UG/II/ELECT/H/III/17(Old)

2017

ELECTRONICS

[Honours]

PAPER – III

Full Marks : 100

Time : 4 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

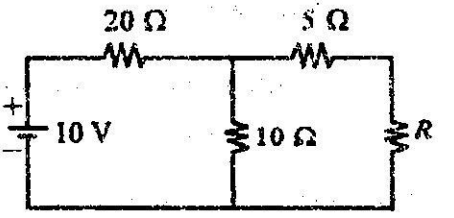
[OLD SYLLABUS]

GROUP – A

Answer any **two** questions : 15 × 2

1. (*a*) State and prove Norton's theorem.

(*b*) In the following circuit calculate the resistance *R* which will allow maximum power dissipation in it. Also calculate the maximum power.



(*c*) Discuss the principle of operation and applications of Anderson bridge. 5 + 5 + 5

2. (*a*) Draw the Energy band diagram of a P-N Junction diode. Indicate Fermi level and built-in-potential. Draw again the energy -band diagram when a forward voltage V_F is applied.

(*b*) Compare Zener break down over Avalanche break down in connection with a P-N Junction.

(*c*) Discuss the performance of a P-N junction diode as a half-wave rectifier.

(*d*) Explain how a Zener diode can be used as a voltage regulator. (3 + 2) + 4 + 3 + 3

3. (*a*) Explain the principle of operation of a CMOS NAND gate with suitable circuit diagram.

(*b*) Discuss with proper circuit diagram how an phase-shift oscillator works.

(*c*) Write a short note on IMPATT diode. 5 + 6 + 4

GROUP – B

Answer any five questions : 8 × 5

4. (*a*) Derive the expression for the voltage gain of a feedback amplifier. Hence explain how a feedback amplifier can be converted to an oscillator and derive Barkhausen criteria.

(*b*) Write the characteristics of a ideal op-amp. (3 + 1 + 1) + 3

5. Explain with a circuit diagram the operating principle of a phase-shaft oscillator. Derive the expression for its oscillating frequency. 5 + 3

6. Discuss various current components present in a N-P-N Transistor. Prove that

$$I_C = \beta I_B + (I + \beta)\, ICo \qquad 4 + 4$$

7. For a silicon-controlled rectifier derive the expression of anode current in forward conduction mode. 8

8. Draw the circuit diagram of a common-source *n*-channel JFET amplifier and discuss its small signal operation. Prove that

$$\mu = r_d \cdot g_m \qquad 4 + 4$$

9. Discuss how you can derive '*h*' parameters from the input and output characteristics curve of a transistor. 8

10. (*a*) What are the advantages of *n*-channel MOSFETS over *p*-channel MOSFETS ?

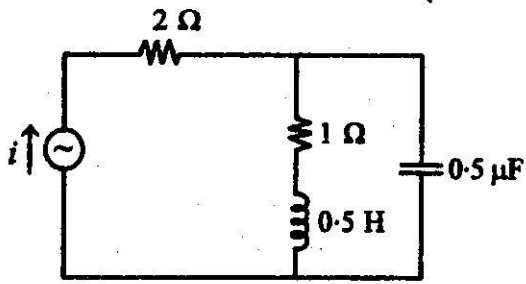
    (*b*) Why ordinary bipolar junction transistors cannot be used at microwave frequencies ?

    (*c*) Explain the rectifying behaviour of a schottky barrier diode with suitable band diagram. 3 + 2 + 3

11. (*a*) Draw the circuit diagram of an OP-Amp differentiator and derive the expression for its output voltage. Draw the shape of the output signal when a square wave is fed at the input of a differentiator.

(*b*) The following circuit is driven by a current source $i = 4\sqrt{2}\sin 314t$ Amp. and is in the steady state. Find the impedance faced by the current source and the power dissipated.

$(1 + 1 + 2) + 4$



GROUP – C

Answer any **five** questions : 4×5

12. *Discuss the working principle of an SMPS.* 4

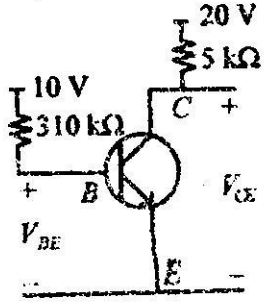
13. What do you mean by class A and class B amplifier ? What is transformer coupled and what is direct coupled amplifier ? 2 + 1 + 1

14. Explain with a neat circuit diagram the principle of operation of an Astable Multivibrator. 4

15. Explain the working principle of a schmitt trigger using an OP-AMP. 4

16. Write a short note on Maxwell's bridge. 4

17. A transistor is operating in the CE mode. Calculate V_{CE} if $\beta = 125$, assume $V_{BE} = 0{\cdot}6$ V. 4



18. What is a light emitting diode ? Why silicon is not preferred as LED material ? 4

19. (*a*) Compare between an emitter follower and a Darlington pair.

(*b*) What is space change capacitance ? 2 + 2

[*Internal Assessment* : 10 Marks]