PHYSICS Paper–B

(Electronics and Solid State Devices–II)

Time Allowed : Three Hours **Maximum Marks : 22**

Note : (i) Attempt **five** questions in all by selecting **two** questions from each Unit-I and II. Question No. 7 (Unit-III) is compulsory.

(ii) Use of non-programmable calculator is allowed.

UNIT–I

1. (a) Draw the structure of *p*-Channel depletion MOSFET and discuss its working in detail. Also draw its drain and transfer characteristics.

(b) A common source FET amplifier uses a.c. drain resistance r_d = 300 kΩ and amplification factor μ = 30. Compute the voltage gain and output impedance for a load resistance R_l = 300 KΩ. $3,1\frac{1}{2}$

2. (a) Explain with the help of a block diagram, the working principle of a feedback amplifier. Find the expression for the voltage gain with feedback.

(b) The overall gain of multistage amplifier is 160. When negative feedback is applied, the gain is reduced to 19.5. Find the fraction of the output that is feedback to the input. $3,1\frac{1}{2}$

3. (a) Draw the circuit diagram of Wein Bridge Oscillator. Explain the principle of its operation. Show that the amplifier used in it must have a gain greater that 3 for sustained oscillations.

(b) A Hartley oscillator has inductances of $L_1 = 300\ \mu H$ and $L_2 = 50\ \mu H$ and a capacitor of 100 pF in the tank circuit. If the mutual inductance of the coils is 30 μH, find the resonant frequency and feedback ratio. 3, 1½

UNIT–II

4. (a) Discuss the working of mono-stable multivibrator using IC 555. Derive the relation for its frequency and duty cycle.

   (b) Draw the block diagram of an Operational Amplifier. Discuss also the different stages of an OP-AMP. 2½, 2

5. (a) Give the circuit, truth table and logic symbol for NAND Gate.

   (b) Solve the given logical expression using Boolean algebra and draw the simplified circuit :

   $Y = AB + A(B + C) + B(B + C)$

   (c) Find the minterms and maxterms of the following expression :

   $f(ABCD) = \bar{A}(\bar{B} + D) + AC\bar{D}$ 1½, 1½, 1½

6. (a) Show that phase velocity of a plane electromagnetic wave in ionosphere is greater than the velocity of light in free space.

   (b) Calculate the power developed by an amplitude modulated wave in a load of 100 Ω when the peak voltage of carrier is 100 volts and the modulated factor is 0.4. 3, 1½

UNIT–III

(Compulsory Question)

7. Attempt any **eight** questions :

   (*a*) Convert the following binary number $(101.0101)_2$ to their decimal equivalent.

   (*b*) State Barkhausen Criterion for sustained oscillations.

   (*c*) Why OP-AMP is generally not used in open loop mode ?

   (*d*) What are the advantages of using phase shift oscillator ?

   (*e*) What is skip distance ?

   (*f*) Name the various modes of propagation of radio waves.

   (*g*) What types of oscillations is produced in tank circuit ?

   (*h*) What happens to the overall gain in positive feedback when $A\beta = 1$.

   (*i*) What are the advantages of FET ?

   (*j*) How will you produce OR gate using NAND gate ? $8 \times ½ = 4$