DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

Test Booklet No. :

Series

00221   **TEST BOOKLET**

GENERAL STUDIES & ELECTRICAL ENGINEERING

A

Time Allowed : 2 Hours   **Full Marks : 200**

Read the following instructions carefully before you begin to answer the questions :

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.

2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**

3. All questions carry equal marks.

   The Answer-Sheet should be submitted to the Invigilator.

   Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.

   Example :

   Suppose the following question is asked :
       The capital of Bangladesh is
       (A) Chennai
       (B) London
       (C) Dhaka
       (D) Dhubri

   You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :

   (A) (B) (C) (D)

   In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :

   (A) (B) ● (D)

   The example shown above is the only correct method of answering.

4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.

5. Please ensure that the Test Booklet has the required number of pages (20) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.

6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.

7. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.

8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.

9. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.

10. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.

11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.

12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.

13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0·25 per 1 (one) mark against each wrong answer.

1. Consider the following statements regarding the Vigyan Dhara Scheme of the Government of India :

   (i) It aims to enhance the S & T infrastructure by fostering well-equipped R & D laboratory in academic institutions.

   (ii) It aims to promote research in key areas such as sustainable energy, water and other critical sectors.

   (iii) It aims to enhance the participation of women in the field of S & T, with the goal of achieving gender parity in Science, Technology and Innovation (STI).

   (iv) It aims to reinforce innovation at all levels, from school education to industry and startups.

   Select the correct answer from the codes given below.

   (A) (i) and (ii) are correct

   (B) (ii) and (iii) are correct

   (C) (ii), (iii) and (iv) are correct

   (D) All statements are correct

2. Consider the following statements in connection with India's participation and achievements in the Paris Summer Olympics held in 2024 :

   (i) The Indian contingent consisted of 117 athletes.

   (ii) Indian athletes won a total of 12 medals which included 2 silver and 10 bronze.

   (iii) Manu Bhaker won the first medal for India.

   (iv) One Indian athlete was disqualified for not fulfilling the weight restrictions of an event.

Select the correct answer from the codes given below.

(A) (i), (ii) and (iii) are correct

(B) (ii), (iii) and (iv) are correct

(C) (i), (iii) and (iv) are correct

(D) All statements are correct

3. Which one of the following statements is correct regarding RHUMI–1?

   (A) It is the first reusable hybrid rocket launched by India.

   (B) It is India's first fast breeder nuclear reactor.

   (C) It is the name of India's first indigenously built submarine.

   (D) It is a lightweight tank designed and fabricated by DRDO for the Indian army.

4. Consider the following statements regarding 'Mission Basundhara' launched by the Government of Assam :

   (i) It is a flagship programme launched by the Revenue and Disaster Management Department.

   (ii) Its aim is to ensure employment generation in the State.

   (iii) It aims to make land revenue services more accessible to citizens.

   (iv) It is a programme designed to ensure sustainable development of the tea gardens.

Select the correct answer from the codes given below.

(A) (i) and (ii) are correct

(B) (i) and (iii) are correct

(C) (ii) and (iv) are correct

(D) (i) and (iv) are correct

5. Consider the following statements regarding the 'Action Plan for Introduction of Cheetah' in India :

(i) The first batch of 8 cheetahs was received from Namibia.

(ii) The second batch of 20 cheetahs will be procured from South Sudan.

(iii) The first batch of cheetahs received were released in Kuno National Park.

(iv) The second batch will be released in Manas National Park.

Select the correct statements from the codes given below.

(A) (i), (iii) and (iv)

(B) (ii) and (iii)

(C) (i) and (iii)

(D) (ii) and (iv)

6. Which of the following statements is/are **not correct** with regard to National Register of Citizens, Assam :

(i) The present NRC has its root in the Assam Accord signed in the year 1985.

(ii) The NRC is a list of all the legal citizens of Assam.

(iii) NRC updation basically means the process of enlisting the names of citizens based on Electoral Rolls up to 1971 and 1951 NRC.

(iv) The NRC is governed by the National Register of Citizens Act, 1985.

Select the statement/statements which is/are **not correct**.

(A) (i) only

(B) (iii) and (iv)

(C) (i) and (iii)

(D) (iv) only

7. Match the pairs given below and choose the correct match from the codes given below :

Names (Sportsperson)		*Sports associated with*
(a) Jamuna Boro	(i)	Cricket
(b) Nayanmoni Saikia	(ii)	Boxing
(c) Jintimani Kalita	(iii)	Athletics
(d) Amlan Borgohain	(iv)	Lawn Ball

Codes :

(A) (a)—(i), (b)—(ii), (c)—(iii), (d)—(iv)

(B) (a)—(ii), (b)—(i), (c)—(iv), (d)—(iii)

(C) (a)—(ii), (b)—(iv), (c)—(i), (d)—(iii)

(D) (a)—(iii), (b)—(i), (c)—(iv), (d)—(ii)

8. Consider the following statements regarding the National Sports Day of India :

(i) It is celebrated on 29th of September, every year.

(ii) It is celebrated to commemorate the birth anniversary of Major Dhyan Chand.

(iii) It is celebrated to commemorate the birth anniversary of Milkha Singh.

(iv) It is celebrated to commemorate the birth anniversary of Ranjit-sinhji Vibhaji Jadeja.

Select the correct statement/statements from the codes given below.

(A) (i) and (ii)

(B) (i) and (iii)

(C) (i) and (iv)

(D) Only (ii)

9. List—I gives the names of persons associated with music and List—II gives the names of musical instruments. Match List—I and List—II and select the correct match from the codes given below :

List—I		*List—II*	
(a)	Tanmoy Bose	(i)	Classical Vocalist
(b)	Indira P. P. Bora	(ii)	Flutist
(c)	Prabhat Sharma	(iii)	Tabla
(d)	Parween Sultana	(iv)	Classical Dance

    Codes :

    (A) (a)—(iii), (b)—(iv), (c)—(ii), (d)—(i)

    (B) (a)—(i), (b)—(ii), (c)—(iii), (d)—(iv)

    (C) (a)—(ii), (b)—(iii), (c)—(iv), (d)—(i)

    (D) (a)—(iii), (b)—(iv), (c)—(i), (d)—(ii)

10. Which of the following awards were conferred on Dr. Bhupen Hazarika?

    (i) Dada Saheb Phalke Award

    (ii) Bharat Ratna

    (iii) Padma Bhushan

    (iv) Padma Vibhushan

    Select the correct answer from the codes given below.

    (A) (i), (ii) and (iii) are correct

    (B) (i), (ii) and (iv) are correct

    (C) (ii), (iii) and (iv) are correct

    (D) All are correct

11. Arrange the following events of the Indian National Movements in the correct sequence of their happening from the codes given below :

    (i) Formation of Muslim League

    (ii) Cripps Mission

    (iii) Rowlatt Act

    (iv) Partition of Bengal

    Codes :

    (A) (iv)—(iii)—(ii)—(i)

    (B) (iv)—(i)—(iii)—(ii)

    (C) (i)—(iv)—(ii)—(iii)

    (D) (i)—(iv)—(iii)—(ii)

12. Consider the following statements and select the correct answer from the codes given below :

    (i) The Brahmo Samaj was founded by Raja Ram Mohan Roy.

    (ii) The Arya Samaj was founded by Dr. Atmaram Pandurang.

    (iii) Prarthana Samaj was founded by Dayananda Saraswati.

    (iv) Ramkrishna Mission was founded by Swami Vivekananda.

    Codes :

    (A) Only (i) is correct

    (B) (i) and (iv) are correct

    (C) (ii) and (iii) are correct

    (D) All statements are correct

13. Consider the following statements regarding the 'Drain of Wealth Theory' :

(i) This theory was put forward by Dadabhai Naoroji.

(ii) Lala Lajpat Rai submitted this theory to the Simon Commission as an explanation of India's poverty.

(iii) Mahatma Gandhi launched the Swadeshi Movement to establish the truth of this theory.

(iv) The theory highlighted how British economic policies exploited India.

Select the correct answer from the codes given below.

(A) (i), (ii) and (iv) are correct

(B) (ii) and (iii) are correct

(C) (i) and (iv) are correct

(D) (iii) and (iv) are correct

14. Which of the following statement/statements is/are correct?

(i) *Charaka Samhita* deals mainly with surgery.

(ii) One of the oldest palm leaf manuscripts of *Sushruta Samhita* is preserved at the Kaiser Library of Nepal.

(iii) The three 'doshas' (faults) central to Ayurveda are 'vata' (wind), 'pitta' (bile) and 'kapha' (phlegm).

Select the correct answer from the codes given below.

(A) Only (i) is correct

(B) (i) and (ii) are correct

(C) (ii) and (iii) are correct

(D) All statements are correct

15. Assamese language has been declared as a Dhrupadi language. Consequent to this declaration, the Union Government is required to

(i) offer financial grant to universities in other countries to open study centres to popularize the language

(ii) institute professional chair in all central universities

(iii) institute two international awards in the language

(iv) take necessary steps to provide safeguard to the language

Select the correct answer from the codes given below.

(A) (i), (ii) and (iii) are correct

(B) (ii), (iii) and (iv) are correct

(C) (i), (iii) and (iv) are correct

(D) All of the above are correct

16. List—I gives the names of some temples/monastries in India and List—II gives the names of places where these are situated. Match List—I and List—II and select the correct match from the codes given below :

List—I (Temples/Monastries)	List—II (Places)
(a) Lingaraj Temple	(i) New Delhi
(b) Rumtek Dharma Chakra	(ii) Bhubaneswar
(c) Lakshmi Narayan Temple	(iii) Thiruvananthapuram
(d) Padmanabha- swamy Temple	(iv) Gangtok

Codes :

(A) (a)—(i), (b)—(ii), (c)—(iii), (d)—(iv)

(B) (a)—(iii), (b)—(iv), (c)—(i), (d)—(ii)

(C) (a)—(iv), (b)—(i), (c)—(ii), (d)—(iii)

(D) (a)—(ii), (b)—(iv), (c)—(i), (d)—(iii)

17. Consider the following pairs :

Famous places	Banks of the river where situated
(a) Ayodhya	Ganga
(b) Ahmedabad	Sabarmati
(c) Sambalpur	Mahanadi
(d) Siliguri	Teesta

Which of the pairs given above is/are **incorrectly** matched?

(A) Only (a)

(B) (a) and (c)

(C) Only (c)

(D) (b) and (c)

18. Consider the following statements regarding Andaman and Nicobar Islands :

(i) A city in these islands is named as Sri Vijaya Puram.

(ii) One of the islands has a national park called Mount Manipur.

(iii) One of the aboriginal tribes who live there are known as the Uyghur.

(iv) These islands have the only active volcano in the Indian subcontinent.

Select the correct answer from the codes given below.

(A) (i), (ii) and (iii) are correct

(B) (iii) and (iv) are correct

(C) Only (i) and (ii) are correct

(D) (i), (ii) and (iv) are correct

19. As per judgement of the Supreme Court of India, which of the following constitutes the basic structure of the Indian Constitution?

(i) Federalism

(ii) Social justice

(iii) Fundamental Duties

(iv) Freedom and dignity of the individual

Select the correct answer from the codes given below.

(A) (i) and (iii) are correct

(B) (ii), (iii) and (iv) are correct

(C) (i), (ii) and (iv) are correct

(D) Only (ii) and (iv) are correct

20. Consider the following statements and select the statement/statements which is/are **not correct** :

(i) e-Prastuti is a project by the National Information Centre, Assam, to standardize and digitize Government Websites and public administration system.

(ii) e-Prastuti ensures uniformity in all Assam Government Websites.

(iii) e-Prastuti ensures consistent, accurate and updated content in the Government Websites.

(iv) e-Prastuti ensures upgradation of Website development skills of Government employees through training and workshop.

Codes :

(A) Only (i)

(B) Only (i) and (ii)

(C) (i), (ii) and (iii)

(D) (ii), (iii) and (iv)

21. Which of the following statements with regard to the Constitution of India are correct?

   (i) The 4th Schedule of the Constitution deals with allocation of seats in the Council of States.

   (ii) The 6th Schedule deals with provisions relating to the administration of tribal areas in some States.

   (iii) The 7th Schedule deals with special status for the States of Nagaland and Jammu and Kashmir.

   (iv) The 10th Schedule deals with and elaborates Fundamental Duties of citizens.

   Select the correct answer from the codes given below.

   (A) (ii) and (iv) are correct

   (B) (iii) and (iv) are correct

   (C) (i) and (ii) are correct

   (D) (ii) and (iii) are correct

22. Consider the following statements regarding the RESET programme of the Government of India :

   (i) It aims to empower the rural youth.

   (ii) It aims to empower the retired government employees.

   (iii) It aims to rehabilitate drug-addicted persons.

   (iv) It aims to empower retired sportspersons.

   Select the correct statement from the codes given below.

   (A) (i) and (iii)

   (B) (ii) and (iv)

   (C) Only (iii)

   (D) Only (iv)

23. In the midterm examination, Rabin and Rubul scored more than Haren. Paban scored more than Rubul in the same examination. Based on the above information, one concludes that among Rabin, Rubul, Haren and Paban, Haren's score is the lowest.

   Identify the nature of the conclusion.

   (A) The conclusion is true

   (B) The conclusion is false

   (C) The conclusion is uncertain

   (D) Data are not sufficient to arrive at a conclusion

24. Consider the following statements :

   (i) While going out for morning walk, Mr. Bhuyan took the umbrella with him after checking the weather report.

   (ii) Anticipating a traffic congestion on account of the scheduled protest rally of the local trade union, Mr. Gupta decided to leave the office early.

   (iii) Mr. Borah bought a particular brand of smartphone after referring to several favourable reviews posted by satisfied customers.

   (iv) Mr. Das usually buys lottery tickets on Sunday because one of his close friends had told him that Sunday is his lucky day.

   Identify the speculative activity from those narrated above from the codes given below.

   (A) (i)

   (B) (ii)

   (C) (iii)

   (D) (iv)

25. Identify the missing letter from the codes given below :

P	M	J
Y	V	S
H	E	?

Codes :

(A) A (B) B

(C) C (D) D

26. Identify the most appropriate substance that can be added to the given list from the codes given below :

   carbon dioxide, methane, nitrous oxide, CFC-12, __?__

Codes :

(A) acetic acid

(B) xenon dioxide

(C) formaldehyde

(D) HFC-23

27. The combined age of four persons is 80 years at present. What was the combined age of the same four persons 3 years ago?

(A) 77 years (B) 74 years

(C) 71 years (D) 68 years

28. Naren can type 100 pages in 10 hours, Rani can do the same work in 15 hours. Both Naren and Rani work together for 5 hours. The remaining job was done by Rakhi in 2 hours. If Naren and Rani got ₹ 2,400 for the whole work, how much did Rakhi get for the work done by her?

(A) ₹ 300 (B) ₹ 400

(C) ₹ 500 (D) ₹ 600

29. There are twenty people working in an office. The first group of five people works between 8 AM and 2 PM. The second group of ten people works between 10 AM to 4 PM. The third group of five people works between 12 noon to 6 PM. There are three computers in the office which all employees frequently use. During which of the following hours, the computers are likely to be used most?

(A) 1 PM to 3 PM

(B) 12 noon to 2 PM

(C) 2 PM to 4 PM

(D) Cannot be ascertained

30. Read the following statements and conclusions carefully. Select the set of conclusions which logically follows from the given statements. Choose the correct option from the codes given below :

Statements :

1. Some cubes are squares.

2. All squares are circles.

Conclusions :

(a) All cubes are circles.

(b) Some circles are cubes.

(c) Some circles are squares.

(d) All squares are cubes.

Codes :

(A) Only conclusion (a) follows

(B) Conclusions (a), (b) and (c) follow

(C) Only conclusions (b) and (c) follow

(D) Conclusions (c) and (d) follow

31. If a battery has a nominal voltage of $1.25\,V$ to $1.5\,V$, what is the type of cell used?

(A) Lithium ion

(B) Lead acid

(C) Nickel-cadmium

(D) Zinc-silver oxide

32. _____ is one of the most important materials that is also known as solar grade silicon.

(A) Crushed silicon

(B) Crystalline silicon

(C) Powdered silicon

(D) Silicon

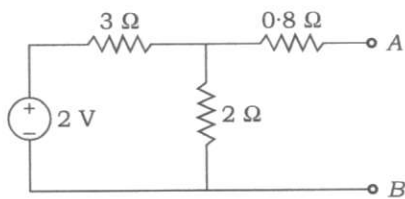**33.** Norton equivalent between A and B for the circuit shown in Fig. 1 is

Fig. 1

(A) 2 A and 2·5 Ω

(B) 0·5 A and 1 Ω

(C) 1 A and 2 Ω

(D) 0·4 A and 2 Ω

34. The voltage of the node a with respect to o for the circuit shown in Fig. 2 is
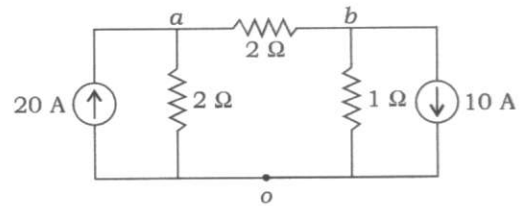
Fig. 2

(A) 20 V

(B) 40 V

(C) 50 V

(D) 60 V

35. The current waveform, as shown in Fig. 3, is applied in a pure resistor $10\,\Omega$ (ten ohms). The power dissipated in the resistor is
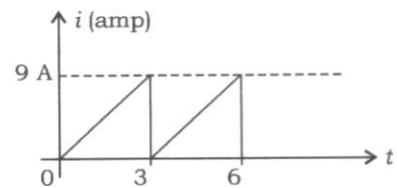
Fig. 3

(A) 270 W

(B) 135 W

(C) 52 W

(D) 7 W

36. A charge of 1 coulomb is placed near a grounded conducting plate at a distance of 1 m. What is the force between them?

(A) $\dfrac{1}{4\pi\varepsilon_0}$ N

(B) $\dfrac{1}{8\pi\varepsilon_0}$ N

(C) $\dfrac{1}{16\pi\varepsilon_0}$ N

(D) $16\pi\varepsilon_0$ N

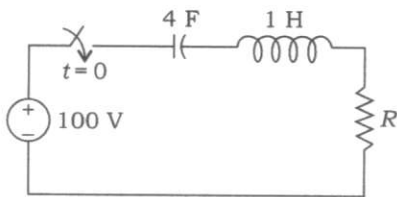**37.** In a given circuit in Fig. 4, the value of R that will give critical damping is

Fig. 4

(A) 2 Ω   (B) 1 Ω

(C) 4 Ω   (D) 10 Ω

38. An alternator is delivering power to a balanced load at unity power factor. The phase angle between the line voltage and the line current is

(A) 90°   (B) 60°

(C) 0°   (D) 30°

39. If the readings of two wattmeters are equal and positive in two-wattmeter method, the load power factor in a balanced 3-phase, 3-wire circuit will be

(A) zero   (B) 0·5

(C) 0·866   (D) unity

40. A current of

$$0\cdot5 + 0\cdot3 \sin \omega t - 0\cdot2 \sin 2\omega t$$

is passed through a moving coil and a moving iron ammeter which are in series. The reading of moving coil and moving iron ammeter will be respectively

(A) 0·5 A and 0·561 A

(B) 0·6 A and 0·561 A

(C) 0·561 A and 0·5 A

(D) 0·1 A and 0·5 A

41. The experimental setup in Fig. 5 below measures the value of unknown resistance in two steps :

* When $V = 24$ V, r is set at 400 Ω and $S = 80$ Ω, the galvanometer shows a deflection of 30°.

* When switch is thrown to position 2, the supply voltage drops down to 12 V and the galvanometer still shows a deflection of 30°.
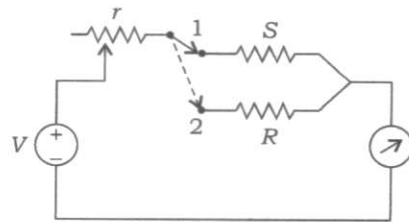
The value of unknown resistance is

Fig. 5

(A) 80 Ω

(B) 60 Ω

(C) 40 Ω

(D) 20 Ω

42. Two ammeters, one with full-scale current of 1 mA and internal resistance of 100 Ω and the other full-scale current of 10 mA and internal resistance of 25 Ω are in parallel. What is the total current these two meters can carry without any meter out of scale?

(A) 1 mA

(B) 10 mA

(C) 11 mA

(D) 5 mA

43. The full-scale deflection current of a meter is 1 mA and its internal resistance is 100 Ω. This meter is to have full deflection when 100 V is measured. What is the value of series resistor to be used?

(A) 100 kΩ

(B) 99·90 kΩ

(C) 99·99 Ω

(D) 100 Ω

44. A 200 V/100 V, 50 Hz transformer is to be excited at 40 Hz from 100 V side. For the exciting current to be same, the applied voltage should be

(A) 150 V

(B) 80 V

(C) 100 V

(D) 125 V

45. In case of 3-phase induction motor, shaft power is 2700 W and mechanical losses are 180 W. At a slip of 4%, the rotor ohmic losses are

(A) 115·2 W

(B) 120 W

(C) 108 W

(D) 105 W

46. A 6-pole lap wound DC machine has an armature resistance of 0·06 Ω. If the machine is rewound for wave winding, then its armature resistance is

(A) 0·06 Ω

(B) 10·36 Ω

(C) 0·54 Ω

(D) 1·08 Ω

47. A DC series motor is driving a constant torque load, at 500 r.p.m., the field turns are divided into two groups connected in series. If the field turns are connected in parallel, then speed will be

(A) 500 r.p.m.

(B) $\dfrac{500}{\sqrt{2}}$ r.p.m.

(C) $500 \times \sqrt{2}$ r.p.m.

(D) 1000 r.p.m.

48. If two 500 V full-scale voltmeters V_1 and V_2 having resistances 200 kΩ/V and 250 kΩ/V, respectively, are connected in series to measure 900 V, then

(A) V_1 and V_2 read 400 V each

(B) V_1 reads 400 V and V_2 reads 500 V

(C) V_1 reads 500 V and V_2 reads 400 V

(D) V_1 and V_2 read 0 V

49. A sinusoidal waveform, when observed on an oscilloscope, has a peak-to-peak amplitude of 14 cm. If the vertical sensitivity setting is 5 V/cm, then RMS value of the voltage will be

(A) 24·8 V

(B) 49·6 V

(C) 9·9 V

(D) 3·54 V

50. For the system

$$\dot{X} = \begin{bmatrix} 2 & 3 \\ 0 & 5 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} u$$

which of the following statements is true?

(A) The system is controllable but unstable.

(B) The system is uncontrollable and unstable.

(C) The system is controllable and stable.

(D) The system is uncontrollable and stable.

51. The transfer function of the system described by

$$\frac{d^2y}{dt^2} + \frac{dy}{dt} = \frac{du}{dt} + 2u$$

with u as input and y as output is

(A) $\dfrac{s+2}{s^2 + s}$

(B) $\dfrac{s+1}{s^2 + s}$

(C) $\dfrac{2}{s^2 + s}$

(D) $\dfrac{2s}{s^2 + s}$

52. The eigenvalues of the system represented by

$$\dot{X} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix} X$$

are

(A) 0, 0, 0, 0

(B) 1, 1, 1, 1

(C) 0, 0, 0, −1

(D) 1, 0, 0, 0

53. A control system is defined by the following mathematical relationship :

$$\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 5x = 12(1 - e^{-2t})$$

The response of the system at $t \to \infty$ is

(A) $x = 6$

(B) $x = 2$

(C) $x = 2 \cdot 4$

(D) $x = -2$

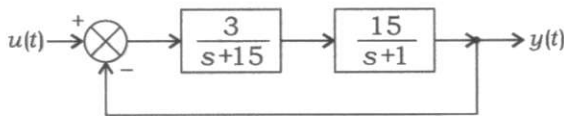**54.** The roots of the closed-loop characteristic equation of the system shown in Fig. 6 are

Fig. 6

(A) -1 and -5

(B) 6 and 10

(C) -4 and -15

(D) -6 and -10

55. The loop gain GH of a closed-loop system is given by the following expression :

$$\frac{k}{s(s+2)(s+4)}$$

The value of k for which the system just becomes unstable is

(A) $k = 6$

(B) $k = 8$

(C) $k = 48$

(D) $k = 96$

56. The impulse response of an LTI system is $h(t) = e^{-5t}u(t)$. If the output of the system is $y(t) = e^{-3t}u(t) - e^{-5t}u(t)$, then the input $x(t)$ is given by

(A) $e^{-3t}u(t)$

(B) $2e^{-3t}u(t)$

(C) $e^{-5t}u(t)$

(D) $2e^{-5t}u(t)$

57. A transfer function of a system is given as

$$\frac{100}{s^2 + 20s + 100}$$

The system is

(A) an overdamped system

(B) an underdamped system

(C) a critical damped system

(D) an unstable system

58. A transmission line having a surge impedance of $400\,\Omega$ is connected with a cable which has surge impedance of $40\,\Omega$. A surge magnitude of $100\,kV$ is travelling from the transmission line towards the cable. The transmitted voltage will be

(A) $100\,kV$

(B) $30 \cdot 6\,kV$

(C) $18 \cdot 18\,kV$

(D) $36 \cdot 36\,kV$

59. The total iron loss in a transformer core at normal flux density was measured at 25 Hz and at 50 Hz and was found to be 250 W and 800 W respectively. The hysteresis loss at 50 Hz would be

(A) 100 W

(B) 150 W

(C) 200 W

(D) 600 W

60. A two-winding 220 V/110 V, 1·5 kVA transformer is reconnected as a 220 V/330 V auto-transformer. It is rerated as

(A) 3·88 kVA

(B) 4·488 kVA

(C) 1·58 kVA

(D) 2·258 kVA

61. The power is transmitted through a transmission line of impedance $(r + jx)$ at equal voltage at both ends. The maximum power can be transferred under the steady-state condition if

(A) $x = r$

(B) $x = \sqrt{2}\,r$

(C) $x = \sqrt{3}\,r$

(D) $x = 2r$

62. To test the insulator against HV surges caused by lightning, the test normally adopted is

(A) 50 c/s dry flash-over test

(B) impulse flash-over test

(C) 50 c/s flash-over test

(D) 50 c/s wet flash-over test

63. The divergence of the vector field
$$V(x, y, z) = -(x\cos xy + y)i + (y\cos xy)j + (\sin z^2 + x^2 + y^2)k$$
is

(A) $22\cos z^2$

(B) $\sin xy + 2z\cos z^2$

(C) $x\sin xy - \cos z$

(D) $\sin xy$

64. A solid sphere made of insulating material has a radius R and has a total charge Q distributed uniformly in its volume. What is the magnitude of electric field intensity E, at a distance $r\,(0 < r < R)$ inside the sphere?

(A) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{Qr}{R^3}$

(B) $\dfrac{3}{4\pi\varepsilon_0}\dfrac{Qr}{R^3}$

(C) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r^2}$

(D) $\dfrac{1}{4\pi\varepsilon_0}\dfrac{QR}{r^3}$

65. A 1–φ half-wave rectifier is used to supply to a load of impedance 8 Ω from 220 V, 50 Hz AC supply at a firing angle of 60°. The effective value of voltage is

(A) 160 V

(B) 172 V

(C) 140 V

(D) 120 V

66. Which of the following specifications is **not** correct for a common-collector amplifier?

(A) High i/p impedance

(B) Low o/p impedance

(C) High voltage gain

(D) High current gain

67. In a transistor circuit shown in Fig. 7 below, the collector to ground voltage is +20 V. The possible condition is
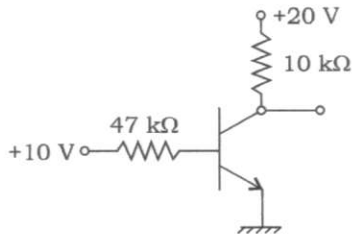

Fig. 7

(A) collector-emitter terminal shorted

(B) emitter to ground connection open

(C) 10 kΩ resistor open

(D) collector-based terminal shorted
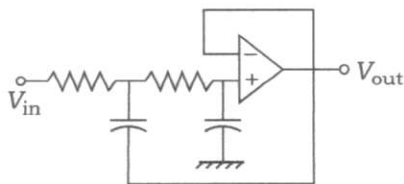
68. The circuit shown in Fig. 8 below is a

Fig. 8

(A) low-pass filter

(B) high-pass filter

(C) band-pass filter

(D) band-reject filter

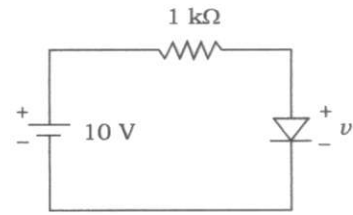**69.** The i-v characteristic of the diode in the circuit shown in Fig. 9 below is

Fig. 9

$$i = \begin{cases} \dfrac{v - 0 \cdot 7}{500} \text{A}, & v \geq 0 \cdot 7 \text{ V} \\ \quad 0 \text{ A}, & v < 0 \cdot 7 \text{ V} \end{cases}$$

The current in the circuit is

(A) 10 mA   (B) 9·3 mA

(C) 6·67 mA   (D) 6·2 mA

70. A converter which can operate both in 3-pulse and 6-pulse mode is a

(A) 1-phase full-converter

(B) 3-phase half-wave converter

(C) 3-phase semi-converter

(D) 3-phase full-converter

71. A four-quadrant chopper **cannot** be operated as

(A) one-quadrant chopper

(B) cycloconverter

(C) inverter

(D) bidirectional rectifier

72. For low-speed high-power reversible operation, the most suitable drives are

(A) voltage source inverter-fed AC drives

(B) current source inverter-fed AC drives

(C) dual converter-fed DC drives

(D) cycloconverter-fed AC drives

73. The total gain of a multistage amplifier is less than the product of the gains of individual stages due to

(A) power loss in the coupling device

(B) loading effect of the next stage

(C) the use of many transistors

(D) the use of many capacitors

74. Consider an angle-modulated signal

$$x(t) = 6\cos[2\pi \times 10^6 t + 2\sin(8000\,\pi t) + 4\cos(8000\,\pi t)]\ \text{V}$$

The average power of $x(t)$ is

(A) 10 W (B) 18 W

(C) 20 W (D) 28 W

75. A message signal

$$m(t) = \cos 2000\,\pi t + 4\cos 4000\,\pi t$$

modulates the carrier

$$c(t) = \cos 2\pi f_c t$$

where $f_c = 1\ \text{MHz}$ to produce an AM signal. For demodulating the generated AM signal, using an envelope detector, the time constant RC of the detector circuit should satisfy

(A) $0\cdot5\ \text{ms} < \text{RC} < 1\ \text{ms}$

(B) $1\ \mu\text{s} \ll \text{RC} < 0\cdot5\ \text{ms}$

(C) $\text{RC} \ll 1\ \mu\text{s}$

(D) $\text{RC} \gg 0\cdot5\ \text{ms}$

76. In a commercial broadcasting system, the FM signal has a centre frequency 105 MHz and the highest frequency of 105·3 MHz. When modulated by a signal 5 kHz, the modulation index will be

(A) 6 (B) $\dfrac{1}{6}$

(C) 2 (D) 5

77. In PAM, the carrier wave consists of a periodic train of rectangular pulses and the carrier frequency is equal to

(A) the bandwidth of the modulating signal

(B) the sampling rate of the modulating signal

(C) at least ten times greater than the bandwidth of the modulating signal

(D) twice the bandwidth of the modulating signal

78. A 1 MHz sinusoidal signal carrier is amplitude modulated by a symmetrical square wave of period 100 μs. Which of the following frequencies will **not** be present in the modulated signal?

(A) 990 kHz (B) 1020 kHz

(C) 1010 kHz (D) 1030 kHz

79. A 4 GHz carrier is DSB-SC modulated by low-pass message signal with maximum frequency of 2 MHz. The resultant signal is to be ideally sampled. The maximum frequency of the sampling impulse train should be

(A) 4 MHz (B) 8 GHz

(C) 8 MHz (D) 8·004 GHz

80. The frequency modulated (FM) radio frequency range is nearly

(A) 2500–3000 MHz

(B) 150–200 MHz

(C) 90–105 MHz

(D) 30–70 MHz

81. The output of a logic gate is 1 when all its inputs are at logic 0. The gate is either

(A) a NAND or an EX-OR gate

(B) a NOR or an EX-OR gate

(C) an AND or an EX-OR gate

(D) a NOR or an EX-NOR gate

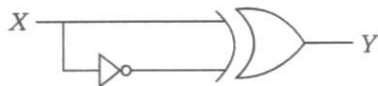**82.** The output Y of the logic gate circuit shown in Fig. 10 is

Fig. 10

(A) 1
(B) 0
(C) X
(D) $\bar{X}$

83. The demodulation of a delta-modulated signal is achieved by
(A) differentiation
(B) sampling
(C) integration
(D) band-pass filtering

84. In a 400 kV network, 360 kV is recorded at a 400 kV bus. The reactive power absorbed by the shunt reactor rated for 50 MVAR, 400 kV connected at the bus is
(A) 61·73 MVAR
(B) 55·56 MVAR
(C) 45 MVAR
(D) 40·5 MVAR

85. A lightning arrester connected between the line and earth in a power system
(A) protects the terminal equipment against travelling surges
(B) protects the transmission line against direct lightning stroke
(C) supresses high frequency oscillation in the line
(D) reflects back the travelling wave approaching it

86. Wave winding is employed in a DC machine of
(A) high current and low voltage rating
(B) low current and high voltage rating
(C) high current and high voltage rating
(D) low current and low voltage rating

87. A 4-pole generator with 16 coils has a two-layer lap winding. The pole pitch is
(A) 32
(B) 16
(C) 8
(D) 4

88. When the shunt field of a DC compound generator is connected across both in series field and armature, such a connection is known as
(A) short shunt
(B) long shunt
(C) cumulative compounding
(D) differential compounding

89. The current drawn by a 220 V DC motor of armature resistance 0·5 Ω and back e.m.f. 200 V is
(A) 40 A
(B) 44 A
(C) 400 A
(D) 440 A

90. A DC motor develops the maximum mechanical power when the armature is such that
(A) back e.m.f. is equal to $\frac{3}{4}$th of the applied e.m.f.
(B) back e.m.f. is equal to one-half of the applied e.m.f.
(C) back e.m.f. is equal to $\frac{1}{4}$th of the applied e.m.f.
(D) back e.m.f. is equal to $\frac{2}{3}$rd of the applied e.m.f.

91. If the dimensions of all parts of the synchronous generator and the number of field and the armature turns are doubled, then the generated voltage will change by a factor of
(A) 1
(B) 2
(C) 4
(D) 8

92. The magnetic field required to reduce the residual magnetization to zero is called

(A) retentivity
(B) coercivity
(C) hysteresis
(D) saturation magnetization

93. Load frequency control is achieved by properly matching the individual machine's

(A) reactive power
(B) generated voltage
(C) turbine inputs
(D) turbine and generator rating

94. Bundled conductors are mainly used for high voltage overhead transmission lines to

(A) reduce transmission line losses
(B) increase mechanical strength of the line
(C) reduce corona
(D) reduce sag

95. Series capacitive compensation in EHV transmission lines is used to

(A) reduce the line loading
(B) improve the stability of the system
(C) reduce the voltage profile
(D) improve the protection of the line

96. In a Schering bridge balance, the following values are obtained :

$C_2 = 100 \ \mu F$, $R_3 = 100 \ \Omega$, $R_4 = 300 \ \Omega$, $C_4 = 0 \cdot 5 \ \mu F$, $f = 50 \ Hz$

The unknown capacitance C_1 and its loss angle δ are respectively

(A) $300 \ \mu F$, $0 \cdot 27°$
(B) $300 \ pF$, $2 \cdot 7°$
(C) $300 \ \mu F$, $2 \cdot 7°$
(D) $100 \ \mu F$, $2 \cdot 5°$

97. The line constants of a 200 km, 3-ϕ, 50 Hz transmission line are given as following :

$A = D = 0 \cdot 938 \ \angle 1 \cdot 2°$

$B = 131 \cdot 2 \ \angle 72 \cdot 3° \ \Omega/phase$

$C = 0 \cdot 001 \ \angle 90° \ S/phase$

The sending-end voltage is 230 kV. The value of the line charging current, when the load is disconnected, will be

(A) 0 A
(B) 132·8 kA
(C) 100·5 kA
(D) 141·5 A

98. Torque/weight ratio of an instrument indicates

(A) selectivity
(B) accuracy
(C) fidelity
(D) sensitivity

99. Compared to continuous time system, the discrete system is

(A) more accurate and more stable
(B) more accurate but less stable
(C) less accurate and less stable
(D) less accurate but more stable

100. The steady-state performance of a control system yields a non-zero finite value of the velocity error constant. The type of the system is

(A) Type 0
(B) Type 1
(C) Type 2
(D) Type 3

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