UG/I/ELECT/Gen/I/15

2015

ELECTRONICS

[General]

PAPER – I (New)

Full Marks : 100

Time : 3 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

[NEW SYLLABUS]

GROUP – A

Answer any **two** questions: 15 x 2

1. (*a*) Draw the circuit diagram of a full-wave rectifier with a capacitor filter and explain its operation. 7

(*b*) Show the different current components of a *p-n-p* transistor when its J_{EB} is forward biased and J_{CB} is reverse-biased, discussed their origin. Show the relation amongst. The different current components. 8

2. (*a*) With a neat sketch describe the structure of a *n*-channel JFET and explain its principle of operation. Why field-effect transistor is called unipolar device ? 3 + 4 + 1

(*b*) Draw the circuit diagram of a Wien-bridge oscillator. Find an expression for frequency of oscillation. 7

3. (*a*) Write the characteristics of an ideal Op-Amp and a practical Op-Amp. 3

(*b*) Draw the circuit diagram of an adder-circuit using Op-Amp and find an expression for output voltage. 3

(*c*) What do you mean by class-A, class-B and class-C amplifier ? Discuss their biasing conditions. 3 + 6

GROUP – B

Answer any **five** questions : 8 × 5

4. (*a*) Explain the meaning of hole as referred to a semiconductor. Is an *n*-type semiconductor negatively charged ? 3

   (*b*) What is *a p-n* junction ? Explain how does a barrier field appear across a *p-n* junction ? 2 + 3

5. (*a*) A Sinusoidal voltage is applied to a series LCR-Circuit. Find an expression for steady state current. 5

   (*b*) What do you resonance condition of the above circuit ? Find an expression for resonance frequency. 1 + 2

6. (*a*) A series RC circuit is fed with a dc source. Find an expression for charge stored in the capacitor with time. 6

(*b*) What do you mean by the time-constant of the circuit ? 2

7. (*a*) Prove that maximum power is transfer to a load when value of the load is equal to the source resistance. 4

(*b*) State and explain KVL and KCL. 2 + 2

8. (*a*) Draw the circuit diagram of a puss-pull amplifier and explain its operation. 2 + 3

(*b*) Discuss the advantages and disadvantages a class-B push-pull amplifier. 3

9. (*a*) Define the hybrid parameters for a basic transistor circuit in any configuration and give its hybrid model. 3+ 3

(*b*) What are the advantages of *h*-parameters ? 2

10. (*a*) Discuss the principle of operation of a crystal oscillator. Mention its two advantages. 5 + 1

(*b*) Why is the frequency stability of an oscillator high when a piezoelectric crystal is used ? 2

11. (*a*) What do you mean by R-C coupled amplifier ? Draw the circuit diagram of a R-C coupled amplifier and explain its operation. 2 + 2 + 2

(*b*) Also draw its frequency response characteristics and discuss it. 2

GROUP – C

Answer any **five** questions : 4 × 5

12. Why does electrical conductivity of a semiconductor increases with increase of temperature ? What will happen, if a semiconductor is heavily-doped ? 2 + 2

13. How are the width of the space-charge region and the barrier height affected when a *p-n* junction is (*i*) forward-biased and (*ii*) reverse-biased ? 2 + 2

14. Explain how a Zener-diode acts as a voltage regulator. 4

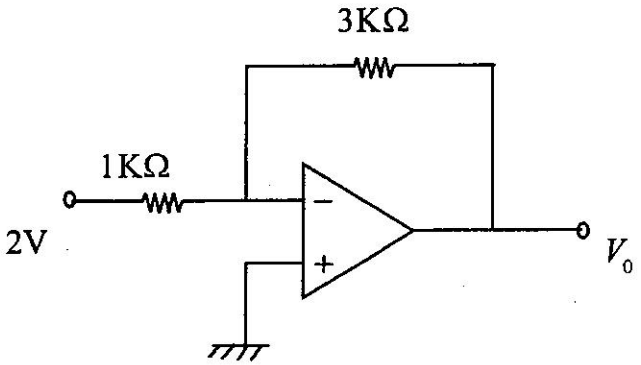
15. The current flowing through a *p-n* junction Si-diode is 60 mA for a forward bias of 0·9 volt at 300 K. Determine the static and dynamic resistance of the diode. 4

16. What is a DIAC ? Draw its current-voltage characteristic. Write its applications. 1 + 2 + 1

17. State and explain superposition theorem for network analysis. 4

18. An *n-p-n* transistor with $\alpha = 0{\cdot}98$ is operated in the *CB*-configuration. If the emitter current is 3 mA and the reverse saturation current is $I_{Co} = 10\ \mu A$, what are the base current and the collector current ? 4

19. For inverting Op-Amp circuit (fig. below) determine input-current and output voltage for an input-voltage of 2V. 4



[*Internal Assessment* – 10 Marks]