

**SYLLABUS FOR GSAT-2012 ENTRANCE TEST**  
**For admission into**  
**M.Sc. ELECTRONICS SCIENCE OR M.Sc. PHYSICS**  
**(Test Code No: 102)**

**SECTION-A**

**(15 bits: 15 marks)**

**1. (a) RC and RL Circuits:** Transient response of RL and RC circuits with step input– time constants. Frequency response of RC and RL circuits – Types of Filters: Low pass filter – High pass filter – frequency response - Passive differentiating and integrating circuits. **Resonance:** Series resonance and parallel resonance RLC circuits – Resonant frequency – Q factor – Band width – Selectivity.

**OR**

**1. (b) Mechanics, Waves and Oscillations:**

Conservation of energy, Conservation linear momentum and Conservation of angular momentum, Kepler's laws, Simple harmonic oscillator and solution of the differential equation, Compound pendulum, Torsion pendulum, Damped harmonic oscillator, Resonance.

**2. (a) PN Junction:** Depletion region – Junction capacitance – Diode equation (no derivation) – Effect of temperature on reverse saturation current – construction, working, V-I characteristics and simple applications of i) Junction diode ii) Zener diode iii) Tunnel diode and iv) Varactor diode.

**OR**

**2. (b) Interference, Diffraction and Polarization:**

Interference: Coherence, Interference by division of wave front, Interference by division of amplitude, Newton's rings, Michelson's Interferometer, Diffraction: Fraunhofer diffraction-single slit, Diffraction grating. Polarization: Methods of Polarization, Phenomenon of double refraction, Nicol's prism.

**3. (a) Bipolar Junction Transistor (BJT):** PNP and NPN transistors–current components in BJT – BJT static characteristics (Input and Output) – Early effect- CB, CC,CE configurations (cut off, active, and saturation regions) CE configuration as two port network – h-parameters – h-parameter equivalent circuit. **UJT, SCR**

**OR**

**3. (b) Electrostatics, Dielectrics, Magnetostatics and Electromagnetic wave equation:**

Coulomb's law, Gauss's law, Capacitance of a parallel plate capacitor, Electrostatic energy of a charged capacitor, Relation between D, E and P, Dielectric constant and Electric susceptibility, Capacitor with a dielectric, Biot-savart's law, Divergence of B, Ampere's law, Solenoid, Hall effect., Faraday's law, Lenz's law, Time-varying magnetic field, Self-induction and mutual induction, Displacement current, Ampere's law in general form, Maxwell's equations, EM waves.

**SECTION-B**

**(20 bits: 20 marks)**

**4. (a) Rectifiers**– Halfwave, fullwave and bridge rectifiers- Efficiency- Ripple factor- regulation

**OR**

**4. (b) Steady currents and Alternative currents:**

Current density, Equation of continuity, Electrical conductivity and Ohm's law, Kirchhoff's laws, Thevenin's and Norton's theorems, Sinusoidal voltage and current amplitude, RMS value, Power factor, Reactance and Impedance, Inductive and capacitive reactance, Circuit with R and L and Circuit with R and C, Types of filters: low pass filter, high pass filter, Frequency response, LCR circuit, Q factor.

5. (a) **Feedback:** Positive and negative feedback- Effect of feedback on gain, band width, noise, input and output impedances.

**OR**

5. (b) **Modern Physics:**

Bohr's atomic theory, Sommerfield's elliptic orbit theory, Vector atom model, Pauli's exclusion principle, Stern and Gerlach experiment, Raman effect, De Broglie's concept of matter waves, Electron diffraction, Planck's quantum theory, Photoelectric effect, Compton effect, Heisenberg's uncertainty principle, Schrödinger's wave equation, properties of wave function..

6. (a) **Operational Amplifiers:** Differential amplifier- Block diagram of Op-Amp- Ideal characteristics of Op-Amp- Op-Amp parameters- Input resistance- Output resistance- Common mode rejection ratio (CMMR)- Slew rate- Offset voltages – Input bias current- Basic Op-Amp circuits- Inverting Op-Amp- Virtual ground- Non-inverting Op-Amp- Frequency response of Op-Amp.

**OR**

6. (b) **Nuclear Physics:**

Basic properties of the nucleus: size, charge and mass, Nuclear forces, Semiempirical mass formula, Nuclear stability, Alpha, Beta and Gamma rays, G.M counter and Cyclotron..

7. (a) **Communications:** Need for modulation-Types of modulation- Amplitude, Frequency and Phase modulation. Advantages of modulation

**OR**

7. (b) **Solid State Physics:**

Crystalline nature of matter, Crystal systems, Bravais lattices, Miller indices, Diffraction of X-rays, Band theory of solids , classification of matter on the basis of band theory, Semiconductors: P-Type and N-type semiconductors, Magnetic materials and their properties. Superconductivity: Meissner effect, Type-I and Type-II superconductors, isotope effect, energy gap. Spontaneous and Stimulated emission, Population inversion, He-Ne and Ruby lasers, Optical fiber, Principles of optical fiber communication.

## **SECTION-C**

**(25 bits: 25 marks)**

8. (a) **Digital Electronics:** Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables Universal building blocks NAND and NOR gates. Laws of Boolean algebra De Morgan's Theorems Simplification of Boolean expressions

**OR**

8 (b) **Digital Electronics:** Introduction to number systems, Logic gates OR, AND, NOT, X-OR, NAND, NOR gates - Truth tables Universal building blocks NAND and NOR gates. Laws of Boolean algebra De Morgan's Theorems Simplification of Boolean expressions

9. (a) **Combinational and Sequential circuits:** Multiplexer and De-Multiplexer – Decoder, Half adder, Full adder and Parallel adder circuits. Flip flops – RS, D, JK and JK Master-Slave Counters and Registers

**OR**

9. (b) **Diodes and Transistors:** Junction diode, Volt-Ampere characteristics, Rectifiers: Half, Full and Bridge rectifiers - Ripple factor, Capacitive and inductive filters, Zener diode and its characteristics, Transistors, Currents in a transistor, DC Alpha, CB, CC and CE configurations, Characteristics of CE configuration.

**10. (a) Introduction to Microprocessor:** Intel 8085 Microprocessor – central processing unit CPU – arithmetic and logic unit ALU – timing and control unit – register organization – address, data and control buses- pin configuration of 8085 and its description. Instruction set of 8085, instruction and data formats- classification of instructions – addressing modes

**OR**

**10. (b) Amplifiers, Oscillators and Modulation:**

Concept of an amplifier, classification of amplifiers, Oscillators, Modulation and detection: Amplitude modulation and Frequency modulation, Demodulation using diodes, Elementary principles of radio transmission and reception

## MODEL QUESTIONS

- Storage of 1 KB means the following number of bytes
  - 1000
  - 964
  - 1024
  - 1064
- What is the octal equivalent of the binary number: 10111101
  - 675
  - 275
  - 572
  - 573
- A NAND gate is called a universal logic element because
  - It is used by everybody
  - Any logic function can be realized by NAND gates alone
  - All the minimization techniques are applicable for optimum NAND gate realization
  - Many digital computers use NAND gates
- In a C-E configuration, an emitter resistor is used for
  - Stabilization
  - ac signal bypass
  - collector bias
  - higher gain
- The input/output relationship of the common-collector and common-base amplifiers is
  - 270 degrees
  - 180 degrees
  - 90 degrees
  - 0 degrees
- What is the angular momentum of the electron in the ground state of an atom?
  - $l=0$
  - $l=1$
  - $l=1/2$
  - None of the above
- For the X-ray diffraction through the crystal, the wavelength of incident radiation must be
  - $\sim 1\text{\AA}$
  - $>1\text{\AA}$
  - $< 1\text{\AA}$
  - None of the above
- Which of the following is true?
  - The mass of the stable nucleus is always less than the sum of the masses of its nucleons
  - The mass of the stable nucleus is always greater than the sum of the masses of its nucleons
  - The mass of the stable nucleus is equal the sum of the masses of its nucleons
  - None of the above
- The conductivity of semi conductor
  - increases with temperature
  - decreases with temperature
  - remains unchanged under any circumstances
  - becomes zero at absolute zero