development Process: Need Assessment, Formulation of Aims and Objectives, Taxonomies of Educational Objectives, Selection of Content, Development of Curricular Materials.
- II. Process of Teaching and Teaching Strategies**
- Process of Classroom Communication
 - Factors affecting Classroom Communication
 - Barriers to Classroom Communications
 - Use of Instructional Materials and Media
- III. Educational Assessment and Evaluation**
- Concept of Classroom Assessment and Evaluation
 - Distinction between Assessment, Evaluation and Measurement
 - Approaches to Evaluation: Formative Evaluation; Summative Evaluation
 - Types of Test: Essay Type; Objective Type: Multiple Choice, True-False Items, Matching Type; Principles of Construction of these Test
 - Characteristics of a Good Test: Validity, Reliability, Objectivity, Usability
- IV. Research Methods in Education**
- Research Instruments: Questionnaire: Interview; Test; Observation; Rating Scale
 - Research Proposal and Report Writing.

SUGGESTED READINGS

S.No.	Title	Author
1.	An Introduction to Vector Analysis	Khalid Latif,
2.	Introduction to Mechanics	Q.K. Ghorl
3.	An Intermediate Course in Theoretical Mechanics	Khalid Latif,
4.	Differential Equations with Boundary Value Problems	D. G. Zill and M. R. Cullen
5.	Elementary Differential Equations	E.D. Rainville, P.E. Bedient and R.E. Bedient
6.	Elements of Numerical Analysis	F. Ahmad and M.A Rana
7.	Mathematical Methods	S. M. Yousaf, Abdul Majeed, Muhammad Amin
8.	Research in Education	JW Best
9.	Integrating Education Technology into Teaching	Roblyer
10.	Curriculum Development	S. M. Shahid
11.	Educational Measurement and Evaluation	S. M. Shahid
12.	Educational Administration	S. M. Shahid

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-210/2022-R
Particulars of post	General Staff Officer, Grade-I (Classified Radiologist) (BS-19), PET CT Scan Department, Armed Forces Institute of Radiologist and Imaging, Ministry of Defence.
Minimum Qualification & Experience:	<ul style="list-style-type: none"> i) MBBS or equivalent qualification from a University recognized by PM&DC. ii) FCPS (Radiology) or equivalent qualification recognized/ registered by the PM&DC. iii) One (1) year Fellowship degree/ OJT in PET CT. iv) Seven (7) years post qualification working experience at any renowned medical imaging setup.

Part-I: 25 Marks (MCQ)

25 MCQ Questions on Part-II & Part-III.

Part-II: (Qualification Based) (Descriptive) 25 MarksCore courses of **MBBS Degree****Part-III: (Professional) (Descriptive) 50 Marks**

- i. Core courses of FCPS in **Radiology**.
- ii. Core Courses of Specialization in **PET CT**.

Note: (Equal weightage for each topic at Part-III)

PAPER-II: PROFESSIONAL**Max Marks: 100****Time Allowed: 3 Hours**

Case No.	F.4-211/2022-R
Particulars of post	General Staff Officer, Grade-I (Classified Radiologist) (BS-19), Interventional Radiology Department, Armed Forces Institute of Radiologist and Imaging, Ministry of Defence.
Minimum Qualification & Experience:	<ul style="list-style-type: none"> i) MBBS or equivalent qualification from a University recognized by PM&DC. ii) FCPS (Radiology) or equivalent qualification recognized/ registered by the PM&DC. iii) One (1) year Fellowship degree/ OJT in Interventional Radiology. iv) Seven (7) years post qualification working experience at any renowned medical imaging setup.

Part-I: 25 Marks (MCQ)

25 MCQ Questions on Part-II & Part-III.

Part-II: (Qualification Based) (Descriptive) 25 MarksCore courses of **MBBS Degree****Part-III: (Professional) (Descriptive) 50 Marks**

- i. Core courses of FCPS in **Radiology**.
- ii. Core Courses of Specialization in **Interventional Radiology**.

Note: (Equal weightage for each topic at Part-III)