2018

PHYSICS

PHY 104

ELECTRONICS

Full Marks : 80

Time: 3 Hours

The figures in the margin indicates full marks for the questions

1. Answer the following questions 1x5=5

   (a) Choose the correct statement

   (i) MOSFET is a bipolar device.

   (ii) MOSFET is a unipolar device. 1

   (b) When the Fermi level lies in the conduction band, the semiconductor is known as_____. 1

   (c) How does the output of SR flip flop change when clock is 0? 1

   (d) What is SWR and what does it represents? 1

   (e) What is the maximum modulus of a 3-bit binary counter. 1

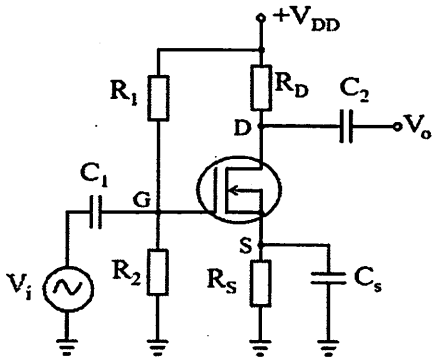
2. Answer the following questions 2x5=10

   (a) Explain why oxide layer is used in MOSFET. 2

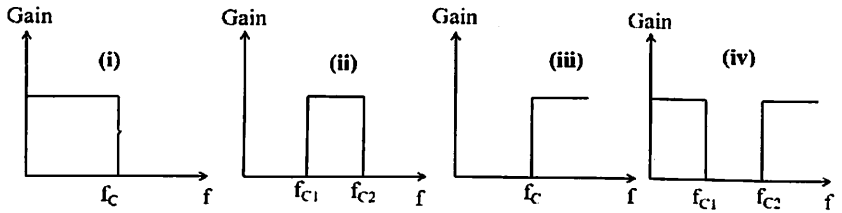
   (b) Design a phase shift oscillator for operation at frequency 1 kHz. 2

   (c) Explain how transconductance of D-MOSFET varies with drain current. 2

(d) Determine the gain of thefollowing amplifier 2



(e) Identify the types filter represented by following response curves. 2



3. Answer the following questions (any five) 5x5=25

(a) Draw a circuit diagram and obtain an expression for transfer function of first order Butterworth high pass (HP) filter and hence determine the cut-off frequency. 1+3+1

(b) Design a saw tooth wave generator using Opamp and describe the operation of the circuit. 1+4

(c) Express the following SOP expression into standard SOP form, map and simplify the expression using K-map.

$F = \overline{BC} + A\overline{B} + AB\overline{C} + A\overline{B}C\overline{D} + \overline{A}\overline{B}\overline{C}D + A\overline{B}CD$ 2+2+1

(d) Describe with band diagram how negative resistance occurs in tunnel diode. 5

(e) Describe the basic elements of a microprocessor. 5

(f) Design a circuit using Opamp to solve the following equations

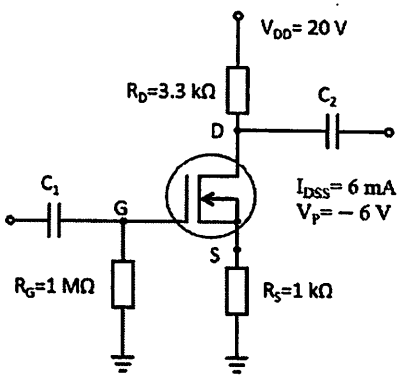
(i) $5\frac{d^2V}{dt^2} - 2\frac{dV}{dt} + 8V + 1 = 0$ $2^1/_2+2^1/_2$

(ii) $2x + 3y + 4z = 0$

$x + y + 5 = 0$

$x + y + z = 0$

(g) Sketch the transfer characteristics for the circuit given below. Setup Q-point and determine $V_{DS(Q)}$ and $V_{S(Q)}$. 3+2



4. Answer any four of the following questions 4x10=40

(a) Draw a labelled diagram of the basic structure of p-channel E-MOSFET and describe its operation. What is CMOS? Explain with circuit diagram how CMOS can be used as an inverter? 2+4+1+3

(b) Describe the operation of JK-flip flop with circuit diagram. What is D-flip flop? How D-flip flop is different from JK-flip flop? Describe how data is transferred to output in D-flip flop. 5+1+1+3

(c) Explain the three main phenomena involved in signal transmission? Describe how the voltage and current vary in a transmission line terminated by zero load. What is the value of SWR of such transmission line? 3+6+1

(d) What are the two basic functions of a register? Explain with circuit diagram how a four bit data (1010) are serially entered into and serially taken out of a 4-bit shift register. Develop and analyse the timing diagram for the register. 1+7+2

(e) Discuss the modulation index, side bands and energy distribution in amplitude modulation. Illustrate the frequency spectra of amplitude modulated wave graphically. 8+2

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