E 2797 (Pages : 4) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S) EXAMINATION, MARCH/APRIL 2012

Fourth Semester

Core Course—ELECTRONICS

(Common for B.Sc. Physics Model I, B.Sc. Physics Model II, B.Sc. Physics–EEM and B.Sc. Physics—Instrumentation)

Time : Three Hours Maximum Weight : 25

Notes : 1. *Time allotted for the examination is* 3 *hours.*

2. *Answer* **all** *questions in Part A, any* **five** *from Part B, any* **four** *from Part C and any* **two** *from Part D.*

3. *Candidates can use scientific, non-programmable calculators/ Mathematical tables.*

Part A

Answer **all** *questions.*

This part contains 4 *bunches of* 4 *objective/one answer type questions.*
For each bunch, Grade A will be awarded if all the 4 *answers are correct,*
B for 3, C for 2, D for 1 and E for 0.
Weight 1 each for every bunch.

BUNCH 1

Choose the most appropriate alternative :

1. The depletion region or space charge region or transition region in a semiconductor PN junction diode has :
   (a) Electrons and holes. (b) Positive ions and negative ions.
   (c) Positive ions and electrons. (d) No ions, electrons or holes.
2. The minority carrier concentration in a diode is largely a function of :
   (a) Reverse biasing voltage. (b) Forward biasing voltage.
   (c) Temperature. (d) The amount of doping.
3. In a Zener diode, large reverse current is due to :
   (a) Collision. (b) Presence of impurities.
   (c) Rupture of bonds. (d) Lower resistance in reverse biased region.
4. If the output voltage of a bridge rectifier is 100 V, the PIV of the diode will be :
   (a) $100\sqrt{2}$ V. (b) 100π V.
   (c) $50\,\pi$V. (d) $\frac{200}{\pi}$ V.

Turn over

BUNCH 2

5. The main component responsible for lowering of gain in an RC coupled amplifier in low frequency range is :
   (a) Biasing system. (b) Resistor R_E.
   (c) Coupling capacitor C_C. (d) Transistor itself.
6. In cascading amplifiers the intermediate stage is :
   (a) CB. (b) CE.
   (c) CC. (d) None of the above.
7. Class AB operation is often used in power amplifiers in order to :
   (a) Get maximum efficiency. (b) Remove even harmonics.
   (c) Overcome cross-over distortion. (d) Reduce collector dissipation.
8. An ideal op-amp is used to make an inverting amplifier. The two input terminals of the op-amp are at the same potential because :
   (a) The two input terminals are directly shorted internally.
   (b) The open loop voltage gain of the op-amp is infinity.
   (c) CMRR is infinity.
   (d) Both (b) and (c).

BUNCH 3

9. An ideal amplifier is one which :
   (a) Has infinite voltage gain.
   (b) Responds only to signal at its input terminals.
   (c) Has positive feedback.
   (d) Gives uniform frequency response.
10. Unique features of a CC amplifier circuit is that it :
   (a) Steps up the impedance level.
   (b) Does not increase signal voltage.
   (c) Acts as an impedance matching device.
   (d) All of the above.
11. If properly biased, JFET will act as a :
   (a) Current controlled voltage source.
   (b) Current controlled current source.
   (c) Voltage controlled voltage source.
   (d) Voltage controlled current source.

12. The only drawback of using negative feedback in amplifiers is that it involves :

(a) Gain stability. (b) Gain sacrifice.

(c) Frequency dependence. (d) Temperature sensitivity.

BUNCH 4

13. If Barkhausen criterion is not fulfilled by an oscillator circuit, it will :

(a) Produce high-frequency whistles.

(b) Produce damped waves continuously.

(c) Becomes an amplifier.

(d) Stops oscillating.

14. The primary advantage of a crystal oscillator is that :

(a) It can oscillate at any frequency.

(b) It gives a high output voltage.

(c) Its frequency of oscillation remains almost constant.

(d) It operates on very low d.c. supply voltage.

15. A linear diode detector utilizes :

(a) Linear portion of static characteristics of diode.

(b) Linear portion of dynamic characteristics of diode.

(c) Square law portion of dynamic characteristics of diode.

(d) Rectification property of diode.

16. In the FM wave described by equation $v = 15 \sin (4 \times 10^8 t + 3 \sin 1100t)$, the maximum frequency deviation is :

(a) 175 Hz. (b) 525 Hz.

(c) 3 Hz. (d) 58.33 Hz.

$(4 \times 1 = 4)$

Part B (Short Answer Type Questions)

Answer any **five** *questions.*
Weight 1 *each.*

17. What are the different types of *p-n* junction capacitances ? What are their causes ?

18. Distinguish between the centre tapped and bridge rectifiers.

19. Draw the circuit diagram of a voltage tripler using diodes.

20. Define, basically the three operating regions of a bipolar transistor ?

21. Draw the *h*-parameter equivalent circuit for a cc configuration, giving typical parameter values.

22. List the *four* types of negative feedbacks, giving their block schematics.

23. What is virtual ground in an op-amp circuit ? What are the conditions to be satisfied to have the virtual ground in an op-amp circuit ?

24. Sketch and label the frequency spectrum of an AM wave when a 625 kHz carrier is modulated by audio waves of 50 Hz to 5 kHz signal.

(5 × 1 = 5)

Part C (Short Essays/Problems)

Answer any **four** *questions.*
Weight 2 *each.*

25. A - π filter in a full wave rectifier uses $C_1 = C_2 = 470\ \mu F$ and L = 10 H. The load current is 300 mA at 100 V dc. Calculate the ripple factor.

26. Determine (a) the applied voltage to achieve a forward current of 0.45 μA in a *pn* junction Si diode at T = 300 K, if the reverse saturation current is 1.0 nA. (b) If the reverse saturation current in a Ge diode is 10 μA, what current would result if the voltage in part (a) is applied in the forward direction ?

27. Calculate the d.c. bias currents and voltages for a voltage divider bias circuit having R_1 = 40 K. R_2 = 10 K, R_C = 1.5 K, R_E = 2K, V_{CC} = 10V, β = 100 and V_{BE} = 0.7 V.

28. A germanium transistor has $I_{CBO} = 10\ \mu A$, $\alpha = 0.98$ and I_C = 1mA. Determine the emitter current and β of the transistor.

29. A Hartley oscillator is designed with L_1 = 2mH, L_2 = 20 μH and a variable capacitor. Determine the range of capacitance values, if the frequency of oscillation is varied between 950 and 2050 kHz.

30. A 500 W carrier is simultaneously amplitude modulated by two audio waves with modulation percentage of 50% and 80% respectively. What is the total sideband power radiated ?

(4 × 2 = 8)

Part D (Essay Type Questions)

Answer any **two** *questions.*
Weight 4 *each.*

31. With a neat circuit diagram, describe how a Zener shunt voltage regulator provides voltage regulation against variations in the input voltage and output current ? Design the circuit for an output voltage of 5V, to load upto a maximum of 50 mA.

32. Draw the CE amplifier circuit. Sketch its *h*-parameter equivalent circuit and derive expressions for its voltage and current gains, input and output resistances.

33. With a circuit diagram, explain how sustained sinusoidal oscillations are produced in a RC phase-shift oscillator ? Explain the function of each component in the circuit.

(2 × 4 = 8)