E 1604 (Pages : 4) Reg. No.....

Name.....

C.B.C.S.S. – B.Sc. DEGREE EXAMINATION, APRIL 2011

Fourth Semester

Core Course—ELECTRONICS

(Common for B.Sc. Physics Model I, B.Sc. Physics Model II, B.Sc. Physics–EEM 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. When a PN junction is forward biased :
   (a) there is no movement of carriers.
   (b) majority carriers from each region are injected into the other region.
   (c) only holes from P region are injected into N region.
   (d) only electrons from N region are injected into P region.
2. The potential barrier existing across a PN junction :
   (a) prevents flow of minority carriers.
   (b) prevents neutralization of acceptor and donor atoms.
   (c) prevents total recombination of holes and electrons.
   (d) facilitates recombination of holes and electrons.
3. Maximum rectifying efficiency of half wave rectifier is :
   (a) 0.812. (b) 1.21.
   (c) 50. (d) 0.406.

Turn over

4. Zener breakdown occurs :
   (a) mostly in germanium diodes.
   (b) in lightly doped junctions.
   (c) due to thermally generated minority carriers.
   (d) due to rupture of covalent bonds.

BUNCH 2

5. In a properly biased NPN transistor, most of the electrons from the emitter :
   (a) recombine with holes in base.
   (b) recombine with holes in emitter.
   (c) are stopped by the junction barrier.
   (d) pass to the collector through the base.
6. In an amplifier, the coupling capacitors are employed for :
   (a) limiting the bandwidth. (b) matching the impedances.
   (c) controlling the output. (d) preventing of d.c. mixing with input or output.
7. Transformer coupling is used in class A amplifier so as to make it :
   (a) less bulky. (b) less costly.
   (c) distortion free. (d) more efficient.
8. Ideal op-amp has input impedance of :
   (a) 1 mΩ. (b) 1 Ω.
   (c) zero. (d) infinity.

BUNCH 3

9. For generating a 1 kHz signal, the most suitable circuit is :
   (a) Untuned collector oscillator. (b) Hartley oscillator.
   (c) Colpitts oscillator. (d) Wien-Bridge oscillator.
10. In an RC phase-shift oscillator, the minimum number of RC networks to be connected in cascade will be :
   (a) 1. (b) 2.
   (c) 3. (d) 4.
11. The modulation index of an AM wave is changed from 0 to 1. The transmitted power is :
   (a) unchanged. (b) halved.
   (c) doubled. (d) increased by 50%

12. AM is used for radio broadcasting because :

(a) it is more immune to noise than other modulation systems.

(b) compared with other systems it required less transmitting power.

(c) its use avoids receiver complexity.

(d) no other modulation system can provide the necessary bandwidth for high fidelity.

BUNCH 4

13. An FM signal with a modulation index m_f is passed through a frequency tripler. The wave in the outlet of the tripler will have a modulation index of :

(a) $mf/3$. (b) m_f

(c) $3m_f$ (d) $9m_f$

14. When the modulating frequency is doubled, the modulation index is halved, and the modulating voltage remains constant. The modulation system is :

(a) amplitude modulation. (b) frequency modulation.

(c) phase modulation. (d) any one of the three.

15. A clipper circuit always :

(a) needs a d.c. source.

(b) clips some past of the input signal.

(c) clips upper portion of the input signal.

(d) clips both half cycles of the input signal.

16. The primary function of a clamper circuit is to :

(a) suppress the variations in the signal voltage.

(b) raise the positive half cycle of the signal.

(c) lower the negative half cycle of the signal.

(d) introduce a d.c. level into an a.c. signal.

(4 × 1 = 4 weight)

Part B (Short Answer Type Questions)

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

17. Sketch the forward and reverse characteristics of a silicon diode.

18. What is PIV ? Write its value for HWR, bridge and centre tapped rectifier ?

19. Which rectifier filter gives ripple factor independent of the load ? Give reasons.

20. What are the conditions to be followed when a voltage multiplier circuit is used ?

21. Compare the input resistances of CB and CE configurations, giving typical values.

22. What is cross-over distortion ? Which circuit shows the same and how it can be eliminated ?

23. What happens to the input and output resistances of an amplifier when a negative voltage-series feedback is used ?

24. Draw a voltage follower circuit using op-amp and express its R_i and R_o.

(5 × 1 = 5 weight)

Part C (Short Essays/Problems)

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

25. Draw the Zener shunt voltage regulator. Design it for an output voltage 5 V, max : load current 20 mA.

26. Draw the circuit of a voltage tripler and explain its working.

27. Define α and β and derive the relationship between them. Calculate I_c of a transistor whose $I_B = 12\ \mu A$ and $\alpha = 0.993$.

28. What is virtual ground in an op-amp ? What are the conditions to maintain the same ?

29. Draw the circuit diagram of a Colpitts oscillator. Calculate its frequency when $C_1 = 10$ pF and $C_2 = 22$ pF and $L = 100\ \mu H$.

30. A broad cast AM transmitter radiates 100 W of carrier power. What will be the radiated power at 70% modulation ?

(4 × 2 = 8 weight)

Part D (Essays Type Questions)

Answer any **two** *questions.*
Each question carries a weight of 4.

31. Draw the complete circuit diagram (as a single connected unit) of a power supply. It uses a bridge rectifier, a π filter and a Zener shunt regulator. Briefly explain the working of each component in it.

32. Draw the experimental set up to obtain the input and output VI characteristics of a CB configuration. With the help of the neat sketch, describe the shapes of the characteristics.

33. With a neat circuit diagram, explain how Barkhausen criteria are satisfied in an RC phase-shift oscillator ?

(2 × 4 = 8 weight)