

2021

(CBCS)  
(3<sup>rd</sup> Semester)  
**ELECTRONICS**

THIRD PAPER  
**[Electronic Devices and Amplifiers]**

*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.

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**SECTION : A – OBJECTIVE**

( Marks: 30 )

Choose the correct answer from the following:

1x30=30

1. The gate of a *JFET* is ..... biased
  - a) reverse
  - b) forward
  - c) reverse as well as forward
  - d) one side
  
2. The input impedance of a *JFET* is ..... that of an ordinary transistor.
  - a) equal to
  - b) less than
  - c) more than
  - d) twice
  
3. A *MOSFET* can be operated with.....
  - a) negative gate voltage only
  - b) positive gate voltage only
  - c) positive as well as negative gate voltage
  - d) neither positive nor negative gate voltage
  
4. Which of the following devices has the highest input impedance?
  - a) *JFET*
  - b) *MOSFET*
  - c) crystal diode
  - d) ordinary transistor

5. A *MOSFET* uses the electric field of a .....to control the channel current.
- a) capacitor
  - b) battery
  - c) generator
  - d) voltage
6. The pinch-off voltage in a *JFET* is analogous to ..... voltage in a vacuum tube.
- a) anode
  - b) cathode
  - c) grid cut off
  - d) fluoresce gas
7. The device that exhibits negative resistance region is .....
- a) diac
  - b) triac
  - c) transistor
  - d) *UJT*
8. The *UJT* may be used as .....
- a) an amplifier
  - b) a sawtooth generator
  - c) a rectifier
  - d) a regulator
9. An *SCR* is a ..... triggered device.
- a) voltage
  - b) current
  - c) voltage as well as current
  - d) pulse
10. An *SCR* is turned off by .....
- a) reducing anode voltage to zero
  - b) reducing gate voltage to zero
  - c) reverse biasing the gate
  - d) reducing the holding & latching currents
11. When the temperature increases, the inter-base resistance ( $R_{BB}$ ) of a *UJT* .....
- a) increases
  - b) decreases
  - c) remains the same
  - d) insufficient data

12. In an SCR circuit, the angle of conduction can be changed by .....
- a) changing anode voltage
  - b) changing gate voltage
  - c) reverse biasing the gate
  - d) reducing the holding currents
13. If the collector current flows at all times during the full cycle of the input signal, the power amplifier is known as ..... power amplifier.
- a) Class – A
  - b) Class – B
  - c) Class – C
  - d) Class – AB
14. The maximum overall efficiency of a class-B push-pull amplifier cannot exceed ...
- a) 100 %
  - b) 78.5 %
  - c) 50 %
  - d) 85 %
15. A class-B push-pull amplifier has the main advantage of being free from ...
- a) any circuit imbalance
  - b) unwanted noise
  - c) even-order harmonic distortion
  - d) dc magnetic saturation effects
16. In the double tuned circuit, if the mutual inductance between the two tuned circuits is decreased, the level of resonance curve is.....
- a) remains the same
  - b) lowered
  - c) raised
  - d) insufficient
17. The voltage gain of a tuned amplifier is ..... at resonant frequency.
- a) minimum
  - b) maximum
  - c) half-way between maximum and minimum
  - d) zero

18. A tuned amplifier uses ..... load
- a) resistive
  - b) capacitive
  - c) LC tank
  - d) inductive
19. A transistor behaves as a linear device for .....
- a) small signals only
  - b) large signals only
  - c) both small and large signals
  - d) no signal
20. The dimension of  $h_i$  parameter is ....
- a) mho
  - b) ohm
  - c) farad
  - d) henry
21. If temperature changes,  $h$  parameters of a transistor.....
- a) may or may not change
  - b) do not change
  - c) also change
  - d) is zero
22. RC coupling is used for ..... amplification
- a) voltage
  - b) current
  - c) power
  - d) frequency
23. The frequency response of Transformer coupling is .....
- a) good
  - b) very good
  - c) excellent
  - d) poor
24. An autotransformer consists of 200-turn winding connected to 200 V a.c. supply mains. For getting 24 V output, the winding should be tapped at turn number ...
- a) 24
  - b) 12
  - c) 100
  - d) 72

25. When a differential amplifier is operated single-ended.....
- a) the output is grounded
  - b) one input is grounded and signal is applied to the other
  - c) both inputs are connected together
  - d) the output is not inverted
26. The common-mode gain is .....
- a) very high
  - b) very low
  - c) always unity
  - d) unpredictable
27. If  $A_{DM} = 3500$  and  $A_{CM} = 0.35$ , the  $CMRR_{dB}$  is .....
- a) 20 dB
  - b) 100 dB
  - c) 80 dB
  - d) 60 dB
28. Current cannot flow to ground through .....
- a) a mechanical ground
  - b) an a.c. ground
  - c) a virtual ground
  - d) an ordinary ground
29. A certain non-inverting amplifier has  $R_i$  of  $1\text{ k}\Omega$  and  $R_f$  of  $100\text{ k}\Omega$ . The closed loop voltage gain is .....
- a) 100,000
  - b) 1000
  - c) 101
  - d) 100
30. For an OP-amp with negative feedback, the output is .....
- a) equal to the input
  - b) increased
  - c) fed back to the inverting input
  - d) fed back to the noninverting input

## SECTION : B – SHORT ANSWER

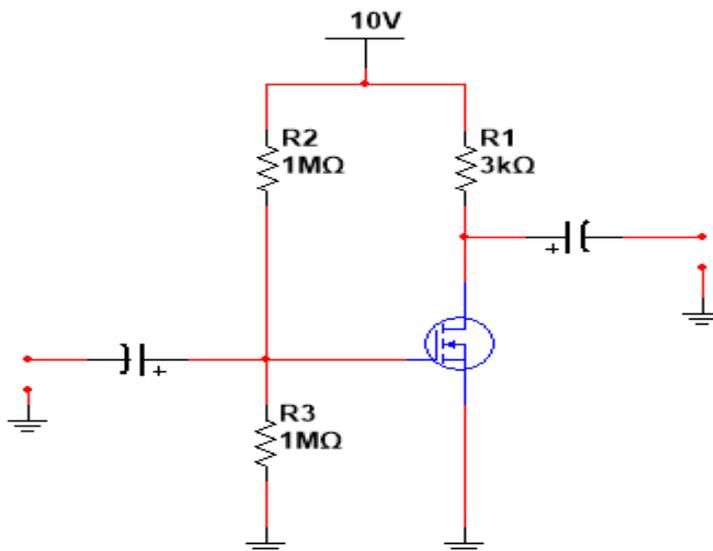
(Marks : 45)

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

3x15=45

### Unit I

1. Explain the working of *N-channel DE – MOSFET* along with the suitable diagram
2. Draw and explain the drain characteristic of *JFET*. What is Pinch-off Voltage?
3. Determine the value of  $I_D$  for the circuit shown below. The data sheet for this particular *MOSFET* gives  $I_{D(on)} = 10\text{ mA}$  at  $V_{GS} = 10\text{ V}$  and  $V_{GS(th)} = 1.5\text{ V}$ .



4. The data sheet of a *JFET* gives the following information:  $I_{DSS} = 3\text{ mA}$ ,  $V_{GS(off)} = -6\text{ V}$  and  $g_{m(max)} = 5000\text{ }\mu\text{s}$ . Determine the trans-conductance for  $V_{GS} = -4\text{ V}$  and find drain current  $I_D$  at this point

## Unit II

5. Draw the equivalent circuit of a *UJT* and discuss its working from the circuit.
6. Explain the construction of a *SCR* with its transistor analogy. Sketch the *V-I* characteristics and show the holding and latching current..
7. Draw the circuit diagram of a *SCR* full wave rectifier. Derive the expression for average voltage  $V_{av}$  and average current  $I_{av}$ .
8. Given silicon *UJT* has inter-base resistance of  $10\text{ k}\Omega$ . It has  $R_{B1} = 6\text{ k}\Omega$  with  $I_E = 0$ . Find,
  - (a) *UJT* current if  $V_{BB} = 20\text{ V}$  and  $V_E$  is less than  $V_P$ .
  - (b)  $\eta$  and  $V_A$
  - (c) Peak point voltage  $V_P$

## Unit III

9. Show that the efficiency of transformer coupled Class – A amplifier is 50% in an ideal case.
10. Draw a neat circuit diagram of Class-B push-pull amplifier and explain its working.
11. Why tuned circuits are not used for low frequency amplification? It is desired to obtain a bandwidth of 200 kHz at an operating frequency of 10MHz using a double tuned circuit. What value of co-efficient of coupling should be used?
12. With a neat diagram, explain the working of double-tuned amplifier.

## Unit IV

13. A transistor used in CE arrangement has the following set of  $h$  parameters when the d.c. operating point is  $V_{CE} = 10\text{ volts}$  and  $I_C = 1\text{ mA}$ :  $h_{ie} = 2000\ \Omega$ ;  $h_{oe} = 10^{-4}\text{ mho}$ ,  $h_{re} = 10^{-3}$ ;  $h_{fe} = 50$ . Determine (i) input impedance (ii) current gain (iii) voltage gain. The a.c. load seen by the transistor is  $r_L = 600\ \Omega$  and a source resistance of  $R_S = 2\text{ k}\ \Omega$ .
14. Draw the  $h$ -parameter equivalent circuit of transistor in CE configuration. Express the input impedance, current gain and voltage gain of the CE configuration in terms of  $h$ -parameters and load.
15. With a suitable diagram, explain the frequency response of an RC-coupled Transistor amplifier
16. Explain the construction and operation of transformer-coupled amplifier

## Unit V

17. With the help of a circuit diagram, explain the operation of a balanced differential amplifier.
18. What is the difference between common-mode signals and differential-mode signals? A differential amplifier has an output of  $1V$  with a differential input of  $10\text{ mV}$  and an output of  $5\text{ mV}$  with a common-mode input of  $10\text{ mV}$ . Find the CMRR in  $dB$ .
19. Why the 'summing point' of the Operational Amplifier called 'virtual ground'? What are the characteristics of an Ideal Operational Amplifier?
20. Derive an expression for overall gain in an inverting OP-AMP.

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