Far Western University

Service Commission

Syllabus 2081

Special Internal Competition for the Post of Lecturer

Subject: Electronics and Communication Engineering **Full Marks 50**

Paper: II **Time: 2 hrs**

This paper will include questions to assess the subject-specific or content knowledge of the candidates. Questions will be asked from the following content areas that are covered in the curricula of the Bachelor's and Master's degree programs.The distribution of questions will be as follows:

1) Long Answer Questions – 3 questions x 10 Marks = 30 Marks
2) Short Answer Questions – 2 Questions x 10 Marks = 20 Marks (Each short answer question will have 2 questions with 5 marks each)

.No.	Themes	Sub Themes
1.	**Basics of Electrical Fundamentals**	Conducting and insulating materials. Series and parallel electric circuits, linear and non-linear circuit, active and passive circuits Network theorems: understanding and application of superposition theorem, Thevenin`s theorem, Norton`s theorem, maximum power transfer theorem Magnetic circuits: Flux linkage, inductance and energy; magnetic materials and their properties; magnetically induced emf and force Alternating current fundamentals: Principle of generation of alternating voltages and currents and their equations and waveforms, average, peak and rms values, Analysis of R-L, R-C, R-L-C circuits, resonance in AC series and parallel circuit, active and reactive power, power factor
2.	**Power Supply System**	Single phase and three phase AC power supply systems, AC/DC generators, Rectifiers and filters, regulated power supply system, uninterruptible power supply systems, Characteristics of conventional and Lithium Ion batteries, Renewable Energy (Fundamentals of solar, wind, hydro)
3.	**Electronic Device And Circuit**	Diodes (Tunnel, varactor, zener, diac, Triac, bridge, Impatt, Gunn, photo) and applications, Bipolar transistors switching characteristics, unijunction transistor, MOS transistors switching characteristics, SCRs 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, thyristor, controlled rectifier circuits, seven segment display Amplifiers (Classes, IF, RF, tuned, feedback amplifiers, Klystrons, Magnetrons),clipper circuits Oscillators circuits (crystal controlled, wien bridge oscillators, tuned, LC oscillators, resonant circuit controlled, high frequency oscillators, RC oscillators,)

		Transducers (microphones, speakers, strain gauges, piezoelectric, light and heat sensors)
4.	**Wave Propogation**	Layers (D, E, F1, F2, F),Ionospheric wave propagation, tropospheric propagation, scatter propagation, refraction Electromagnetic Waves (LW, MW, SW, VHF, UHF, SHF), propagation characteristics, LOS (line of sight) communication Fading of radio waves, transmission equations, multipath techniques, time and frequency dispersive parameters, doppler effect in radio communication Indoor and outdoor propagation of radio waves specific to cellular communication Diversity and Equalization techniques in radio communication Traffic in communication systems, Erlang measurement)
5.	**Antennas and Transmission Lines**	Elementary Antennas (Radiation Resistance, Dipole, Marconi, half wave and quarter Wave) Antennas used in SW bands (Rhombic, Log Periodic, radiation patterns) Antennas used in VHF, UHF and SHF bands (Yagi-Uda,Cassgrain/Parabolic, radiation patterns) Transmission Lines (Types, characteristics, resonant, non-resonant, losses, applications) Wave Guides (Types, propagation, termination and attenuation, couplers, coupling waveguide energy, microstrip and stripline) Maxwell's first equation and application, divergence theorem, energy and potential, Fourier series and transform, Laplace equation and Poisson equation, ampere's circuital law, curl, wave motion in free space, perfect dielectric and losses,)
6.	**Antennas and Transmission Lines**	Elementary Antennas (Radiation Resistance, Dipole, Marconi, half wave and quarter Wave) Antennas used in SW bands (Rhombic, Log Periodic, radiation patterns) Antennas used in VHF, UHF and SHF bands (Yagi-Uda,Cassgrain/Parabolic, radiation patterns) Transmission Lines (Types, characteristics, resonant, non-resonant, losses, applications) Wave Guides (Types, propagation, termination and attenuation, couplers, coupling waveguide energy, microstrip and stripline) Maxwell's first equation and application, divergence theorem, energy and potential, Fourier series and transform, Laplace equation and Poisson equation, ampere's circuital law, curl, wave motion in free space, perfect dielectric and losses,)
6.	**Communication Systems**	Modulation Systems (AM, SSB, FM (limiters, discriminators, phase-locked loop)), PM Communication Techniques (frequency conversion, frequency synthesis, demodulators, facsimile, cellular, spectrum and spectrum analyzer) Digital Communication (sampling theorem, quantizer, error detection and correction, Parity che, coding, code transmission, PWM, PCM/ADPCM,, delta modulation, digital data, Shannon's information theory and channel capacity) Noises (atmospheric, thermal, partition, white noise, Gaussian noise, signal noise ratio), noise performance of AM and FM receiver, figure of merit Digital Modulation (ASK/PSK/QPSK/MSK/QAM/CDMA/ FDMA/DSSS), pulse modulation, modulation and demodulation circuits, Frequency hopping, frequency converter and mixers, bit error rate of receivers. Advance Communication Systems (Difference between wire communications and radio communication, signal and noise measurements, echo and singing, space/time/frequency /wave length division, multiplexing
7.	**Satellite Communication**	Working principles, frequency spectrum, uplink and downlink, satellite orbits, random systems, station keeping systems

	System	Characteristics of the satellite systems, method of modulation, noise consideration in satellite systems, system noise allocation, noise margins Satellite system performance, direct satellite broadcasting system), packet broadcasting, Satellites orbits, footprint, coverage of remote are through satellites Satellite power systems, 24 hour solar radiation, satellite photovoltaic modules and energy storage systems Affordability, reliability of satellite systems, satellite cost and benefit analysis
8.	**Information and Communication Technology**	Computer architecture, microprocessor fundamental, microcomputer systems Parallel and serial interfaces, RS-232 standards, flow charts, algorithms, variables, constants, data types, Arithmetic expressions, arrays, concept of operating system, basic concept on internet, e-mail and web-page (such as DNS, IP, URL, http, ftp, IRQ, Routers). Server (web, email, printer), general concept of cyber security (digital signature, SPAM, VIRUS, WORM, hiking, cracking) Basic concept on internet, e-mail and web-page (such as DNS, IP, URL, http, ftp, IRQ, Routers), general concept of cyber security (SPAM, VIRUS, WORM, hiking, cracking) Aviation Electronics (terrestrial and satellite navigation systems, landing systems), Surveillance systems (RADARS, Navigation aid systems)
9.	**Radio Mass Communication Systems**	Broadcasting Systems (audio), (different types, audio bandwidth, index of modulation, recording, mixer and applications) Radio studio equipment (architectural acoustics, sound intensity, reverberation time, absorption of sound, special microphones) Television broadcasting systems (different types, video system and composite video signal, video bandwidth, scanning, HDTV, recording, mixer, applications) Television broadcasting studio equipment (lighting, architectural acoustics, sound intensity, reverberation time, absorption of sound, special microphones, video cameras) Power systems used in broadcasting systems (diesel generators, single phase and three phase AC supply) Applications of renewable energy sources (hydro, wind, solar) for powering radio stations in remote areas
10.	**Project Planning, Design, And Implementation**	Project scheduling and management – project classifications; project life cycle phases; project planning process; project scheduling (bar chart, CPM, PERT); resources levelling and smoothing; monitoring/evaluation/controlling; Project management information system; project risk analysis and management; project financing, tender and its process, and contract management Engineering professional practice – environment and society; professional ethics; regulatory environment; contemporary issues and problems in engineering;

Model Questions:

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Post: Lecturer **Time 2hrs**

Paper: II

Attempt all questions

Long Answer Questions: 3 x 10 Marks = 30 Marks

1. **Explain with verifiable examples why telecommunication services are so important for National security? What needs to be done so that Telecom Companies make more profit by providing good quality services to people?**
2. **Differentiate between the satellite and terrestrial communication systems. Which one is more reliable and cost effective?**
3. **Which logic gate is known as a universal logic gate? Show how it can be realized using electronic circuit components.**

Short Answer Questions: 2 x 10 Marks = 20 Marks (5 Marsk each)

4. **a. Show how an email sent from a location in Kathmandu reaches a location in the USA. How much energy is used in doing so?**

   b. How does echo occur in transmission line network? How can it be suppressed?

5. **a. What is the main principle of parabolic Antenna? Where is it used?**

   b. Which source of energy is generally used to power BTS installed in remote areas? Why is this source better than other similar sources?

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Special Internal Competition for the Post of Lecturer
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1.	**Construction Materials and Concrete Technology**	Properties and uses of building materials: stones, bricks, ceramics, metals, timber and wood products Asphalt, paints, varnishes, polymers, and modern construction materials **Constituents and properties of concrete** Concrete mix design principles and methods Testing of concrete (fresh and hardened) Mixing, transportation, placing, compaction, and curing of concrete Admixtures and their applications High-strength and special concretes
2.	**Soil Mechanics and Foundation Engineering**	Soil formation, classification, and index properties Engineering properties of soils and soil parameters Permeability, seepage, and flow through soils Compaction and consolidation of soils Laboratory and field testing of soils Bearing capacity of soils Shallow foundations: types and design concepts Introduction to deep foundations
3.	**Structural Analysis**	Stresses and strains Moment of inertia and centroid Theory of flexure and torsion Shear force, bending moment, and deflection of beams and frames Energy methods and virtual work method Three-hinged structures Indeterminate structures Slope deflection method and moment distribution method Influence line diagrams for statically determinate structures
4.	**Design of Reinforced Concrete, Steel, and Timber Structures**	Design philosophy of reinforced concrete structures Analysis and design of RC beams and slabs (bending, shear, deflection) Bond stress and anchorage Design of axially loaded columns Isolated and combined footing design Steel structures: standard and built-up sections

		Design of bolted and welded connections Design of tension members, compression members, columns, and column bases Timber structures: properties of timber, stresses, and design of beams and columns
5.	**Engineering Surveying and Geomatics**	Principles of surveying and linear measurements Errors and corrections in chain and tape measurements Compass and plane table surveying Leveling: principles, adjustments, benchmarks, booking, and reductions Longitudinal and cross-sections Contouring: characteristics and methods Theodolite traversing and traverse adjustment Computation of coordinates and closing errors Total station survey Photogrammetric and modern surveying techniques
6.	**Building Technology and Construction Practices**	Components of buildings and their functions Building planning principles and structural considerations Building construction practices in Nepal Indigenous construction technologies Local and modern construction materials used in Nepal Strength, durability, and serviceability considerations Seismic and climatic considerations in building construction
7.	**Construction Management, Estimating, Economics, and Professional Practice**	Construction planning and scheduling Types of contracts and contractual procedures Tendering process and bidding documents Contractor prequalification and tender evaluation Dispute resolution and contract administration Material management and procurement Cost control and quality control Occupational health and safety Project monitoring, evaluation, and quality assurance plans Estimating, costing, valuation, and specifications Engineering economics: time value of money, IRR, NPV, benefit–cost analysis Professional ethics and code of conduct Nepal Engineering Council Act and regulations Public procurement practices in Nepal
8.	**Transportation Engineering**	Transportation systems and classification Road transport system in Nepal Road classification (NRS, IRC) Feasibility studies of road projects Geometric design of highways Road drainage systems Hill road engineering: alignment, hairpin bends, bioengineering Pavement types and components Road maintenance, repair, and rehabilitation Low-cost road construction Suspended and suspension bridges in Nepal

9.	**Water Supply, Sanitation, and Environmental Engineering**	Rural and community-based water supply systems Surface and groundwater sources Water demand estimation and quality standards Water treatment processes Intakes, reservoirs, transmission, and distribution systems Pipe materials, fittings, and pipeline design Operation and maintenance of water supply systems Sanitation systems: on-site and sewerage systems Wastewater treatment and disposal Solid waste management: collection, transportation, disposal Sanitary landfill, composting, and incineration Environmental health engineering and epidemiology Pathogens and waterborne diseases
10	**Energy Systems, Irrigation, and Advanced Geotechnical Engineering**	Hydrological studies for water resources projects Planning and design of small hydropower projects Hydraulic structures: dams, spillways, surge tanks, stilling basins River diversion and river training works Alternative and renewable energy systems in Nepal Irrigation development status in Nepal Methods and suitability of irrigation Design of irrigation canals Operation and management of irrigation systems Farmer-managed irrigation systems Flood control and mitigation measures Water logging problems and remedies Advanced geotechnical engineering: soil exploration, in-situ tests Retaining walls, piles, well foundations Ground improvement techniques Slope stability and soil–structure interaction

Model Questions

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Post: Lecturer **Time 2hrs**
Paper: II

Attempt all questions

Long Answer Questions: 3 x 10 Marks = 30 Marks)

1. Explain the criteria for selecting aggregates and stones for concrete works in building construction. Discuss common defects in aggregates, including alkali–aggregate reaction, and explain methods for its detection and prevention.

2. You are assigned to assess traffic conditions at major road intersections of an urban municipality. Explain the methods of selecting survey locations, traffic data collection techniques, and traffic analysis. Present hypothetical data and analyze the results to suggest improvements.

3. Draw the shear force diagram and bending moment diagram for a simply supported beam subjected to a uniformly distributed load and a point load. Explain the significance of these diagrams in structural design.

Short Answer Questions: 2 x 10 Marks = 20 Marks (5 Marsk each)

4,a Explain the use of modern surveying equipment (such as Total Station, GPS, and Drone Survey) in road alignment surveys.

4.b Mention the major geometric parameters to be considered in hill road design.

5.a List the major components of a good urban sewerage system and briefly explain their functions.

5.b Explain the potential of major renewable energy sources in the Far Western Province of Nepal.