LATERAL ENTRY ENTRANCE EXAMINATION SYLLABUS

for

B.Tech Electronics & Communication Engineering

INSTRUCTIONS

There will be two papers as per details given below:

A. **PAPER A- GENERAL**:

This shall be a common paper for all streams. This shall consist of objective type questions from Physics & Mathematics taught at the Ist& 2nd semester level of B.Tech. at Islamic University of Science & Technology.

B. **PAPER B- ELECTRONICS & COMMUNICATION ENGINEERING:**

This shall consist of objective type questions from the core branches of Electronics and Communication Engineering.

SYLLABUS

PAPER A

Mathematics-I

Introduction to differential calculus, Leibnitz's Theorem for n^{th} derivative, Taylor's theorem, Tangent and Normal, Partial Differentiation, Euler's theorem, Double points, asymptotes, curvature and tracing of curves. Limit, continuity and differentiability of functions of several variables, chain rule, Jacobi theorem.

Taylor's theorem of one and two variables, extrema of functions, two or more variables using method of Lagrange's multipliers.

Ordinary differential equations, Ordinary differential equations reducible to exact differential equations, Linear differential equations, Linear differential equations and equations reducible to linear form.

Linear and Non-linear differential equation, linear differential equations of second and higher order with constant and variable coefficients, Simultaneous differential equation, Simultaneous differential equation of the form dx/P = dy/Q = dz/R , Applications of ordinary differential equations, Algebraic Equation, Elements of the theory of polynomial equations.

Fundamental theorem of Algebra, Relation between the roots and the coefficients of an equation, Solution of cubic & bi-quadratic equations

Mathematics II

Differential Equation: Partial differential equations of first order, langrage linear equation Standard form, Partial differential equation of second and higher order, Homogenous partial differential equations with constant coefficients, Non- homogenous linear differential equations. Applications of partial differential equations, vibration of stretched flexible string, heat flow equation. Wave equation, solutions by the method of separation of variables. Series solutions of ordinary differential equations

Fourier series: Fourier Series, Integral Calculus**:** Differential under the sign of integration. Double and triple integrals, change of variables, Beta and Gamma functions

Matrices: Review of algebra of matrices, partitioning of Matrices, skew and skew-Hermitian Matrices. Orthogonal and unitary matrices, Triangular matrices, Rank of a matrix. Equivalent matrices, elementary transformations, Inverse of matrix and solution of simultaneous equation by elementary operation. Normal form, Eigen values, and eigen vectors of a matrix. Caley-Hamilton theorem,

Physics-I

Vector Analysis, Rotation of coordinate axis and transformation of vectors, Gradient of scalar field, divergence and curl of vector field in Cartesians, spherical polar and cylindrical coordinate systems, Gauss's divergence theorem, Stokes's theorem, Green's theorem, successive application of del (Δ)operator, vector identities, problems of these concepts

Collision of particles, Conservative and non-conservative forces, elastics and inelastic scattering, frames of references, laboratory and center of mass system, kinematics of elastics scattering in laboratory system, application of conservation theorem in solving collision and scattering problems.

Vibration and Acoustics, Differential equation of simple harmonic motion, energy of simple harmonic oscillator, damped harmonic motion, energy dissipation, forced oscillations, amplitude and velocity resonance, sharpness of resonance, energy consideration in forced oscillations, acoustic of buildings, applications

Electromagnetic Theory: Coulombs law and Gauss's theorem, calculation of electric field and potential, divergence and curl of electric field and potential, Biot -Savart's law, Ampere's theorem, divergence and curl of magnetic field, Faraday's law,

Maxwell's equation, electromagnetic wave equation in free space, its solution in one dimension and discussion, energy and momentum in electromagnetic wave, Laplace and Poisson's equations, Introduction to plasma: Debye shielding, plasma parameter, plasma frequency, collision in plasma, problems

Physics II

Quantum Mechanics & Statistical Physics: De-Broglie Hypothesis, Davison Germer experiment, wave function and its properties, expectation value, Wave Packet, Normalisation factor, Uncertainty principle. Schrödinger Equation for free Particle, Time Dependent Schrödinger Equation, Tunnelling effect, Qualitative Features of Maxwell Boltzman, Bose-Einstein and Fermi-Dirac statistics distribution, functions & their comparison (no derivation)

Solid State physics: Formation of energy bands in metals, semiconductors and insulators; intrinsic and extrinsic semiconductors, Fermi energy levels for doped, undoped semiconductors and p-n junction; Tunnel diode, Zener diode.

Superconductivity: Meissner Effect, Type I and Type II Superconductors, BCS theory (Qualitative only), London's equation, properties of superconductors & applications, elementary idea of Nanotechnology.

Interference of Light & Diffraction: Interference due to division of wave front and division of amplitude, Young's double slit experiment, Interference, Principle of Superposition, Theory of Biprism, and Interference from parallel thin films, Newton rings, and Michelson interferometer.

Diffraction: Fresnel Diffraction, Diffraction at a straight edge, Fraunhoffer diffraction due to N slits, Diffraction grating, dispersive power of Grating.

Special theory of Relativity and Nuclear & Particle Physics: Frames of reference, Michelson-Morley experiment, Basic postulates of special theory of relativity, Length contraction, time dilatation, Time-energy relation, Nuclear Mass & Size, Constituents of the Nucleus,Concept of Binding Energy, Fission & Fusion, α, β & γ –decay, Elementary idea of Nuclear Models, Classification and properties of Elementary particles, Exact conservation laws, Fundamental interactions, Quark model.

Lasers*:* Introduction, Principle of laser, Stimulated and spontaneous emission, Population inversion, Einstein coefficients, optical pumping, Resonant Cavity and its modes, He-Ne Laser, Ruby Laser, Semiconductor Lasers, Applications of Lasers.

PAPER B

Basic Electrical Engineering

Electric Circuits Laws: Basic electric circuit terminology, Ohm's law, Kirchhoff's current law (KCL) and Kirchhoff's Voltage law (KVL) , circuit parameters (resistance, Inductance and capacitance), series and parallel combinations of resistance, Inductance and capacitance , Nodal analysis. Energy Source, Ideal and Practical voltage and current sources and their transformation, Dependent voltage sources and dependent current sources, D.C. Circuit Analysis,Power and energy relations, Analysis of series and parallel d.c. circuits, Loop and Nodal methods of circuit analysis, Thevenin's and Norton's theorems, maximum Power theorem, Superposition theorem

Steady State A.C three phases Circuits: Delta - star (Y) Transformation, Concept of a 3-phase voltage, wye (Y) circuits. Delta (Δ) circuits, Current and voltage relations in Y and Δ Circuits, Characteristics of a 3 -phase system. Magnetically Coupled circuits, Mutual inductance, theory of magnetic circuits and electromagnetism, Transformers

Basics of Electronics

Introduction to Semiconductors: p and n types, transport mechanism of charge carriers, electric properties, Hall effect etc. Electronic Devices, their characteristics and applications.

PN junction diode: current components in p-n junctions, characteristics-piecewise linear approximation, temperature dependence, diode resistance, diode capacitance, switching times, circuits etc, basic operation of zener diode, avalanche breakdown diode, schottky diodes, tunnel diode, Rectifiers (Half wave rectifier, Full wave rectifier: CT & Bridge type), filters (pie and T), clippers, clampers, peak detector, sampling gate, voltage multipliers.

Special semiconductor devices: TRIAC, DIAC, SCR, UJT, Photodiode, Phototransistor, LCD, LED, MOS, VMOS, Solar cells, Photoconductive cell, Cathode Ray Oscilloscope: Basic operation and measurement applications

Electronic Devices and Circuits

BJT and JFET's: operation and characteristics, models, application as low and high frequency amplifiers, MOSFET types, operation and characteristics, biasing and h-parameter model

Feedback: Feedback Basics, negative feedback, effect of negative feedback on the performance of amplifiers e.g., on bandwidth, types of feedback amplifiers, current-shunt, current-series, voltage-shunt and voltage series feedback, analysis of the feedback amplifier circuits, sinusoidal oscillators: basic operation, analysis of general oscillator circuits, barkhausen criterion, various types of oscillator circuits and their analysis: Hartley, Colpitts, Crystal, Phase shift, Wein bridge, design of practical oscillator circuits.

Power Amplifiers: classification of power amplifiers, Class A , Class B, Class AB and Class C power amplifiers, analysis and design, power supplies and IC regulators, Multivibrators: bi-stable, mono-stable and astable multivibrator circuits and their analysis, Wave form generators, triangular and square wave generators

Digital Electronics and Logic Design

Binary, octal, and hexa- decimal number systems, binary arithmetic, binary code, excess-3 code, gray code, error detection and correction codes. Boolean algebra: Postulates and theorems, logic functions, minimization of Boolean functions using algebraic, Karnaugh map and Quine – McClausky methods, realization using logic gates.

Combinational Circuits: Introduction to combinational circuits, realization of basic combinational functions like Adder, Subtractor, Encoder/Decoder, Multiplexer, Comparators, delays and hazards in combinational circuits, code converters.

Sequential Circuits: Flip-Flops: SR, JK, T, D, Master/Slave FF, triggering of FF, analysis of clocked sequential circuits-their design, state minimization, state assignment, circuit implementation, registers: shift registers, inter-conversion of shift registers, Ripple counters.

Communication System

Evolution, introduction and benefits of communication technology, Classification of signals (deterministic & non-deterministic signals, even & odd signals).

Amplitude modulation (AM): Modulation & Need for modulation, definition, AM modulation index, spectrum of AM signal, power analysis of AM signal, Standard AM generation, detection using envelop detector. DSB/SC-AM, Generation & detection of SSB-SC modulation. **Frequency modulation (FM):** Basic definition, Frequency modulation index, Carson Bandwidth of FM signal, Narrow band and broad band FM signal. Generation of FM, Detection of FM.

Receivers: Tuned radio frequency receiver, heterodyne receiver, image frequency, pre-emphasis, de-emphasis, Frequency division multiplexing (FDM).

Pulse modulation Techniques: Pulse Amplitude modulation (PAM), Pulse Position Modulation (PPM) Pulse Width Modulation (PWM).

SCHEME OF EXAMINATION

PAPER	A		B
SUBJECT	PHYSICS	MATHEMATICS	E&C Engineering
MARKS/NATURE OF PAPER	20 OBJECTIVE	20 OBJECTIVE	60 OBJECTIVE