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NATIONAL INSTITUTE OF TECHNOLOGY
Surat (Gujarat)

The following details MUST be filled by the candidate:

Application ID	
Candidate's name	
Post applied for	Senior Executive Engineer (Civil/ Electrical)
Mobile number	
Date of written test	20.02.2021
Signature of candidate	
Signature of invigilator	

Instructions:

- Candidate is required to return this question booklet to the invigilator before leaving the hall.
 - This question paper contains 50 questions related to Electrical Engineering. Each question carries 1 mark. There is no negative marking.
 - The written test duration is 2 hours.
 - Candidate is required to write his/her choice (e.g., a or b or c or d) in the answer sheet given separately. Inappropriate actions such as writing more than one choice, writing the choice in an ambiguous manner, overwriting, cutting, etc. will be awarded 0 mark corresponding to that question.
-
- The characteristic equation of a (3x3) matrix P is defined as $a(\lambda) = |\lambda I - P| = 2\lambda^3 + \lambda^2 + \lambda + I = 0$. If I denote identity matrix, then the inverse of matrix P will be
(A) $(2P^2 + P + I)$ (B) $(2P^2 + P + I)$ (C) $-(2P^2 + P + I)$ (D) $-(2P^2 + P + I)$
 - The solution of the first order differential equation $x'(t) = -5x(t)$, $x(0) = x_0$ is:
(A) $x(t) = x_0 e^{-5t}$ (B) $x(t) = x_0 e^{-5}$ (D) $x(t) = x_0 e^{-1/5}$ (C) $x(t) = x_0 e^{-t}$
 - The function $f(x) = x^3 - 6x^2 + 9x + 25$ has
(A) a maxima at $x=1$ and a minima at $x=3$ (B) a maxima at $x=3$ and a minima at $x=1$
(C) no maxima but a minima at $x=1$ (D) a maxima at $x=1$ but no minima
 - For the differential equation $dy/dt + 5y = 0$ with $y(0) = 1$, the general solution is
(A) e^{5t} (B) e^{-5t} (C) $5e^{-5t}$ (D) $e^{\sqrt{-5}t}$
 - The inductance of a long solenoid of length 1000 mm wound uniformly with 3000 turns on a cylindrical paper tube of 60mm diameter is
(A) 32mH (B) 3.2 mH (C) 3.2μH (D) 3.2 H

6. The circuit shown in the Fig.1 is equivalent to a load of

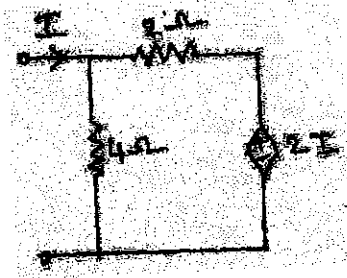


Fig. 1

- (A) $4/3$ ohms (B) $8/3$ ohms (C) 4 ohms (D) 2 ohms

7. A passive 2-port network is in a steady-state. Compared to its input, the steady state output can never offer

- (A) higher voltage (B) lower impedance
(C) greater power (D) better regulation

8. Two conductors are carrying forward and return current of $+I$ and $-I$ as shown in Fig.2. The magnetic field intensity $\vec{H}$ at point P is

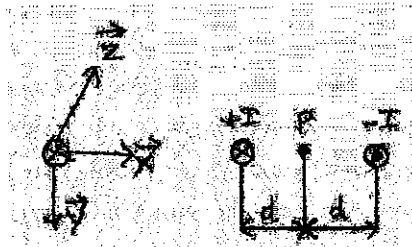


Fig.2

- (A) $\frac{I}{\pi d} \vec{y}$ (B) $\frac{I}{\pi d} \vec{x}$ (C) $\frac{I}{2\pi d} \vec{y}$ (D) $\frac{I}{2\pi d} \vec{x}$

9. For the circuit given below, the Thevenin's resistance across the terminals A and B is

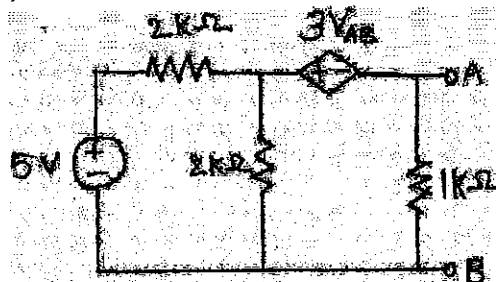


Fig.3

- (A) 0.5 k Ω (B) 0.2k Ω (C) 1k Ω (D) 0.11k Ω

10. The meter constant of an energy meter is 1200 revolutions per KWh. It is found to make 20 revolutions in 80 seconds. Determine the load on the meter is.

- (A) 75 kW (B) 0.75 kW (C) 7.5 kW (D) 750 kW

11. A PMMC voltmeter is connected across a series combination of a DC voltage source $V_1 = 2\text{ V}$ and an AC voltage source $V_2(t) = 3 \sin(4t)$. The meter reads

- (A) 2V (B) 5V (C) $(2 + \sqrt{3}/2)\text{ V}$ (D) $(\sqrt{17}/2)\text{ V}$

12. which meter is suitable for the measurement of 10mV at 50Hz?

- (A) Moving-iron Voltmeter (B) Vacuum Tube Voltmeter (VTVM)
(C) Electrostatic Voltmeter (D) Cathode Ray Oscilloscope (CRO)

13. The type of power amplifier which exhibits crossover distortion in its output is

- (A) Class A (B) Class B (C) Class AB (D) Class C

14. Among the following four, the slowest ADC (analog-to-digital converter) is

- (A) parallel comparator (i.e., flash) type (B) successive approximation type
(C) integrating type (D) counting type

15. Assume that the N-channel MOSFET shown in Fig.4. is ideal, and that its threshold voltage is +1.0V. The voltage V_{ab} between nodes a and b is:

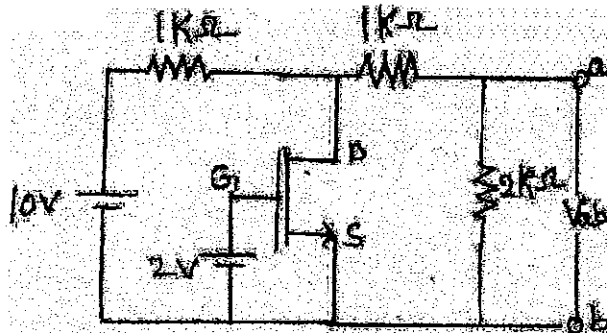


Fig.4

- (A) 5V (B) 2V (C) 1V (D) 0V

16. In Fig.5, as long as $X_1 = 1$ and $X_2 = 1$, the output Q remains

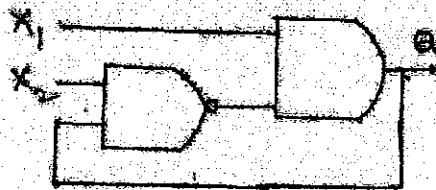


Fig.5

- (A) at 1 (B) at 0 (C) at its initial value (D) unstable

17. The output characteristics of a MOSFET, is a plot of

- (A) I_d as a function of V_{gs} with V_{ds} as a parameter
(B) I_d as a function of V_{ds} with V_{gs} as a parameter

- (C) I_g as a function of V_{gs} with V_{ds} as a parameter
 (D) I_g as a function of V_{ds} with V_{gs} as a parameter

18. The common emitter forward current gain of the transistor shown in $\beta_f = 100$. The transistor is operating in

- (A) Saturation region (B) Cut-off region (C) Reverse Active Region (D) Forward Active Region

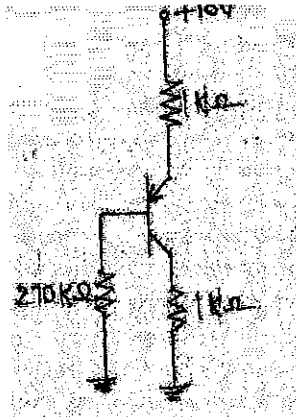


Fig.6

19. The feedback factor for the circuit shown in Fig.7.

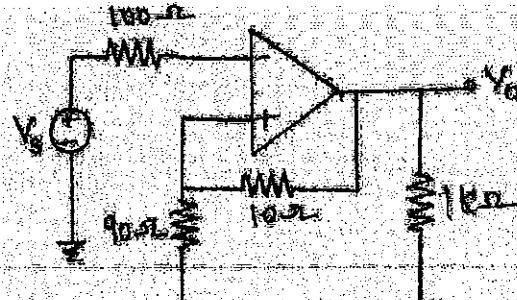


Fig.7

- (A) 9/100 (B) 9/10 (C) 1/9 (D) 1/10

20. Which of the following is not a step in making ceramics?

- (A) Powder pressing (B) Sintering (C) Alloying (D) Vitrification

21. What is the example of diamagnetic materials?

- (A) Quartz (B) Pyrite (C) Montmorillonite (D) Biotite

22. In Operating Systems, which of the following is/are CPU scheduling algorithms?

- (A) Round Robin (B) Shortest Job First (C) Priority (D) All of the mentioned

23. Most computers use the _____ representation when performing arithmetic operations with integers.

- (A) signed-magnitude (B) signed-1's complement

24. When a program is being executed in an 8085 microprocessor, its Program Counter contains

- (A) the number of instructions in the current program that have already been executed
- (B) the total number of instructions in the program being executed
- (C) the memory address of the instruction that is being currently executed
- (D) the memory address of the instruction that is to be executed next

25. The time signal $x(t)$ corresponding to $X(s) = \frac{s+3}{s^2+2s+2}$ will be

- (A) $(2e^{-2t} - e^{-t})u(t)$
- (B) $(2e^{-t} - e^{-2t})u(t)$
- (C) $(2e^{-2t} + e^{-t})u(t)$
- (D) $(2e^{-t} + e^{-2t})u(t)$

26. which type of signal is ramp signal?

- (A) power signal
- (B) energy signal
- (C) both power and energy signal
- (D) neither power nor energy signal

27. The Fourier series for the function $f(x) = \sin^2 x$ is

- (A) $\sin x + \cos x$
- (B) $1 - \cos 2x$
- (C) $\sin 2x + \cos 2x$
- (D) $0.5 - 0.5 \cos 2x$

28. Fig.9 shows a feedback system where $K > 0$. The range of K for which the system is stable will be given by

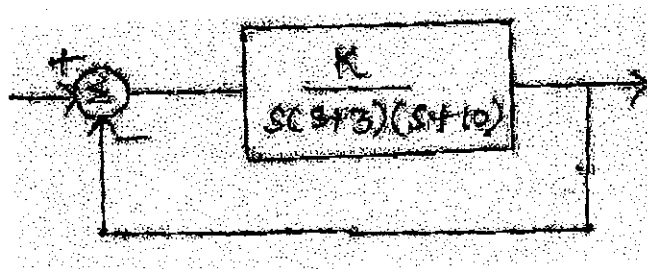


Fig. 9

- (A) $0 < K < 30$
- (B) $0 < K < 39$
- (C) $0 < K < 390$
- (D) $K > 390$

29. The system $\dot{x} = Ax + Bu$ with $A = \begin{bmatrix} -1 & 2 \\ 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ is

- (A) stable and controllable
- (B) stable but uncontrollable
- (C) unstable and uncontrollable
- (D) unstable but controllable

30. The transfer function $C(s)/R(s)$ of the system, whose block diagram is given below is

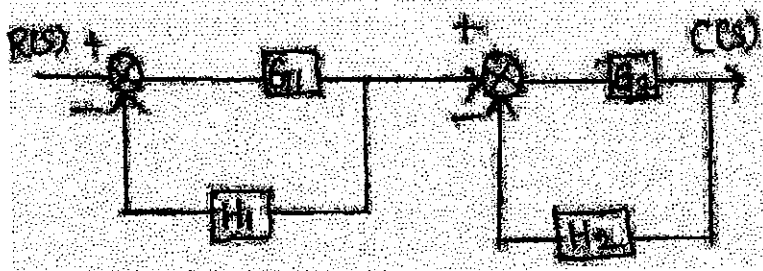


Fig. 10

(A) $\frac{G_1 G_2}{1 + G_1 H_1 + G_2 H_2 - G_1 G_2 H_1 H_2}$

(B) $\frac{G_1 G_2}{1 + G_1 H_1 + G_2 H_2 + G_1 G_2 H_1 H_2}$

(C) $\frac{G_1 G_2}{1 + G_1 H_1 + G_2 H_2}$

(D) $\frac{G_1(1 + G_2 H_2) + G_2(1 + G_1 H_1)}{1 + G_1 H_1 + G_2 H_2 + G_1 G_2 H_1 H_2}$

31. The number of roots of the equation $2s^2 + s^3 + 3s^2 + 5s + 7 = 0$ that lie in the right of s plane is
 (A) zero (B) one (C) two (D) three

32. The block diagram shown in Fig.11 gives a unity feedback closed loop control system. The steady state error in the response of the below system to unit step input is

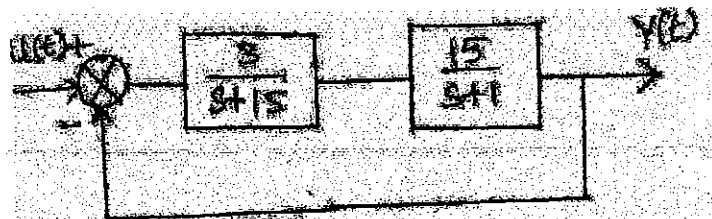


Fig. 11

(A) 25%

(B) 0.75%

(C) 6%

(D) 33%

33. A single-phase transformer has a turns ratio of 1:2, and is connected to a purely resistive load as shown in the Fig.12. The magnetizing current drawn is 1A, and the secondary current is 1A. If core losses and leakage reactance are neglected, the primary current is

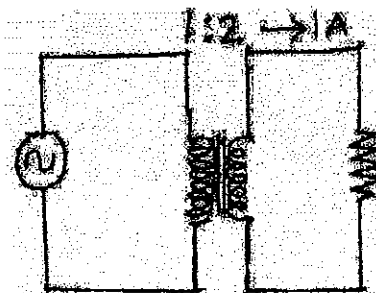


Fig. 12

34. In a DC machine, which of the following statements is true?
 (A) Compensating winding is used for neutralizing armature reaction while interpole winding is used for producing residual flux
 (B) Compensating winding is used for neutralizing armature reaction while interpole winding is used for improving commutation
 (C) Compensating winding is used for improving commutation while interpole winding is used for neutralizing armature reaction
 (D) Compensation winding is used for improving commutation while interpole winding is used for producing residual flux
35. The type of single-phase induction motor having the highest power factor at full load is
 (A) shaded pole type (B) split-phase type
 (C) capacitor-start type (D) capacitor-run type
36. The total core loss of a 400 V, 50 Hz transformer is 2400W, when it is supplied by 200 V, 25 Hz loss is 800W. Calculate eddy current loss and hysteresis loss?
 (A) 1000W, 1400W (B) 1600W, 800W
 (C) 800W, 1600W (D) 1400W, 1000W
37. A 1.8° step, 4-phase stepper motor has a total of 40 teeth on 8 poles of stator. The number of rotor teeth for this motor will be
 (A) 40 (B) 50 (C) 100 (D) 80
38. A 400V, 50 kVA, 0.8 pf leading Δ -connected, 50 Hz synchronous machine has a synchronous reactance of 2Ω and negligible armature resistance. The friction and windage losses are 2kW and the core loss is 0.8 kW. The shaft is supplying 9kW load at a power factor of 0.8 leading. The line current drawn is
 (A) 12.29 A (B) 16.24 A (C) 21.29 A (D) 36.88 A
39. Out of the following plant categories
 (i) Nuclear (ii) Run-of-river (iii) Pump Storage (iv) Diesel
 The base load power plants are
 (A) (i), (ii) and (iv) (B) (ii), (iii) and (iv) (C) (i), (ii) and (iii) (D) (i), (iii) and (iv)
40. Four identical alternators each are rated for 20 MVA, 11 KV having a sub-transient reactance of 16% are working in parallel. The short circuit level at the busbar is
 (A) 500MVA (B) 400MVA (C) 125MVA (D) 100MVA
41. High voltage dc transmission requires filters for:
 (A) Line commutated converters (B) Voltage sourced converters
 (C) Both of these (D) None of these

42. The zero-sequence circuit of the three-phase transformer shown in the Fig.13 is

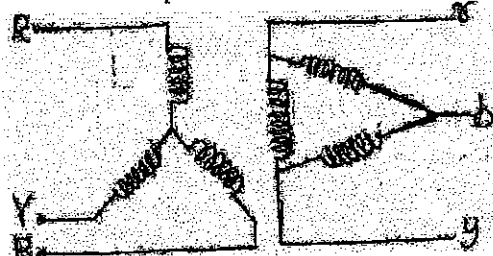
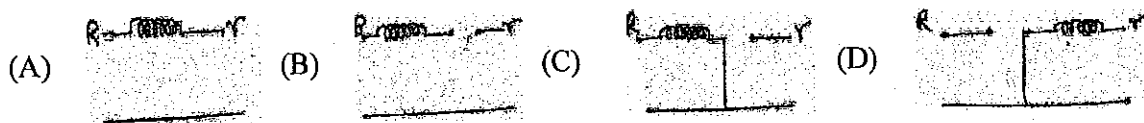


Fig. 13



43. Shunt compensation in EHV line is resorted to

- (A) Improve voltage profile (B) Reduce fault current
(C) Improve stability (D) Increase current

44. For the Y-bus matrix of a 4-bus system given in per unit, the buses having shunt elements are

$$Y_{bus} = j \begin{bmatrix} -5 & 2 & 2.5 & 0 \\ 2 & -10 & 2.5 & 4 \\ 2.5 & 2.5 & -9 & 4 \\ 0 & 4 & 4 & -8 \end{bmatrix}$$

- (A) 3 and 4 (B) 2 and 3 (C) 1 and 2 (D) 1, 2 and 4

45. A three phase, 33 kV oil circuit breaker is rated 1200 A, the symmetrical breaking capacity is 2000 MVA, 3 secs. Then the making capacity is.

- (A) 5000 MVA (B) 5100 MVA (C) 5200 MVA (D) 5400 MVA

46. The power electronic converter shown in the Fig. 14 has a single-pole double-throw switch. The pole P of the switch is connected alternately to throws A and B. The converter shown is a

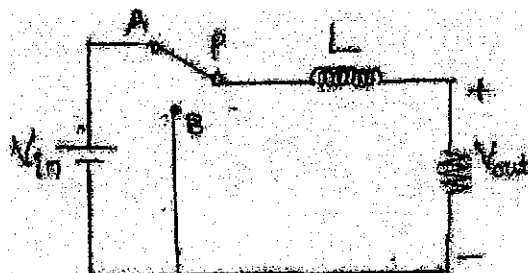
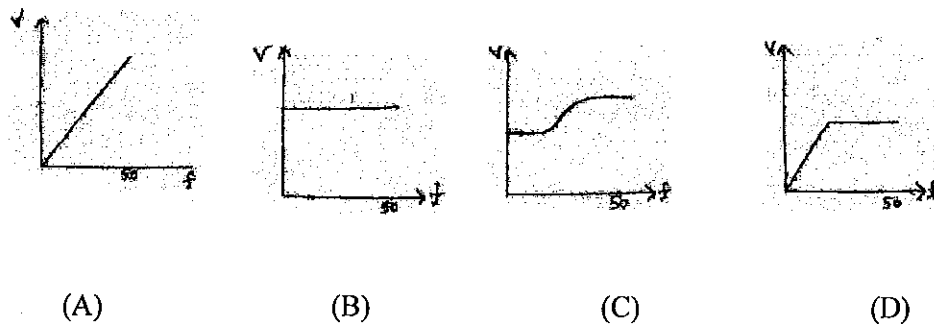


Fig. 14

- (A) step-down chopper (buck converter) (B) half-wave rectifier

47. The speed of a 3-phase, 440 V, 50 Hz induction motor is to be controlled over a wide range from zero speed to 1.5 time the rated speed using a 3-phase voltage source inverter. It is desired to keep the flux in the machine constant in the constant torque region by controlling the terminal voltage as the frequency changes. The inverter output voltage vs frequency characteristic should be



48. A step-down delta-star transformer, with per-phase turns ratio of 5, is fed from a 3-phase, 1100 V, 50 Hz source. The secondary of this transformer through a 3-pulse type rectifier feeds a R load of 10Ω . Find the maximum value of the load current (phase).

- (A) $\sqrt{2} \cdot 11$ A (B) 11 A (C) 22 A (D) $\sqrt{2} \cdot 22$ A

49. In case of an armature controlled separately excited dc motor drive with closed loop speed control, an inner current loop is useful because it

- (A) limits the speed of the motor to a safe value
(B) helps in improving the drive energy efficiency
(C) limits the peak current of the motor to the permissible value
(D) reduces the steady state speed error

50. Fig. 15 shows a chopper operating from a 150 V dc input. The duty ratio of the main switch S is 0.8. The load is sufficiently inductive so that the load current is ripple free. The average current through the diode D under steady state is

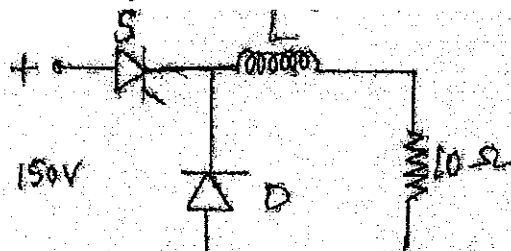


Fig. 15

- (A) 12A (B) 2.4A (C) 24A (D) 1.2A

Senior Executive Engineer (Electrical)

KEY

1.D*	11.A	21.A	31.C	41.C
2.A	12.D	22.D	32.A	42.C
3.A	13.B	23.C	33.C	43.A
4.B	14.C	24.D	34.B	44.C
5.A	15.D	25.B	35.D	45.B
6.B	16.D	26.D	36.B	46.A
7.C	17.B	27.D	37.B	47.A
8.A	18.D	28.C	38.C	48.D
9.B	19.B	29.D	39.A	49.C
10.B	20.C	30.B	40.A	50.C

*Options are repeated and hence 01 mark is given to all candidates.

