Model Question Paper(2)
(Model I, Model II and Model III)

MAHATMA GANDHI UNIVERSITY

B.Sc. Physics Programme

IV Semester Examination. ……..…….. (Month) ……..… (Year)

PH4B01U – ELECTRONICS

Instructions:

Time allotted: 3 hours

Answer all questions in part A. this contains 4 bunches of 4 objective 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. Answer any 5 questions from part B, any 4 from part C and any 2 from part D. Candidates can use non-programmable calculators (ordinary/scientific) and/or tables.

Part A (Objective type – weight 1 each)

Bunch I

1. A Si diode is in series with a 1.0 KΩ resistor and a 5 V battery. If the anode is connected to the positive battery terminal, the cathode voltage with respect to the negative terminal is:
   (a) 0.7 V (b) 0.3 V (c) 4.3 V (d) 4.7 V
2. The junction resistance of a P-N junction diode is:
   (a) large for high values of forward current
   (b) small for high values of forward current
   (c) small for low values of forward current
   (d) independent of current, instead just depends on the type of diode.
3. When a 60 Hz sinusoidal voltage is applied to the input of a full wave rectifier, the output frequency is:
   (a) 120 Hz (b) 60 Hz (c) 240 Hz (d) 0 Hz
4. In a shunt capacitor filter, the ripple
   (a) is independent of load resistance
   (b) decreases with decrease in load resistance
   (c) increases with increase in load resistance
   (d) increases with decrease in load resistance

Bunch II

5. In zener breakdown, the carrier generation is due to
   (a) collision of carriers with the immobile ions
   (b) thermal agitation
   (c) direct rupture of covalent bonds by the electric field
   (d) collision and also by thermal agitation

6. When operated in cut off and saturation, the transistor acts like
   (a) a linear amplifier (b) a switch (c) a variable capacitor (d) a variable resistor.

7. The collector current of a transistor amplifier is hundred times its base current. Its β_{DC} is:
   (a) 100 (b) 0.99 (c) 50 (d) 200.

8. A transistor amplifier is biased using potential divider bias. Removal of the emitter bypass capacitor will produce
   (a) positive feedback of the signal (b) negative feedback of the signal
   (b) high current through R_E which will damage the transistor (d) no change

Bunch III

9. In a Class AB amplifier, the collector current flows through the collector load
   (a) during the complete cycle of input signal
   (b) only during half cycle of the input signal
   (c) less than half cycle of the input signal
   (d) during more than half cycle of the input signal

10. The unit of the transistor h-parameter h_{oe} is
    (a) ohm (b) mho (c) ampere (d) having no unit.

11. An oscillator differs from an amplifier because
    (a) it requires no DC supply
    (b) it has more gain
    (c) it always has the same output
    (d) it requires no input signal.

12. In amplifiers with positive feedback, the phase difference between input voltage and the feedback voltage is
    (a) $\pi/2$ or odd multiples of $\pi/2$ (b) π or odd multiples of π
    (b) 0 or multiples of 2π (d) $3\pi/2$

Bunch IV

13. Which of the following statements is wrong?
    (a) a tuned circuit is an essential component of all types of oscillator circuits
    (b) a Hartley oscillator uses inductive feed back
    (c) a crystal oscillator has greater frequency stability
    (d) phase shift oscillators are not suitable for variable frequency work.

14. For an op-amp with negative feed back, the output is
    (a) equal to the input
    (b) increased
    (c) fed back to the non-inverting input.
    (d) fed back to the inverting input.

15. When modulation is 100%, the power of a side band is ……. of the total power carried by the AM wave.
    (a) one-half (b) one-third (c) one-sixth (d) two-third.

16. When the frequency deviation is doubled in FM,
    (a) modulation is doubled
    (b) modulation is halved
    (c) carrier swing is halved
    (d) carrier swing is doubled.

Part B (Short answer questions – weight 1 each)

17. Explain the formation of the depletion region in an open circuited PN junction.
18. Name the two types of reverse breakdowns, which occur in a PN junction diode. What are the reasons for both?
19. Sketch the typical common base input characteristic curves for an NPN transistor. Label all variables. Explain how you will calculate the input dynamic resistance of the transistor from the curves.
20. Explain thermal runaway in a transistor.
21. Sketch with their symbols, the basic structure of N-channel FET and MOSFET.
22. Draw the block representations of the 4 types of negative feed back circuits.
23. Draw the circuit of an op-amp which employs negative feed back with a resistor. Show the voltage polarities and direction of currents through the input and output. Explain the concepts of virtual ground and summing point.
24. What is meant by detection? Explain how AM signals are detected using junction diode.

Part C (Short essay/Problems – weight 2 each)

25. Calculate the static and dynamic resistance of a Ge PN junction diode at temperature 27°C when a forward voltage of 0.3 V is applied across it. The reverse saturation current is 1 µA. Electronic charge = 1.6×10^{-19} C. Boltzmann's constant = 1.38×10^{-23} JK^{-1}.
26. A full wave rectifier is constructed using a centre-tapped transformer (12-0-12 volt rms). The internal resistance of the diode is 500 Ω. The load resistance is 1 KΩ. Calculate (a) I_{dc} (b) V_{dc} (c) DC output power and (d) ripple voltage (rms value).
27. The reverse saturation current I_{CBO} of a transistor is 10 µA when used in the common base configuration. When the transistor is connected in the common emitter mode with base current of 0.3 mA, calculate the collector current.
28. A transistor is biased using voltage divider bias method. The supply voltage is 20 V. Collector load R_C = 4.7 KΩ and emitter resistance R_E = 1 KΩ. The potential dividers are R_1 = 100 KΩ and R_2 = 10 KΩ. Find the Q-point. Also draw the DC load line.
29. An amplifier has a gain of 400 without feedback. When negative feedback is applied, the gain reduces to 80. Calculate the voltage feed back. If after a few years the gain without feedback falls by 10%, calculate the percentage fall in gain with feed back.
30. In an AM wave, the modulation index = 0.5. If the carrier and one side band are suppressed, find the percentage power saving. What change will occur by increasing the modulation index to 1?

Part D (Essay-type questions – weight 4 each)

31. With the help of a neat diagram, explain the working of a full wave bridge rectifier. Obtain expressions for the efficiency and ripple factor of a full wave rectifier.
32. Explain the need for the biasing of a transistor amplifier. Explain the voltage divider bias in detail and describe how the method achieves stability of operating point.
33. Explain with a neat diagram the working of Colpitts oscillator. Give expression for the frequency and explain how sustained oscillations are obtained.

Answer key for part-A (only for valuation):

1.c, 2.b, 3.a, 4.d, 5.c, 6.b, 7.a, 8.b, 9.d, 10.b, 11.d, 12.c, 13.a, 14.d, 15.c, 16.a