**E 7198**    (Pages : 4)    Reg. No...................................

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# B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2014

## Fourth Semester

### Core Course—ELECTRONICS

(Prior to 2011 Admissions)

[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

*Answer **all** questions in Part A, any **five** from Part B,*
*any **four** from Part C and any **two** from Part D.*
*Candidates can use scientific, non-programmable calculators/Mathematical tables.*

### Part A

*Answer **all** questions.*

*This part contains 4 bunches of **four** objective / one answer type questions.*

Bunch 1 (Choose the most appropriative alternative)

1. When a forward bias is applied to a PN-junction, the width of the depletion layer ?

    (a)  Remains the same.          (b)  Is Increased.

    (c)  Is decreased.              (d)  May increase *or* decrease.

2. If the output voltage of a bridge rectifier is 10 Volt, the PIV of the diode will be :

    (a)  $10\sqrt{2}$ volt.          (b)  $\dfrac{20}{\pi}$ volt.

    (c)  $10\,\pi$ volt.             (d)  $5\,\pi$ volt.

3. Which *one* of the following is true of a bipolar transistor ?

    (a)  Both base and emitter are heavily doped.

    (b)  Collector is lightly doped and emitter is heavily doped.

    (c)  Collector is heavily doped and emitter is lightly doped.

    (d)  Both the collector and emitter are heavily doped.

4. A common collector amplifier has the highest :

    (a)  Voltage gain.             (b)  Current gain.

    (c)  Power gain.               (d)  Output resistance.

**Turn over**

Bunch 2 (Choose the most appropriate alternative)

5. The primary function of a filter in a rectifier circuit is to :

   (a) Minimise a.c. input variations.

   (b) Suppress odd harmonics in the rectifier output.

   (c) Stabilise d.c. level of the output voltage.

   (d) Remove ripples from the rectified output.

6. In a transistor, if electrons flow into the emitter :

   (a) Holes flow out of emitter.

   (b) Electrons flow into the collector.

   (c) Electrons flow out of collector.

   (d) Holes flow out of collector.

7. In which of the following class, the distortion is minimum ?

   (a) A.                              (b) B.

   (c) C.                              (d) AB.

8. JFET has main drawback of :

   (a) Having low input impedance.

   (b) Having high output impedance.

   (c) Being noisy.

   (d) Having small gain-bandwidth product.

Bunch 3 (Choose the most appropriate alterntive)

9. Class AB operation is often used in power amplifier in order to :

   (a) Get maximum efficiency.          (b) Remove even harmonics.

   (c) Overcome cross-over distortion.  (d) Reduce collector dissipation.

10. In frequency modulation :

    (a) The frequency of the carrier remains constant.

    (b) The amplitude of the carrier remains constant.

    (c) The amplitude of the carrier wave is varied.

    (d) The frequency of the signal is made equal to the carrier frequency.

11. In a transistor Hartley oscillator :

    (a) Inductive feedback is used.

    (b) Untapped coil is used.

    (c) Entire coil is in the output circuit.

    (d) None of the above.

12. Without a d.c. source in the circuit a clipper acts like a :

    (a)  Clamper.                  (b)  Rectifier.

    (c)  Chopper.                 (d)  Demodulator.

### Bunch 4 (Fill in the blanks using appropriate words)

13. A zener diode operates under ———— bias for the application as voltage regulator.

14. For a transistor to operate as an amplifier, the emitter-base junction must be ———— biased.

15. The bandwidth of an ideal OP-amp is ————.

16. The maximum value of modulation index permitted in AM is ————.

$(4 \times 1 = 4)$

## Part B (Short Answer Type Questions)

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

17. Draw the equivalent circuit of a Si diode in forward bias condition.

18. Why $\pi$-filters are not suitable for varying loads ?

19. Why the width of the base region of a BJT is kept very low and collector region very large ?

20. Compare the voltage gains of CC, CB and CE configurations, giving typical practical values.

21. What is pinch-off voltage in a JFET ?

22. What are the advantages of crystal oscillator ?

23. Draw the circuit of a unity follower using OP-amp ?

24. What is overmodulation distortion in AM ? How it can be prevented ?

$(5 \times 1 = 5)$

## Part C (Short Essays / Problems)

*Answer any **four** questions.*
*Each carries a weight of 2.*

25. Derive the expressions for the (i) ripple factor and (ii) rectification efficiency of a bridge rectifier.

26. Draw the circuit of a diode clipper which clips at + 5 volt and – 6 volt of the input. Assuming $V_2 = 0.5$ volt, calculate the bias voltages in your circuit.

27. A germanium transistor with $\alpha = 0.98$ gives a reverse saturation current $I_{CO} = 10$ $\mu$ A in CB configuration. When the transistor is used in CE configuration with a base current of 0.22 $\mu$A, calculate the collector current ?

28. A base-bias circuit has $V_{CC} = 10$ V, $R_C = 820$ $\Omega$, $R_B = 330$ k$\Omega$ and $\beta = 200$. Calculate the base current of the transistor if $V_{BE} = 0.6$ volt.

**Turn over**

29. Draw the circuit diagram of an inverting amplifier using OP-amp and calculate the resistor values if the circuit is to have a gain of 15.

30. An FM signal is given by $v = 12 \sin (5 \times 10^8 t + 5 \sin 500 \, t)$. Calculate the (i) modulation index ; (ii) carrier frequency ; (iii) carrier amplitude ; (iv) modulating frequency.

$(4 \times 2 = 8)$

## Part D (Essay Questions)

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

31. With a neat circuit diagram, describe the working of a zener diode shunt voltage regulator. Explain how it provides output voltage regulation against changes in (i) input voltage and (ii) output current ?

32. Draw the voltage divider bias CE amplifier circuit. Deduce its a.c. equivalent circuit. Using $h$-parameters draw the simplest a.c. equivalent circuit of the above and derive expressions for (i) input resistance and (ii) current gain.

33. Draw a three-input adder using OP-amp. Derive expression for its output voltage. Modify the circuit to find the average of the three inputs.

$(2 \times 4 = 8)$