2021

(CBCS)
(5th Semester)
ELECTRONICS

SIXTH PAPER
[Analog Circuits & Modulation]

Full Marks: 75
Time: 2 hours

INSTRUCTIONS TO CANDIDATES

(Please read the instructions carefully before you start writing your answers)

1. Questions should be attempted as per instructions.

2. Do not copy the Questions. Indicate the Section and Question No. clearly while attempting the answer.

3. For Multiple choice answers, candidate should indicate the Question No., Sub. No., (if any) and the correct answer. For example :

   1.   Name the State capital of Mizoram.

   (a) Lunglei

   (b) Aizawl

   (c) Champhai

   Candidate should provide answer as—Q. No. *1* : *(b) Aizawl* [Candidate should avoid writing only *(b)*]

4. Section B - Answer to Short Answer should be limited to **One Page** only.

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

2021

(CBCS)
(5th Semester)
ELECTRONICS

SIXTH PAPER
[Analog Circuits & Modulation]

Full Marks: 75
Time: 2 hours

The figures in the margin indicate full marks for the questions

SECTION : A – OBJECTIVE

(Marks: 30)

Choose the correct answer from the following: 1x30=30

1. A crystal diode has forward resistance of the order of...
   a) KΩ
   b) Ω
   c) MΩ
   d) <1Ω

2. The reverse current in a diode is of the order of...
   a) kA
   b) mA
   c) μA
   d) A

3. The ratio of reverse resistance and forward resistance of a germanium crystal diode is about...
   a) 1:1
   b) 100:1
   c) 1000:1
   d) 40000:1

4. The maximum efficiency of a half-wave rectifier is...
   a) 81.2%
   b) 40.6%
   c) 25%
   d) 50%

5. A half-wave rectifier has an input voltage of 240V r.m.s. If the step-down transformer has a turn's ratio of 8:1, what is the peak load voltage? Ignore diode drop.
   a) 42.5V
   b) 27.5V
   c) 30V
   d) 86.5V

6. If biasing is not done in an amplifier circuit, it results in...
   a) excessive collector bias
   b) unfaithful amplification
   c) decrease in base current
   d) low base current

7. In voltage divider bias $V_{CC} = 25V$; $R_1 = 10K\Omega$; $R_2 = 2.2K\Omega$ $R_3 = 3.6K\Omega$ and $R_E = 1K\Omega$. What is the emitter voltage?
   a) 4.9 V
   b) 6.7 V
   c) 3.8V
   d) 5.3V

8. The value of stability factor for a base-resistor bias is...
   a) $R_B(\beta+1)$
   b) $(\beta+1)$
   c) $(\beta+1)R_C$
   d) $(1-\beta)$

9. The operating point is also called the...
   a) cut off point
   b) linear point
   c) saturation point
   d) quiescent point

10. The biasing circuit has a stability factor of 50. If due to temperature change, I_{CBO} changes by $1\mu A$, then I_C will change by...
   a) $50\mu A$
   b) $25\mu A$
   c) $100\mu A$
   d) $20\mu A$

11. For proper amplification by a transistor circuit, the operating point should be located at ...... of the d.c. load line.
   a) cut off point
   b) the maximum current point
   c) saturation point
   d) middle

12. Thermal runaway occurs when...
   a) junction capacitance is high
   b) transistor is not biased
   c) collector is reverse biased
   d) emitter is forward biased

13. An ideal value of stability factor is...
   a) less than 250
   b) more than 100
   c) 1
   d) 50

14. The base resistor method is generally used in ...
   a) switching circuits
   b) balancing circuit
   c) rectifier circuits
   d) amplifier circuits

15. The maximum collector efficiency of *Class B* operation is...
   a) 50%
   b) 75.8%
   c) 45%
   d) 25%

16. A 2-transistor Class *B* power amplifier is commonly called ...... amplifier
   a) differential
   b) dual
   c) symmetrical
   d) push-pull

17. If a transistor is operated in such a way that output current flows for 60° of the input signal, then it is ......operation.
   a) Class *C*
   b) Class *AB*
   c) Class *A*
   d) Class *B*

18. The maximum efficiency of transformer coupled class *A* power amplifier is...
    a) 40%
    b) 75.8%
    c) 50%
    d) 25%

19. The push-pull circuit must use......operation
    a) Class A
    b) Class AB
    c) Class C
    d) Class B

20. What turn ratio (Np/Ns) of transformer is required to match 4Ω speaker to a transistor having an output impedance of 8000 Ω?
    a) 44.7
    b) 35.2
    c) 54.3
    d) 32.6

21. Power amplifiers generally use transformer coupling because transformer permits...
    a) cooling of the circuit
    b) distortion less output
    c) good frequency response
    d) impedance matching

22. Modulation is done in...
    a) antenna
    b) between transmitter and radio receiver
    c) transmitter
    d) radio receiver

23. In a transmitter, ... oscillator is used
    a) Hartley
    b) RC phase-shift
    c) Wien-bridge
    d) Crystal

24. Over modulation (amplitude) occurs when signal amplitude is ...... carrier amplitude.
    a) equal to
    b) greater than
    c) less than
    d) 2 times

25. The major advantage of FM over AM is...
- a) reception is less noisy
- b) higher carrier frequency
- c) smaller bandwidth
- d) small frequency deviation

26. If $A_{min} = 40$ and $A_{max} = 60$, what is the percentage modulation.
- a) 30%
- b) 20%
- c) 50%
- d) 10%

27. In TV transmission, sound signal is...
- a) amplitude
- b) frequency
- c) phase
- d) both phase and frequency

28. If $A_{DM} = 3500$, and $A_{CM} = 0.35$, the $CMRR$ is.....
- a) $80db$
- b) $50db$
- c) $90db$
- d) $35db$

29. A certain OP-amp has bias currents of $50\mu A$ and $49.3\mu A$. The input offset current is...
- a) $49.7\mu A$
- b) $850nA$
- c) $99.3\mu A$
- d) $700nA$

30. The output of a particular OP-amp increases $8V$ in $12\mu s$. The slew rate is...
- a) $90V/\mu s$
- b) $1.5V/\mu s$
- c) $0.67V/\mu s$
- d) $58V/\mu s$

SECTION : B – SHORT ANSWER

(Marks : 45)

Answer the following questions in not more than 1 (one) page each, choosing 3 (three) questions from each unit.   3x15=45

Unit I

1. Design a Zener Regulator for the following specifications
   Output Load Voltage, $V_0 = 6V$

   Load Current, $I_L = 15mA$

   Input Voltage, $V_i = 10V \pm 2V$

   Zener Wattage, $P_Z = 450mW$

2. Explain the working of Bridge rectifier with a neat diagram

3. Find the value of R in the circuit shown in Fig.1, when the voltage across the *zener* is $10V$ and the *zener* current is $20mA$.
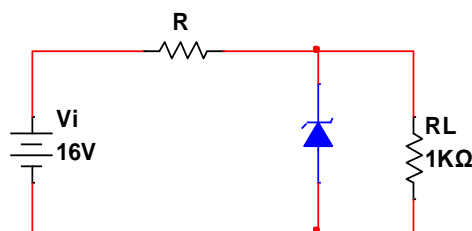

Fig.1

4. Prove that the efficiency of a full wave centre-tapped rectifier is $\eta = 81.2\%$

Unit II

5. Prove that the stability factor $S = (1 + \beta) \dfrac{1 + \dfrac{R_B}{R_E}}{1 + \beta + \dfrac{R_B}{R_E}}$ for a Self Bias or

   Emitter Bias or Voltage divider Bias

6. With supporting diagram and waveforms, explain the working of a Push-Pull Amplifier.

7. Prove that a transformer coupled Class-A power amplifier has maximum collector efficiency of 50%.

8. Referring Fig.2, calculate (i) input power (ii) collector efficiency of a amplifier. It is given that the voltage result in a base current of 10mA and the value of β=25.


Fig.2
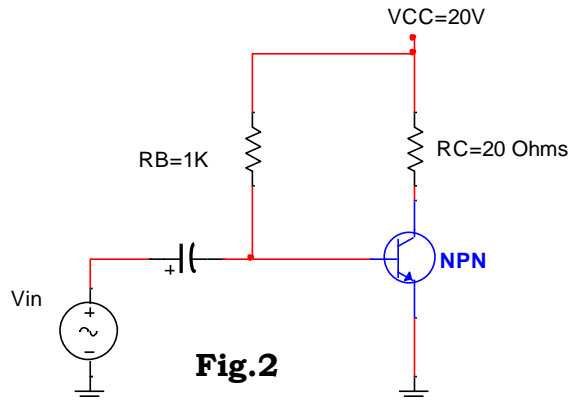
Unit III

9. Discuss the operation of a differential amplifier using transistor model.

10. What do you meant by CMRR? What is common-mode and differential mode signals

11. What do you mean by (i) output offset voltage (ii) input offset current and (iii) bandwidth of an op-amp?

12. Derive an expression for the voltage gain of inverting and non-inverting amplifier

Unit IV

13. What is a voltage follower? What is virtual ground? What do you mean by slew rate of an op-amp?

14. Explain the *d.c* analysis of differential amplifier.

15. Discuss the operation of OP-amp differentiation and integration

16. Determine the output voltage for the summing amplifier shown in Fig. 3.

Fig. 3
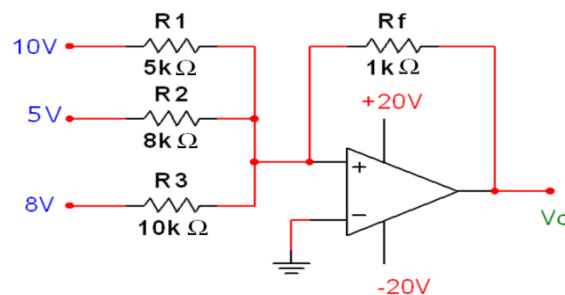
Unit V

17. A 400W carrier is modulated on a depth of 75%; calculate the total power in the modulated wave in the following forms of AM.
    a) Double sideband with full carrier(DSBFC)
    b) Double sideband suppressed carrier (DSBSC)
    c) Single sideband suppressed carrier (SSB)

18. What are the different types of modulation? How we can modulate AM wave using square-law modulator?

19. Describe the function and working of an envelope detector.

20. Prove that modulation index $\beta = \dfrac{\Delta f}{f_m}$ for single tone frequency modulation.

***** End of question *****