चिलिमे जलविद्युत कम्पनी लिमिटेड

प्राविधिक सेवा, ईलेक्ट्रोनिक्स/कम्युनिकेसन समूह, तह-७, ईन्जिनियर पदको
प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

१. शैक्षिक योग्यताः चिलिमे जलविद्युत कम्पनी लिमिटेड कर्मचारी सेवा शर्त विनियमावली २०७१ मा व्यवस्था भए अनुसार ।

२. लिखित परीक्षाको बिषय, पूर्णाङ्क, परीक्षा प्रणाली, प्रश्न संख्या, अंकभार र समय निम्नानुसार हुनेछ ।

पत्र	विषय	परीक्षा प्रणाली		प्रश्न संख्या	प्रति प्रश्न अंकभार	पूर्णाक	समय
प्रथम	सेवा सम्बन्धि (प्रथम)	बस्तुगत बहुउत्तर		३०	०.५	१५	३० मिनेट
द्वितीय	सेवा सम्बन्धि (द्वितीय)	बिषयगत	लामो उत्तर	२	१०	७०	२ घण्टा ३० मिनेट
			छोटो उत्तर	१०	५		

३. बस्तुगत बहुउत्तर परीक्षा प्रणालीमा प्रत्येक पश्नका चार वटा सम्भाव्य उत्तर दिइने छ । प्रश्नको उत्तर लेख्दा केरमेट गरेको, दोहोरो लेखेको, सच्याएको, निर्दिष्ट स्थानभन्दा अन्यत्र लेखेको वा उत्तर नै सारेकोलाई गल्ती मानिनेछ ।

४. प्रत्येक गलत उत्तर वापत सो प्रश्न वापत पाउने अंकको ०.२ (बीस प्रतिशत २०%) का दरले सो बिषयमा पाएको कूल प्राप्तांकबाट घटाईनेछ ।

५. कालो/नीलो मसी मात्र भएको डटपेन/कलमले उत्तरको लागि निर्धारित कोठाका पश्नमा क,ख,ग,घ मध्ये एउटा मात्र सहि उत्तर स्पष्ट रूपले लेख्नुहोला । पेन्सिलले लेखेकोलाई मान्यता दिइने छैन ।

६. प्रथम र द्वितीयपत्रको परीक्षा २ पटक गरेर हुनेछ । प्रथम पत्रको परीक्षा सकिएपछि द्वितीयपत्रको परीक्षा तत्काल हुनेछ ।

७. द्वितीयपत्रको लिखित परीक्षाको माध्यम नेपाली वा अंग्रेजी भाषा हुनेछ ।

प्रथमपत्र - ईलेक्ट्रोनिक्स/कम्युनिकेसन (I)

Paper I:

1. Electric Circuit (0.5×4=2Marks)

elements of circuit, series and parallel circuits, Kirchoff's laws, single phase and three phase circuits, power and energy in AC circuits, Transfer functions, frequency response of networks, Fourier series transient and steady state response , Single phase and Polyphase AC power supply systems, Electrical motors, AC/DC generators, Rectifiers and filters, Regulator power supply system, Uninterruptible Power Supply Systems.

2. Electronics Circuits and semiconductor devices (0.5×4=2 Marks)

Diodes (Tunnel, varactor, zener, diac, Triac, bridge, Impatt, Gunn, photo) and applications, Bipolar transistors switching characteristics, unijunction transistor, MOS transistors switching characteristics, SCR, UJT, TTL logic circuits, NMOS/CMOS logic circuits, memory: RAM, DRAM, PROM, EPROM, operational amplifiers, Butterworth and Chebysev filters, A/D converters, adders, arithmetic operations, digital comparators, parity check generator, multiplexer and demultiplexer, flip-flops, shift register, counters, sequence generators, oscillators(wien bridge oscillators, tuned, LC oscillators, crystal, clap modification), resosant circuits, thyristor, controlled

rectifier circuits, 7 segment display, amplifier (Untuned, push-pull, feedback amplifiers, Klystron, Magetrons) bode plot analysis, Emitter, clipper, collector, clamper circuits

Semiconductor Materials: Intrinsic and extrinsic semiconductor, impurities, doping, p & n type semiconductor, majority and minority charge carriers, theory of PN junction

Semiconductor Devices: Diodes (PN junction diode, zener diode, LED, photo diode, tunnel diode, varactor diode, schottky diode), Bipolar transistors and its configurations, Field effect transistor, switching circuits-TTL, MOSFET, NMOS.

3. Digital Logic and Digital Electronics (0.5×3=1.5 Marks)

Digital and Analog Systems, Number Systems, Logic gates, Combinational Logic and Sequential Logic, Arithmetic Circuits, MSI Logic circuits, Counters and Registers, IC logic families, interfacing with Analog Devices, Memory Devices, Bipolar Transistor switching characteristics, MOS transistor switching characteristics, Bipolar transistor logic circuits, NMOS family of logic circuits, CMOS family of logic circuits.

4. Communication System (0.5×6=3 Marks)

Analog Communication: Modulation, theory and generation of AM, DSB-SC, SSB, FM and PM, Comparison between AM, FM and PM; AM, FM and PM transmitters/receivers, superheterodyne receiver, IF and RF amplifiers, automatic gain control(AGC), balance slope detector, phase discriminator, ratio detector, FM stereo principle, equalizers, noise in analog communication systems.

Digital Communication: Advantages and disadvantages of digital communications, principle of PAM, PWM,PPM and PCM, OOK, PSK, DPSK, Four phase PSK, FSK and QAM techniques, noise in digital communication systems.

Optical Fiber communication: Advantages and disadvantages of optical transmission, optical spectrum, types of optical fibre cable, attenuation in optical fibre cable, joining of fibres-mechanical coupling and fusion splicing, laser diodes, photodiodes, attenuation measurements, operation and line supervision

Power Line Carrier Communication (PLCC): General theory, transmission channels, frequency range, modulation techniques, carrier frequency generation, transmitting amplifier, pilot channel, demodulation, HF filter tuning, line equalization,

Microwave communication: Microwave transmission and reception, micro triodes, clystrons, magnetrons.

Wireless Communication:

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, Eudfire pattern, Pattern synthesis

5. Signal analysis and processing (0.5×3=1.5 Marks)

Discrete probability theory, Information theory, Shannon-Hartley law, transmission of signal, impulse response and convolution, Fourier series, Fourier transform, unit step, delta, sinc and signum function, helbert transform, LTI system, system described by differential and difference equations, FIR and IIR filters, discrete Fourier transforms, IDFT, FFT, Parseval's theorem, energy, power and autocorrelation, Z transform.

6. Electromagnetic fields, transmission lines and Antennas (0.5×4=2 Marks)

Electromagnetic fields: Electrostatic fields in free space, Gauss's law in integral form and applications, Wave equations -polarization, wave impedance, skin effect, reflection and refraction at the interface between two media, standing wave ratio, Impedance matching, quarter wave transformer.

Transmission lines: Principles, fundamentals of transmission lines, characteristics impendence, types of Transmission lines, equivalent diagram of T.L., matched and mismatched of Transmission lines, losses in Transmission lines, standing waves, Power and signal transmission capability of lines.

Waveguides and resonators: Theory and operation of waveguide, parallel plane, rectangular, circular, ridged and flexible wave guides, waveguide coupling, matching and attenuation, theory and operation of resonator.

Antennas: types, antenna gain, antenna resistance, bandwidth, beam width, polarization, directivity, effect of antenna height, dipole, dipole arrays, folded dipole, yagi, parabolic, horn, helical, discone and loop antennas, propagation in the radio frequency spectrum.

7. Computer System and Network (0.5×3=1.5 Marks)

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), RISC and CISC, assembly language programming, I/O and interrupt servicing, Multiplexing, (time, frequency and code division multiplexing), Data communication , 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)

8. Instrumentation and control (0.5×3=1.5 Marks)

Applied electronics: Voltage summing, Voltage buffer, switched mode power supply(SMPS), Inverters, choppers, diode, thyristors, triac, controlled rectifier circuit, Darlington pair, wave shaping circuits, active filters, phase lock loops.

Instrumentation: Instrumentation system, Theory of measurement-static performance, accuracy, precision, sensitivity, resolution and linearity, dynamic performance, response time, frequency response, bandwidth and errors in measurements.

Measurement transducers: Temperature, light level, strain and displacement, acceleration, pressure, force, velocity, magnetic field measurement.

Digital to analog conversions and vice versa.

Output devices: Indicators, meters, strip chart recorder, magnetic tape recorders

Component modeling and linearization: Differential equations and transfer functions, state space formulation, fluid, fluidic and thermal system components, linearized approximation of non-linear characteristics.

System transfer functions and response: Combinations of components to physical systems, system reductions, Laplace transform steady state equilibrium system.

Stability: characteristic equation, complex plane interpretation of stability, root locations and stability, root locus method, frequency response method, performance specifications for control system

दोश्रोपत्र - ईलेक्ट्रोनिक्स/कम्युनिकेसन (II)

1. Electric Circuit (5 Marks)

elements of circuit, series and parallel circuits, Kirchoff's laws, single phase and three phase circuits, power and energy in AC circuits, Transfer functions, frequency response of networks, Fourier series transient and steady state response , Single phase and Polyphase AC power supply systems, Electrical motors, AC/DC generators, Rectifiers and filters, Regulator power supply system, Uninterruptible Power Supply Systems.

2. Electronics Circuits and semiconductor devices (10 Marks)

 Diodes (Tunnel, varactor, zener, diac, Triac, bridge, Impatt, Gunn, photo) and applications, Bipolar transistors switching characteristics, unijunction transistor, MOS transistors switching characteristics, SCR, UJT, TTL logic circuits, NMOS/CMOS logic circuits, memory: RAM, DRAM, PROM, EPROM, operational amplifiers, Butterworth and Chebysev filters, A/D converters, adders, arithmetic operations, digital comparators, parity check generator, multiplexer and demultiplexer, flip-flops, shift register, counters, sequence generators, oscillators(wien bridge oscillators, tuned, LC oscillators, crystal, clap modification), resosant circuits, thyristor, controlled rectifier circuits, 7 segment display, amplifier (Untuned, push-pull, feedback amplifiers, Klystron, Magetrons) bode plot analysis, Emitter, clipper, collector, clamper circuits

Semiconductor Materials: Intrinsic and extrinsic semiconductor, impurities, doping, p & n type semiconductor, majority and minority charge carriers, theory of PN junction

Semiconductor Devices: Diodes (PN junction diode, zener diode, LED, photo diode, tunnel diode, varactor diode, schottky diode), Bipolar transistors and its configurations, Field effect transistor, switching circuits-TTL, MOSFET, NMOS.

3. Digital Logic and Digital Electronics (5 Marks)

Digital and Analog Systems, Number Systems, Logic gates, Combinational Logic and Sequential Logic, Arithmetic Circuits, MSI Logic circuits, Counters and Registers, IC logic families, interfacing with Analog Devices, Memory Devices, Bipolar Transistor switching characteristics, MOS transistor switching characteristics, Bipolar transistor logic circuits, NMOS family of logic circuits, CMOS family of logic circuits.

4. Communication System (10 Marks)

Analog Communication: Modulation, theory and generation of AM, DSB-SC, SSB, FM and PM, Comparison between AM, FM and PM; AM, FM and PM transmitters/receivers, superheterodyne receiver, IF and RF amplifiers, automatic gain control(AGC), balance slope detector, phase discriminator, ratio detector, FM stereo principle, equalizers, noise in analog communication systems.

Digital Communication: Advantages and disadvantages of digital communications, principle of PAM, PWM,PPM and PCM, OOK, PSK, DPSK, Four phase PSK, FSK and QAM techniques, noise in digital communication systems.

Optical Fiber communication: Advantages and disadvantages of optical transmission, optical spectrum, types of optical fibre cable, attenuation in optical fibre cable, joining of fibres-mechanical coupling and fusion splicing, laser diodes, photodiodes, attenuation measurements, operation and line supervision

Power Line Carrier Communication (PLCC): General theory, transmission channels, frequency range, modulation techniques, carrier frequency generation, transmitting amplifier, pilot channel, demodulation, HF filter tuning, line equalization,

Microwave communication: Microwave transmission and reception, micro triodes, clystrons, magnetrons.

Wireless Communication:

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, Eudfire pattern, Pattern synthesis

5. Signal analysis and processing (5 Marks)

Discrete probability theory, Information theory, Shannon-Hartley law, transmission of signal, impulse response and convolution, Fourier series, Fourier transform, unit step, delta, sinc and signum function, helbert transform, LTI system, system described by differential and difference equations, FIR and IIR filters, discrete Fourier transforms, IDFT, FFT, Parseval's theorem, energy, power and autocorrelation, Z transform.

6. Electromagnetic fields, transmission lines and Antennas (10 Marks)

Electromagnetic fields: Electrostatic fields in free space, Gauss's law in integral form and applications, Wave equations -polarization, wave impedance, skin effect, reflection and refraction at the interface between two media, standing wave ratio, Impedance matching, quarter wave transformer.

Transmission lines: Principles, fundamentals of transmission lines, characteristics impendence, types of Transmission lines, equivalent diagram of T.L., matched and mismatched of Transmission lines, losses in Transmission lines, standing waves, Power and signal transmission capability of lines.

Waveguides and resonators: Theory and operation of waveguide, parallel plane, rectangular, circular, ridged and flexible wave guides, waveguide coupling, matching and attenuation, theory and operation of resonator.

Antennas: types, antenna gain, antenna resistance, bandwidth, beam width, polarization, directivity, effect of antenna height, dipole, dipole arrays, folded dipole, yagi, parabolic, horn, helical, discone and loop antennas, propagation in the radio frequency spectrum.

7. Computer System and Network (5 Marks)

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), RISC and CISC, assembly language programming, I/O and interrupt servicing, Multiplexing, (time, frequency and code division multiplexing), Data communication , 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)

8. Instrumentation and control (5 Marks)

Applied electronics: Voltage summing, Voltage buffer, switched mode power supply(SMPS), Inverters, choppers, diode, thyristors, triac, controlled rectifier circuit, Darlington pair, wave shaping circuits, active filters, phase lock loops.

Instrumentation: Instrumentation system, Theory of measurement-static performance, accuracy, precision, sensitivity, resolution and linearity, dynamic performance, response time, frequency response, bandwidth and errors in measurements.

Measurement transducers: Temperature, light level, strain and displacement, acceleration, pressure, force, velocity, magnetic field measurement.

Digital to analog conversions and vice versa.

Output devices: Indicators, meters, strip chart recorder, magnetic tape recorders

Component modeling and linearization: Differential equations and transfer functions, state space formulation, fluid, fluidic and thermal system components, linearized approximation of non-linear characteristics.

System transfer functions and response: Combinations of components to physical systems, system reductions, Laplace transform steady state equilibrium system.

Stability: characteristic equation, complex plane interpretation of stability, root locations and stability, root locus method, frequency response method, performance specifications for control system

9. Engineering economics and financial analysis (5 Marks)

Essential business and accounting terminology: Cost classification and analysis, Interest and time value of money, demand analysis and sales forecasting tariff structure; methods of economic / financial analysis, investment decision, interest and time value of money.

Basic Methodology of Engineering Economics studies: Cost benefit analysis, risk analysis, investment decision, Internal rate of return, net present worth, payback period.

10. Electronic Construction and Safety Engineering (5 Marks)

Prototyping methods: Breadboards, PC prototyping boards

Printed Circuits: PC board fabrication, PC board designs, CAD/CAM

Safety and Precautions: Safety rules and regulations, storage and handling of Explosives, compressed gases and flammable substances, safety and precautions in case of hazards

Earthing and shielding techniques: Fire hazards, firefighting techniques and equipment

Noise Hazards: Sources of Noise, control Noise and its effect on health, first aid requirements for after the event treatment.

11. Institutional Knowledge (5 Marks)

a) Knowledge about of Nepal Electricity authority, Chilime Hydropower Company Ltd, Its organizational structure and functions.

b) Knowledge of various power plants of Nepal, their types, salient features and their geographical locations

c) Knowledge on Nepalese power transmission system, voltage levels and lengths, export-import links for power exchange with India.

✡