पाटन स्वास्थ्य विज्ञान प्रतिष्ठान सेवाआयोग

प्राज्ञिक सेवा, रेडियोलोजी समूह, **Neuro-Intervention** उपसमूह, सहायक प्राध्यापक पद, नवौं (९ ख) तहको खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

Paper II Technical Subject

Section (A) Radiology- 45 Marks

(1 critical analysis Q -15 mark + 3 long Q- 30 marks)

1. **Physics in radiology**
   - 1.1 Production of x-rays
   - 1.2 Interaction of x-rays with metals
   - 1.3 X-ray tube
   - 1.4 Radiation protection
   - 1.5 Basic physics and advances in fluoroscopy/ imaging intensifier
   - 1.6 Basic physics and advances in CR/DR system
   - 1.7 Basic physics and advances in CT
   - 1.8 Basic physics and advances in MRI
   - 1.9 Basic physics and advances in USG
   - 1.10 Introduction to nuclear medicine

2. **Sectional and Imaging anatomy**
   - 2.1 Cross-sectional & imaging anatomy of brain
   - 2.2 Cross-sectional and imaging anatomy of chest
   - 2.3 Cross-sectional and imaging anatomy of Abdomen
   - 2.4 Anatomy of orbits and its bones
   - 2.5 Vascular anatomy of brain/head
   - 2.6 Vascular anatomy of abdominal aorta and its branches
   - 2.7 Vascular anatomy of upper and lower limbs
   - 2.8 Relevant Embryology

3. **Nervous system**
   - 3.1 Craniocerebral Trauma
   - 3.2 Imaging of non-traumatic SAH
   - 3.3 Imaging of non-traumatic ICH
   - 3.4 Imaging of stroke
   - 3.5 Cerebral ischemia
   - 3.6 Brain tumors and tumor like processes
   - 3.7 Extra-axial Tumors
   - 3.8 Imaging of sellar tumours
   - 3.9 Non-neoplastic and neoplastic spinal cord pathologies

4. **Head & Neck**
   - 4.1 Radiological imaging of diseases and conditions related to Ear, Nose, Throat
   - 4.2 Radiological imaging of diseases of thyroid, salivary gland and other soft tissue neck
5. **Paediatric imaging**
   - 5.1 Imaging of congenital CNS malformations

6. **Recent advances in radiology and imaging**
   - 6.1 Teleradiology, Radiology Information System & PACS
   - 6.2 Newer advances in CR/ DR system, Fluoroscopy and Mammogram
   - 6.3 Newer advances in CT and MRI

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7. **CVS & Interventional**
   - 7.1 Radiological imaging of aortic and peripheral arterial diseases
   - 7.2 Radiologic approach to pulmonary thromboembolism
   - 7.3 Heart and pericardium
   - 7.4 Congenital and acquired heart disease
   - 7.5 Image guided radiological procedures and contrast media

8. Anatomy

1. Basic neuro- and vascular anatomy

2. Embryology of the nervous system, brain, spinal cord and peripheral nervous system

3. Embryology of the vascular system as relevant to the nervous system

4. Anatomy of the vascular system in general with special emphasis on blood supply to the brain and spinal cord and functional vascular anatomy of CNS.

5. Anatomy of the brain and spinal cord, peripheral nervous system

6. Embryology and anatomy of the spine

7. Embryology and anatomy of the skull and face. 8. Anatomy of musculo-skeletal system in relation to CNS and PNS.

9. Physiology

1 Basic and applied neuro- and vascular physiology including cardiac hemodynamics, ECG, EEG.

2 Physiology of nerve conduction, cerebral and spinal blood circulation
3 3 Basics of physiology of peripheral vascular system.
4 4 Physiology of cerebral circulation CSF dynamics and functional inter-relationship of CNS haemodynamics and hydrodynamics.
5 5 Basic and applied neurophysiology including cardiac haemodynamics.

10. Pathology

1 Pathological basis of neurological and vascular disorders

2 Congenital lesions of the central nervous system – brain, spine and spinal cord and organs of special senses

3 Neoplastic disease of the head and neck, skull base including pathologies of temporal bone and orbit

4 Neoplastic diseases of the brain, spine and its coverings.
5 Infective and inflammatory lesion of the CNS
6 Degenerative and demyelinating diseases of the CNS
7 Vascular and ischaemic lesions of brain and spine. Intracranial aneurysms and AVMs
8 Intracranial hemorrhage
9 Hydrocephalus Cerebral edema
10 Neonatal and perinatal CNS disorders
11 Genetic and inherited disorders of CNS
12 Metabolic and Immunologic disorders affecting CNS

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11. Neuro-chemistry and Neuro-pharmacology

1 Contrast media in imaging

2 Emergency drugs in Neuroimaging and Interventional Therapeutic Neuroradiology

3 Antiplatelets and anticoagulants. Vasodilators Vasoconstrictors Embolic agents Thrombolytic agents Anaesthetic and analgesic drugs with respect to neuro-imaging and neuro- intervention Antibiotics Anti-inflammatory drugs Cortico-steroids

3 Drugs to counter cerebral edema Drugs to control hypertension Drugs for renal diseases
4 Drugs used in Neurointervention and Therapeutic Neuroradiology

12. Physical principles of imaging

1 Image intensifier and TV and Flat Panel Detectors , Tomography Angiography and Digital subtraction and angiography

2 Computed Tomography and recent advancements in CT, Ultrasound and Doppler and their recent advances

3 Magnetic Resonance Imaging, angiography, spectroscopy, FMRI (Diffusion, Perfusion), molecular imaging and recent advances

5 Film processing techniques – wet and dry
6 Principles of single photon emission and positron emission tomography (SPECT and PET)
7 Fusion Imaging technologies –SPECT, CT PET, MR PET etc.
8 Basics of Nuclear Medicine and safe handling of radioactive material.
9 Radiation protection and Recommendations
10 Computers in Radiology Picture archival and communication systems and Teleradiology
11 New image storage technologies, CLOUD storage systems

Section (B) Neuro-Intervention - 55 Marks
(1 critical analysis Q -15 marks + 4 long Q -40 marks)

1. Basic Imaging of head, neck, chest, abdomen, spine and extremities
2. CT and Dual energy; CT angiography, CT perfusion ,3D post processing. CT radiation including practice of "imaging gently" based on- As Low As Reasonably Achievable (ALARA)
3. MRI sequences and paameters, MR angiography, MRI safety
4. Advanced imaging techniques (functional MRI, spectroscopy, diffusion/perfusion, diffusion tensor, Fusion imaging)
5. Diagnosis of acute arterial wall dissection, subclavian steal syndrome
6. Imaging of peripheral vascular disease
7. Catheter directed Angiography
8. Angiographic contrast media, contrast utilization including dose and safety.
9. Needles, Guide Wires and Stents

10. Embolization materials
11. Risk management in interventional procedures
12. Universal protocol in interventional radiology
13. Radiation safety in interventional radiology
14. Infection control and sterile technique in interventional radiology
15. Sedation, analgesia and anesthesia
16. Management of contrast media reactions
17. Quality improvement strategies in interventional radiology
18. Outpatient drainage catheter care
19. Commonly use medication and dosages
20. Interventional procedures
    - Image guided FNA in different sites/tumors of head and neck
    - Image guided Trucut biopsy procedures
    - Catheter drainage in collections/abscess in head and neck

21 . Therapeutic and Interventional Neuroradiology

1 Endovascular recanalization / revascularization techniques.

2 Drugs and materials used in endovascular, interventional neuroradiology

3. Embolization Techniques

4. Embolization of CNS lesions.

5. Embolization of craniofacial lesions

6. Interventions in spinal vascular lesions.

7. Thrombolytic therapy in CNS lesions,

8 Spinal interventions –Chemonucleolysis

9. PLDD (Percutaneous Laser disc decompression), Vertebroplasty, Kyphoplasty, Percutaneous Biopsy. Others – Facet Joint Injections etc. Atreriovenous Malformations (AVM) and Fistulae (AVF): Natural History, aetiopathogenesis, clinical features, Imaging and management.

10. Dural Arteriovenous Malformation (DAVFs): Natural History, aetiopathogenesis, clinical features, Imaging and management.

11. Carotico cavernous Fistula (CCF): Aetiopathogenesis, natural history, clinical features and management.

12 Spinal Vascular Malformations: Natural History, aetiopathogenesis, clinical features, Imaging and management. Embolization of vascular lesions of head and neck and spine: meningiomas, juvenile angiofibromas, paragangliomas, tumors of vertebral bodies etc.

13 Intracranial Aneurysms: Natural History, aetiopathogenesis, clinical features,

14 Imaging and Endovascular management. PTA and stenting of the intracranial vessels. Vein of Galen aneurysmal malformations: Natural history, aetiopathogenesis, clinical features,

15 Imaging and Endovascular management -Management of Post SAH vasospasm/ vascular spasm of the CNS vessels due to other causes

16 Management of acute ischemic stroke and related issues

17 Management of dural sinus thrombosis

18 Complications in Interventional and Therapeutic Neuroradiological procedures and their management
19 Tools and devices for Therapeutic and Interventional Neuroradiology

20 Pre-procedure and post-procedure care of patient

21 Techniques in Therapeutic and Interventional Neuroradiology

22 Pharmacology as applied to Therapeutic and Interventional Neuroradiology

23 Managements of AVFs and acute traumatic CNS vascular lesions Stereotactic Radiotherapy in AVMs and DAVFs- concepts and indications

24 Chemotherapy for cranial and orbital malignancies Wada Testing

25 Temporary Balloon Occlusion test (BTO) of cerebral vessels Permanent Balloon Occlusion of cerebral vessels Traumatic lesions of supra-aortic vessels

26 Inferior petrosal sinus sampling

27 Intracranial arterial thrombolysis / embolectomy and venous thrombolysis

28 Percutaneous treatment of herniated disc

29 Nerve blocks Intra-vascular ultrasound

30 percutaneous sclerotherapy,

31 spine pain management

22. Imaging in disorders of brain, spinal cord, orbit, base of skull, head and neck

1 Disorders of brain development CNS

2 Manifestations of phakomatoses and other inherited syndromes

3 Epilepsy

4 White matter disorders and inherited metabolic disorders

5 Intra-axial brain tumors

6 Extra-axial brain tumors

7 Intracranial haemorrhage

8 Intracranial vascular malformations and aneurysms

9 Cerebral ischaemia and infarction

10 Head trauma

11 Intracranial infection / inflammation

12 Metabolic and immunological disorders of CNS

13 Genetic and hereditary disorders of CNS

14 Normal ageing, dementia and neurodegenerative disorders

15 The skull base. Sella turcica and parasellar region

16 Anatomy and diseases of temporal bone

17 Eye, orbit and visual system

18 Paranasal sinuses, temporal bone

19 Congenital anomalies of spine and spinal cord: embryology and malformations

20 Degenerative disease of spine

21Neoplastic diseases of spine and spinal cord

22 Spinal trauma

23 Vascular disorders of spine and spinal cord

24 Spinal infections and inflammatory disorders

23. Angiographic interventional procedures

1. Basics principles

1.1 Periopertive manangement including infrastructure and staffing

1.2 Diagnostic arteriography, venography, pulmonary arteriography

1.3 Stent grafts and basic principles of stent grafting

1.5 Diagnosis and management of endoleaks

1.6 Device migration, dislocation, kinking and occlusion

2. Procedures

2.1 Protocoling and performing patient procedures, including lumbar puncture, myelography, intrathecal chemo, kyphoplasty, and CT guided biopsies

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2.2 Vascular intervention (know the indications for angioplasty, thrombolysis, embolic therapy)

2.5 Central venous accessed

2.6 Retrival of intravascular foreign bodies

Following pattern will be used for formation of paper I & II as far as possible.

Paper I				
Part	**Section**	**Weightage**	**No. Questions & Weightage**	
			Objective Multiple Choice	**Subjective**
I	A	20		2 Questions x 10 Mark = 20
	B	30		3 Questions x 10 Mark = 30
II	C	25	25 Questions x 1 Mark = 25	
	D	25	25 Questions x 1 Mark = 25	
Paper II				
Section		**Weightage**	**No. Questions & Weightage**	
			Long answer	**Critical Analysis**
A		45	3 Questions x 10 Mark = 30	1 Questions x 15 Mark = 15
B		55	4 Questions x 10 Mark = 40	1 Questions x 15 Mark = 15

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