नेपाली सेना

प्रा.उ.से.ईलोक्ट्रोनिक्स एण्ड कम्युनिकेशन ईन्जिनियर (खुला) पदको लिखित परीक्षाको पाठ्यक्रम

समय : २ घण्टा ३० मिनेट

पुर्णाङ्क : १००
उत्तीर्णाङ्क : ४०

यो पाठ्यक्रम नेपाली सेनाको विभिन्न ईकाईहरुमा रिक्त रहेको **प्रा.उ.से.ईलोक्ट्रोनिक्स एण्ड कम्युनिकेशन ईन्जिनियर (खुला)** पदका उम्मेदवार छनौट परीक्षाको लागि निर्धारण गरिएको हो । लिखित परीक्षामा सरिक हुने उम्मेदवारहरुको पेशा सम्बन्धि विषयलाई आधारमानी प्रश्नहरु सोधिने छ ।

(क) लिखित परीक्षाको माध्यम नेपाली/अंग्रेजी वा दुवै भाषा हुनेछ ।

(ख) लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र अर्को चरणको परीक्षामा सम्मिलित गराईने छ ।

(ग) प्रश्न पत्र निर्माण गर्दा पाठ्यक्रममा समावेश भएका सबै विषयहरुलाई समेटिनेछ ।

(घ) नेपाली सेनाको आवश्यकता तथा विविध परिस्थितमा नेपाली सेना अनुकुल हुने गरी उल्लेखित विवरणहरुमा हेरफेर हुन सक्नेछ ।

(ङ) पाठ्यक्रमको रुपरेखा देहायमा उल्लेख गरे अनुसार हुनेछ ।

(च) पाठ्यक्रम लागु मिति २०७३/१/१२ गते ।

विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्न संख्या x अङ्क	समय
पेशा सम्बन्धी	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	४० प्रश्न x १ अङ्क = ४०	२ घण्टा ३० मिनेट
			विषयगत (Subjective)	छोटो उत्तर	६ प्रश्न X ५ अङ्क = ३०	
				लामो उत्तर	३ प्रश्न X १० अङ्क = ३०	

पेशा सम्बन्धी विषयको पाठ्यक्रम

(SYLLABUS FOR ELECTRONIC AND COMMUNICATION ENGINEER)

1. COMPUTER

1.1 Computer Programming

1.1.1 **Introduction to C programming**

Character set, Keywords, and Data Types, Constants and Variables, Operators and Statements

1.1.2 **Input and Output**

Formatted input/output, Character input/output, Programs using input/output statements

1.1.3 **Control Statements**

1.1.4 **User-Defined Functions**

Function definition and return statement, Function prototypes, call by value and call by reference, Recursive functions

1.1.5 **Array and Strings**

One-dimensional Arrays, Multidimensional Arrays, String and string manipulation, Passing Array and String to function

1.1.6 **Structures**

Processing a Structure, Structures and Function

1.1.7 **Pointers**

Pointer declaration, Pointer arithmetic, Pointer and Array, Passing Pointers to a Function, Pointers and Structure

1.1.8 **Data Files**

Defining opening and closing a file, Input/output operations on files

1.2 Microprocessors

1.2.1 **Introduction**

Basic block diagram of computer, bus organization, stored program concept, introduction to Register Transfer Language

1.2.2 **Programming with 8085 and 8086 microprocessor**

Instruction Format and Data Format, Addressing modes, Instruction sets, various programs in 8085 and 8086

1.2.3 **Microprocessor System**

Bus structure, memory device classification and hierarchy, interfacing I/O and Memory, address decoding

1.2.4 **Parallel interface**

Modes: simple, wait, single handshaking and Double handshaking, introduction to PPI

1.2.5 **Serial Interface**

Synchronous and Asynchronous transmission, serial interface standard: RS232, RS423, RS422, USB, introduction to DMA

1.2.6 **Interrupt Operations**

Interrupt Processing Sequence, Interrupt service routine, interrupt processing in 8085

1.2.7 **Advanced Topics**

Resource allocation and deadlock, RISC and CISC architecture

1.3 **Computers and Network**

Different between analogue and digital computer, Binary system and Boolean algebra, Gates, Computer structure (I/O devices, Storage devices, Memories) and typical processor architecture, CPU and memory organization, buses, Characteristics of I/O and storage devices, Processing unit and controller design, hardware and micro program control, Instruction sets and addressing modes, memory systems (main, auxiliary, virtual, cache), assembly language programming, I/O and interrupt servicing, Multiplexing, (time, frequency and code division multiplexing), Digital networks: ISDN, frame relay and ATM. Protocols: (such as ISO/OSI reference model, X.25, IP), LAN/WAN topologies, access schemes, medium access and logic layers; CSMA/CD and token ring protocols; segmented and hubbed LANs, Operating system principles, components, and usage(Multitasking and/or multiprocessing, Real-time aspects)

2. ELECTRICAL

2.1 Electrical Machines

2.1.1 Magnetic circuits and Induction

Magnetic circuits, Ohm's law for magnetic circuits, series and parallel magnetic circuits, B-H relationship, Hysteresis loss and Eddy current loss, Faraday's law of electromagnetic induction, force on current carrying conductor

2.1.2 Transformer

Construction detail, working principle ideal transformer no load and load operation, losses in transformer, efficiency and condition for maximum efficiency

2.1.3 DC Generator

Construction details and armature winding, working principle, method of excitation, types of DC generator, characteristics, losses in DC generator, efficiency and voltage regulation

2.1.4 DC Motor

Working principle, back emf, methods of excitation, types of DC motor, performance characteristics, speed control (armature control and field control), losses and efficiency

2.1.5 Three phase induction machines

Three phase induction motor, three phase induction generator

2.1.6 Three phase synchronous machines

Three phase synchronous generator, three phase synchronous motor

2.2 Power System

2.2.1 General background

Generation, transmission and distribution component, AC Vs DC Transmission, single phase Vs three phase power delivery

2.2.2 Introduction to Power System Protection

Power system faults and protection principle, fuse as a protection device, relays; working and types, circuit breakers; working and types, basic protection schemes for generators, motors, transformers and transmission lines

2.3 **Instrumentation**

2.3.1 **Instrumentation Systems**

Functions of components of instrumentation system

2.3.2 **Theory of measurement**

Static Performance parameters- accuracy, precision, sensitivity, resolution and linearity, Dynamic performance parameters-response time, frequency response and bandwidth, errors in measurement, Measurement of voltage and current

2.3.3 **Transducer**

2.3.4 **Electrical Signal Processing and transmission**

Basic Op-amp characteristics, Instrumentation amplifier, signal amplification, attenuation, integration, differentiation, effect of noise, fibre optics, electro-optic conversion devices

2.3.5 **Analog-digital and Digital-analog conversion**

Analog and digital signal, digital to analog convertors, analog to digital convertors

2.3.6 **Digital instrumentation**

Sample data system, sample and hold circuit, components of data acquisition systems

2.3.7 **Electrical equipment**

Wattmeter, Energy meter, Frequency meter, Power factor meter, Instrument transformer

2.4 **Control System**

2.4.1 **Component Modeling, Linearization:**

Differential equation and transfer function notations, State-space formulation of differential equations, matrix notation, Mechanical components: mass, spring, damper, Electrical components: inductance, capacitance, resistance, sources, motors,tachometers, transducers, operational amplifier circuit, Fluid and fluidic components, Thermal system components, Mixed system, Linearized approximations of non-linear characteristics

2.4.2 **System Transfer Functions and Responses:**

Combinations of components to physical systems, Block diagram algebra and system reduction, Mason's loop rules, Laplace transform analysis of systems with standard input functions - steps, ramps, impulses, sinusoids, Initial and final steady-state equilibria of systems, Principles and effects of feedback on steady-state gain, bandwidth, error magnitude, dynamic responses

2.4.3 **Stability**

Heuristic interpretation of the conditions for stability of a feedback system, Characteristic equation, complex plane interpretation of stability, root locations and stability, Routh-Hurwitz criterion, eigenvalue criterio, Setting loop gain using the R-H criterion, Relative stability from complex plane axis shifting

3. ELECTRONICS

3.1 Basic and Advanced Electronics

3.1.1 Diodes

Semiconductor diode characteristics, modeling of Semiconductor diode

3.1.2 Transistors

BJT configuration and biasing, T and μ model, BJT switch and logic circuit, MOSFET and CMOS, MOSFET as logic circuits

3.1.3 Operational Amplifier

Bias circuits suitable for IC design, The widlar currant source, The differential amplifier, Active loads, Output stages, Input offset voltage, Input bias and input offset currents, Output impedance, Differential and common-mode input impedances, DC gain, bandwidth, gain-bandwidth product, Common-mode and power supply rejection ratios, Higher frequency poles, settling time, Slew rate, Noise in operational amplifier circuits

3.1.4 Power Supplies and Voltage Regulators:

DC Power Supply, Half-wave and full-wave rectifiers, Capacitive filtering, Zener diodes, band gap voltage references, constant current diodes, Zener diode voltage regulators, Series transistor-zener diode voltage regulators, Series transistor-zener diode-constant current diode voltage regulators

3.1.5 Untuned and Tuned Power Amplifiers and Oscillator Circuits

Amplifier classification,Direct-coupled push-pull stage, Transformer-coupled push-pull stages, Tuned power amplifiers, Power dissipation considerations, CMOS inverter relaxation oscillator, Operation amplifier based relaxation oscillators, Voltage-to-frequency converters, Sinusoidal oscillators, Conditions for oscillators, Amplitude and frequency stabilization, Swept frequency oscillators, Frequency synthesizers, Function generator

3.1.6 Log antilog amplifier and power electronics

Instrumentation and Isolation amplifier, Logarithmic Amplifier, Anti-logarithmic amplifier, Log-Antilog Circuit Applications, Switched Power Supplies, Diodes, thyristors, triacs, Controlled rectifier circuits, Inverters, Choppers, DC-to-dc conversion, AC-to-ac conversion

3.1.7 Nano Technology

Introduction and application of Nano Technology, Nenoelectronics, Synthesizing of Carbon Nanomaterials, Development of Nanophosphors, Semiconducting Nanomaterials and applications, Nanocomposites based Solar cells and LED

3.2 Electronic Circuits

3.2.1 DC Circuits

Series circuits, parallel circuits, Kirchhoff's law, Power and Energy

3.2.2 Network Theorems

Nodal Analysis, Mesh Analysis, Thevnin's Theorem, Nortan's Theorem, Maximum Power transfer Theorem

3.2.3 **Single phase AC Circuit Analysis**

Current and Voltage in an inductive, capacitive circuits, Concept of complex impedance and admittance, AC series and parallel circuits, RL, RC, and RLC circuit analysis

3.2.4 **Power in AC Circuits**

Active and Reactive power, Power factor and its practical importance, Improvement of Power factor, Measurement of power in a single phase AC circuit

3.2.5 **Three Phase Circuit Analysis**

Basic concept and advantages of Three phase circuit, Phase and line quantities, Voltage and current computation in 3-phase balance and unbalance circuits, Measurement of power and power factor in 3-phase system

3.2.6 **Transient Analysis in RLC Circuit**

Initial conditions, Solution of differential equations with constant coefficients, Complete Time Domain Response of Second and Higher order Systems, Use of Laplace Transform Techniques for Solution of Ordinary Differential Equations with constant Coefficients, Transfer Functions, poles and Zeros of Networks

3.2.7 **Frequency Response of Network**

Magnitude and Phase response, Basic concept of filters, high pass, low pass, band pass and band stop filters

3.2.8 **Fourier series and Transform**

Basic concept of Fourier series and analysis, introduction to Fourier transforms

3.2.9 **Two-Port Parameters of Networks**

Definition of two-port networks, two port circuit parameters, Interconnection of two port network

3.3 **Logic Circuit**

3.3.1 **Digital Logic**

The basic gates (NOT, OR, AND) universal logic gates (NOR, NAND) AND -OR- INVERT gates

3.3.2 **Combinational Logic Circuits**

Boolean Laws and Theorems, Truth Table, SOP and POS method, Karnaugh Simplifications

3.3.3 **Data Processing Circuits**

Multiplexer, DE multiplexers, Decoder, Encoder

3.3.4 **Flip Flops**

3.3.5 **Sequential Machines**

Synchronous machine, Asynchronous machines, Digital Design examples

3.4 **Filter Design**

The filter design problem, Kinds of filters in terms of frequency response, History of filter design and available filter technologies, Ideal low pass, high pass, band pass and bands top functions, Low pass approximations including Butterworth, Chebyshev, inverse Chebyshevand elliptic, Frequency transformations: lowpass to highpass, lowpass to bandpass and lowpass to bandstop

4. COMMUNICATION

4.1 Communication System

4.1.1 Analog communication system

4.1.1.1 Representation of basic communication system, components of communication system, communication channel, Need for modulation, Amplitude Modulation and Demodulation, Frequency Modulation and demodulation, Phase modulation

4.1.1.2 Frequency division Multiplexing system, Super heterodyne receiver in communication system, Representation of random signals and noise in communication system, Noise performance of analog communication systems, comparison of AM (DSB-FC, DSB-SC, SSB) and FM (Narrow band and Wide band) in terms of power efficiency, channel bandwidth and complexity

4.1.2 Digital communication system

4.1.2.1 Digital communication sources, transmitters, transmission channels and receivers, Noise, distortion and interference, fundamental limitations due to noise, distortion and interference, source coding, coding efficiency, Shannon-fano and Huffman codes, coding of continuous time signals (A/D conversion)

4.1.2.2 Sampling Theory: Nyquist-Kotelnikov sampling theorem for strictly band- limited continuous time signal, reconstruction of sampled signal, ideal, flat top and natural sampling process, sampling of band- pass signals, sub- sampling theory, practical considerations: aperture effect, aliasing effect

4.1.2.3 Pulse Modulation system: PAM, generation, bandwidth requirement, spectrum, reconstruction methods, pulse code modulation as a result of A/D conversion, quantization noise, SNR, differential PCM, delta modulation, Parametric speech coding, vocoders

4.1.2.4 Introduction to digital modulation techniques (ASK, FSK, PSK, DPSK, QPSK, GMPSK), demodulation of binary digital modulated signals (coherent and non-coherent), modems and its application, Noise performances of modulated digital systems

4.1.2.5 Error control coding techniques: Basic principles, types, linear block codes (systematic and non systematic), binary cyclic codes (systematic and non systematic), convolution codes

4.2 Electromagnetic, Antenna and Propagation

4.2.1 Electric Field

Coulomb's law, Electric Field intensity, Gauss's law and application, Physical significance of divergence, divergence theorem, Electric potential and potential gradient, Free and bound charge, polarization, relative permittivity, electric dipole, current , current density, conservation of charge, continuity equation, relaxation time

4.2.2 **Magnetic Field**

Biot-Savart's law, Magnetic field intensity, Ampere's circuital law and its application, magnetic flux density, Physical significance of curl, stoke's theorem, scalar and vector potential, Magnetic force, magnetic torque, magnetic moment, magnetic dipole, magnetization

4.2.3 **Wave equation and wave propagation**

Faraday's law, transformer emf, motional emf, displacement current, Maxwell's equations, Uniform plane waves in dissipative media, Polarization, Wave impedance, Skin effect, A. C. resistance, Poynting vector, Reflection and refraction at the interface between two media, Reflection coefficient, Standing wave ratio, Impedance matching, types of wave and propagation, Quarter wave transformer

4.2.4 **Transmission lines**

Transmission line equation, Input impedance, reflection coefficient, standing wave ratio, impedance matching

4.2.5 **Wave guides:** Rectangular wave guide, transverse electric mode, transverse magnetic mode

4.2.6 **Antennas:** Introduction to antenna, all antenna types and properties

4.3 **Digital Signal Processing**

4.3.1 **Introduction**

Basic elements of DSP, need for digital signal processing over analog signal processing, A/D and D/A conversion

4.3.2 **Discrete-time signals and system**

Elementary discrete-time signals, linearity, shift invariance, causality of discrete systems, LTI systems

4.3.3 **Z-Transform**

One side and two side transform, ROC, left sided, right sided and two sided sequence, properties of z-transform

4.3.4 **Discrete Fourier transform**

Definition and application, frequency domain sampling, properties of Discrete Fourier Transform

4.3.5 **Implementation of Discrete-time system**

Structures for FIR and IIR, direct form, cascaded and parallel form, lattice structure for FIR, frequency response

4.4 **Wireless Communications**

Radio frequency band, Propagation theory (groundwave, spacewave, tropospheric, ionospheric), Euler-Larmour theory, LOS (line of sight) and non-LOS model, Okumara and Hata model, Mobile Technologies (DECT, GSM, CDMA2000-1x and etc.), Fundamental of satellite communication (tracking, Satellite orbits and Radio spectrum, satellite wave propagation and satellite antennas), digital satellite communication system, earth stations, Kepler’s laws of orbital motion, signal to noise ratio, interference between different wireless systems. Antennas (Directional, Non-directional, reflective), impedance and effective length of antenna as transmitter & receiver, Radiation pattern, broad-side pattern, Endfire pattern, Pattern synthesis, satellite, satellite types, satellite communication

4.5 **Optical System**

Laser, Photocell, photo device (LED, CRT, photovoltaic, photo-multipliers, APD's PCN), Principle of optical communication, Total internal reflection, Snell's law, Chemical vapour Deposition, optical fibers types, capacity and properties, optical transmission, optical transmitters and receivers, interconnected and switched, Joining techniques, splices, connectors and coupling, fiber optics networks, optical switching, underground cabling (Route and ambient consideration, tension prediction)

यस पेशा सम्बन्धी विषयको पाठ्यक्रमका एकाईहरुबाट सोधिने प्रश्नहरुको संख्या निम्नानुसार हुनेछ ।

एकाइ नं. (Unit No.)	अङ्कभार (Weightage)	बहुवैकल्पिक प्रश्न (MCQs) को संख्या	छोटो उत्तर प्रश्नको संख्या	लामो उत्तर प्रश्नको संख्या
१	१५	५	६ प्रश्न X ५ अङ्क	३ प्रश्न X १० अङ्क
२	२५	१०		
३	२५	१०		
४	३५	१५		
जम्मा	**१००**	४० प्रश्न x १ अङ्क = ४० अङ्क	६ प्रश्न X ५ अङ्क = ३० अङ्क	३ प्रश्न X १० अङ्क = ३० अङ्क