

Bs/PHYM-401

2026

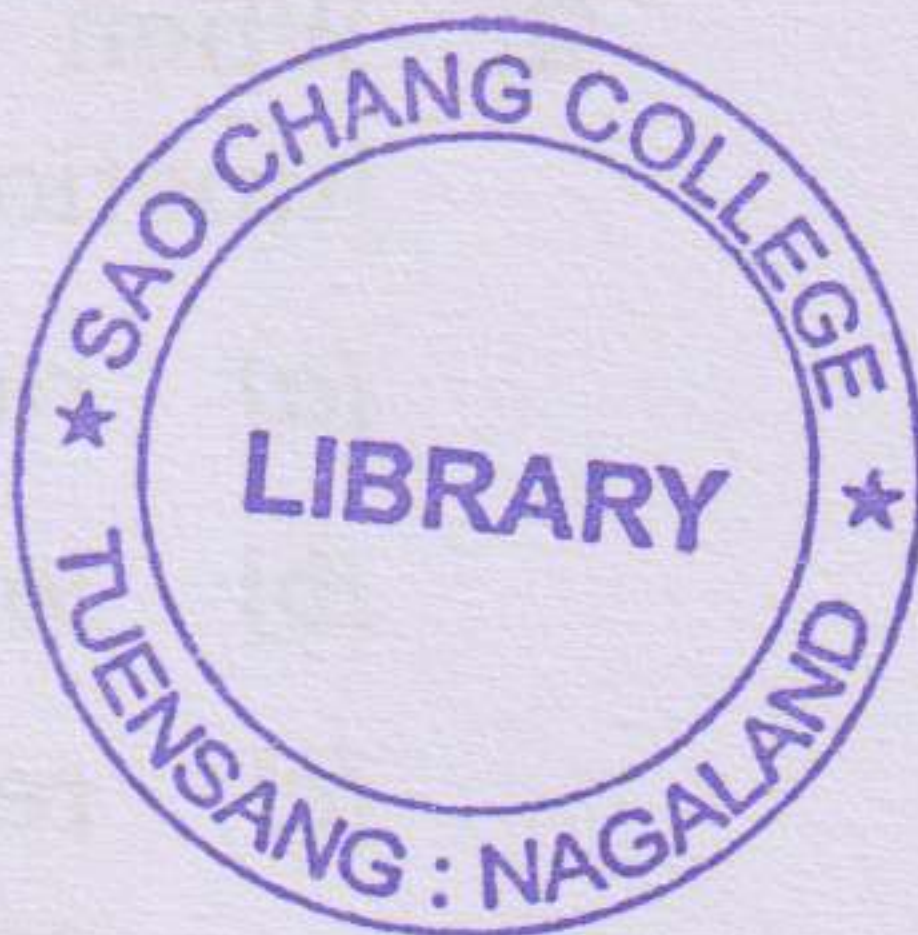
(FYUGP)

(4th Semester)

PHYSICS

(MINOR)

Paper : PHYM-401



(Analog System and Applications)

Full Marks : 75

Pass Marks : 40%

Time : 3 hours

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

(PART : A—OBJECTIVE)

(Marks : 25)

SECTION—I

(Marks : 15)

Choose the correct option : $1 \times 15 = 15$

1. Drift current in a p - n junction is due to

- (a) electric field
- (b) collision of electrons
- (c) charge carrier density
- (d) None of the above

26L/412

(Turn Over)

2. When a forward bias is applied to a $p-n$ junction, it
 - (a) raises the potential barrier
 - (b) lowers the potential barrier
 - (c) reduces the majority carrier current to zero
 - (d) None of the above
3. The potential barrier in a silicon diode is
 - (a) 0.2 V
 - (b) 1.1 V
 - (c) 1.4 V
 - (d) 0.7 V
4. Why does a full-wave rectifier have twice the efficiency of a half-wave rectifier?
 - (a) It makes use of transformer
 - (b) The ripple factor is much less
 - (c) It utilizes both half-cycles of the input
 - (d) Its output frequency is double the line frequency
5. In which of the following configurations, current gain is maximum?
 - (a) Common base (CB)
 - (b) Common collector (CC)
 - (c) Common emitter (CE)
 - (d) None of the above

6. The DC load line is drawn between
 - (a) cut-off and saturation points
 - (b) active and cut-off points
 - (c) active and saturation points
 - (d) None of the above
7. Where does the Q-point lie for class B amplifier?
 - (a) Active
 - (b) Cut-off
 - (c) Saturation
 - (d) Between saturation and active
8. Which amplifier is commonly used as a frequency multiplier?
 - (a) Class A
 - (b) Class B
 - (c) Class C
 - (d) All of the above
9. The least efficient amplifier among all classes is
 - (a) class B
 - (b) class A
 - (c) class AB
 - (d) class C

(4)

10. When negative voltage feedback is applied to an amplifier, its voltage gain will
- (a) increase
 - (b) reduce
 - (c) remain the same
 - (d) first increase and then decrease
11. An amplifier with the negative feedback
- (a) reduces the noise
 - (b) controls the gain
 - (c) reduces the phase distortion
 - (d) All of the above
12. What will be the phase shift of feedback circuit in R - C phase shift oscillator?
- (a) 180° phase shift
 - (b) 360° phase shift
 - (c) 90° phase shift
 - (d) 60° phase shift
13. The input impedance of an ideal OP-AMP is
- (a) zero
 - (b) infinite
 - (c) any value between zero and infinity
 - (d) None of the above

(5)

14. The output impedance of an ideal OP-AMP is
- (a) zero
 - (b) infinite
 - (c) any value between zero and infinity
 - (d) None of the above
15. An ideal OP-AMP requires infinite bandwidth because
- (a) output common mode noise voltage is zero
 - (b) signals can be amplified without attenuation
 - (c) output can drive infinite number in devices
 - (d) output voltage occurs simultaneously with input voltage change

SECTION—II

(Marks : 10)

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

1. How can we get an n -type semiconductor and a p -type semiconductor?
2. What is a Fermi level?
3. Why is a rectifier required?

(6)

4. What is A/D converter?
5. What is slew rate?
6. What do you mean by coupling amplifiers?
7. What are the advantages of phase shift oscillators?
8. Why is positive feedback not used in amplifiers?
9. What is an OP-AMP?
10. Define CMRR.

(PART : B—DESCRIPTIVE)

(Marks : 50)

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

GROUP—A

1. Describe the *n*-type and *p*-type semiconductor along with their energy band diagram. $5+5=10$
2. Derive the equation of a barrier potential for a semiconductor. 10

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(Continued)

(7)

GROUP—B

3. (a) Show that the efficiency and ripple factor of a full-wave rectifier are 81.2% and 0.48, respectively. $3+3=6$
(b) Describe the mechanism of a photodiode and mention its uses. 4
4. (a) What is Q-point in a transistor? Describe the DC load line with a diagram. $2+6=8$
(b) Why is BJT called current-controlled device? 2

GROUP—C

5. (a) What is the need for biasing a transistor? Give reasons for the shift of Q-point. $4+2=6$
(b) With the circuit diagram of CE amplifier using hybrid model, describe its output characteristics. 4
6. (a) Describe any *one* of the following : 6
(i) Class A amplifier
(ii) Class B amplifier
(b) Define the harmonic and crossover distortion. $2+2=4$

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(Turn Over)

GROUP—D

7. Describe the phase shift oscillator and analyse the circuit for frequency and condition of sustained oscillations. 4+6=10
8. Derive the output voltage expression for R - $2R$ ladder DAC and weighted-resistor DAC. 6+4=10

GROUP—E

9. (a) List the characteristics of an OP-AMP. 6
(b) What are common-mode voltage gain and differential voltage gain? 2+2=4
10. Describe the OP-AMP as an adder as well as a subtractor. 5+5=10
