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10ELN15/25

First / Second Semester B.E. Degree Examination, June/July 2011
Basic Electronics

Time: 3 hrs.

Max. Marks:100

Note: 1. *Answer any FIVE full questions, choosing at least two from each part.*
      2. *Answer all objective type questions only in OMR sheet page 5 of the answer booklet.*
      3. *Answer to objective type questions on sheets other than OMR will not be valued.*

PART – A

1 **a.** Choose the correct answers for the following :
   i)   Forward voltage across a conducting silicon diode is
        A) 0.3V   B) 0.7V   C) –0.7V   D) –0.3V
   ii) Zener diode regulates only when it is connected in _____ mode.
        A) forward bias   B) reverse bias   C) short   D) open
   iii) I_{rms} for half wave rectifier is _____

$$\text{A) } \frac{I_m}{2} \qquad \text{B) } \frac{I_m}{\sqrt{2}} \qquad \text{C) } \frac{2 I_m}{\pi} \qquad \text{D) } \frac{I_m}{\pi}$$

   iv) Peak inverse voltage for bridge rectifier is

$$\text{A) } V_m \qquad \text{B) } 2V_m \qquad \text{C) } \frac{V_m}{2} \qquad \text{D) } \frac{V_m}{\sqrt{2}} \quad \textbf{(04 Marks)}$$

   b. Deduce the following for FWR :
       i) I_{rms} ii) I_{dc} iii) Ripple factor   iv) Efficiency of rectification.   **(08 Marks)**

   c. i)   Calculate the ripple voltage of a full wave rectifier with a 120 µf capacitor connected to
            a load and load current of 60 mA, frequency of 50 Hz.
        ii) If the peak voltage of the rectified wave is 60V, calculate the DC voltage.
        iii) Calculate the ripple factor.   **(08 Marks)**

2 **a.** Choose the correct answers for the following :
   i)   When a transistor is used as a switch, it works in the following region :
        A) active and cut-off   B) saturation and cut-off
        C) saturation and active   D) none of these
   ii) If the transistor amplifier has voltage gain of 100, if the input voltage is 15 mV, then
        the output voltage is
        A) 1.5V   B) 15V   C) 0.15V   D) 1.15V
   iii) The phase difference between input and output of an emitter follower is
        A) in-phase   B) out-of-phase   C) 90°   D) 45°
   iv) An amplifier is generally connected in _____ mode.
        A) saturation   B) cut-off   C) active   D) short **(04 Marks)**

   b. A transistor amplifier connected in CE mode has β = 100 and I_B = 50 µA. Compute the
       values of I_C, I_E and α.   **(06 Marks)**

   c. Draw a sketch to show the various currents in a NPN transistor and deduce the relationship
       between various components.   **(10 Marks)**

3 a. Choose the correct answers for the following :
  i) Which is the bias technique that is very widely used
     A) fixed   B) collector   C) emitter   D) voltage divider
  ii) Which transistor bias circuit has poor stability because its Q-point varies with β_{dc}?
     A) collector feedback   B) base
     C) voltage divide   D) emitter
  iii) Emitter follower is a _____.
     A) voltage amplifier   B) current amplifier
     C) attenuator   D) none of these
  iv) Emitter follower has an input of 1 volt, then its output voltage is _____.
     A) 0.5V   B) 10V   C) 1V   D) 5V   **(04 Marks)**
  b. Explain the concept of voltage divider bias technique using transistor. **(10 Marks)**
  c. A collector to base circuit has V_u = 24V, R_B = 180KΩ, R_C = 3.3KΩ and V_{CE} = 10V. Calculate h_{FE}, determine V_{CE} when a new transistor is replaced having h_{FE} = 120. **(06 Marks)**

4 a. Choose the correct answers for the following :
  i) The function of gate in SCR is to control the _____.
     A) flow of current   B) voltage regulation
     C) voltage amplification   D) none of these
  ii) η of UJT is known as _____ ratio.
     A) ON   B) pulse
     C) negative   D) intrinsic stand-off
  iii) The minimum point in V-I characteristic of UJT is known as _____ point.
     A) negative   B) valley   C) latching   D) firing
  iv) For a JFET, the value of V_{DS} at which I_D becomes essentially constant is the
     A) pinch-off voltage   B) cut-off voltage
     C) breakdown voltage   D) ohmic voltage   **(04 Marks)**
  b. Explain V-I characteristic of SCR. **(08 Marks)**
  c. Explain working principle of UJT. **(08 Marks)**

PART – B

5 a. Choose the correct answers for the following :
  i) Cut-off frequencies of an amplifier are also called as
     A) half power points   B) square points
     C) amplified points   D) none of these
  ii) The objective of using a crystal oscillator is to get
     A) DC   B) 50-70 Hz
     C) stable frequency   D) variable frequency
  iii) An oscillator uses
     A) negative feedback   B) +ve feedback
     C) +ve and –ve feedback   D) none of these
  iv) Which of the following oscillators is used to generate high frequencies?
     A) RC-phase shift   B) wien bride
     C) L-C oscillator   D) blocking oscillator   **(04 Marks)**
  b. Explain the working of RC coupled amplifier with its frequency response. **(08 Marks)**
  c. Explain Barkhauson criterion. **(02 Marks)**
  d. In a Hartley oscillator L_1 = 20 µH, L_2 = 2 mH and capacitor is variable. Find the range of C if frequency is varied from 1 MHz to 2.5 MHz. **(06 Marks)**

6 a. Choose the correct answers for the following :
   i) An ideal OP-AMP has
       A) infinite input impedance   B) infinite voltage gain
       C) zero output resistance   D) all of these
   ii) The differential amplifier has
       A) one input and one output   B) two inputs and two outputs
       C) two inputs and one output   D) one input and two outputs
   iii) An OP-AMP shorted between inverting terminal and output terminal is called
       A) adder   B) voltage follower   C) integrator   D) inverter
   iv) The voltage gain of an OP-AMP in the open loop condition is of the order of
       A) 10^1 B) 10^2 C) 10^4 D) 10^6 (04 Marks)
   b. Draw the following circuits using OP-AMP:
       i) adder   ii) voltage follower   iii) integrator   iv) differentiator   (08 Marks)
   c. Explain the working of CRT.   (08 Marks)

7 a. Choose the correct answers for the following :
   i) The two complement of $(1\ 0\ 0\ 1)_2$ is _____ .
       A) 1001   B) 0010   C) 0110   D) 1010
   ii) The decimal number 20 in hexadecimal code is
       A) 41   B) 14   C) 140   D) 410
   iii) The principle used to transmit the signal is
       A) modulation   B) de-modulation   C) amplification   D) attenuation
   iv) 9's complementation is used for _____ .
       A) addition   B) subtraction   C) multiplication   D) division
                                                                                  (04 Marks)
   b. Explain the working of super heterodyne receiver with a suitable block diagram.   (08 Marks)
   c. Perform the following :
       i) $(101010111100)_2 = (\ ?\ )_8 = (\ ?\ )_{16}$
       ii) $(240)_{10} = (\ ?\ )_2 = (\ ?\ )_{BCD}$
       iii) $(28)_{10} - (19)_{10}$ using 1's and 2's complement method
       iv) $(1100)_2 + (1111)_2$ and $(123)_8 + (126)_8$ (08 Marks)

8 a. Choose the correct answers for the following :
   i) Simplified form of Boolean expression of $1 + AB$ is
       A) 1   B) AB   C) $\overline{AB}$ D) $A + B$
   ii) Expression for EX-OR gate with inputs 'A' and 'B' is
       A) $A + B$ B) $A\overline{B} + \overline{B}A$ C) $AB + \overline{A}\overline{B}$ D) none of these
   iii) Simplification of $\overline{A}\overline{B}$ is
       A) $A + B$ B) $\overline{A} + B$ C) $A + \overline{B}$ D) $\overline{A} + \overline{B}$
   iv) Full adder has _____ inputs.
       A) 1   B) 2   C) 3   D) 4   (04 Marks)
   b. i) Realize $Y = \overline{A}B + A\overline{B}$ by using minimum number of NAND gates.
       ii) Simplify $ABC + A\overline{B}C + AB\overline{C} + \overline{A}BC$ and realize using basic gates.   (08 Marks)
   c. State and prove Demorgan's theorem.   (04 Marks)
   d. Simplify $\overline{\overline{XY} + XYZ} + X(Y + X\overline{Y})$.   (04 Marks)

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PART – A

1 **a.** Select the correct answer :
  i) An excessively high reverse voltage applied to a junction diode will cause an effect known as:
   A) punch through   B) saturation   C) diffusion   D) avalanche break down

  ii) Forward biasing a P-N junction
   A) increases its resistance
   C) shorts the junction
   B) decreases its resistance
   D) increases the potential barrier height

  iii) When a diode is heavily doped,
   A) the zener voltage will be low
   C) the depletion region will be thin
   B) the avalanche voltage will be high
   D) the leakage current will be low.

  iv) Leakage current of a junction diode
   A) is due to majority carriers
   C) is in mA or μA range
   B) decreases with temperature
   D) depends on the method of its fabrication.
   (04 Marks)

  b. What is a P-N junction? Discuss its behaviour under i) No bias; ii) Forward bias; iii) Reverse bias. **(10 Marks)**

  c. For a bridge rectifier circuit, derive the expression for i) Average value, ii) Rectifier efficiency. **(06 Marks)**

2 **a.** Select the correct answer :
  i) The efficiency of half wave rectifier is
   A) 40.6%   B) 0.46%   C) 1.21%   D) 81.2%

  ii) A zener diode
   A) is always forward biased
   C) has a sharp breakdown at low reverse voltage
   B) is connected in series
   D) has a negative resistance.

  iii) A filter circuit is used to remove the
   A) AC voltage   B) DC voltage   C) Both A and B   D) None of these.

  iv) If, by mistake, AC source in a bridge rectifier is connected across the dc terminals, it will burn out and hence short _____ diodes.
   A) one   B) two   C) three   D) four   **(04 Marks)**

  b. In a full wave bridge rectifier, the transformer secondary voltage is $100 \sin \omega t$. The forward resistance of each diode is 25Ω and the load resistance is 950Ω. Calculate
   i) DC output voltage   ii) ripple factor   iii) efficiency of rectification   iv) PIV across non-conducting diode. **(09 Marks)**

  c. Sketch typical transistor common-base current gain characteristics. Explain the shape of the characteristics. **(07 Marks)**

3 a. Select the correct answer :
i) The biasing circuit, which gives most stable operating point is
A) Base bias   B) Collector to base bias C) Voltage divider bias D) None of these

ii) The arrow on the emitter of a transistor indicates
A) the direction of electron flow   B) the positive voltage point
C) the direction of positive current flow D) the ground connections.

iii) The common emitter transistor circuit configuration is most often used because of its higher
A) power gain   B) frequency
C) output impedance   D) voltage gain.

iv) In a transistor with normal bias, the emitter junction
A) is reversed biased   B) has a high resistance
C) has a low resistance   D) emits carriers in base which are in majority there
(04 Marks)

b. Define 'α' and 'β' of a transistor. Show that $\beta = \dfrac{\alpha}{(1-\alpha)}$.   (04 Marks)

c. Discuss the causes of unstability in a transistor.   (06 Marks)

d. In the circuit shown in Fig.Q3(d), a NPN Transistor with β = 100 is used. Find I_C and V_{CE}. Draw the DC load line output characteristics and indicate the Q point. Take V_{BE} = 0.7 Volts.
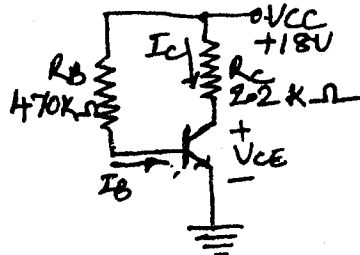

Fig.Q3(d)   (06 Marks)

4 a. Select the correct answer :
i) A JFET behaves like a
A) Resistor   B) Constant current
C) Constant voltage source   D) All the above in different regions.

ii) When JFET is operated above pinch off voltage, its drain current
A) increases sharply   B) becomes constant
C) starts decreasing   D) becomes zero.

iii) The output of a UJT can be taken from its
A) base 1   B) base 2   C) emitter   D) any one of three terminals

iv) When a UJT is turned ON, the resistance between emitter terminal and base 1 is
A) increased   B) decreased   C) zero   D) infinite   (04 Marks)

b. Sketch the voltampere characteristic of a typical silicon-controlled rectifier. Explain the behavior of the SCR reference to its V-I characteristic.   (08 Marks)

c. Draw the output characteristics of a P-channel JFET with external bias. Indicate various regions of operation and explain the shapes of the curves qualitatively.   (08 Marks)

PART – B

5 a. Select the correct answer :
   i) As compared to the resistance of the source, the input impedance of a good voltage amplifier should be
      A) high   B) low   C) equal   D) twice.

   ii) Coupling capacitors mainly affect
      A) upper cut-off frequency   B) lower cut-off frequency
      C) with upper and lower cutoff frequency D) gain in high frequency range.

   iii) The voltage gain of a common-base amplifier depends upon
      A) load resistor RL   B) Input resistance of transistor
      C) ac alpha   D) All the above.

   iv) In a common base amplifier, a smaller load resistance will produce:
      A) high voltage gain   B) high current gain
      C) low power gain   D) all the above.   **(04 Marks)**

   b. What is an oscillator? Write the circuit of a phase-shift oscillator and describe its operation given the expression for its frequency of oscillation.   **(09 Marks)**

   c. Sketch a typical frequency response graph for an RC coupled amplifier. Briefly explain the salient points on it.   **(07 Marks)**

6 a. Select the correct answer :
   i) An advantage of an inverting amplifier is its ability to handle _____ input at a time.
      A) more than one   B) less than one   C) equal to one   D) None of these.

   ii) Op-amp is a direct coupled multistage
      A) voltage amplifier   B) current amplifier
      C) voltage-current amplifier   D) power amplifier

   iii) The common-mode rejection ratio of an ideal op-amp is
      A) zero   B) low   C) high   D) infinite.

   iv) _____ converts physical quantity to electrical signal.
      A) Receiver   B) Transducer   C) Modulator   D) Transmitter.   **(04 Marks)**

   b. Derive an expression for output voltage of an op-amp
      i) Inverting amplifier   ii) Adder   iii) Integrator.   **(10 Marks)**

   c. What do you mean by the term modulation? Why is it required in communication system?
                                                                              (06 Marks)

7 a. Select the correct answer :
   i) Radio communication is the process of sending information in the form of
      A) mechanical signal   B) electrical signal
      C) electro-mechanical signal   D) all of these.

   ii) $(762)_8 = (?)_{10}$
      A) $(468)_{10}$ B) $(248)_{10}$ C) $(128)_{10}$ D) $(498)_{10}$

   iii) $(0.125)_{10} = (?)_2$
      A) $(0.001)_2$ B) $(0.010)_2$ C) $(0.100)_2$ D) $(0.110)_2$

   iv) Computer system only support numbers for the
      A) binary data   B) decimal number   C) hexadecimal number   D) octal number
                                                                              (04 Marks

b. Convert : i) $(434.514)_8 = (?)_{10} = (?)_{16}$

          ii) $(44030)_{10} = (?)_2 = (?)_{16}$

         iii) To subtract $(101011)_2$ from $(100110)_2$ using 2's complement. **(09 Marks)**

c. A 500 W, 1 MHz carrier is amplitude modulated with a sinusoidal signal of 1 kHz. The depth of modulation is 60%. Calculate the band width power in the side bands and the total power transmitted. **(04 Marks)**

d. Write the symbol, truth table and output expression for EX-OR gate. **(03 Marks)**

8 a. Select the correct answer :

   i) In a half adder when both the inputs A and B are high then

     A) SUM = 1 and carry = 0   B) SUM = 0 and carry = 0

     C) SUM = 0 and carry = 1   D) All of these.

   ii) NAND gate is a combination of _____ gate.

     A) OR and NOR   B) NOT and NAND

     C) NOT and AND   D) None of these.

   iii) Demorgan theorem states that $\overline{A + B} =$ _____

     A) $\overline{A} + \overline{B}$ B) $\overline{A} \cdot \overline{B}$ C) $\overline{AB}$ D) None of these.

   iv) $A + \overline{A} =$ _____

     A) 0   B) 1   C) A   D) None of these. **(04 Marks)**

b. Simplify and realize the expression $(A + \overline{B} + C)(\overline{A} + B + C)(\overline{A} + B)$ using only NAND gates. **(06 Marks)**

c. Draw the circuit of a TWO input transistor logic NAND gate. Explain its operation. **(07 Marks)**

d. Draw the logic circuit of Full adder. **(03 Marks)**

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