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. 06/2017

S. No	Case No. F.4-	Particulars of Post(s)	Qualifications for Posts	Test Specification	Topics of Syllabi
1.	52/2017	**Assistant Director** (BS-17), Directorate of Dock Workers Safety Headquarters, Karachi, Ministry of Ports and Shipping.	i. Bachelor's degree in Mechanical or Electrical Engineering. ii. Two (2) years post qualification experience of testing appliances/ inspection of loading/ discharging of cargo on ports. iii. Knowledge of Labour Laws, Dock Labourers Act and the Pakistan Dock Labourers Regulations.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Safety and Efficiency Measures • Common Types of Electrical and Mechanical Hazards • Destructive and Non-Destructive Methods of Wire Testing • Methods of testing of safe working load of a crane • Labour Laws (National/International/ Maritime), • Dock Labourers Act 1934 • Pakistan Dock Labourers Regulations, 1948
2.	74/2017	**Inspector** (BS-16), Anti Narcotics Force, (Narcotics Control Division) Ministry of Interior & Narcotics Control.	i. Second Class or Grade 'C' Bachelor's Degree or equivalent qualification recognized by HEC. ii. Two (2) years post qualification experience in Law Enforcement Agency/Security Agency.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Grammar Usage, Sentence Structuring **Part-II** • Basic knowledge of Narcotics Substances Act,1997 • International Conventions and Agreements on Drug Control. • Role of United Nations Organization for Drug Control (UNODC) • Role of Pakistan's Anti Narcotics Control Setup in Drug Control • Sources of Terrorist Financing
3.	141/2017	**Assistant Private Secretary** (BS-16), Office of the Chief Engineering Adviser/ Chairman Federal Flood Commission, Ministry of Water and Power.	i. Second Class or Grade 'C' Bachelor's degree from a University recognized by HEC ii. Minimum shorthand speed 100 W.P.M. and typing speed 50 W.P.M. iii. Must be computer literate.	• Typing Test with minimum Speed of 50 W.P.M **50 Marks** • Shorthand Test with minimum Speed of 100 W.P.M **50 Marks**	

S. No	Case No. F.4-	Particulars of Post(s)	Qualifications for Posts	Test Specification	Topics of Syllabi
4.	144/2017	**Assistant Private Secretary** (BS-16), National Industrial Relations Commission (NIRC), Ministry of Overseas Pakistanis & Human Resource Development.	i. Second Class or Grade 'C' Bachelor's degree from a University recognized by HEC ii. Minimum shorthand speed 100 W.P.M. and typing speed 50 W.P.M. iii. Must be computer literate.	• Typing Test with minimum Speed of 50 W.P.M **50 Marks** • Shorthand Test with minimum Speed of 100 W.P.M **50 Marks**	
5.	146/2017	**Librarian** (BS-16), Military College Jhelum, Ministry of Defence.	Second Class or Grade 'C' Bachelor's degree in Library Science/ Information Science from a University recognized by HEC. **OR** Second Class or Grade 'C' Bachelor's degree from a University recognized by HEC with one (1) year Diploma in Library Science/ Information Science.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Grammar Usage, Sentence Structuring **Part-II** • Introduction to Library & Information Science • Information Sources and Services • Classification: Theory and Practice • Cataloguing: Theory and Practice • Collection, Maintenance and Issuance of Library Books. • Management of Libraries & Information Centres • Library Automation/Information Storage & Retrieval • Research Methods & Techniques for Librarians • Rules & Procedures of Write off the Library Losses • Classification of Records
6.	148/2017	**General Staff Officer (GSO-2 Education) Civilian** (BS-17), Military College Jhelum, Ministry of Defence.	Second Class or Grade 'C' Master's degree in Education from a University recognized by HEC.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Educational Guidance & Counselling, • Educational Planning & Management, • Educational Administration and Supervision, • Classroom Management and Discipline • Testing and Evaluation • Report Writing • Issues related to Education in Pakistan
7.	149/2017	**Medical Officer** (BS-17), Military College Jhelum, Ministry of Defence.	MBBS or equivalent qualification recognized by Pakistan Medical & Dental Council. **OR** Captain/ Major (Retired) from Army Medical Corps.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Core courses of **MBBS** degree program. • Health Policy of the Government, • Health Administration

S. No	Case No. F.4-	Particulars of Post(s)	Qualifications for Posts	Test Specification	Topics of Syllabi
8.	152/2017	**Experimental Officer** (BS-16), Institute of Optronics, Ministry of Defence Production.	i. Second Class or Grade 'C' Bachelor's degree in Physics/ Mathematics or equivalent qualification from a University recognized by the HEC. ii. Two (2) years post qualification experience of Research in Scientific /Technical Organization.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Grammar Usage, Sentence Structuring **Part-II** • Heat & Thermodynamics, • Electricity & Electrostatics, • Electromagnetism, • Waves, Motion & Force, • Work, Energy, • Sound, • Gravitational Force, • Calculus • Trigonometry • Geometry • Matrices, Determinants and Linear Equations • Mechanics • Research Methodology • Report Writing
9.	154/2017	**Assistant Engineer** (BS-17), Institute of Optronics, Ministry of Defence Production.	Second Class or Grade 'C' B.E degree in Mechanical/ Electrical or equivalent qualification from a University recognized by the HEC.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Computer Fundamentals • Computer Aided Design and Simulation • Engineering Drawing and Graphics • Mechanics of Machines • Measurement & Instrumentation • Electrical Network Analysis • Electronic Devices and Circuits • Electromagnetic Field Theory • Signals and Systems • Report Writing • Data Analysis • Inventory

S. No	Case No. F.4-	Particulars of Post(s)	Qualifications for Posts	Test Specification	Topics of Syllabi
10.	155/2017	**System Analyst** (BS-17), Institute of Optronics, Ministry of Defence Production.	Second Class or Grade 'C' Master's degree in Computer Science/ Information Technology or equivalent qualification from a University recognized by HEC. **OR** Second Class or Grade 'C' Bachelor's degree in Computer Science/ BIT (4 years duration) or equivalent qualification from a University recognized by the HEC.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Computer Architecture, • Software Architecture, • Software Quality Assurance, • Coding, Writing, Testing and Debugging of Software Applications, • Computer Networks and Internet, • Object Oriented Programming, • Unified Modeling Language (UML) • Database Management Systems, • Online Systems, • IT Audit and Security, • Data Communication/Protocols
11.	156/2017	**Software Engineer** (BS-17), Institute of Optronics, Ministry of Defence Production.	Second Class or Grade 'C' Master's degree in Computer Science/ Information Technology/ Software Engineering or equivalent qualification from a University recognized by the HEC. **OR** Second Class or Grade 'C' Bachelor's degree in Computer Science/ Software Engineering/ BIT (4 years duration) or equivalent qualification from a University recognized by the HEC.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Software Architecture, • Software Quality Assurance, • Coding, Writing, Testing and Debugging of Software Applications, • Computer Networks and Internet, • Development of Basic Algorithms, • Object Oriented Programming, • Software Research and Development, • Unified Modeling Language (UML) • IT Audit and Security, • Operating Systems Architecture • Data Communication/Protocols

S. No	Case No. F.4-	Particulars of Post(s)	Qualifications for Posts	Test Specification	Topics of Syllabi
12.	159/2017	**Assistant Technical Officer** (BS-16), Institute of Optronics, Ministry of Defence Production.	i. Second Class three (3) years Diploma of Associate Engineering in Mechanical/ Electrical/ Electronics/ Instrumentation Technology or equivalent qualification from a recognized Polytechnic Institute/ College. ii. Four (4) yeas post Diploma experience in a recognized Institute/ Lab/ Workshop/ Production facility or Academic Institution.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Grammar Usage, Sentence Structuring **Part-II** • Basic Electronics and Test Equipments • Communication Principles • Fundamentals of Wireless Communication • Basics of Computer Software/Hardware • Transmission System • Research Methodology
13.	160/2017	**Technical Officer** (BS-17), Institute of Optronics, Ministry of Defence Production.	Second Class or Grade 'C' B.E degree in Mechanical/ Electrical/ Electronics or equivalent qualification from a University recognized by the HEC.	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Vocabulary, Grammar Usage, Sentence Structuring **Part-II** • Basic Electronics and Test Equipments • Communication Principles • Fundamentals of Wireless Communication • Basics of Computer Software/Hardware • Basics of Computer Networking • Engineering design needs for production inventory • Use of Diagnostic Equipments
14.	172/2017	**Senior Auditor (**BS-16), Controller General of Accounts Organization, Finance Division.	Second Class or Grade 'C' Bachelor's Degree in Business Administration (Finance/ Accounting)/ Commerce/ Economics/ Statistics/ Mathematics or equivalent from a University recognized by HEC. **OR** Second Class or Grade 'C' Bachelor's degree with ICMA one year post graduate Certificate or CA (Foundation) or ACCA (knowledge level qualified).	Objective Type Test (MCQ) **Part-I** English =20 marks **Part-II** Professional Test =80 marks	**Part-I** Grammar Usage, Sentence Structuring **Part-II** • Accounting Principles & Procedures, • Journal, Ledger & Cash Book, • Preparation of Annual Budget, • Heads of Accounts, Re-appropriation of Funds • Preparation of Pension Documents. • Financial Accounting • Financial Management • Cost Accounting • Business taxation • Public Procurement Rules, 2004 • Basic IT Knowledge

Schemes and Syllabi for Written Examination (Descriptive) for All Posts in BS-18 & BS-19 included in Consolidated Advertisement No. 06/2017

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 (Cambridge University Press)
2.	Practical English Usage	M. Swan (Oxford University Press)
3.	The Little, Brown Handbook	H. Ramsey Flower & Jane Aaron (The Little, Brown & Co; Harper Collins)
4.	A University English Grammar	R. Quirk & S. Greenbaum (ELBS; Longmans)
5.	Write Better, Speak Better	Readers Digest Association
6.	Modern English in Action	Henry Christ (D.C. Heath & Co.)
7.	Exploring the World of English	Syed Saadat Ali Shah

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-29/2017-R
Particulars of post	**Research officer** (BS-18), Ministry of Law, Justice and Human Rights.
Minimum Qualification & Experience:	i. Bachelor's degree in Law or equivalent. ii. Five (5) years post qualification experience of work in judicial or legal appointment or legal research work or practice as an Advocate of High Court.

LAW: 100 Marks

I. Definitions of Crime

II. All Provisions of:

i. Concept of arbitration, arbitration with or without intervention of court and in civil suits.

ii. Establishment of Civil Courts with their Original & Appellate Jurisdiction.

iii. The Code of Civil Procedure, 1908

iv. Pakistan Panel Code, 1860

v. Qanun-e-Shahdat Order, 1984

vi. Criminal Procedure Code, 1898

SUGGESTED READINGS

S.No.	Title	Author
1.	Pakistan Panel Code, 1860	M. Mahmood
2.	Criminal Procedure Code, 1898	Shaukat Mahmood
3.	Law of Evidence	Justice (R) Khalid ur Rahman Khan as adapted from Principles and Digest of the Law of Evidence by M. Monir
4.	Qanun-e-Shahdat Order, 1984	
5.	The Code of Civil Procedure, 1908	Aamir Raza A. Khan
6.	The Arbitration Laws in Pakistan	M. Mahmood
7.	Civil Courts Ordinance, 1962	Nisar Ahmad Nisar

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-51/2017-R
Particulars of post	**Director** (BS-19), Geological Survey of Pakistan, Ministry of Petroleum and Natural Resources.
Minimum Qualification & Experience:	i. Second Class or Grade 'C' M.Sc. degree in Geology or equivalent qualification from a University recognized by the HEC. ii. Post qualification Research experience of twelve (12) years in the field of Geology including three (3) years experience to plan, organize, conduct and supervise geological field programme for geological surveys. iii. Must have published five (5) research papers in the field of Geology.

Geology: 100 Marks

I. Stratigraphy and Palaeontology

Principles of stratigraphy; laws of superposition and faunal succession. Geological time scale with divisions. Classification and nomenclature of stratigraphic units: lithostragraphic units, biostratigraphic units and chronostratgraphic units.

Introduction to fossils and their significance; modes of fossilization, Study of morphology, range and broad classification of major invertebrate phyla; Introduction to micro fossils; Introduction to Paleobotany; Introduction and classification of major vertebrates; Introduction to micropaleontology

II. Mineralogy

Classification of minerals; Study of internal structure; polymorphism and isomorphism; paragenesis; Physical and optical properties of the common silicate and non-silicate mineral groups; Introduction to crystallography; elements of symmetry, study; normal classes of crystallographic systems.

III. Structural Geology and Tectonics

Stress-strain concepts; factors which control the mechanical behavior of materials; Folds, Faults, Joints, Foliation: terminology, classification and relationship with bedding; Lineation, Unconformity.

Plate tectonics theory; Geological evidences for continental drift; Sea-floor spreading; Oceanic ridges; Continental rifts; Intra-oceanic islands; Hot spot and Mantle plumes; Wilson Cycle; Tectonic framework of Pakistan.

IV. Sequence Stratigraphy

Introduction, history, concept and significance of sequence stratigraphy; Data sources: seismic reflections, outcrops, well logs, core and seismic facies; Sea level changes, their causes and effects; Accommodation, eustatic and relative sea curve; Hierarchy of sequence stratigraphic elements; Types of sequences and systems tracts.

V. Mineral and Energy Resources

Introduction of geological exploration/prospecting. Brief description of hydrocarbons, coal, gemstones, copper, lead, zinc, iron, gold, chromite, manganese, salt, gypsum, bauxite, sulphur, barite, fluorite, clays, phosphorite, building and dimension stones, industrial rocks and minerals, radioactive minerals and rocks with special reference to economic mineral deposits in Pakistan.

Origin, occurrence, and depositional environments of coal; coal Constitution and kinds of coals.Coal rank, grade and calorific value. Coal deposits of Pakistan with reference to Thar Coal. Geothermal energy resources of Pakistan.

VI. Engineering and Environmental Geology

Rock and soil mechanics and its application in civil engineering; Rock mass characteristics; Geotechnical studies of rocks and soils; Geological factors and strength of rocks; Study of geological factors in relation to the construction of buildings and foundations, roads, highways, tunnels, dams and bridges; Application of geophysical methods for site investigation; Construction materials; Mass movement, their causes and prevention.

VII. Economic and Applied Geology

Metallic and Non-metallic mineral resources of Pakistan. Mineral-based industries. Overview of Recodec Copper. Radioactive minerals and their occurrences in Pakistan. Gemstones of Pakistan

Geology of Reservoirs, Dams .Highways and Tunnels. Major natural hazards and their Impact on the environment with special reference to Pakistan.

SUGGESTED READINGS

S. No.	Title	Author
1.	Principles of Paleontology	Raup, D.M. & Stanley, S.M
2.	Principles of Sedimentology and Stratigraphy	Boggs, S
3.	Mineralogy	Perkins, D
4.	Plate Tectonics – Geodynamics	Moores, E.M. & Twiss, R.J
5.	Structural Geology	Twiss, R.J. & Moores, E.M.,
6.	Sequence Stratigraphy	Emery, D. & Myers, K.J.,
7.	Geology of Pakistan	Bender, F.K. & Raza, H.A.,
8.	Environmental Geology	Montgomery, C.W.,
9.	Economic Geology: Principles and Practice	Walter L. Pohl
10.	Energy Resources	Brown and Skipsy
11.	Pakistan Energy Yearbook 2012	Ministry of Petroleum and Natural Resources Hydrocarbon Development Institute of Pakistan. Islamabad

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-75/2017-R
Particulars of post	**Assistant Professor (Economics) (Male)** (BS-18), Federal Government Educational Institutions (FGEI) (Cantts/Garrisons), Ministry of Defence.
Minimum Qualification & Experience:	Ph.D. Degree in the relevant subject with 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 with five (5) years post qualification teaching experience at College/ University level.

Part-I: (Economics) 50 Marks

I. Micro Economics

Consumer behaviour, Determination of market demand and supply i.e. concept of elasticity of Demand & Supply, Static, Comparative Static Analysis, Distinction between partial and general equilibrium analysis (basic level) theory of the Firm, Producer's equilibrium, Pricing factors of production

II. Macro Economics

Basic Economic Concepts, National Income Accounting, Consumption Function, Multiplier, Accelerator, Component of Aggregate Demand, Labour Demand and Supply, Un-Employment, Determination of equilibrium level of income and output (at least with reference to two or three school of thought), Inflation.

III. Public Financing

Government expenditure, Sources of Government Revenue, Privatization, Taxes and non-taxes, Incidence of different taxes, Public Debt, Objectives, methods of repayment, Deficit financing, General Equilibrium Analysis, Welfare Economics, Fiscal Policy.

IV. Role of Foreign Trade and Aid in Economic Development

Trends in Pakistan's Balance of Payments, Terms of Trade, Changes in direction of trade, Trends in Pakistan's major exports and imports, Causes of significant changes in the trends, the role of migration and remittances in Pakistan's economy, costs and benefits of Foreign Aid, Role of Foreign Investment.

V. Major Issues in Pakistan Economy

Energy crisis, Corruption, Bad governance, External debt accumulation and dependency, Unemployment, Income inequality, Inflation, Fiscal and trade deficits, Balance of payment issues, Shortage of irrigation water.

Part-II: (Professional) 50 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. Educational Administration and Supervision

- The Concept of Administration
- Educational Supervision

V. Research Methods in Education

- Scientific Method and its Application in Education
- Sampling Techniques:
- Research Instruments: Questionnaire: Interview; Test; Observation; Rating Scale
- Research Proposal and Report Writing

SUGGESTED READINGS

S. No.	Title	Author
1.	A Text-book of Economics Theory	Stonier & Hague
2.	Government Finance—An Economic Analysis	Due John, F.
3.	Microeconomic	Ferguson, C.E. & Gould, J.P., Nicholson, Mankiw
4.	Macroeconomics	Rudigar Dorubush and Stanley Fisher Blanchard
5.	Foreign Aid Theory and Practice in Southern Asia	Wolf, Jr. DC
6.	History of International Trade	Findlay, R and O' Rourke, K
7.	Research in Education	JW Best
8.	Integrating Education Technology into Teaching	Roblyer
9.	Curriculum Development	S. M. Shahid
10.	Educational Measurement and Evaluation	S. M. Shahid
11.	Educational Administration	S. M. Shahid

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-143/2017-R
Particulars of post	**Deputy Director (LAB/NEQS)** (BS-18), Pakistan Environmental Protection Agency (Pak-EPA), Ministry of Climate Change.
Minimum Qualification & Experience:	i. Second Class or Grade 'C' M.Sc. in Biology/ Chemistry/ Bio-Chemistry/ Chemical Technology. ii. Five (5) years post qualification experience in BS-16 or above or equivalent in any of the prescribed educational qualification in Govt./ Semi-Govt./ Reputable Organization.

Professional: 100 Marks

Photosynthesis: Plant pigments, Light reaction, CO2 fixation, Mechanism of photophosphorylation.

I. Respiration: Glycolysis, Kreb cycle, Mechanism of oxidative phosphorylation.

II. Molecular Biology: Nucleic acids, DNA as hereditary material, DNA replication, Transcription, Genetic code, Protein synthesis, Genetic engineering and its application, Genetically Modified Organisms (GMO).

III. Inorganic Chemical Industries.—Sulphuric Acid, Fixation of Nitrogen, Chemical Fertilizers, Semi-conductivity devices. Cement, Glass and Ceramics.

IV. Chemical Kinetics.—Rate law and its determination Order of reaction. Experimental methods. Temperature Dependence of rate constants. Study of mechanism of a few selected reactions (1st and 2nd under reaction only).

V. Surface Chemistry and Catalysis.—Physical adsorption and chemisorption. Surface area determination. Homogeneous and Heterogeneous Catalysis. Acid-base and Enzyme Catalysis.

VI. Physical Organic Chemistry.—Elements of Organic reaction mechanism. Optical and Geometric Isomerism. Conformational analysis. Resonance. H—Bond and its effects on the properties of Organic Compounds.

VII. Aromatic Chemistry.—Structure of Benzene with particular reference to Mechanism of Electrophilic Substitution Reactions.

VIII. Chemistry of Natural Products.—Elementary study of Carbohydrates. Oils and Fats. Alkaloids and Vitamins.

IX. Industrial Organic Chemistry.—Organic Polymers. Fermentation processes including preparation of Anti-Biotics. Petro-Chemical Industry.

X. Environmental Pollution: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, Solid Waste, Water Logging & Salinity, Deforestation, Desertification, Eutrophication, Global and regional air pollution problems (Greenhouse effect, Global Warming/Climate Change, Ozone Depletion, Acid Rain).

XI. Climate Change: Climate Pattern at local, regional and global scale. Different types of climate including tropical and mid latitude climate, polar climates. Climate change processes, Drivers and Indicators of Climate Change, Effects of Climate Change on natural and societal systems. Carbon foot print. Climate change adaptation and mitigation, Clean Development Mechanism (CDM), REDD+. Global environmental politics on climate change: role of India, China and USA (Copenhagen Accord 2009).

XII. Environmental Laws

SUGGESTED READINGS

S. No.	Title	Author
1.	Plant Physiology	Taiz, L.& E. Zeiger
2.	Ilmi Biomolecules, Cell Biology and Genetics.	Cheema, T.A. and Cheema Z.T.
3.	Plant and Environment	Daubermine, R, F
4.	Environmental Science: Earth as a living Planet	Botkin, D. Keller, E.
5.	Environmental Health; Ecological Perspective	Kathryn Hilgenkamp
6.	Advanced Inorganic Chemistry 3rd Ed.	Cotton. F.A. and Wilkinson Groffrey
7.	Inorganic Chemistry, 3rd Ed. 1983	Hukeavy, James E.
8.	Physical Chemistry 5th Ed.	Moore, Walter J.
9.	Mechanism & Structure in Organic Chemistry	Gould, Edwards
10.	Organic Chemistry 2nd Ed.	Morrison, Robert Thornton & Boyd R.N.

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-150/2017-R
Particulars of post	**Associate Professor (Mathematics)** (BS-19), Military College Jhelum, Ministry of Defence.
Minimum Qualification & Experience:	Ph. D Degree in the relevant subject with eight (8) years post qualification teaching and administrative experience at College/ University level. **OR** M. Phil Degree in the relevant subject with ten (10) years post qualification teaching and administrative 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 twelve (12) years post qualification teaching and administrative experience at College/ University level.

Part-I: (Mathematics) 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. Fourier series and partial differential equations

- Trigonometric Fourier series; sine and cosine series; Bessel inequality; summation of infinite series; convergence of the Fourier series.
- Partial differential equations of first order; classification of partial differential equations of second order; boundary value problems; solution by the method of

separation of variables; problems associated with Laplace equation, wave equation and the heat equation in Cartesian coordinates.

VI. 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-II: (Professional) 50 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. Educational Administration and Supervision

- The Concept of Administration
- Educational Supervision

V. Research Methods in Education

- Scientific Method and its Application in Education
- Sampling Techniques:
- 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. Ghori
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 and 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.4-157/2017-R
Particulars of post	**Senior System Analyst** (BS-18), Institute of Optronics, Ministry of Defence Production.
Minimum Qualification & Experience:	i. Second Class or Grade 'C' Master's degree in Computer Science/ Information Technology or equivalent qualification from a University recognized by HEC. **OR** Second Class or Grade 'C' Bachelor's degree in Computer Science/ BIT (4 years duration) or equivalent qualification from a University recognized by the HEC. ii. Five (5) years post qualification experience of Programming/ Systems Analysis/ Software Development/ Web Based Software.

I. Computer Architecture

Microprocessor Bus Structure (Address/Data/Control), Registers and Flags, Storage Hierarchy (Main/Virtual/Cache/Secondary memory), Peripheral communication, CPU, ALU, Principles of Instruction Set Design, Multiprocessors & Thread Level Parallelism.

II. Object Oriented Programming

Data types, control structures, functions, arrays, classes, methods, object and encapsulation; constructors and destructors, operator and function overloading, virtual functions, derived classes, inheritance and polymorphism, I/O and file processing.

III. Data Structure and Algorithms

Stack and Queue, Sequential Search, Binary Search, Bubble sort, Merge sort, Quick sort, Insertion sort, Selection Sort, Linked Lists, Infix to postfix conversions, Expression tree construction, Tree traversals, Graph representation and traversal, Minimum spanning tree.

IV. Database Management Systems

Entity Relationship modeling, Relational data model and algebra, Structured Query language, Database design, functional dependencies and normal forms, concurrency control and recovery techniques, Database security and authorization.

V. Computer Communications and Networks

Asynchronous and Synchronous transmission, LAN/WAN/MAN, Network layers, Transport layer protocols TCP/IP, UDP, Error Control, Flow Control, Multiplexing, Routing, Bridging, Network security issues.

VI. Operating Systems

Process and CPU management, Multithreading, Deadlocks, Memory management and virtual memory, External Fragmentation, Paging and Demand Paging, File management systems, Scheduling and dispatch, Introduction to concurrency.

VII. Software Engineering

Introduction to Software Engineering, Software Process Framework, Process Models, Software Engineering Practices, Requirement Engineering, Testing Strategies, Quality Management

Suggested Reading

S. No.	Title	Author
1.	Modern Operating Systems	Andrew S. Tanenbaum
2.	Operating System Concepts	Addison-Wesley
3.	Algorithms and Data Structures	N. Wirth
4.	Data structures	Aaron M. Tanenbaum,
5.	Database Systems: A Practical Approach to Design, Implementation and Management	R.Connolly and P.Begg
6.	Introduction to Computer Networks	A. S. Tanenbaum
7.	Computer Networks and Internets	Douglas E. Comer
8.	Computer Architecture: A Quantitative Approach	Hennessy & Patterson
9.	Computer Organization & Architecture: Designing for performance	W. Stallings
10.	Software Engineering: A Practioner's Approach	Roger Pressman,
11.	Ian Sommerville. Software Engineering	Addison-Wesley

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-158/2017-R
Particulars of post	**Senior Engineer** (BS-18), Institute of Optronics, Ministry of Defence Production.
Minimum Qualification & Experience:	i. Second Class or Grade 'C' Master's/ Bachelor of Engineering degree in Mechanical/ Electrical/ Electronics or equivalent qualification from a University recognized by the HEC. ii. Five (5) years post qualification experience in relevant field.

Engineering: 100 Marks

I. Mechanical Engineering Fundamentals

Mechanics and Strength of Materials: Concept of Stress and Strain, bending, torsion, geometric properties of areas, principal stresses, Tensile testing, Stress- Strain curve, True Stress & Strain, Shear Stress & Strain, Concept of elastic and plastic deformation, Yield & ultimate Tensile strengths, Elongation, Toughness and Resilience, Ductility and Malleability, Hardness Testing, Brinell and Rock well Hardness test, bending moment,

Fluid Mechanics: Properties and basics of fluid mechanics, loss of head, power transformation by fluids, pumps, turbines. Fluid static's, Fluid dynamics, Types of flow: Turbulent and Laminar, Reynold's number.

Manufacturing: Different manufacturing processes like Casting, Forging, Machining, Rolling, Extrusion, Wire-drawing, welding, Turning (lathe), Milling, Shaping, Gear cutting, Drilling, Fitting.

II. 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.

III. 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.

SUGGESTED READINGS

S. No.	Title	Author
1.	Human Resource Management	H.T.Graham &Roger Bennett
2.	Management	James A.F.Stoner, R.Eward Freeman, Daniel R.Gilbert Jr.
3.	Fluid mechanics with engineering applications	Finnemore/ Franzini.
4.	Schaum Outline Series; Strength of Materials	Williym A. Nash
5.	Fluid Mechanics	Lewitt
6.	Manufacturing Processes for Engineering Materials	Kalpakgjian
7.	Electrical Technology	B.L. Tharaja
8.	Electronic Devices and Circuits.	Bogart
9.	DC Machines	P.C. Sen
10.	Semiconductors	Manzar Saeed

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-163-**A**/2017-R
Particulars of post	**Assistant Professor (Male)** (**Mathematics**) (BS-18), Federal Government Educational Institutions (FGEI) (Cantts/ Garrisons), Ministry of Defence.
Minimum Qualification & Experience:	Ph.D. Degree in the relevant subject with 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 with five (5) years post qualification teaching experience at College/ University level.

Part-I: (Mathematics) 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. Fourier series and partial differential equations

- Trigonometric Fourier series; sine and cosine series; Bessel inequality; summation of infinite series; convergence of the Fourier series.
- Partial differential equations of first order; classification of partial differential equations of second order; boundary value problems; solution by the method of separation of variables; problems associated with Laplace equation, wave equation and the heat equation in Cartesian coordinates.

VI. 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-II: (Professional) 50 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. Educational Administration and Supervision

- The Concept of Administration
- Educational Supervision

V. Research Methods in Education

- Scientific Method and its Application in Education
- Sampling Techniques:
- 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. Ghori
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 and 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.4-163-**B**/2017-R
Particulars of post	**Assistant Professor (Male)** (**Statistics**) (BS-18), Federal Government Educational Institutions (FGEI) (Cantts/ Garrisons), Ministry of Defence.
Minimum Qualification & Experience:	Ph.D. Degree in the relevant subject with 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 with five (5) years post qualification teaching experience at College/ University level.

Part-I: (Statistics) 50 Marks

I. Descriptive Statistics

Definition, Importance and scope of Statistics, Descriptive and Inferential Statistics, Presentation of the Data, Tables, Graphs and Charts: Stem-and leaf diagram, Box and Whisker Plots. Measures of Central Tendency/location, Measures of Dispersion/ Variability: Measures of Skewness and Kurtosis.

II. Basic Probability

Basic Probability Concepts, Additive and Multiplicative laws of Probability, Joint and Marginal Probabilities, Conditional Probability and Statistical Independence, Bayes' rule. Concept of a Random Variable, Mathematical Expectations, Discrete and Continuous Random Variables, Probability Distribution, Mean and Variance of a discrete random variables.

III. Probability Distributions

Discrete and Continuous Probability Distributions. Properties & applications of Binomial, Poisson, Hyper-geometric Distributions. Normal Distribution and its properties, Standard Normal Curve, Normal approximation to Binomial and Poisson distribution.

IV. Regression Analysis & Correlation Analysis

Concepts of Regression and Correlation and their application, Simple and Multiple Linear Regression (upto three variables), Estimation of the Parameters, Method of least square, Inference regarding regression parameters

Correlation, Correlation Coefficient, Properties of Correlation Coefficient, Inference regarding correlation coefficient, Partial Correlation and Multiple Correlation (upto three variables).

V. Sampling & Sampling Distributions

Population and Sample, Advantages of Sampling, Sampling Design, Probability &Non-Probability Sampling techniques. Brief Concepts of Simple Random, Stratified, Systematic, Cluster, Multiple and Multistage Sampling. Purposive, Quota Sampling, Convenience & Accidental Sampling.

Sampling with and without replacement, Application of Central Limit Theorem in Sampling, Sampling Distribution of Mean, difference between two Means, Proportion, difference between two Proportion and Variance.

VI. Statistical Inferences

Estimation: Point Estimation, Properties of a good Estimator. Interval Estimation. Interval Estimation of Population mean. Large and small sample confidence intervals for Population Mean.

Hypothesis Testing: Types of errors. Hypothesis Testing for Population Mean. Inferences for Two Population Means. Inferences for the Mean of Two Normal Populations using Independent Samples (variances are assumed Equal). Inference for Two Populations Mean using Paired Samples. Inferences for Population Proportions. Confidence Intervals and hypothesis Testing for Population Proportion. Inferences for Two Populations Proportions using Independent Samples, Estimation of sample size

Analysis of categorized data. Goodness of fit tests. Contingency tables. Test of independence in contingency tables.

Part-II: (Professional) 50 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. Educational Administration and Supervision

- The Concept of Administration
- Educational Supervision

V. Research Methods in Education

- Scientific Method and its Application in Education
- Sampling Techniques:
- Research Instruments: Questionnaire: Interview; Test; Observation; Rating Scale
- Research Proposal and Report Writing

SUGGESTED READINGS

S. No.	Title	Author
1.	Principles and Procedures of Statistics	Steel, R and Torrie, J.H.
2.	Introduction to Statistical Theory, Part-I & II	Chaudhry, S.M. and Kamal, S.
3.	Introduction to Probability Theory and Statistical Inference, 3rd Edition.	Larson, H.J.
4.	Fundamentals of Modern Statistical Methods	Wilcox, R.
5.	Statistical Methods	Aggarwal, Y.P.
6.	Research in Education	JW Best
7.	Integrating Education Technology into Teaching	Roblyer
8.	Curriculum Development	S. M. Shahid
9.	Educational Measurement and Evaluation	S. M. Shahid
10.	Educational Administration	S. M. Shahid

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-163-**C**/2017-R
Particulars of post	**Assistant Professor (Male)** (**Health & Physical Education**) (BS-18), Federal Government Educational Institutions (FGEI) (Cantts/ Garrisons), Ministry of Defence.
Minimum Qualification & Experience:	Ph.D. Degree in the relevant subject with 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 with five (5) years post qualification teaching experience at College/ University level.

Part-I: (Health and Physical Education) 50 Marks

I. Philosophical Basis of Physical Education

Philosophy and Physical Education, Physical Education as Discipline, Scientific Foundation of Physical Education, Physical Education and Recreation, Leadership in Physical Education

II. Scientific Sports Coaching

Sports Planning, Periodisation of Training, Systemization of Training, Data Collection, Coach and Professional Ethics

III. Evaluation in Physical Education and Sports

Evaluation and Administration of Tests, Basic Statistics, Measurement of Physical Fitness, General Motor Ability, Cardiovascular Fitness, Rating Scales in Physical Education.

IV. Exercise Physiology

Muscular System and Exercise, Cardiovascular System and Exercise, Environment and Exercise, Nervous System and Exercise, Glandular System and Exercise, Gender Differences, Obesity

Part-II: (Professional) 50 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. Educational Administration and Supervision

- The Concept of Administration
- Educational Supervision

V. Research Methods in Education

- Scientific Method and its Application in Education
- Sampling Techniques:
- Research Instruments: Questionnaire: Interview; Test; Observation; Rating Scale
- Research Proposal and Report Writing

SUGGESTED READINGS

S. No.	Title	Author
1.	Health & Physical Education.	Dr. A. Waheed Mughal
2.	Education in Physical Education.	Shamshad Ahmed
3.	Sports in Society : Issue & Controversies,	Jay Coackley
4.	Modern Measurement.	Osterlind J. Steven
5.	Introduction to Measurement in PE and Exercise Science	Margaret J. Safrit PhD, Terry M. Wood PhD
6.	Physiology of Sports	Reilly T and Williams
7.	Essentials of Exercise Physiology.	Shaver
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.4-164/2017-R
Particulars of post	**Radiologist** (BS-18), Armed Forces Institute of Rehabilitation Medicine, Ministry of Defence.
Minimum Qualification & Experience:	i. MBBS with FCPS in Radiology from CPSP. ii. Five (5) years post FCPS experience as Radiologist in a Government Organization

Part-I: (Qualification Based) 50 Marks

Core courses of **MBBS Degree**

Part-II: (Professional) 50 Marks

Core courses of FCPS in **Radiology.**

PAPER-II: PROFESSIONAL

Max Marks: 100 Time Allowed: 3 Hours

Case No.	F.4-165/2017-R
Particulars of post	**Assistant Professor (Mathematics) (Female)** (BS-18), Islamabad Model Colleges for Girls, Federal Directorate of Education, Capital Administration & Development Division.
Minimum Qualification & Experience:	Ph.D. Degree in the relevant subject with 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 with five (5) years post qualification teaching experience at College/ University level.

Part-I: (Mathematics) 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. Fourier series and partial differential equations

- Trigonometric Fourier series; sine and cosine series; Bessel inequality; summation of infinite series; convergence of the Fourier series.
- Partial differential equations of first order; classification of partial differential equations of second order; boundary value problems; solution by the method of separation of variables; problems associated with Laplace equation, wave equation and the heat equation in Cartesian coordinates.

VI. 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-II: (Professional) 50 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. Educational Administration and Supervision

- The Concept of Administration
- Educational Supervision

V. Research Methods in Education

- Scientific Method and its Application in Education
- Sampling Techniques:
- 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. Ghori
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 and 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