

नेपाल सरकार
गृह मन्त्रालय
प्रहरी प्रधान कार्यालय
(मानवश्रोत एवं प्रशासन विभाग, भर्ना तथा छनौट महाशाखा)
नक्साल, काठमाण्डौ ।

प्राबिधिक प्रहरी निरीक्षक (वायोमेडिकल इन्जिनियर) समूहको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम ।

पाठ्यक्रमको रूपरेखा:- यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिईने छ :-

प्रथम चरण:- लिखित परीक्षा (Written Examination)

पूर्णाङ्क :- २५०

द्वितीय चरण:- अन्तरवार्ता (Interview)

पूर्णाङ्क :- ३५

प्रथम चरण:- लिखित परीक्षा योजना (Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या अङ्कभार	समय
प्रथम	वायोमेडिकल इन्जिनियरिङ्ग	१००	४०	बस्तुगत बहुउत्तर (Multiple Choice)	१००X१ = १००	१ घण्टा १५ मिनेट
द्वितीय		१००	४०	विषयगत (Subjective)	५X२० = १००	३ घण्टा
तृतीय	नेपाल प्रहरी सेवा सम्बन्धी	५०	२०	बस्तुगत बहुउत्तर	१०X१ = १०	१ घण्टा १० मिनेट
				विषयगत	लामो उत्तर १X१० = १० छोटो उत्तर ६X५ = ३०	

द्वितीय चरण

परीक्षाको किसिम	पूर्णाङ्क	परीक्षा प्रणाली
ब्यक्तिगत अन्तवार्ता	३५	मौखिक

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ ।

२. लिखित परीक्षाको दुवै पत्रको विषयवस्तु एउटै हुनेछ ।

३. प्रथम तथा द्वितीयपत्रका पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुनेछ । तृतीय पत्रको हकमा तृतीय पत्रको पाठ्यक्रममा उल्लेख भए बमोजिम हुनेछ ।

Section	I	II	III	IV	V	VI	VII	VIII
प्रथम पत्र	१२	१२	१२	१०	१२	१२	१०	२०
द्वितीय पत्र	२	२	२	२	२	२	२	६

४. प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

६. वस्तुगत बहुउत्तर (Multiple Choice) प्रश्नहरूको उत्तर सही दिएमा प्रत्येक सही उत्तर बापत पुरा अङ्क प्रदान गरिनेछ भने गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
७. द्वितीय पत्रको विषयगत प्रश्नका लागि तोकिएका २० अङ्कका प्रश्नहरूको हकमा ५ अङ्कको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
८. द्वितीय पत्रको पाठ्यक्रमलाई ४ वटा खण्ड/एकाईमा विभाजन गरिएको छ, ४ वटा खण्ड/एकाईको लागि ४ वटै उत्तरपुस्तिका दिइनेछ र परिक्षार्थीले प्रत्येक खण्ड/एकाईका प्रश्नहरूको उत्तर सोही खण्ड/एकाईको उत्तर पुस्तिकामा लेख्नु पर्नेछ ।
९. यस पाठ्यक्रममा जेसुकै लेखिएको भएता पनि पाठ्यक्रममा परेका ऐन, नियमहरू परीक्षाको मिति भन्दा ३ (तीन) महिना अगाडि (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायमरहेकालाई यस पाठ्यक्रममा रहेको सम्झनु पर्दछ ।
१०. प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको अन्तर्वार्तामा सम्मिलित गराइनेछ ।
११. पाठ्यक्रम लागू मिति :

प्राविधिक प्रहरी निरीक्षक (वायोमेडिकल इन्जिनियर) को खुल्ला प्रतियोगिताको लिखित परिक्षाको पाठ्यक्रम

Section: I

A. ENGINEERING MATHEMATICS I

- 1 Limits and Continuity of a Function
- 2 Derivatives
- 3 Applications of Derivatives
- 4 Integration
- 5 Applications of Integral Calculus
- 6 Plane Analytic Geometry
- 7 Vector Algebra

B. PHYSICS

- 1 Simple Harmonic Motion
- 2 Wave in Elastic Media
- 3 Acoustics
- 4 Electrostatics
- 5 Direct Current
- 6 Magnetism and Magnetic Fields
- 7 Electromagnetic Oscillations
- 8 Electromagnetic Waves
- 9 Optics
- 10 Physical Optics

C. COMMUNICATIVE ENGLISH

- 1 Oral Communication
- 2 Reading: Intensive and Extensive
- 3 Writing

D. INTRODUCTION TO COMPUTER AND PROGRAMMING

- 1 Introduction to computer
- 2 Introduction of programming
- 3 Data types, operators and some statement
- 4 Variables ,input and output
- 5 Control structure
- 6 Array
- 7 Function
- 8 Pointer
- 9 Structure and Unions
- 10 Data Files
- 11 Graphics

E. ENGINEERING DRAWING

1. Instrumental Drawing, Practices and Techniques
2. Freehand Technical Lettering
3. Dimensioning
4. Plane Geometrical Construction
5. Basic Descriptive Geometry
6. Multiview Drawings (Orthographic Projection)

7. Pictorial Drawing
8. Introduction to AutoCad: Drawing Practicals

F. BASIC ELECTRICAL ENGINEERING

1. Basic Concept of DC Circuit
2. Circuit Analysis
3. AC Circuit
4. Three Phase AC Circuit
5. Transformers

Section II

A. ENGINEERING MATHEMATICS II

- 1.0 Analytic Geometry of 3-D
- 2.0 Infinite Series
- 3.0 Plane Curves and Polar Coordinates
- 4.0 Vector Calculus
- 5.0 Differential Equations

B. CHEMISTRY

GROUP A (Physical)

- 1.0 Review lectures of Bohr Theory and Sommerfeld Theory
- 2.0 Chemical Bonding
- 3.0 Electrochemistry
- 4.0 Introductory Thermodynamics

GROUP B (Inorganic)

- 1.0 Co-ordination Complexes
- 2.0 Transition Element
- 3.0 Silicones – Properties and Uses
- 4.0 Environmental Chemistry

GROUP C (Organic)

- 1.0 Types of Organic Reaction
- 2.0 Stereochemistry
- 3.0 Organometallic Compounds
- 4.0 Explosives
- 5.0 Polymers & Polymerization

C. BASIC MECHANICAL ENGINEERING

1.0.0 Workshop technology

- 1.1.0 Basic Tools, Hand operating operations and Measuring
- 1.2.0 Machine Tools
- 1.3.0 Metal Joining: Soldering, Brazing, Gas welding, Arc welding, Safety
- 1.4.0 Measuring and Gaging: Rulers, Scales, Depth gages, Micrometer, Vernier calipers, Dial indicators.

2.0.0 Applied Mechanics:

- 2.1.1 Introduction
- 2.1.2 Concept of a particle, Rigid body, Principles of forces, Free body diagram, Equilibrium in two dimensions.
- 2.1.3 Distributed forces, Centre of gravity, Centroid of lines, areas and volumes.
- 2.1.4 Friction and Laws of Friction
- 2.1.5 Rectilinear and curvilinear motion of particles, Position, Velocity and acceleration.

2.1.6 Dynamics, Kinetics & Kinematics.

3. Mechanics and Properties of Solids:

3.1 Stress, Strain, Stress-Strain diagram, Hookes Law

3.2, Thermal stress of elasticity.

3.3. Temperature Effects

3.4. Torsion

3.5. Bending of beams, Pure bending, Shearing force, Bending moment, Shearing force and bending moment diagram.

D. ELECTRO-ENGINEERING MATERIALS

1.0 Theory of Metal

2.0 Free Electron Theory of Conduction in Metals

3.0 Conduction in Liquid and Gases

4.0 Magnetic Materials and Superconductivity

5.0 Dielectric Materials

6.0 Semi-Conducting Materials

E. COMPUTATIONAL SYSTEM & DATABASE CONCEPT

1.0 Introduction to Matlab

2.0 Arrays

3.0 Writing script files and Functions

4.0 Simple graphics

5.0 Data and data flow in Matlab

6.0 Handle graphics and user interface

7.0 Introduction to DBMS

8.0 Concepts of Database systems

9.0 SQL & Normalization Steps

F. DIGITAL LOGIC

1.0 Numbering Systems

2.0 Boolean Algebra and Logic Gates

3.0 Simplification of Boolean Functions

4.0 Combinational Logic

5.0 Sequential Logic

6.0 Registers, Counters and the Memory Unit

Section - III

A. ENGINEERING MATHEMATICS III

1. Matrices and Determinant

2. Laplace Transformation

3. Line Integration

4. Surface Integrals and Volume Integrals

5. Integral Theorems

B. BIO-ENGINEERING MATERIALS AND COMPONENTS

1. Properties of Materials
2. Introduction to Bio-materials
3. Polymers
4. Bioresorbable and Bioerodible Materials
5. Ceramics, Glasses and Composites
6. Natural Materials
7. Composites
8. Thin films, Grafts and Coatings
9. Fabrics
10. Biologically Functional Materials
11. Natural Tissues
12. Biology, Biochemistry and Medicine
13. Testing of Biomaterials
14. Degradation of Materials in Biological Environment
15. Perspectives and Possibilities in Biomaterials Science

C. HUMAN ANATOMY AND PHYSIOLOGY I

1. Introduction to Human Body
2. Introduction to the Chemistry of Life: Atoms, Molecules & Compounds. Biological Molecules & Body Fluids
3. The Cells, Tissues & Organization of the Body, Disorder of the Cells & Tissues
4. The Skin. Structure, Function & Disorder of Skin
5. The Skeleton, Axial Skeleton & Appendicular Skeleton Bones. Diseases Related to Bones. Healing of Bones
6. The joint. Types of Joints. Main synovial Joints of the Limbs. Disorders of Joints
7. The Muscular System. Muscles of Face, Neck, Back, Abdominal Wall & Pelvic Floor. Diseases of muscles. Healing of muscle, Repair of Nerves Supplying Muscles
8. The Nervous System. Neurons, CNS, Brain, Spinal Cord, Peripheral Nervous system. Autonomic Nervous System. Disorders of Brain, Spinal Cord & Peripheral Nervous System. Responses of Nervous Tissue to Injury
9. The Special Senses. Hearing & Balance of Ear, Sight & Eye, Sense of Smell, Sense of Taste, Disease of Ear & Eye

D. FLUID MECHANICS

1. Introduction
2. Fluid Pressure & Forces
3. Buoyancy & Flootation
4. Fluid Kinematics
5. Dynamics of Flow
6. Introductions on to Thermodynamics and Heat Transfer

E. CELL BIOLOGY AND IMMUNOLOGY

1. Cell biology
2. Bio molecules
3. Molecular biology and genetics
4. Immunology

5. Blood
6. Eukaryotes and prokaryotes

F. MICROPROCESSORS

1. Introduction
2. Microprocessor instruction
3. Assembly language programming
4. Bus structure and memory devices
5. Input/output interfaces
6. Interrupt
7. Multiprogramming
8. Introduction to advanced microprocessor architecture

Section - IV

A. APPLIED MATHEMATICS

1. Complex variables
2. Transforms
3. The Fourier series, Integral and Transform
4. Partial Differential Equation
5. Linear Programming

B. ELECTRONIC DEVICES AND CIRCUITS

1. Semiconductor Diodes
2. Bipolar Junction Transistor
3. Field Effect Transistor
4. Operational Amplifier Circuits
5. Operational Amplifier Characterization
6. Power Supplies and Voltage Regulators
7. Untuned and Tuned Power Amplifiers
8. Filter Circuits

C. SOCIOLOGY

1. Introduction
2. Language of sociology
3. Fundamental concepts in sociology
4. Nepalese culture and society
5. Community and development

D. BIOMECHANICS

1. Force in Joint
2. Skeletal Biology
3. Mechanical Properties of Tissues
4. Mechanics of Soft Tissues
5. Synovial Joint Mechanics
6. Muscle Mechanics
7. Modalities of Elastic and Viscoelastic Solids, Constitutive Equations,

8. Introduction to Bio-Fluid Mechanics

E. RESEARCH METHODOLOGY

1. Introduction
2. Research methodology
3. Research design
4. Sampling, data collection and data analysis
5. Mean, median and standard deviation
6. Research, proposal and report writing

F. HUMAN ANATOMY AND PHYSIOLOGY II

1. Brief revision of blood component. haemostasis & thrombosis. disorders of blood coagulation. blood cells disorders
2. The cardiovascular system. blood vessels, blood pressure, pulse & circulation of the blood
3. The lymphatic system. lymph, lymph vessels, lymphatic organs & tissue
4. The respiratory system, nose, nasal cavity, pharynx, larynx, trachea, bronchi, lungs. respiration. disorder of upper respiratory tract, bronchi & lungs
5. The digestive system, oral cavity. digestion, absorption & metabolism. diseases related to digestive system
6. The urinary system. kidney, ureters, urinary bladder, bladder, urethra. disease related to system
7. The endocrine system. pituitary, thyroid, adrenal, pancreas, pineal & thymus gland
8. Reproductive system. male & female reproductive organs. diseases related to sex organs

Section - V

A. PROBABILITY AND STATISTICS

1. Introduction and Descriptive Statistics
2. Probability
3. Discrete Random Variables and Probability Distribution
4. Continuous Random Variables and Probability Distributions
5. Joint Probability Distributions and Random Samples
6. Point Estimation
7. Hypothesis Testing Procedures Based on a Single Sample
8. Hypothesis Testing Based on Two Samples
9. Interval Estimation
10. Simple Linear Regression and Correlation
11. The Analysis of Categorical Data

B. NUMERICAL METHODS

1. Introduction
2. Solution of Nonlinear Equations
3. Interpolation
4. Numerical Differentiation and Integration
5. Matrices and Linear Systems of Equations
6. Numerical Solution of Ordinary Differential Equations

7. Numerical Solution of Partial Differential Equations

C. MEASUREMENT AND INSTRUMENTATION

1. Measurement and Error
2. Measurements and Control by Analog and Digital System
3. Transducers and Sensors
4. Analog Signal Conditioning
5. Digital Signal Conditioning
6. Output Devices, Display and Recording Systems

D. CONTROL SYSTEMS

1. Introduction
2. System Modeling
3. Transfer Functions and Responses
4. Stability
5. Root Locus Method
6. Frequency Response Methods
7. Computer Simulation of Control Systems
8. Performance Specifications for Control Systems

E. BIOMEDICAL EMBEDDED SYSTEM DESIGN

1. Background
2. Hardware fundamentals
3. Advanced hardware fundamentals
4. Assembly language programming
5. Microcontrollers
6. Embedded software development tools
7. System design with microcontrollers
8. Emerging concepts

F. COMMUNICATION SYSTEMS

1. Analog and Digital Communication Systems
2. Continuous Wave Linear Modulators
3. Frequency Modulation (FM) and Phase Modulation (PM)
4. Protocol Architecture
5. Transmission Media
6. Signal Encoding Techniques
7. Digital Data Communication Technique
8. Data Link Control
9. Multiplexing
10. General Concept of Wireless Communication System

Section - VI

A. ENGINEERING ECONOMICS

1. Introduction
2. Cost Classification and Analysis
3. Interest and the Time Value of Money
4. Basic Methodologies of Engineering Economic Studies
5. Cash/Benefit Analysis
6. Investment Decisions
7. Risk Analysis
8. Taxation System in Nepal
9. Demand Analysis and Sales Forecasting

B. TISSUE DEVICE INTERACTIONS

1. Introduction to Tissue-Device Interactions and Their Importance
2. Inflammation, Wound Healing and Foreign Body Response
3. The Effect of Biomaterials on the Host
4. Blood-Biomaterials Interactions
5. Endothelial Cells and Biomaterials
6. The Extra cellular Matrix and Biomaterials
7. Bacteria and Biomaterials
8. Integrins Adhesion Molecules and Biomaterials
9. Controlling, manipulating the material/host interactions by changing material, Chemistry i.e. surface charge, physical properties eg. Shape, topography, porosity and others

C. MEDICAL IMAGING I

1. Basic Principles of Medical Imaging
2. Radiation Physics
3. X-rays
4. X-ray Equipment
5. Radiographic Imaging
6. Basics of Radioisotope Imaging

D. BIOMEDICAL INSTRUMENTATION I

1. Fundamental of Medical Instrumentation
2. Bioelectric Signals and Electrodes
3. Physiological Transducers
4. Recording System
5. Biomedical Recorders
6. Patient Monitoring Systems
7. Arrhythmia and Ambulatory Monitoring Instruments
8. Foetal Monitoring Instruments
9. Biomedical Telemetry and Telemedicine
10. Oximeters
11. Cardiac Output Measurement
12. Pulmonary Function Analyzers

E. MEDICAL ELECTRONICS

1. Thyristors and Other Devices
2. Stability and Oscillators
3. Waveguides and Components
4. Nanoelectronics

F. BIOMEDICAL DIGITAL SIGNAL PROCESSING

1. Introduction to Signal and System
2. Difference Equations and Frequency Response
3. Basic of Digital Filter
4. FIR Filter Design
5. IIR Filter Design
6. The Discrete Fourier Transform
7. Signal Averaging
8. Data Reduction Techniques
9. Real Time Biomedical System

Section - VII

A. ORGANISATION AND PROJECT MANAGEMENT

- 1 Introduction
- 2 Organisation
- 3 Leadership and Motivation
- 4 Personnel Management
- 5 Project Planning
- 6 Project Monitoring and Evaluation (M&E) and Control
- 7 Capital Planning and Budgeting

B. BIOMEDICAL INSTRUMENTATION II

- 1 Clinical Laboratory Equipments
- 2 Blood Gas Analysers
- 3 Blood Cell Counters:
- 4 Audiometers and Hearing Aids
- 5 Patient Safety
- 6 Cardiac Pacemakers
- 7 Cardiac Defibrillators
- 8 Instruments for Surgery
- 9 Laser Applications in Biomedical Field
- 10 Physiotherapy and Electrotherapy Equipment
- 11 Haemodialysis Machines
- 12 Lithotripters
- 13 Anaesthesia Machine
- 14 Ventilators
- 15 Radiotherapy Equipment
- 16 Automated Drug Delivery Systems

C. MEDICAL IMAGING II

- 1 Principle and Equipment for Diagnostic Imaging
- 2 Digital Imaging
- 3 Computer Tomography (CT)
- 4 Magnetic Resonance Imaging (MRI)
- 5 Ultrasonography (USG)

D. IMPLANTABLE DEVICES

- 1 Introduction to Implants and Their Necessity in Human Life
- 2 Cardiovascular Implants
- 3 Non Thrombogenic Treatments and Strategies
- 4 Dental Implants
- 5 Plastic Surgery Implant
- 6 Orthopaedic Implants
- 7 Catheters
- 8 Biomaterials Used in Urology
- 9 Prosthesis for Drug Delivery
- 10 Different Kinds of Artificial Organs
- 11 Introduction to Tissue Engineering
- 12 Implants and Device Failure

E. STRUCTURAL BIOMATERIALS

1. Introduction
2. Structure and properties of biological tissues
3. Microscopic and macroscopic structure of tissues
4. Determination of physical structure and modeling
5. Assembly of biological macromolecules
6. Mechanical properties of tissues
7. Pathobiology and response to tissue injury

Section - VIII

A. MEDICAL INDUSTRY MANAGEMENT

1. Introduction:
2. Types of Medical Devices:
3. Structure of Multinationals:
4. Roles of the Medical Device Industry:
5. International Standards:
6. Risk Assessment and Management:
7. Product Liability:
8. Clinical Requirements and Their Implication in Device Design:
9. Protection of Intellectual Property:
10. Introduction of Clinical Evaluation of Medical Devices:
11. Case Studies: Implantable Devices:
12. Case Studies: Tissue Engineering Products:
13. Case Studies: Other Devices:

14. Architectural Planning of Hospitals:
15. Basics of Hospital Management:
16. Selection and Purchase of Medical Equipment:
17. Peripheral Devices Used in Hospitals:

B. ENGINEERING PROFESSIONAL PRACTICE

1. Background Perspective:
2. Ethics and Professionalism:
3. Roles of Professional Association:
4. Legal Aspect of Professional Engineering in Nepal:
5. The Roles and Practice of Professional Engineering in Other Countries:
6. Case Studies Involving Professional Ethical Issues Chosen From a Wide Range of Topics:

C. MINIMALLY INVASIVE MEDICAL TECHNOLOGY

1. Chemical sensors
2. Neuro-electrical signal recording
3. Pressure sensors
4. General techniques and applications
5. Endoscopic surgery
6. Image-guided surgery
7. Ablation
8. Drug delivery

D. MEDICAL IMAGE PROCESSING

1. Introduction
2. Fundamentals of Image Processing
3. Medical Image
4. Medical Image Segmentation
5. Expert
6. Image Segmentation
7. Image Data Compression

E. THEORY OF MEDICAL ROBOTICS

1. Introduction of Robotics:
2. Review of Technology
3. Fuzzy Logic
4. Medical Robotics in Surgery
5. Robotic Rehabilitation Therapy
6. Telesurgery

F. NEURAL NETWORK

1. Introduction to Neural Networks
2. Neural Networks Architecture
3. Artificial Neural Networks (ANN)
4. The Learning Mechanisms

5. Associative models
6. Applications of ANN
7. Neural networks in medicine
8. Introduction to Genetic Algorithms and Fuzzy Logic

G. MEDICAL INFORMATICS

1. Database system
2. Review of telecommunication and computer networks
3. System analysis and design/System design and engineering
4. Information security and privacy
5. Medical informatics application to health services
6. Expert system and Clinical decision support system

H. TELEMEDICINE AND TELEHEALTH

1. Introduction and history of remote management of diseases
2. Telehealth: A patient perspective
3. Telecommunication technologies in healthcare
4. Clinical Applications
5. Special settings
6. Telehealth and relationship with physicians
7. Telehealth care transactions
8. Regulatory considerations, security and privacy
9. Market for telehealth services
10. Contracting for telehealth care
11. Starting Telemedicine
12. Choosing the right technology for telemedicine
13. Telemedicine and Telehealth in Nepalese Context
14. Future of Telehealth and Telemedicine

Model Questions:

1. What is electrostatic induction? Write its industrial uses and hazards in brief.
2. Can you define Dynamics, Kinetics & Kinematics in short?
3. What is Tissue repair & regeneration?
4. How diffusion of Z-transforms occurs?
5. Classify Transducer/Sensor in brief.
6. What are the elements of costs?
7. Write shortly on defibrillator analyzer.
8. Differentiate rigid and flexible endoscopies.