

NATIONAL COUNCIL OF SCIENCE MUSEUMS
(Ministry of Culture Government of India)
APTITUDE TEST FOR CURATOR (Electronics)
PART II

NAME:

Marks:70

Form No:

Duration:3 hours

PART A (OBJECTIVE)

Instructions to Candidates:

- (a) Please read the questions thoroughly and answer carefully.
- (b) Answer should be written only in the answer sheet given on the front page
- (c) Each correct answer carries one mark.
- (d) Do not detach the answer sheet from the Question paper
- (e) Answer found most suitable should be " ✓ "marked in the appropriate column given in the answer sheet.

(30x1=30 Marks)

1. Movement of holes in a semiconductor:
 - A. Is like a flow of electrons in the same direction
 - B. Is possible only if the current is high enough
 - C. Results in a certain amount of electric current
 - D. Causes the material to stop conducting

2. A stroke of lightning:
 - A. Is caused by a movement of holes in an insulator
 - B. Has a very low current
 - C. Is a discharge of static electricity
 - D. Builds up between clouds

3. Biasing in an amplifier circuit:
 - A. Keeps it from oscillating.
 - B. Matches it to other amplifier stages in a chain.
 - C. Can be done using voltage dividers.
 - D. Maximizes current flow

4. An advantage of a rheostat over a potentiometer is that:
 - A. A rheostat can handle higher frequencies.
 - B. A rheostat is more precise.
 - C. A rheostat can handle more current.
 - D. A rheostat works better with dc.

5. A battery delivers 12 V to a bulb. The current in the bulb is 3 A. What is the resistance of the bulb?
 - A. 36 Ω .
 - B. 4 Ω .
 - C. 0.25 Ω .
 - D. 108 Ω .

6. A semiconductor material is made into N type by:
 - A. Adding an acceptor impurity
 - B. Adding a donor impurity
 - C. Injecting electrons
 - D. Taking electrons away

7. When a P-N junction does not conduct, it is:
 - A. Reverse biased
 - B. Forward biased
 - C. Biased past the breker voltage
 - D. In a state of avalanche effect

8. If the reverse bias exceeds the avalanche voltage in a P-N junction:
 - A. The junction will be destroyed
 - B. The junction will insulate; no current will flow
 - C. The junction will conduct current
 - D. The capacitance will become extremely high

9. If a half-wave rectifier is used with 117-V rms ac (house mains), the average dc output voltage is about:
 - A. 52.7 V
 - B. 105 V
 - C. 117 V
 - D. 328 V

10. If a full-wave bridge circuit is used with a transformer whose secondary provides 50 V rms, the PIV across the diodes is about:
 - A. 50 V
 - B. 70 V
 - C. 100 V
 - D. 140 V

11. In a PNP circuit, the collector:
 - A. Has an arrow pointing inward
 - B. Is positive with respect to the emitter
 - C. Is biased at a small fraction of the base bias
 - D. Is negative with respect to the emitter

12. In a common-emitter circuit, the gain bandwidth product is:
 - A. The frequency at which the gain is 1
 - B. The frequency at which the gain is 0.707 times its value at 1 MHz
 - C. The frequency at which the gain is greatest
 - D. The difference between the frequency at which the gain is greatest, and the frequency at which the gain is 1

13. The gain of a transistor in a common-emitter circuit is 100 at a frequency of 1000 Hz. The gain is 70.7 at 335 kHz. The gain drops to 1 at 210 MHz. The alpha cutoff is:
- A. 1 kHz.
 - B. 335 kHz.
 - C. 210 MHz.
 - D. None of the above
14. The greatest possible amplification is obtained in:
- A. A common-emitter circuit
 - B. A common-base circuit
 - C. A common-collector circuit
 - D. More than one of the above
15. The configuration noted for its stability in radio-frequency power amplifiers is the:
- A. Common-emitter circuit
 - B. Common-base circuit
 - C. Common-collector circuit
 - D. Emitter-follower circuit
16. A Colpitts circuit is a form of:
- A. Amplifier
 - B. Modulator
 - C. Rectifier
 - D. Oscillator
17. High voltages are better than low voltages for long-distance electric power transmission because:
- A. The lines can better withstand lightning strokes.
 - B. The magnetic fields are weaker
 - C. The electric fields are weaker
 - D. The I^2R losses are lower
18. In an NPN bipolar transistor circuit:
- A. The dc collector voltage is negative
 - B. The output is taken from the base
 - C. The dc collector voltage is positive
 - D. The output is taken from the drain
19. A simple power supply filter can be made using:
- A. A capacitor in parallel with the rectifier output
 - B. A resistor in parallel with the rectifier output
 - C. An inductor in parallel with the rectifier output
 - D. A capacitor in series with the rectifier output

20. Three resistances are in parallel, with values of 100, 200, and 300 ohms. The current through the 200-ohm resistor is 500 mA. What is the voltage across the whole combination?
- A. 100 mV
 - B. 400 V
 - C. 400 mV
 - D. 100 V
21. A resistor of 100 ohms carries 333 mA dc. The power dissipated by that resistor is:
- A. 300 mW
 - B. 11.1 W
 - C. 33.3 W
 - D. 3.33 W
22. If you place a bar of iron inside a cylindrical coil of wire, and then run dc through the wire, you have:
- A. A rheostat
 - B. A permanent magnet
 - C. An electromagnet
 - D. An electric generator
23. How many Flip-Flops are required for mod-16 counter?
- A. 5
 - B. 6
 - C. 3
 - D. 4
24. A 4-bit synchronous counter uses flip-flops with propagation delay times of 15 ns each. The maximum possible time required for change of state will be
- A. 15 ns
 - B. 30 ns
 - C. 45 ns
 - D. 60 ns
25. One of the main shortcomings of MOSFETs is that they:
- A. Are easily damaged by static electricity
 - B. Require high voltages
 - C. Consume large amounts of current
 - D. Have very low gain
26. A complementary-metal-oxide-semiconductor (CMOS) IC:
- A. Employs diodes and NPN transistors on a single chip
 - B. Employs N-channel and P-channel FETs on a single chip
 - C. Uses two chips connected together in a special way
 - D. Uses resistors and PNP transistors on a single chip

27. A piano sounds different than a saxophone, even if the notes are at the same frequency, because of a difference in:
- A. Bias
 - B. Waveform
 - C. Voltage
 - D. Current
28. In a certain resistance-capacitance (RC) circuit, the current leads the voltage by 45 degrees. The resistance is 50 ohms. The capacitive reactance is:
- A. 25 ohms
 - B. -25 ohms
 - C. 50 ohms
 - D. -50 ohms
29. A transformer has a primary-to-secondary turns ratio of 10:1. The input is 120 V rms ac. The output is:
- A. 12 kV rms ac
 - B. 1.2 kV rms ac
 - C. 120 V rms ac
 - D. 12 V rms ac
30. A ring counter consisting of five Flip-Flops will have
- A. 5 states
 - B. 10 states
 - C. 32 states
 - D. Infinite states

PART B (DESCRIPTIVE)

Marks:40

Answer all questions

Question1. Assume that you are visiting an art/Science museum in a post Covid world. How can you make the visit to the museum safe for visitors using technological interventions? List out the technologies to be adopted in museums to make it safe for visitors in a Covid 19 Pandemic world. Your answer should cover the following areas in the museum.

- a) Entrance to the museum
- b) Ticketing
- c) Souvenir Shop
- d) Exhibition
- e) Museum Staff /demonstrators

(5x4=20 marks)

Question2. What are universal gates. Construct a logic circuit using NAND gates only for the expression $X = A \cdot (B + C)$

(5 marks)

Question 3: Write short notes any three of the following

- a. Electronic Nose
- b. Super capacitors
- c. SMDs(Surface Mount Devices)
- d. LiWi Technology

(3 x 5=15 marks)
