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PAPER-II
ELECTRONIC SCIENCE

Signature and Name of Invigilator

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   (Name) _____

2. (Signature) _____

   (Name) _____

Time : 1 ¼ hours]

OMR Sheet No. : ....

(To be filled by the Candidate)

Roll No. [ ][ ][ ][ ][ ][ ][ ]

(In figures as per admission card)

Roll No._____

(In words)

[Maximum Marks : **100**

Number of Pages in this Booklet : **8**	Number of Questions in this Booklet : **50**

Instructions for the Candidates	परीक्षार्थियों के लिए निर्देश

1. Write your roll number in the space provided on the top of this page.
2. This paper consists of fifty multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as below :
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
   (iii) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the oval as indicated below on the correct response against each item.
   Example : (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the items are to be indicated in the **Answer Sheet given inside the Paper I Booklet only.** If you mark at any place other than in the ovals in the Answer Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the test booklet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. You have to return the test question booklet and OMR Answer sheet to the invigilators at the end of the examination compulsorily and must not carry it with you outside the Examination Hall.
10. **Use only Blue/Black Ball point pen.**
11. **Use of any calculator or log table etc., is prohibited.**
12. **There is no negative marks for incorrect answers.**

1. पहले पृष्ठ के ऊपर नियत स्थान पर अपना रोल नम्बर लिखिए ।
2. इस प्रश्न-पत्र में पचास बहुविकल्पीय प्रश्न हैं ।
3. परीक्षा प्रारम्भ होने पर, प्रश्न-पुस्तिका आपको दे दी जायेगी । पहले पाँच मिनट आपको प्रश्न-पुस्तिका खोलने तथा उसकी निम्नलिखित जाँच के लिए दिये जायेंगे, जिसकी जाँच आपको अवश्य करनी है :
   (i) प्रश्न-पुस्तिका खोलने के लिए उसके कवर पेज पर लगी कागज की सील को फाड़ लें । खुली हुई या बिना स्टीकर-सील की पुस्तिका स्वीकार न करें ।
   (ii) कवर पृष्ठ पर छपे निर्देशानुसार प्रश्न-पुस्तिका के पृष्ठ तथा प्रश्नों की संख्या को अच्छी तरह चैक कर लें कि ये पूरे हैं । दोषपूर्ण पुस्तिका जिनमें पृष्ठ/प्रश्न कम हों या दुबारा आ गये हों या सीरियल में न हों अर्थात किसी भी प्रकार की त्रुटिपूर्ण पुस्तिका स्वीकार न करें तथा उसी समय उसे लौटाकर उसके स्थान पर दूसरी सही प्रश्न-पुस्तिका ले लें । इसके लिए आपको पाँच मिनट दिये जायेंगे । उसके बाद न तो आपकी प्रश्न-पुस्तिका वापस ली जायेगी और न ही आपको अतिरिक्त समय दिया जायेगा ।
   (iii) इस जाँच के बाद OMR पत्रक की क्रम संख्या इस प्रश्न-पुस्तिका पर अंकित कर दें ।
4. प्रत्येक प्रश्न के लिए चार उत्तर विकल्प (A), (B), (C) तथा (D) दिये गये हैं । आपको सही उत्तर के दीर्घवृत्त को पेन से भरकर काला करना है जैसा कि नीचे दिखाया गया है ।
   उदाहरण : (A) (B) ● (D)
   जबकि (C) सही उत्तर है ।
5. प्रश्नों के उत्तर केवल प्रश्न पत्र I के अन्दर दिये गये उत्तर-पत्रक पर ही अंकित करने हैं । यदि आप उत्तर पत्रक पर दिये गये दीर्घवृत्त के अलावा किसी अन्य स्थान पर उत्तर चिह्नांकित करते हैं, तो उसका मूल्यांकन नहीं होगा ।
6. अन्दर दिये गये निर्देशों को ध्यानपूर्वक पढ़ें ।
7. कच्चा काम (Rough Work) इस पुस्तिका के अन्तिम पृष्ठ पर करें ।
8. यदि आप उत्तर-पुस्तिका पर अपना नाम या ऐसा कोई भी निशान जिससे आपकी पहचान हो सके, किसी भी भाग पर दर्शाते या अंकित करते हैं तो परीक्षा के लिये अयोग्य घोषित कर दिये जायेंगे ।
9. आपको परीक्षा समाप्त होने पर प्रश्न-पुस्तिका एवं OMR उत्तर-पत्रक निरीक्षक महोदय को लौटाना आवश्यक है और परीक्षा समाप्ति के बाद उसे अपने साथ परीक्षा भवन से बाहर न लेकर जायें ।
10. केवल नीले/काले बाल प्वाईंट पेन का ही इस्तेमाल करें ।
11. किसी भी प्रकार का संगणक (कैलकुलेटर) या लाग टेबल आदि का प्रयोग वर्जित है ।
12. गलत उत्तरों के लिए कोई अंक काटे नहीं जाएँगे ।

ELECTRONIC SCIENCE
Paper – II

Note : This paper contains **fifty (50)** objective type questions, each question carrying **two (2)** marks. Attempt **all** the questions.

1. Which diode exhibits negative resistance characteristics ?
   (A) Zener diode
   (B) Tunnel diode
   (C) Schottky diode
   (D) p-n junction diode

2. The effective mass of an electron in a band with a given (E, K) relationship is given by
   (A) $\dfrac{\hbar}{dE/dK}$
   (B) $\dfrac{\hbar^2}{dE/dK}$
   (C) $\dfrac{\hbar^2}{d^2E/dK^2}$
   (D) $\dfrac{\hbar}{d^2E/dK^2}$

3. Transient response occurs in
   (A) resistive circuit
   (B) reactive circuit
   (C) steady state
   (D) open circuit

4. Superposition theorem is not valid for
   (A) Voltage responses
   (B) Current responses
   (C) Power responses
   (D) Phase responses

5. A field effect transistor is a
   (A) current controlled device
   (B) voltage controlled device
   (C) gain controlled device
   (D) drain controlled device

6. A differential amplifier is invariably in the input stage of all Op-Amps. This is done basically to provide the Op-Amps with a very high
   (A) CMRR
   (B) bandwidth
   (C) slew rate
   (D) open-loop gain

7. In a JK flip-flop the output state will toggle only when
   (A) J = 1, K = 0
   (B) J = 0, K = 1
   (C) J = 0, K = 0
   (D) J = 1, K = 1

8. D to A converter is achieved by
   (A) ladder network
   (B) dual-slope conversion
   (C) astable multivibrator
   (D) voltage controlled oscillator

9. Which interrupt has highest priority in 8085 ?
   (A) RST 7.5
   (B) RST 6.5
   (C) RST 5.5
   (D) TRAP

10. A 4-bit data size is called
    (A) data bus
    (B) baud
    (C) byte
    (D) nibble

11. The storage medium for the static storage class is
    (A) CPU register
    (B) memory
    (C) accumulator
    (D) stack

12. In C, executable program is created by
    (A) compiler only
    (B) linker only
    (C) compiler and linker
    (D) editor

13. The cut off frequency for TEM wave is
    (A) infinity
    (B) zero
    (C) arbitrary frequency
    (D) that of TE_{10}

14. Depth of penetration of electromagnetic wave in free space is
    (A) infinity
    (B) $\dfrac{1}{\alpha}$
    (C) 0
    (D) α

15. Which of the following communication modes support two-way traffic but in only one direction at a time ?
(A) Simplex
(B) Half-duplex
(C) Three-quarter duplex
(D) Full-duplex

16. Intermediate frequency is used in
(A) AM transmitter
(B) FM transmitter
(C) Super heterodyne receiver
(D) Frequency division multiplexing

17. Relaxation oscillator is made using
(A) SCR   (B) FET
(C) UJT   (D) BJT

18. Which can measure pressure directly ?
(A) Thermistor
(B) Bourdon tube
(C) LVDT
(D) Strain gauge

19. Bandwidth offered by optical fiber communication is of the order of
(A) 40 THz   (B) 40 GHz
(C) 40 MHz   (D) 10^{10} Hz

20. In feed-back control system, over-damped condition for damping ratio will be equal to
(A) one
(B) greater than one
(C) less than one
(D) zero

Directions : Q. Nos. **21** to **30 :** Assertion & Reasoning type.
The following questions consist of two statements : one labelled as "Assertion (A)" and the other labelled as "Reason (R)". You are to examine these two statements carefully and decide if the Assertion (A) and the Reason (R) are individually true and if so, whether the

Reason is a correct explanation of the Assertion. Select your answers to these items using the codes given below and mark your answer accordingly.

Codes :
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.

21. **Assertion (A) :** At room temperature, the Fermi level in a p-type semiconductor lies above the valance band, whereas that in the n-type semiconductor lies below the conduction band.
Reason (R)   : At room temperature, the p-type semiconductor is rich in holes whereas the n-type semiconductor is rich in electrons.

22. **Assertion (A) :** Thevenin's theorem is normally used to find the equivalent voltage source and Thevenin's equivalent resistance of a complex network.
Reason (R)   : Thevenin theorem holds good for d.c. voltages but not for a.c. voltages.

23. **Assertion (A) :** In the normal operation of BJT the emitter diode and collector diode are forward biased.
Reason (R)   : In the active region the BJT can provide class-A operation.

24. **Assertion (A) :** R–2R ladder type D/A converter has a higher speed of conversion than a weighted resistance D/A converter.
Reason (R)   : R–2R ladder type D/A converter uses a smaller number of passive components than the weighted resistance D/A converter.

25. **Assertion (A) :** In Intel 8085, the lower type of address and data are multiplexed.

Reason (R) : This helps limit the number of external pin terminals.

26. **Assertion (A) :** User defined functions are available as library functions in C compiler.

Reason (R) : User defined functions help to avoid repetition of same group of statements.

27. **Assertion (A) :** Helical antenna can be used as feeder for large parabolic reflectors to obtain circular polarization.

Reason (R) : Parabolic reflectors reverse the sense of polarization of the wave during reflection.

28. **Assertion (A) :** In Hall effect, the open circuit transverse voltage developed by a current carrying semiconductor with a steady magnetic field imposed perpendicular to the current direction has opposite signs of n-type and p-type semiconductors.

Reason (R) : The magnetic field pushes both the holes and the electrons in the same direction.

29. **Assertion (A) :** Optical fiber have broader bandwidth compared to conventional copper cables.

Reason (R) : The information carrying capacity of optical fibers is limited by dispersion and non-linear effects.

30. **Assertion (A) :** Routh-Hurwitz criter-ion deals with stability of the system.

Reason (R) : Change of sign in the first column of Routh array suggests stability of the system.

31. Consider the devices.
1. JFET   2. MOSFET
3. BJT   4. CMOS
The correct sequence in which the input impedance decreases is
(A) 2, 1, 4, 3   (B) 3, 1, 4, 2
(C) 4, 2, 1, 3   (D) 1, 4, 2, 3

32. Consider the following steps :
1. Etching
2. Exposure of ultra violet radiation
3. Stripping
4. Developing
After a wafer has been coated with photoresist, the correct sequence of these steps in photolithography is
(A) 2, 4, 3, 1   (B) 2, 4, 1, 3
(C) 4, 2, 1, 3   (D) 3, 2, 4, 1

33. Voltage regulator ICs are mentioned below
1. 7809   2. 7805
3. 7815   4. 7812
The correct sequence in which the output increases is
(A) 2, 1, 4, 3   (B) 1, 2, 3, 4
(C) 3, 1, 4, 2   (D) 4, 3, 2, 1

34. Consider the following communication systems :
1. Telephony
2. Radio communication
3. Microwave communication
4. Optical communication
The correct sequence of these systems from the point of view of increasing order of base band channels each one of them can accommodate is
(A) 2, 4, 3, 1   (B) 3, 4, 1, 2
(C) 1, 2, 3, 4   (D) 4, 2, 1, 3

35. Given below is a data size :
1. Byte   2. Nibble
3. Double Word 4. Word
The correct sequence in decreasing order of data size is
(A) 1, 3, 4, 2   (B) 3, 4, 1, 2
(C) 4, 2, 3, 1   (D) 2, 3, 4, 1

Direction : Q. Nos. **36** to **45** :

In the following question, match List–I with List–II and select the correct answer using the codes given below the lists :

36.

	List – I		List – II
(a)	BJT	(i)	Trans-conductance
(b)	JFET	(ii)	Breakdown diodes
(c)	Avalanche effect	(iii)	Photo masking
(d)	IC fabrication	(iv)	Emitter follower

Codes :

	(a)	(b)	(c)	(d)
(A)	(iii)	(ii)	(i)	(iv)
(B)	(iv)	(i)	(ii)	(iii)
(C)	(i)	(iv)	(iii)	(ii)
(D)	(ii)	(iii)	(iv)	(i)

37.

	List – I		List – II
(a)	Laplace	(i)	stability
(b)	Poles and zeros	(ii)	current source
(c)	Norton's theorem	(iii)	short circuit
(d)	y-parameters	(iv)	transient analysis

Codes :

	(a)	(b)	(c)	(d)
(A)	(i)	(iii)	(iv)	(ii)
(B)	(iv)	(i)	(ii)	(iii)
(C)	(ii)	(iii)	(i)	(iv)
(D)	(iii)	(ii)	(iv)	(i)

38.

	List – I		List – II
(a)	Positive voltage regulators	(i)	voltage series
(b)	JFET	(ii)	78 XX
(c)	Feedback	(iii)	Regenerative feedback
(d)	Multivibrator	(iv)	Voltage variable resistor

Codes :

	(a)	(b)	(c)	(d)
(A)	(i)	(iii)	(ii)	(iv)
(B)	(ii)	(iv)	(i)	(iii)
(C)	(iv)	(iii)	(ii)	(i)
(D)	(iii)	(iv)	(i)	(ii)

39.

	List – I		List – II
(a)	Fan out of 10	(i)	Mod-2 addition
(b)	XOR	(ii)	Counter
(c)	Dual slope	(iii)	TTL
(d)	Modular-10	(iv)	A-D conversion

Codes :

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iv)	(iii)
(B)	(ii)	(iii)	(i)	(iv)
(C)	(iv)	(ii)	(iii)	(i)
(D)	(iii)	(i)	(iv)	(ii)

40.

	List – I		List – II
(a)	8085	(i)	Handshake mode
(b)	8031	(ii)	2-key lockout
(c)	8279	(iii)	SID
(d)	8255	(iv)	O-KBROM

Codes :

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iv)	(iii)
(B)	(ii)	(i)	(iii)	(iv)
(C)	(iv)	(iii)	(i)	(ii)
(D)	(iii)	(iv)	(ii)	(i)

41.

	List – I		List – II
(a)	$\% x$	(i)	Post increment
(b)	while (1)	(ii)	character
(c)	$x++$	(iii)	infinite loop
(d)	' $\perp$ '	(iv)	hex

Codes :

	(a)	(b)	(c)	(d)
(A)	(iv)	(iii)	(i)	(ii)
(B)	(iii)	(ii)	(iv)	(i)
(C)	(i)	(iii)	(ii)	(iv)
(D)	(ii)	(iv)	(i)	(iii)

42.

	List – I		List – II
(a)	Capacitive transducer	(i)	Pressure
(b)	Thermocouple	(ii)	Strain
(c)	Load cell	(iii)	Displacement
(d)	Diaphragm	(iv)	Temperature

Codes :

	(a)	(b)	(c)	(d)
(A)	(ii)	(iv)	(iii)	(i)
(B)	(iii)	(i)	(ii)	(iv)
(C)	(ii)	(i)	(iii)	(iv)
(D)	(iii)	(iv)	(ii)	(i)

43.

	List – I		List – II
(a)	Frequency Modulation	(i)	Envelop detection
(b)	Double side suppressed carrier	(ii)	Companding
(c)	PCM	(iii)	Balanced modulator
(d)	Amplitude modulation	(iv)	Pre-emphasis and de-emphasis

Codes :

	(a)	(b)	(c)	(d)
(A)	(i)	(ii)	(iii)	(iv)
(B)	(i)	(ii)	(iv)	(iii)
(C)	(iv)	(iii)	(i)	(ii)
(D)	(iv)	(iii)	(ii)	(i)

44.

	List – I		List – II
(a)	LASER	(i)	Emits light of low intensity
(b)	Solar cell	(ii)	Consumes electrical power due to the incident light
(c)	Photo diode	(iii)	Delivers power to load
(d)	LED	(iv)	Emits high energy coherent beam

Codes :

	(a)	(b)	(c)	(d)
(A)	(iv)	(iii)	(i)	(ii)
(B)	(iii)	(iv)	(ii)	(i)
(C)	(iv)	(iii)	(ii)	(i)
(D)	(iii)	(iv)	(i)	(ii)

45.

	List – I		List – II
(a)	Proportional control	(i)	hysteresis
(b)	On-off control	(ii)	stability
(c)	Bode plot	(iii)	variable gain amplifier
(d)	Routh-Hurwitz	(iv)	frequency response

Codes :

	(a)	(b)	(c)	(d)
(A)	(iii)	(i)	(iv)	(ii)
(B)	(i)	(ii)	(iv)	(iii)
(C)	(ii)	(i)	(iii)	(iv)
(D)	(iv)	(iii)	(i)	(ii)

Read the paragraph and answer the questions **46** to **50**.

Power devices with pnpn layers such as SCR, SCS and GTO belong to thyristor series. However, UJT is also a member of this group. The most popular pnpn device – the SCR was introduced in 1956 by Bell Telephone Laboratories. It has capability to control power as high as 10 MW with individual ratings upto 2000 A at 1800 V. The frequency range of its application has also been extended upto 50 KHz hence it is used in induction heating and ultrasonic cleaning.

A simple p-n junction diode is a rectifier without control action. SCR is a rectifier with control action. The third element called gate enables the controlled rectification gate is used to turn the SCR on but not to turn it off. In the off state the resistance of SCR is large upto 100 KΩ while in the on state its dynamic resistance is typically 0.01 to 0.1 Ω. As it has to handle high power and high temperature, SCR is made of Si.

To turn the SCR on a positive pulse of suitable amplitude must be applied to the gate terminal when the anode is positive with respect to the cathode. However, removal of gate signal does not turn the SCR off. The general methods used for turning the SCR off are (i) anode current interruption and (ii) forced commutation. It is not recommended to turn the SCR on with zero gate signal.

The specifications of SCR given in the data sheet include forward break-over voltage, latching current, holding current, reverse break-down voltage, turn-on time, turn-off time, gate ratings and junction temperature T_j.

Some of the applications of SCR are motor controls, relay controls, inverters, cycloconverters, preventive circuits, regulated power supplies and phase control. Another pnpn device having characteristic similar to that of SCR is SCS – silicon controlled switch. However it has two gate terminals. The additional gate at the anode side can be used to turn SCS off. The turn off time of SCS is 1 to 10 μs as against 5 to 30 μs for that of SCR. Other advantages of SCS over SCR are

1. increased control
2. triggering sensitivity and
3. more predictable firing

At present SCS is limited to low power current and voltage ratings. It can dissipate 100 to 500 mW power. Some of the applications of SCS are pulse generation, voltage sensing and oscillators.

Gate turn off (GTO) switch is one more pnpn device which can be turned on or off with cathode gate. The gate current requirement of GTO is greater than that for SCR but its turn off time (1 μs) is much smaller than that for SCR. This makes GTO a faster device. Some of the applications of GTO are counters, pulse generators, multivibrators and voltage regulators.

Light activated SCR is turned on by the light falling on the gate. It is used as a relay, optical light controller, phase controller and motor control device. An interesting application of LASCR is in AND and OR circuits.

One more pnpn device is Shockley diode which can be used as trigger switch for SCR like UJT. A diac is also used for triggering and it provides triggering in either direction.

A device that can control ac power to the load during the positive and negative cycles of input is called triac. It is basically a diac with a gate terminal for bilateral turn on.

46. In the ON – state the voltage drop across the SCR is approximately equal to
(A) Anode voltage
(B) Cathode voltage
(C) 1 to 1.5 V
(D) Gate voltage

47. For complete isolation between load and signal which device is preferred ?
(A) Diac   (B) LASCR
(C) SCR   (D) Triac

48. Which device is useful for high frequency application ?
(A) SCS   (B) GTO
(C) Triac   (D) SCR

49. There is a danger of $\dfrac{di}{dt}$ failure of SCR if it is triggered with _____ gate current.
(A) positive
(B) negative
(C) zero
(D) sinusoidal

50. Forced commutation is employed when anode voltage is
(A) dc
(B) ac
(C) pulsating
(D) triangular

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