

(2) **Bs/PHYM-201 (N)**

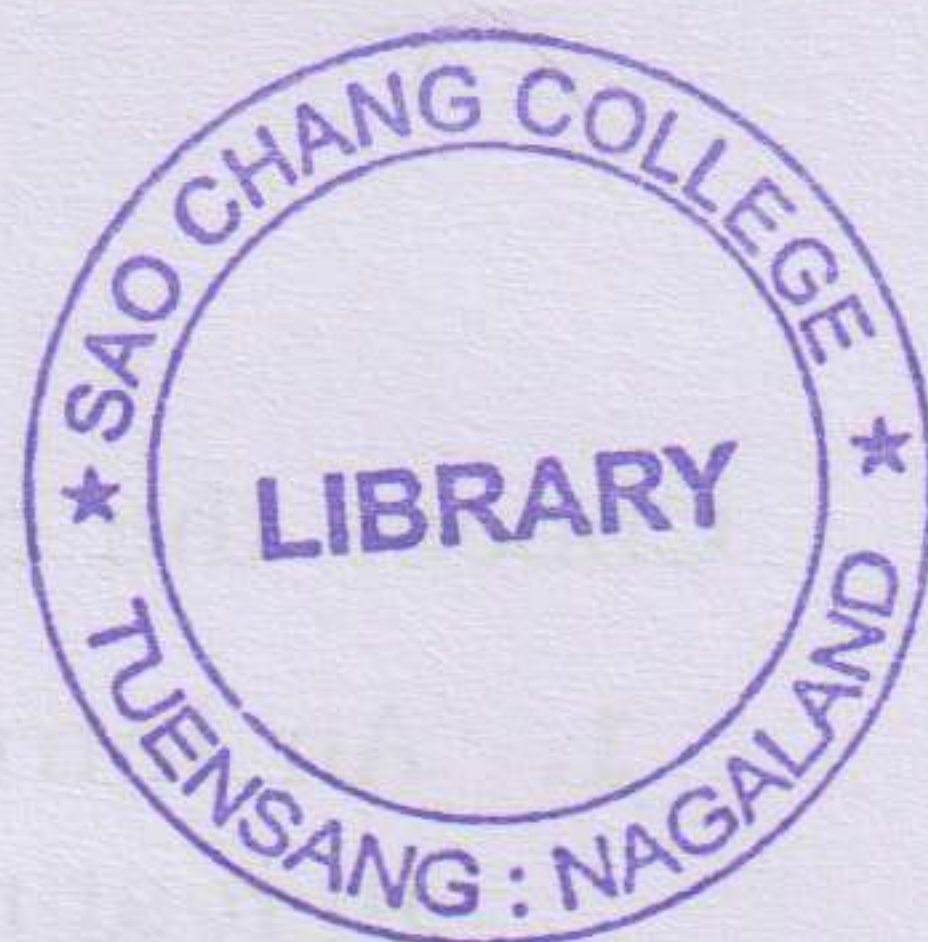
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(FYUGP)

(2nd Semester)

PHYSICS

(MINOR)



Paper : PHYM-201

(**Analog System and Applications**)

(New Course)

Full Marks : 75

Pass Marks : 40%

Time : 3 hours

*The figures in the margin indicate full marks
for the questions.*

26L/341

(Turn Over)

(2)

(PART : A—OBJECTIVE)

(Marks : 25)

SECTION—I

(Marks : 15)

Choose the correct option :

1×15=15

1. An intrinsic semiconductor has some holes in it at room temperature. What causes these holes?
(a) Doping
(b) Free electrons
(c) Thermal energy
(d) Valence electrons
2. The amount of time between the creation of a hole and its disappearance is called
(a) doping (b) life time
(c) recombination (d) valence
3. The voltage where avalanche occurs is called the
(a) barrier potential
(b) depletion layer
(c) knee voltage
(d) breakdown voltage

(3)

4. In a half-wave rectifier, the load current flows for what part of the cycle?
(a) 400
(b) 900
(c) 1800
(d) 3600
5. When reverse bias is applied to a junction diode
(a) potential barrier decreases
(b) potential barrier increases
(c) majority carrier increases
(d) minority carrier increases
6. The phase shift between the input and output voltage in a common-base small signal amplifier is
(a) 180° (b) -180°
(c) 90° (d) 0°
7. The point of intersection of d.c. and a.c. load lines is the
(a) operating point
(b) cut-off point
(c) saturation point
(d) None of the above

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8. In order to achieve good stabilization in potential divider method, current through R_1 and R_2 should be at least
- (a) 10 times I_B
 - (b) 3 times I_B
 - (c) 4 times I_B
 - (d) 0.5 times I_B
9. In RC coupled amplifier, voltage gain over mid-frequency range is
- (a) increasing
 - (b) constant
 - (c) decreasing
 - (d) zero
10. The value of feedback ratio is always
- (a) less than 1
 - (b) more than 1
 - (c) equal to 1
 - (d) None of the above
11. Phase-shift oscillator produces a distortion level of nearly
- (a) 2% in the output signal
 - (b) 5% in the output signal
 - (c) 5% in the input signal
 - (d) 3% in the input signal

(5)

12. The most widely used type of ADC is
- (a) counter type
 - (b) flash type
 - (c) successive approximation type
 - (d) dual slope type
13. The voltage gain of an OP-AMP non-inverting amplifier is
- (a) less than unity
 - (b) greater than unity
 - (c) equal to unity
 - (d) None of the above
14. In phase shifter, shift of phase takes place
- (a) $> 0^\circ$
 - (b) $< 0^\circ$
 - (c) constant
 - (d) between 0° and 360°
15. A voltage comparator can act as a zero crossing detector when
- (a) inverting or non-inverting terminal is grounded
 - (b) inverting terminal is not grounded
 - (c) any terminal is grounded
 - (d) None of the above

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SECTION—II

(Marks : 10)

Answer any *five* questions in brief : $2 \times 5 = 10$

1. Distinguish between drift current and diffusion current in a semiconductor.
2. What do you mean by cut in voltage?
3. Why is collector made larger than emitter and base?
4. Write the operating principle of LED.
5. What is bias stabilization?
6. In an RC-coupled amplifier, the mid-frequency gain is 2000. What will be its value at upper and lower cut-off frequencies?
7. What do you mean by accuracy and step size in terms of DAC?
8. Why is feedback required in amplifier?
9. How can a scale changer and a phase shifter be obtained with an OP-AMP?
10. Find the voltage gain for a non-inverting amplifier circuit with $R_f = 10 \text{ k}\Omega$ and $R_i = 2 \text{ k}\Omega$.

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(PART : B—DESCRIPTIVE)

(Marks : 50)

Answer *five* questions, taking *one* from each Group : $10 \times 5 = 50$

GROUP—A

1. (a) What is meant by mobility of a carrier?
How does it depend upon temperature and doping concentration? $1+3=4$
(b) Explain the fabrication techniques of a P-N junction diode. 5
(c) Define drift velocity. 1
2. (a) On which factor do the height of potential barrier and width of the depletion region depend? 5
(b) What is Fermi level in semiconductor? Show that the Fermi level of an intrinsic semiconductor lies at the middle of the forbidden gap. $1+4=5$

GROUP—B

3. (a) A transistor having $\alpha = 0.9$ and reverse saturation current $I_c = 10 \mu\text{A}$ is operated in CE configuration. If the base current is $250 \mu\text{A}$, calculate the collector current. 3

(8)

- (b) Explain the action of Zener diode as voltage regulator. 4
- (c) Explain why $I_{CEO} \gg I_{CBO}$. 3
4. (a) Discuss the principle and structure of solar cell. 5
- (b) Draw the CE mode input characteristics of a transistor. Explain qualitatively the nature of the curves. 5

GROUP—C

5. (a) Write down the hybrid equation of a transistor, and define the h -parameter. What are the advantages of using h -parameter? 6
- (b) Explain any *two* of the following terms : 2×2=4
- (i) Frequency response
- (ii) Decibel gain
- (iii) Bandwidth of an RC-coupled amplifier
6. (a) Distinguish between class A and class B amplifiers. 3
- (b) The power gain of a CB amplifier is 800 and the voltage amplification factor is 840. Find the collector current, when the base current is 1.2 mA. 3

(9)

- (c) Explain why collector-to-base bias circuit is seldom used. 4

GROUP—D

7. (a) Describe Hartley oscillator circuit, and explain its action. 6
- (b) What is the basic principle of operation of an RC oscillator? 4
8. (a) Find the gain of negative feedback amplifier with block diagram. Discuss the effect of negative feedback on amplifier characteristics. 6
- (b) Explain the working of a binary weighted resistor network. 4

GROUP—E

9. (a) Describe the functions of OP-AMP as (i) inverter, (ii) integrator and (iii) differentiator. 6
- (b) An OP-AMP has a slew rate of 4 V/ μ s and peak output swing of 10 V. Find out the full power bandwidth. 4
10. (a) Define open-loop voltage gain of an OP-AMP. Give its limitation. 3

- (b) Draw the circuit diagram of a bridge amplifier using OP-AMP. Explain its function. 5
- (c) Discuss how OP-AMP can be used as comparator. 2
