5000

POST GRADUATE COMMON ENTRANCE TEST – 2011

DATE and TIME	COURSE	SUBJECT
06-08-2011 **10:30 am to 12:30 pm**	**ME / M. Tech /** **MBA (Infrastructure Management)** **courses offered by VTU / UVCE / UBDTCE**	**Electrical Sciences** E & E / E & C / TC / BME / ME / IT

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
100	**150 Minutes**	**120 Minutes**

MENTION YOUR PGCET NO.					QUESTION BOOKLET DETAILS	
					VERSION CODE	**SERIAL NUMBER**
					A_3	00006435

DOs

1. Check whether the PGCET No. has been entered and shaded in the respective circles on the OMR answer sheet.
2. This question booklet is issued to you by the invigilator after the **2nd Bell, i.e. after 10:25 am.**
3. The serial number of this question booklet should be entered on the OMR answer sheet.
4. The version code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts

1. **The timing and marks printed on the OMR answer sheet should not be damaged / mutilated / spoiled.**
2. The **3rd Bell rings at 10:30 am, till then;**
   - Do not remove the seals of this question booklet.
   - Do not look inside this question booklet.
   - Do not start marking on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 75 (items) questions and each question will have one statement and four answers. (Four different options / responses.)
2. After the 3rd bell is rung at 10:30 am, remove the seals of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start marking on the OMR answer sheet.
3. During the subsequent 120 minutes :
   - Read each question (item) carefully.
   - Choose one correct answer from out of the four available responses (options / choices) given under each question / item. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **only one response** for each question / item.
   - Completely **darken / shade** the relevant circle with a **blue or black ink ballpoint pen against the question number on the OMR answer sheet.**
4. Please note that even a minute unintended ink dot on the OMR answer sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
5. Use the space provided at the bottom on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
6. After the **last bell is rung at 12:30 pm**, stop marking on the OMR answer sheet and affix your **left hand thumb impression** on the OMR answer sheet as per the instructions.
7. Hand over the **OMR answer sheet** to the room invigilator as it is.
8. After separating the top sheet (KEA copy), the invigilator will return the bottom sheet replica (candidate's copy) to you to carry home for self evaluation.
9. Preserve the replica of the OMR answer sheet for a minimum period of ONE year.
10. Only **Non-programmable** calculators are allowed.
11. **Please note this Question Booklet consists of *sub*-branches. Total number of questions is 75. Question Nos. 1 to 45 is compulsory and common to all the branches. Candidate has to answer *any one* paper from Question Nos. 46 – 75 out of the *sub*-branches as opted, by him/her in the Application Form.**

Marks Distribution

PART – *A* : (Section-I) 30 Questions : 30 × 1 = 30 ; (Section-II) : 15 Questions : 15 × 2 = 30
PART – *B* : (Section-I) 20 Questions : 20 × 1 = 20 ; (Section-II) : 10 Questions : 10 × 2 = 20

[P.T.O.

ELECTRICAL SCIENCES

IMPORTANT INSTRUCTIONS AND BRANCHWISE INDEX FOR THE CANDIDATES

Question Nos. 1 to 45 is compulsory and common to all the branches. Question Nos. 46 to 75 are optional. Sub-branches are there in this Booklet. The candidate has to opt any one branch according to his/her Application Form.

PART – A

(Common to E&E/E&C/TC/BME/ME/IT)

SECTION – I

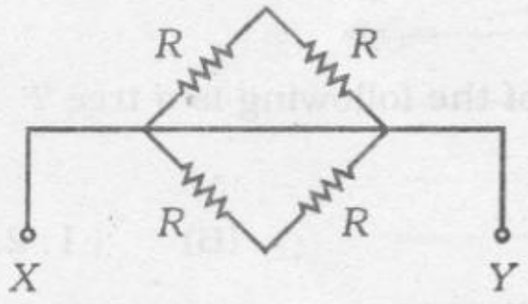
Each question carries *one* mark. 30 × 1 = 30

1. $\int (2 \cos x - 4 \sin x)\, dx$ is

   (A) $2\sin x + 4\cos x$ (B) $2\sin x - 4 \cos x$

   (C) $2\sin x - 4\cos x + c$ (D) $2\sin x + 4 \cos x + c$.

2.

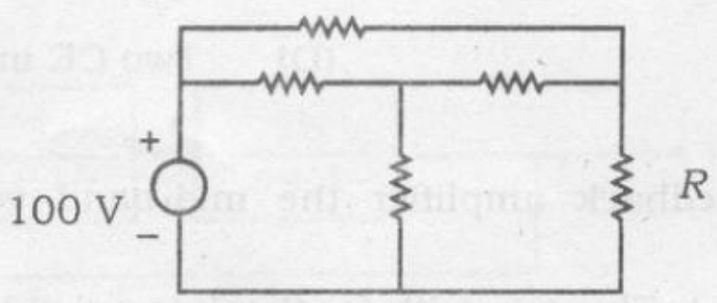


The resistance between *x*–*y* terminals is

(A) R (B) $\frac{R}{2}$

(C) zero (D) $\frac{R}{4}$.

3.



In the figure, the power dissipated by the resistor R is 10 W. If the voltage is increased to 110 V, the power dissipated will be

(A) 12·1 W (B) 21 W

(C) 20 W (D) depends on value of R.

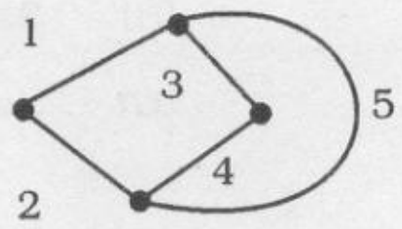
SPACE FOR ROUGH WORK

4. In a series RLC circuit, we get a leading power factor current

(A) at resonant frequency (B) at less than resonant frequency

(C) at greater than resonant frequency (D) at all frequencies.

5.



In the graph shown which of the following is a tree ?

(A) { 1, 2, 3 } (B) { 1, 2, 5 }

(C) { 3, 4, 5 } (D) { 1, 2, 3, 4 }.

6. In a transistor configuration, the voltage gain is found to be 1. The configuration is

(A) CE (B) CB

(C) CC (D) Two CE in cascade.

7. In a voltage-series feedback amplifier the mid-band voltage gain is – 1200. The feedback factor $\beta = -0{\cdot}1$. The gain with feedback is equal to

(A) – 1200 (B) – 120

(C) – 991·7 (D) – 9·917.

SPACE FOR ROUGH WORK

8. The distortion introduced by the non-linear dynamic transfer characteristics may be reduced using

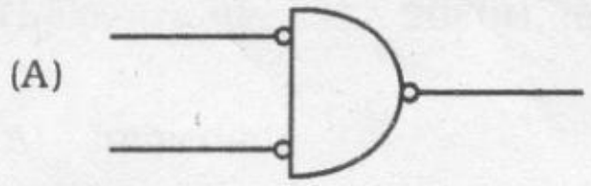
(A) push-pull amplifier configuration

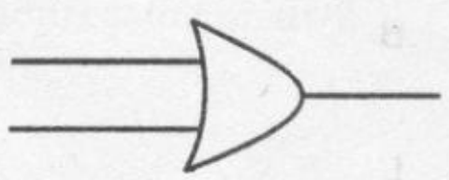
(B) positive feedback amplifier

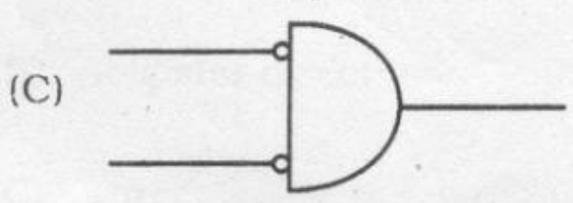
(C) cascading amplifier

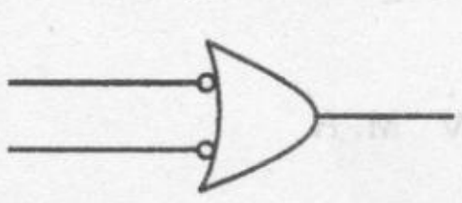
(D) increasing source impedance.

9. Which of the following represents a NAND gate ?

(A) 

(B) 

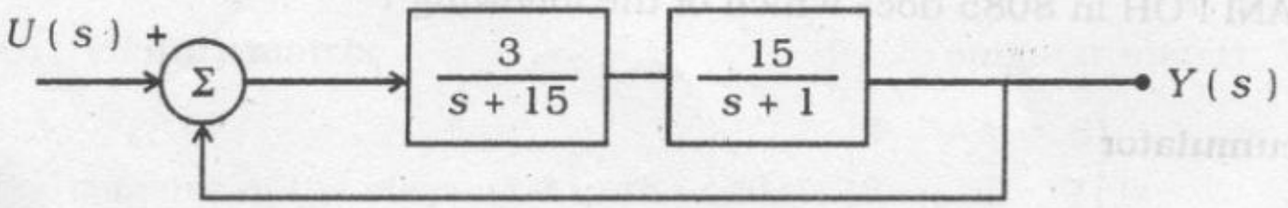
(C) 

(D) 

10. The BCD code for decimal number 12 is

(A) 00001100 (B) 10000010

(C) 00010010 (D) 11000000.

11. 

The steady state error in the response of the above system to a unit step input is

(A) 25% (B) 0·75%

(C) 6% (D) 33%.

SPACE FOR ROUGH WORK

12. A code segment of 8085 is given below :

```
LXI   H, 3FFE
MOV   B, M
INR   L
MOV   A, M
ADD   B
INR   L
MOV   M, A
```

On completion of execution, the result of addition is found in

(A) register A (B) location 2FFE

(C) location 2F00 (D) location 3000.

13. The command ANI FOH in 8085 does which of the following ?

(A) Clears accumulator

(B) Clears the lower nibble of the accumulator

(C) Clears the upper nibble of the accumulator

(D) Sets the lower nibble of the accumulator.

SPACE FOR ROUGH WORK

14. The contents of the accumulator in 8085 is A7 and CY = 0. After the execution of the instruction RLC, the contents of accumulator and CY are

(A) [A] = A8; CY = 0

(B) [A] = 4E; CY = 1

(C) [A] = 4F; CY = 0

(D) [A] = A8; CY = 1.

15. The instruction STA 2080H, in 8085 is of which addressing mode ?

(A) Immediate

(B) Register direct

(C) Direct

(D) Register indirect.

16. The matrix $\begin{bmatrix} 0 & -2 \\ 2 & 0 \end{bmatrix}$ is a/an

(A) symmetric matrix (B) skew-symmetric matrix

(C) identity matrix (D) singular matrix.

17. The cofactor of the element 8 in the matrix $\begin{bmatrix} 3 & -4 & 6 \\ 2 & 5 & 7 \\ 9 & 8 & 0 \end{bmatrix}$ is

(A) – 9 (B) 9

(C) 33 (D) – 33.

SPACE FOR ROUGH WORK

18. The angle θ between two vectors $\vec{a}$ and $\vec{b}$ is given by

(A) $\cos\theta = \dfrac{|\vec{a}\times\vec{b}|}{|\vec{a}.\vec{b}|}$ (B) $\cos\theta = \dfrac{|\vec{a}\times\vec{b}|}{|\vec{a}||\vec{b}|}$

(C) $\tan\theta = \dfrac{|\vec{a}\times\vec{b}|}{|\vec{a}||\vec{b}|}$ (D) $\sin\theta = \dfrac{|\vec{a}\times\vec{b}|}{|\vec{a}||\vec{b}|}$.

19. The magnitude of the position vector of the point (2, 3, – 4) is

(A) $\sqrt{11}$ (B) 0

(C) $\sqrt{29}$ (D) 1.

20. The solution of the equation $x + y\dfrac{dy}{dx} = 0$ is

(A) $x + y = k$ (B) $x^2 + y^2 = k$

(C) $\sqrt{x} + \sqrt{y} = k$ (D) $ln\,(x + y) = k$.

21. A voltage source is connected across an ideal inductor. The current through th inductor is observed to be a constant. The voltage source must be

(A) sinusoidal (B) ramp

(C) step (D) impulse.

22. The current in a circuit is given by $I(s) = \dfrac{3(s+10)}{s(s+12)}$, in the frequency domain. The valu of $i\,(t)$ as $t \to \infty$ is

(A) 0·5 A (B) 0 A

(C) 3 A (D) 2·5 A.

SPACE FOR ROUGH WORK

23. The relationship between the electric field intensity and the potential is given by

(A) $E = -\nabla V$ (B) $E = \int V \cdot dl$

(C) $E = \nabla^2 V$ (D) $E = \nabla \times V$.

24. A full-wave rectifier circuit is supplied by a centre-tap transformer. The peak voltage from end terminal to centre tap is 135 V. Neglecting the forward resistance of the diode, the *d.c.* output voltage is

(A) 135 V (B) 95·45 V

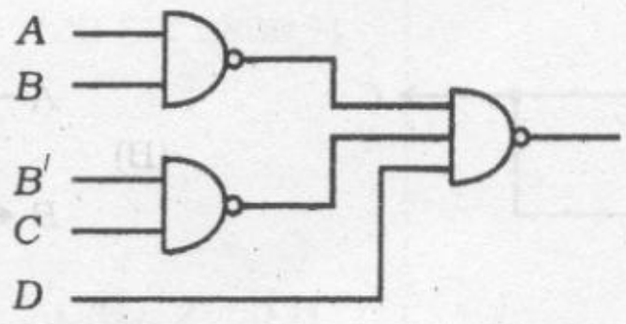
(C) 85·94 V (D) 270 V.

25. In a fixed bias circuit, $V_{CC} = 12$ V and $R_b = 1$ MΩ. If an *n-p-n* silicon transistor is used, the base current I_B is equal to

(A) 12 μA (B) 11·4 μA

(C) 12 A (D) 3·46 μA.

26. The output of the network shown below is given by



(A) $AB + B'C + D$ (B) $AB + B'C + D'$

(C) $(A + B)(B' + C)(D)$ (D) $(A + B)(B' + C)(D')$.

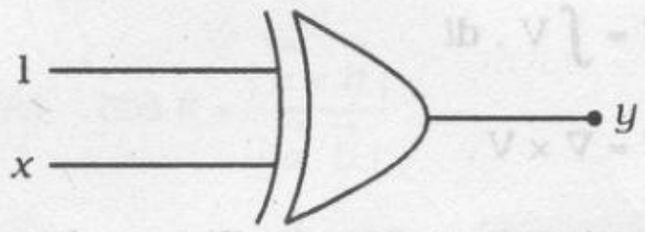
27. A counter is designed with *T* flip-flops. The present state is '011' and the next state is '010'. The input to the *T* flip-flop to have correct state transition at the next clock pulse is

(A) 001 (B) 011

(C) 010 (D) 111.

SPACE FOR ROUGH WORK

28.

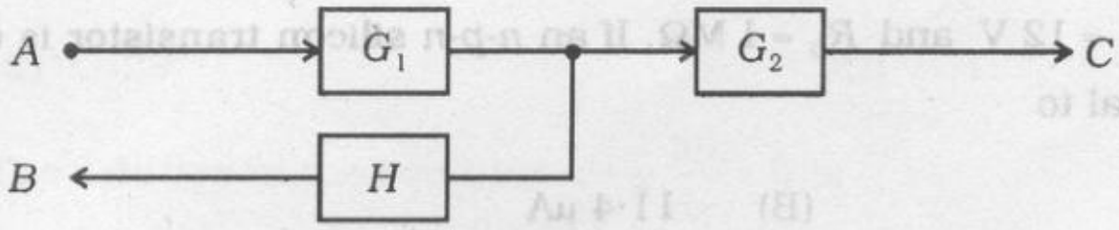


In the above gate the relation between x and y is

(A) $y = x$ (B) $y = 1$

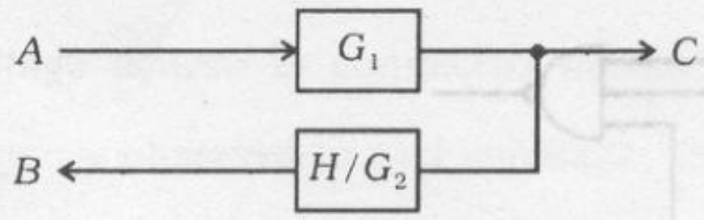
(C) $y = \overline{x}$ (D) $y = 0$.

29.

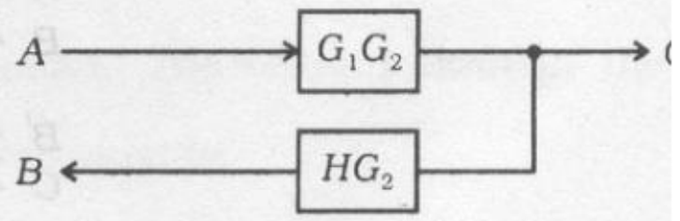


The equivalent for the block diagram is

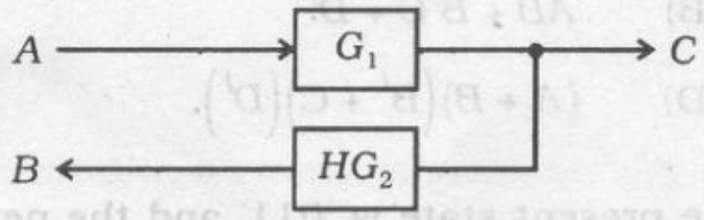
(A)



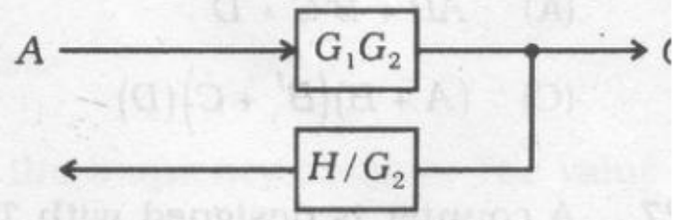
(B)



(C)



(D)



30. The characteristic equation of a system is given by $2s^4 + s^3 + 3s^2 + 5s + 7 = 0$. The number of roots that lie in the right half of s plane is

(A) zero (B) 2

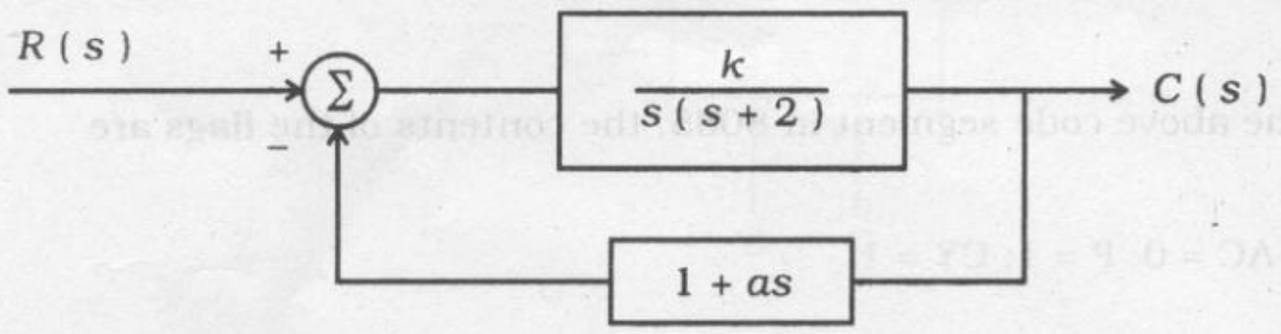
(C) 4 (D) 1.

SPACE FOR ROUGH WORK

SECTION – II

Each question carries *two* marks. $15 \times 2 = 30$

31.



In the above figure damping ratio $\xi = 0 \cdot 7$ and undamped natural frequency $\omega_n = 4$ rad/sec. The values of k and a are

(A) $k = 16, a = 0{\cdot}225$ (B) $k = 8, a = 0{\cdot}225$

(C) $k = 16, a = 0{\cdot}455$ (D) $k = 64, a = 0{\cdot}9$.

32.

Address	Instruction
2000	LXI SP, 2800 H
.	.
.	.
.	.
2040	CALL 2060 H
.	
.	
.	

In the above segment of 8085, what are the contents of the stack and stack pointer after CALL instruction is executed ?

(A) 2040, 2800 (B) 2041, 2401

(C) 2060, 2800 (D) 2043, 27FE.

SPACE FOR ROUGH WORK

33. MVI B, 96H

MVI A, 97H

ADD B

On execution of the above code segment in 8085, the contents of the flags are

(A) S = 0; Z = 0; AC = 0; P = 1; CY = 1

(B) S = 1; Z = 1; AC = 0; P = 0; CY = 1

(C) S = 0; Z = 0; AC = 0; P = 0; CY = 1

(D) S = 0; Z = 1; AC = 0; P = 1; CY = 1.

34. The characteristic table of an *X-Y* flip-flop is given below to be implemented using *J-K* flip-flop. The *J-K* inputs are

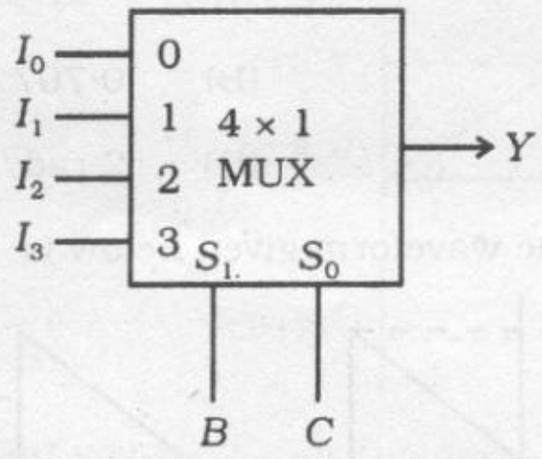
X	Y	Q_{n+1}
0	0	1
0	1	Q_n
1	0	$\overline{Q}_n$
1	1	0

(A) $J = X;\ K = \overline{Y}$ (B) $J = \overline{X};\ K = Y$

(C) $J = Y;\ K = \overline{X}$ (D) $J = \overline{Y};\ K = X$.

SPACE FOR ROUGH WORK

35.

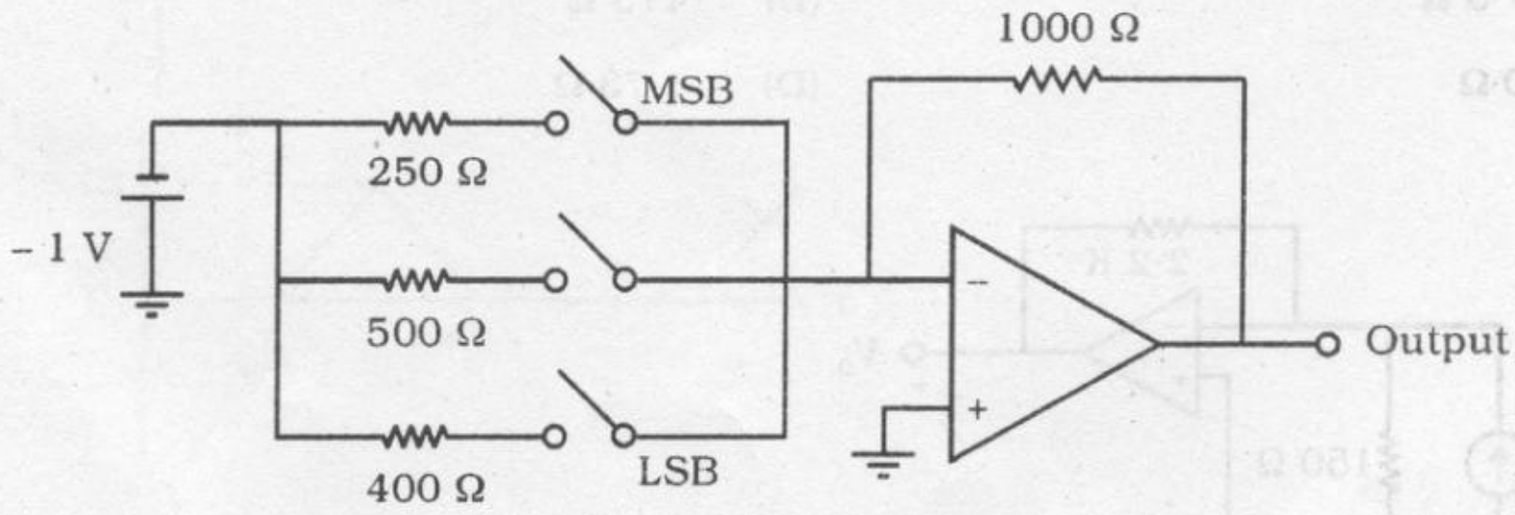


The Boolean function $F\ (A, B, C) = \Sigma\ (1, 3, 5, 6)$ is to be implemented with a 4 × 1 MUX as shown. The inputs I_0, I_1, I_2, I_3 are

(A) 0 1 A A' (B) 1 0 A A'

(C) 0 0 A' A (D) 1 1 A' A.

36.



For switch position 1 1 0 (1 is close and 0 is open) the output voltage is

(A) 2 V (B) 4 V

(C) 6 V (D) 0 V.

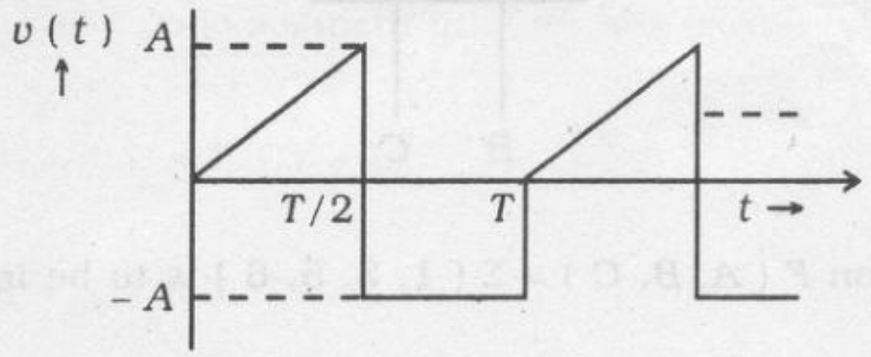
SPACE FOR ROUGH WORK

37. For the transfer function $G(s)H(s) = \dfrac{1}{s(s+1)(s+0\cdot5)}$ the phase cross-over frequency is

(A) 0·5 rad/s (B) 0·707 rad/s

(C) 1·732 rad/s (D) 2 rad/s.

38. The rms value of the periodic waveform given below is



(A) $\sqrt{\frac{2}{3}}A$ (B) $\sqrt{\frac{3}{2}}A$

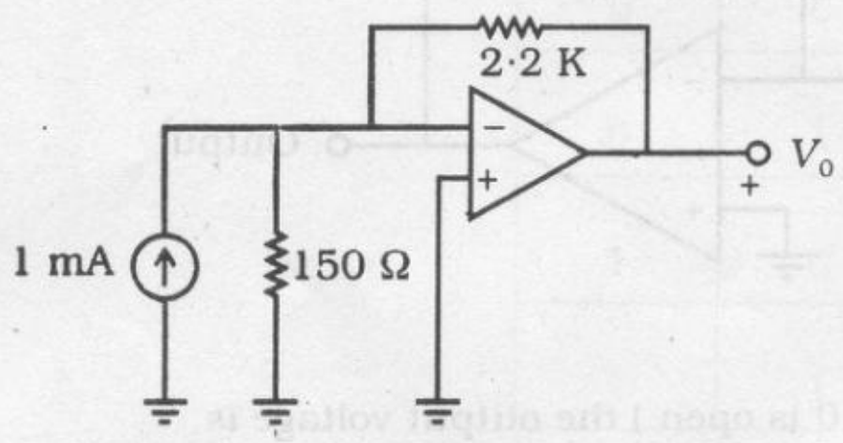
(C) $\sqrt{\frac{1}{3}}A$ (D) $\sqrt{2}A$.

39. The line current drawn by a balanced star connected resistive load from a 173 V 3-ϕ supply is 10 A. The load resistance per phase is

(A) 17·3 Ω (B) 173 Ω

(C) 10 Ω (D) 1·73 Ω.

40.



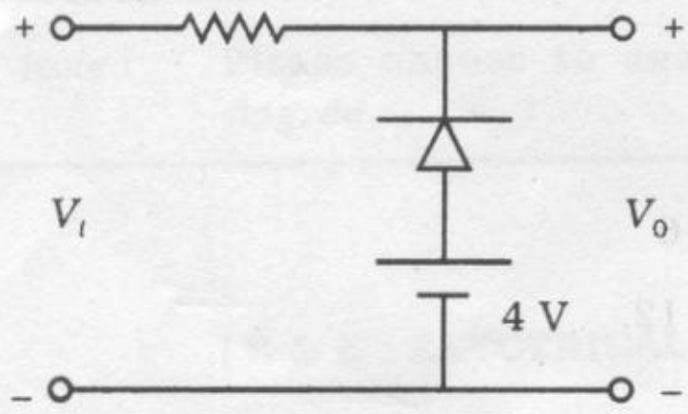
In the circuit v_0 is equal to

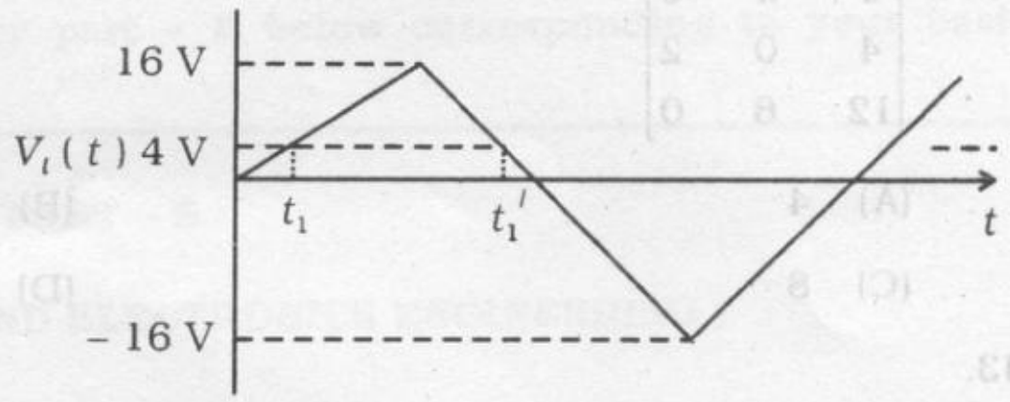
(A) 2·2 V (B) – 2·2 V

(C) 1·5 V (D) – 1·5 V.

SPACE FOR ROUGH WORK

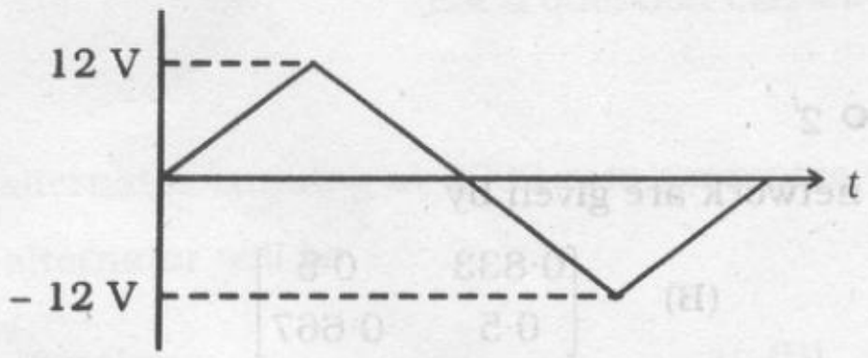
41.



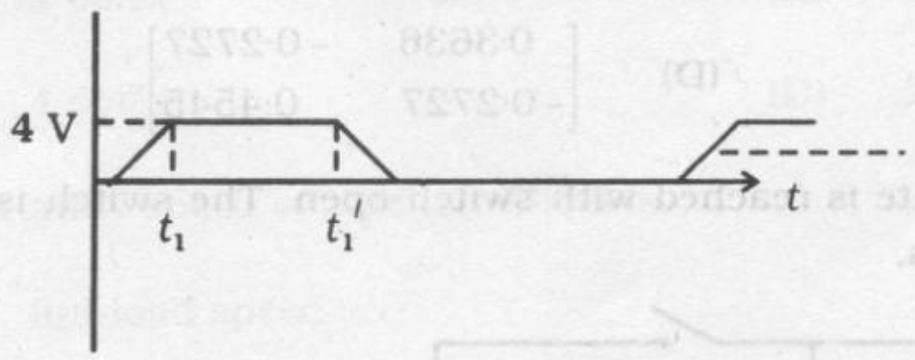


In the circuit shown, the output voltage v_0 for the given input is

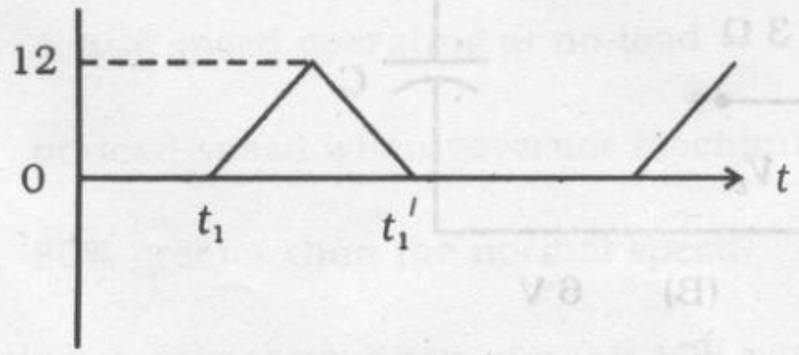
(A)



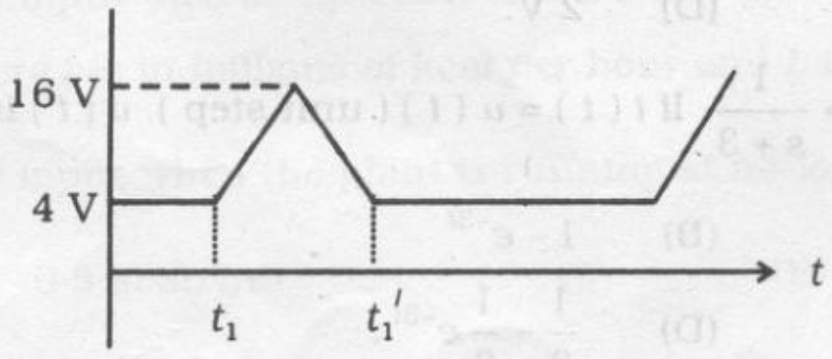
(B)



(C)



(D)



SPACE FOR ROUGH WORK

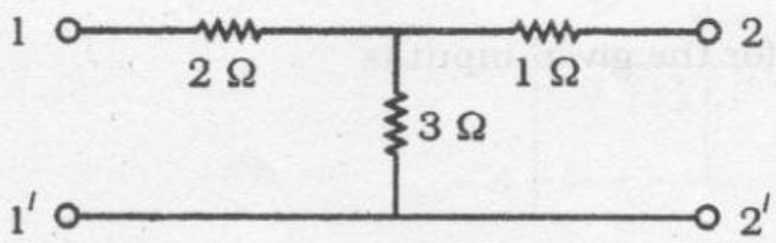
42. What value of x in the given matrix will make it singular ?

$$\begin{bmatrix} 8 & x & 0 \\ 4 & 0 & 2 \\ 12 & 6 & 0 \end{bmatrix}$$

(A) 4 (B) 6

(C) 8 (D) 12.

43.

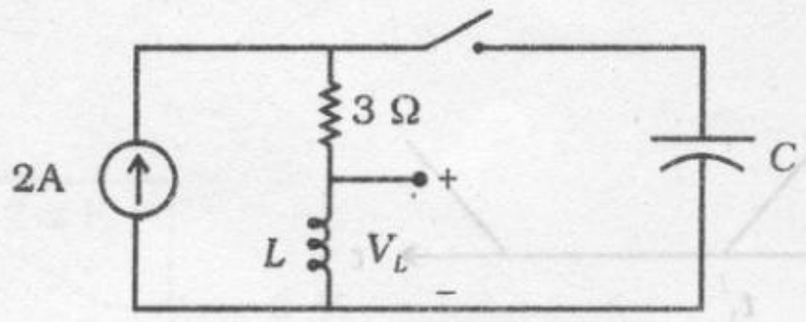


The [Y] parameters of the two port network are given by

(A) $\begin{bmatrix} 5 & 3 \\ 3 & 4 \end{bmatrix}$ (B) $\begin{bmatrix} 0{\cdot}833 & 0{\cdot}5 \\ 0{\cdot}5 & 0{\cdot}667 \end{bmatrix}$

(C) $\begin{bmatrix} 2 & 3 \\ 3 & 1 \end{bmatrix}$ (D) $\begin{bmatrix} 0{\cdot}3636 & -0{\cdot}2727 \\ -0{\cdot}2727 & 0{\cdot}4545 \end{bmatrix}$.

44. In the circuit shown, steady state is reached with switch open. The switch is closed at $t = 0$. At $t = 0^+$, the voltage V_L is,



(A) 0 V (B) 6 V

(C) – 6 V (D) 2 V.

45. A system function is given by $\frac{V(s)}{I(s)} = \frac{1}{s+3}$. If $i(t) = u(t)$ (unit step), $v(t)$ is

(A) e^{-3t} (B) $1 - e^{-3t}$

(C) $1 - 3e^{-3t}$ (D) $\frac{1}{3} - \frac{1}{3}e^{-3t}$.

SPACE FOR ROUGH WORK

Note : **Please choose to answer part – B below corresponding to your basic degree.**

PART – B

(E & E : ELECTRICAL AND ELECTRONICS ENGINEERING)

SECTION – I

Each question carries *one* mark. 20 × 1 = 20

46. An alternator running at 3000 rpm generates voltage of 50 Hz. The number of poles of the alternator will be

(A) 8 poles (B) 6 poles

(C) 4 poles (D) 2 poles.

47. Run-away speed of a pelton wheel is

(A) full-load speed

(B) actual speed operating at no-load

(C) no-load speed when governor mechanism fails

(D) 80% greater than the normal speed.

48. The input-output equation of a 0·5 MW powerhouse is given by $I = 30 + 0 \cdot 8L + 0 \cdot 5L^2$, where I is in millions of kcal per hour and L is in megawatts. The input when the plant is running at no-load will be

(A) 0·5 kcal/hr (B) 21·3 kcal/hr

(C) 30×10^6 kcal/hr (D) 30 kcal/hr.

SPACE FOR ROUGH WORK

49. The conductors used for transmitting power must have which of the followin characteristics ?

(A) It should have low value of specific resistance

(B) It should be light in weight and non-brittle

(C) It should have low cost and high tensile strength

(D) All of these.

50. Ferranti effect on long overhead lines is experienced when

(A) the line is lightly loaded (B) the power factor is unity

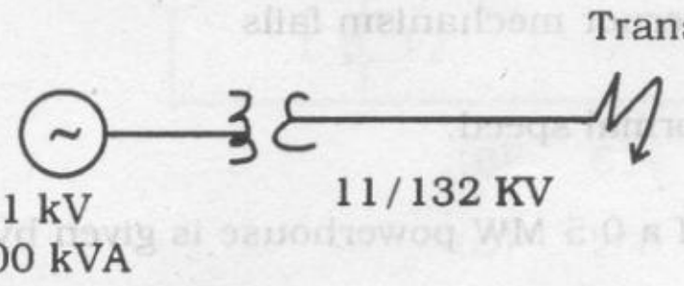
(C) the power factor is loading (D) corona effect is dominant.

51. The percentage reactance can be converted into ohmic value with which of the following formulae ?

(A) $X_{ohms} = \frac{X(\%) \times 100\,(kV)^2}{kVA}$ (B) $X_{ohms} = \frac{X(\%) \times 1000\,(kV)^2}{kVA}$

(C) $X_{ohms} = \frac{X(\%) \times (kV)^2}{1000\ (kVA)}$ (D) $X_{ohms} = \frac{X(\%) \times (10) \times (kV)^2}{kVA}$.

52. For the system shown below the base voltage is,



(A) 11 kV for the system

(B) 132 kV for the system

(C) 11 kV for generator and 132 kV for transmission line

(D) cannot be determined for the given data.

SPACE FOR ROUGH WORK

53. Fuses are used where relays and circuit breakers

(A) fail to interrupt heavy short circuit currents

(B) are not economically justified

(C) are not available

(D) require more care and maintenance.

54. Which of the following equipment one will choose to study the stability of AC power system ?

(A) energymeter (B) network analyser

(C) network synthesizer (D) phase sequence meter.

55. While testing transformer oil for dielectric strength the spherical electrodes are placed in

(A) vertical plane (B) horizontal plane

(C) diagonal plane (D) none of these.

56. What happens if the field winding of a running shunt motor suddenly breaks open ?

(A) Its speed slows down (B) Its speed becomes dangerously high

(C) It gives out sparks (D) It stops at once.

57. The commutator of a *d.c.* machine acts as a

(A) full-wave rectifier (B) half-wave rectifier

(C) controlled full-wave rectifier (D) controlled half-wave rectifier.

58. In Swinburne's test for determination of efficiency of a *d.c.* machine

(A) the no-load losses are calculated and the copper losses are measured

(B) the no-load losses and measured copper losses are calculated

(C) both the no-load losses and the copper losses are measured

(D) both the no-load losses and the copper-losses are calculated.

SPACE FOR ROUGH WORK

59. The no-load current of a transformer in terms of full-load current is usually

(A) 1% to 3% (B) 3% to 15%

(C) 9% to 12% (D) 12% to 20%.

60. The concentric windings are used in core-type transformers with

(A) HT winding placed next to core (B) LT winding placed next to core

(C) LT winding on the outer side (D) None of these.

61. The skin effect increases the effective value of

(A) resistance of the conductor

(B) reactance of the conductor

(C) capacitance of the conductor

(D) inductance & capacitance of the conductor.

62. The major advantage of a bridge rectifier is that

(A) no centre-tap transformer is required

(B) the required peak inverse voltage of each diode is double of that for a full-wave rectifier

(C) peak inverse voltage of each diode is half of that for a full-wave rectifier

(D) the input is more smooth.

63. In a thyristor, holding current is

(A) more than latching current (B) less than latching current

(C) equal to latching current (D) zero.

64. The function of snubber circuit connected across an SCR is to

(A) suppress dv/dt (B) increase dv/dt

(C) decrease dv/dt (D) none of these.

65. For a 3-phase, six-pulse diode rectifier, the average output voltage in terms of maximum value of line voltage V_m is

(A) $\frac{3\sqrt{2}}{\pi} V_m$ (B) $\frac{3 V_m}{\pi}$

(C) $\frac{3\sqrt{3}}{2\pi} V_m$ (D) $\frac{3\sqrt{3}}{\pi} V_m$.

SPACE FOR ROUGH WORK

SECTION – II

Each question carries *two* marks. 10 × 2 = 20

66. A transformer has a core loss of 64 W and copper loss of 144 W, when it is carrying 20% overload current. The load at which this transformer will operate at the maximum efficiency is

(A) 80% (B) 66%

(C) 120% (D) 44%.

67. In a 3-phase star connected alternator a field current of 40 A produces full-load current of 200 A on short circuit and 1160 V an open circuit. If the resistance of the alternator is 0·5 Ω, then the value of synchronous reactance is

(A) 5·78 Ω (B) 16·5 Ω

(C) 3·31 Ω (D) 29 Ω.

68. The forward breakover voltage of a thyristor is 175 volts with a gate pulse of 2 mA. The conduction angle for a sinusoidal voltage of 350 V (peak) is

(A) 0° (B) 30°

(C) 60° (D) 90°.

69. An SCR can be triggered with a $\frac{dv}{dt}$ of 200 V/μs. If the charging current flowing through the junction is 5 mA, the equivalent capacitance of depletion layer is

(A) 20 pF (B) 25 F

(C) 25 pF (D) 250 pF.

70. A 4-pole lap wound armature has 480 conductors and a flux per pole of 25 mWb. The *emf* generated when running at 600 rpm, will be

(A) 240 V (B) 120 V

(C) 60 V (D) 30 V.

SPACE FOR ROUGH WORK

71. Three units of 1 : 5 transformers are connected in Δ – Y to supply a 3-phase load from a 400 V, 3-phase source. The line voltage on the load side is

(A) 1000 V (B) 80 V

(C) 3464 V (D) 803 V.

72. A transmission line is transmitting a fixed amount of power whose efficiency increases when

(A) voltage decreases and power factor remains constant

(B) voltage increases and power factor also increases

(C) voltage decreases and power factor also decreases

(D) voltage is constant and power factor decreases.

73. The power factor of a system on a 460 V, 3-phase, 60 Hz, in which the ammeter indicates 100 amp and the wattmeter reads 62 kW will be

(A) 0·95 (B) 0·78

(C) 0·65 (D) 0·55.

74. The anode current through a conducting SCR is 10A. If its gate current is made half the anode current will become

(A) 0 A (B) 5 A

(C) 10 A (D) 20 A.

75. The p.u. impedance value of an alternator corresponding to base values of 13·2 kV and 30 MVA is 0·2 p.u. The p.u. value for the base values of 13·8 kV and 50 MVA will be

(A) 0·106 p.u. (B) 0·206 p.u.

(C) 0·306 p.u. (D) 0·318 p.u.

SPACE FOR ROUGH WORK

PART – B

(E & C and TC : ELECTRONICS & COMMUNICATION ENGINEERING & TELECOMMUNICATION ENGINEERING)

SECTION – I

Each question carries *one* mark. 20 × 1 = 20

46. For fast switching applications, a power diode should have

(A) low on state voltage and low breakdown voltage

(B) high on state voltage and high breakdown voltage

(C) large reverse recovery time

(D) small reverse recovery time.

47. In a single-phase full-wave A.C. voltage controller with R & L load, if $\beta = 205°$ and delay angle $\alpha = \pi/4$, then the conduction angle of a thyristor is

(A) 280° (B) 220°

(C) 60° (D) 160°.

48. The directivity of a broadside array of height 10 λ and length 20 λ is

(A) 34 dB (B) 43 dB

(C) 53 dB (D) 35 dB.

49. Which of the following pulse modulation systems is analog ?

(A) PWM (B) PCM

(C) Delta (D) Differential delta.

SPACE FOR ROUGH WORK

50. A signal is defined as $x(t) = 4\ \text{tri}(t)$. The value of $x\left(\frac{1}{4}\right)$ is

(A) 4 (B) 3

(C) $\frac{1}{4}$ (D) $\frac{1}{3}$.

51. An analog signal is sampled at 36 kHz and quantized into 256 levels. The time duration of a bit of the binary coded signal is

(A) 3·47 μs (B) 2·77 μs

(C) 1·22 μs (D) 7·86 μs.

52. A coaxial cable having characteristic impedance of 50 Ω is to feed a half-wave dipole antenna of 75 Ω. The necessary matching load is

(A) 3·33 Ω (B) 33·3 Ω

(C) 3·3 kΩ (D) 33 kΩ.

53. The range of firing in case of UJT triggering circuit is

(A) 0 - 90° (B) 0 - 180°

(C) 0 - 270° (D) 0 - 360°.

54. The impulse response $h[n]$ of a linear time invariant system is described by $h[n] = e^{\alpha n}\, u[n] + e^{\beta n}\, u[-n]$ where $u[n]$ denotes the unit step function and α & β are constants. The system is stable if

(A) α is positive & β is negative

(B) α is negative & β is negative

(C) α is positive & β is negative

(D) α is negative & β is negative.

SPACE FOR ROUGH WORK

55. Which of the following is used to download a binary machine program from the development processor's memory into the target processor memory ?

(A) Device programmers

(B) Emulators

(C) Debuggers

(D) Virtual machines.

56. Scaling of channel length by $\frac{1}{\alpha}$ leads to

(A) increase in channel resistance R_{ON}

(B) decrease in channel resistance R_{ON}

(C) no change in channel resistance R_{ON}

(D) infinite value of channel resistance R_{ON}.

57. Which one of the following is *not* embedded system characteristic ?

(A) Single functioned (B) Multi-functioned

(C) Tightly constrained (D) Reactive and real time.

58. A thin dipole antenna is $\frac{\lambda}{15}$. If its loss resistance is 1·2 Ω then the efficiency is

(A) 41·1% (B) 59%

(C) 74·5% (D) 25·5%.

59. For a given data rate, the bandwidth required with *m*-ary transmission is smaller than for binary transmission by

(A) $\log_2 m$ (B) $\frac{\log_2 m}{m}$

(C) $\frac{2}{\log_2 m}$ (D) $\frac{\log_2 m}{2}$.

SPACE FOR ROUGH WORK

60. The rms antenna current of an A.M. transmitter increases by 20% over the unmodulated value. The modulation percentage is

(A) 25 (B) 93

(C) 47 (D) 16.

61. The input impedance of a $\frac{\lambda}{8}$ long short circuited section of a lossless transmission line is

(A) zero (B) capacitive

(C) inductive (D) infinity.

62. Which of the following systems is linear ?

(A) $ax[n] + b$ (B) $x^2[n]$

(C) $x[n^2]$ (D) $e^x[n]$.

63. Voltage source inverter is used when

(A) source inductance is small and load inductance is large

(B) source inductance is large and load inductance is small

(C) source inductance is large and load inductance is large

(D) source inductance is small and load inductance is small.

64. Static current is high in

(A) CMOS inverter (B) BiCMOS inverter

(C) NMOS inverter (D) Transmission gate.

65. The impulse response of an LTI system is $u(t)$. The step response is

(A) $u(t)$ (B) $\delta(t)$

(C) $t \cdot \delta(t)$ (D) $t \cdot u(t)$.

SPACE FOR ROUGH WORK

SECTION – II

Each question carries *two* marks. $10 \times 2 = 20$

66. Given the Z-transform pair

$3^n n^2 U[n] \xleftrightarrow{Z} X[Z]$

the time signal corresponding to $X\left[Z^{-1}\right]$ is

(A) $n^2 3^{-n} U[n]$ (B) $\frac{1}{n^2} 3^{\frac{1}{n}} U[n]$

(C) $n^2 3^{-n} U[-n]$ (D) $\frac{1}{n^2} 3^{\frac{1}{n}} U[-n]$.

67. Electron transit time is directly proportional to ..... and inversely proportional to ..... .

(A) length, V_{ds} (B) V_{ds}, E_{ds}

(C) square of length, V_{ds} (D) E_{ds}, length.

68. A DSB signal is generated using a square law modulator with characteristics $V_o = A V_i + B V_i^3$, the output of the non-linear device can be filtered by bandpass filter and the input signal $V_i = m(t) + \cos(2\pi f_1 t)$. What is the value of f_1 if the carrier frequency of DSB generator is 1 MHz ?

(A) 1 MHz (B) 0·5 MHz

(C) 0·25 MHz (D) 2 MHz.

69. The antenna is desired to operate on a frequency of 30 MHz whose Q is 40. The bandwidth of the antenna is

(A) 705 kHz (B) 750 kHz

(C) 750 Hz (D) 705 Hz.

SPACE FOR ROUGH WORK

70. The ranges of resistance R_1 & R_2 of UJT triggering circuit for the parameters : $V_{BB} = 20$ V, $\eta = 0{\cdot}66$, $I_P = 10\,\mu$A, $V_V = 2{\cdot}5$ V, $I_V = 10$ mA are

(A) 15 kΩ < R_1 < 10 MΩ & 757 kΩ

(B) 5 kΩ < R_1 < 970 kΩ & 7·57 Ω

(C) 100 Ω < R_1 < 6800 Ω & 75·7 kΩ

(D) 1·75 kΩ < R_1 < 680 kΩ & 757 Ω.

71. Consider voice transmission using BPSK signalling at transmission rate of 2400 bps and bandwidth efficiency of 1 bps/Hz. The number of constellation points when data rate is increased to 19·2 kbps is

(A) 512 (B) 256

(C) 128 (D) 8.

72. When 12 thyristors are used in a string to withstand a D.C. voltage of $V_S = 15$ kV and the maximum steady state voltage sharing of each thyristor is 2 kV then the steady state voltage derating factor is

(A) 37·5% (B) 75%

(C) 25·15% (D) 12%.

73. Drain current can be reduced by reducing ..... and by increasing ..... .

(A) L, W (B) W, L

(C) V_{ds}, W (D) V_{ds}, V_{gs}.

74. Let $x_a(t)$ be an analog signal with bandwidth 3 kHz. N point is used to compute spectrum of signal with a resolution less than or equal to 50 Hz. The minimum length of analog signal record is

(A) 0·3 sec (B) 0·03 sec

(C) 0·2 sec (D) 0·02 sec.

75. The radiation resistance of an antenna is 72 Ω and loss resistance is 8 Ω. What will be the directivity if the power gain is 16 ?

(A) 17·78 (B) 17·87

(C) 17·89 (D) 17·98.

SPACE FOR ROUGH WORK

PART – B

(BME and ME : BIOMEDICAL ENGINEERING & MEDICAL ELECTRONICS)

SECTION – I

Each question carries *one* mark. $20 \times 1 = 20$

46. By definition, ultrasound is sonic energy at frequencies

(A) > 20 kHz (B) < 20 kHz

(C) ≥ 20 kHz (D) ≤ 20 kHz.

47. The density of water and most body fluids and tissues is approximately

(A) $2{\cdot}00\ g/cm^2$ (B) $1{\cdot}00\ g/cm^2$

(C) $0{\cdot}5\ g/cm^2$ (D) $0{\cdot}25\ g/cm^2$.

48. The frequency range of *X*-ray is

(A) 10^8 MHz — 10^{10} MHz (B) 10^{10} MHz — 10^{14} MHz

(C) 10^{12} MHz — 10^{16} MHz (D) 10^{14} MHz — 10^{18} MHz.

49. In order to visualize gastrointestinal tract during *X*-ray, barium sulphate is given orally because

(A) foreign bodies and bone absorb *X*-ray images readily than soft tissues

(B) to increase *X*-ray absorption of intestinal tract than surrounding tissue

(C) to make intestinal tract empty to enhance visualisation

(D) to provide different colours to the intestinal tract to enhance visualisation.

50. In which imaging system mathematical reconstruction technique is used to visualise detailed structures of an object ?

(A) *X*-ray image intensifier (B) CT scanner

(C) MRI system (D) Ultrasonic imaging system.

SPACE FOR ROUGH WORK

51. When a sequence is circularly shifted in time by 5 units, the magnitude response

(A) increases by 5 (B) remains unchanged

(C) remains constant (D) shifts by 5 units.

52. To detect QRS complex, the ECG is passed through a bandpass filter with a centr frequency ..... and a bandwidth of ..... .

(A) 25 Hz, 50 Hz (B) 17 Hz, 50 Hz

(C) 17 Hz, 6 Hz (D) 25 Hz, 100 Hz.

53. The transform that is effective in detecting lines in an image is

(A) Fourier (B) Hough

(C) Wavelet (D) Hadamard.

54. The transform used in JPEG image compression is

(A) Discerete cosine transform

(B) Walsh transform

(C) Hadamard transform

(D) K.L. transform.

55. Which of the following filters will in general have best performance in enhancing edg in an image ?

(A) Mean filter (B) Median filter

(C) Laplace filter (D) Mode filter.

56. Glass electrode is used to measure/record

(A) bioelectric potential near within a single cell

(B) EMG potential from the surface of the skin

(C) pH of body fluids

(D) EEG potential from a local region of the brain.

SPACE FOR ROUGH WORK

57. DC defibrillation is used to correct

(A) ventricular fibrillation

(B) arrhythmias

(C) arterial fibrillation

(D) ventricular fibrillation, arterial fibrillation and other arrhythmias.

58. Measurement of cardiac output is carried out by

(A) ultrasound transmission and reflection method

(B) electromagnetic induction flowmeter

(C) indicator dilution method

(D) thermal convection method.

59. Changes in threshold sensitivity associated with various middle ear surgical procedures can be monitored more accurately using

(A) pure tone audiometers (B) speech audiometers

(C) audiometer Bekesy (D) evoke response audiometer system.

60. The amount of gas contained in the lungs at the end of a maximal inspiration is called

(A) vital capacity (B) total lung capacity

(C) inspiratory capacity (D) forced vital capacity.

61. When the signal and noise spectra overlap ..... technique can separate a repetitive signal from noise without distorting the signal.

(A) bandpass filter (B) moving average filter

(C) synchronized averaging (D) notch and comb filter.

SPACE FOR ROUGH WORK

62. The system is linear if it is

(A) homogeneous (B) additive

(C) additive or homogeneous (D) additive and homogeneous.

63. If the frequency of analog sinusoid is $\frac{4}{\pi}$ when sampled using sampling frequency above or below the Nyquist rate, will result in discrete time signal that is.

(A) periodic (B) aperiodic

(C) aliased (D) none of these.

64. When the system has poles inside the unit circle in Z domain

(A) the system is stable and its impulse response is a decaying function

(B) time domain behaviour will be exponentially rising signal

(C) the system is unstable

(D) the impulse response is marginally constant.

65. Multiplication in frequency domain is convolution in time domain. It is a

(A) linear convolution

(B) circular convolution

(C) any type of convolution

(D) linear convolution converted to circular convolution.

SECTION – II

Each question carries *two* marks. 10 × 2

66. The minimum sampling rate required to reconstruct the signal $f(t) = \sin(200$ from its samples is ..... Hz.

(A) 500 (B) 1000

(C) 2000 (D) 4000.

SPACE FOR ROUGH WORK

67. Speech is digitized using a sampling rate of 8 kHz. An antialiasing filter with cut-off frequency of 3·4 kHz is preceded by sampler. The loss of speech signals in the frequency range 3·4 — 20 kHz due to antialiasing filter introduces a degradation in the signal quality. On the other hand, sampling without antialiasing filter also introduces degradation in the signal quality. Which of the following statements is true ?

(A) Degradation with antialiasing filter is less

(B) Degradation without antialiasing filter is less

(C) Degradation with or without antialiasing filter is the same

(D) Degradation with antialiasing filter in the above frequency band is not much important.

68. The 2D DFT of the image $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$ is

(A) $\begin{bmatrix} 4 & 0 \\ 0 & 0 \end{bmatrix}$ (B) $\begin{bmatrix} 0 & 4 \\ 0 & 0 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 0 \\ 4 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 0 & 0 \\ 0 & 4 \end{bmatrix}$.

69. The total number of bits required to represent a 256 ×256 image with 256 gray level is

(A) 524268 (B) 65536

(C) 16777216 (D) 131072.

70. An ECG signal contains combination of base line drift, high frequency noise and power line and its harmonics interference. Which combination of filters are required ?

(A) LP filter, HP filter and Notch filter

(B) LP filter and Comb filter

(C) LP filter, HP filter and Comb filter

(D) LP filter, HP filter and BR filter.

SPACE FOR ROUGH WORK

71. ..... assigns variable length code words to a given quantized data sequenc according to their frequency of occurrence. Data that occur frequently are assigne shorter code words.

(A) Huffman coding (B) Adaptive coding

(C) Runlength coding (D) AZTEC coding.

72. The number of stages of FET computations required for the computation of DFT of 51 point sequence is

(A) 9 (B) 8

(C) 7 (D) 6.

73. Which of the following properties are true for an IIR filter designed using biline transformation method ?

I) Requires the use of antialiasing filter

II) Requires prewrapping the filter cut-off frequencies

III) Not suited for the design of HP filters

IV) Result in unique mapping from analog to digital frequencies.

(A) I & II (B) I & III

(C) II & III (D) II & IV.

74. The number of multiplications required for performing the convolution of t sequences with identical length and using direct method is

(A) 256 (B) 120

(C) 128 (D) 64.

75. The residue method evaluates the residue of the function at poles that are

(A) outside the closed contour in the ROC

(B) anywhere in ROC

(C) inside the closed contour in the ROC

(D) outside the ROC.

SPACE FOR ROUGH WORK

PART – B

(IT : INSTRUMENTATION TECHNOLOGY)

SECTION – I

Each question carries *one* mark. 20 × 1 = 20

46. The numerical aperture of the fibre is expressed as

(A) $(n_1 - n_2)^{\frac{1}{2}}$ (B) $\left(n_1^2 - n_2^2\right)^{\frac{1}{2}}$

(C) $(n_2 - n_1)^{\frac{1}{2}}$ (D) $\left(n_2^2 - n_1^2\right)^{\frac{1}{2}}$.

47. Linearity of a transducer is often specified in terms of

(A) percentage of linearity (B) percentage of non-linearity

(C) percentage of maximum error (D) percentage of error.

48. Bioelectric potentials are generated due to difference in concentration of

(A) Na^+, Cl^- & K^+ (B) Na^+, Cl^- & Mg^+

(C) Na^+, Cl^- & Ca^+ (D) Ca^+, Mg^+ & Cl^-.

49. Which of the following is called as the natural pacemaker of the heart ?

(A) AV node (B) Bundle of Nis

(C) SA node (D) Purkinje fibres.

50. The CO_2 laser emits radiation at the wavelength of

(A) 1·06 μm (B) 325 nm

(C) 2·36 — 3 μm (D) 10·6 μm.

51. Which of the following represents the impulse response of a system defined by $H(z) = z^{-m}$?

(A) $u[n - m]$ (B) $\delta[n - m]$

(C) $\delta[m]$ (D) $\delta[m - n]$.

52. $x(t)$ or $x(n)$ is defined to be a power signal, if and only if the average power content of the signal is a/an

(A) finite quantity and all power signals will have $E = \infty$

(B) infinite quantity and all power signals will have $E = \infty$

(C) infinite quantity and all power signals will have $E = 0$

(D) infinite quantity and all power signals will have $E = 0$.

SPACE FOR ROUGH WORK

53. A discrete time signal $X(n)$ is said to be an even and odd signal if it satisfi condition

(A) $X[-n] = X[n]$ for all n and $X[-n] = -X[n]$ for all n respectively

(B) $X[-n] = -X[n]$ for all n and $X[-n] = X[n]$ for all n respectively

(C) $X[-n] = X[n]$ for all n and $X[-n] = X[n]$ for all n respectively

(D) none of these.

54. A continuous time signal $X(t)$ is said to be periodic with period T, if there is a

(A) negative non-zero value of T for which $X(t+T) = X(T)$ for all t

(B) positive non-zero value of T for which $X(t+T) = X(T)$ for all t

(C) negative non-zero value of T for which $X(t+T) = X(t)$ for all t

(D) positive non-zero value of T for which $X(t+T) = X(t)$ for all t.

55. A continuous time LTI system is represented by the impulse response $h(t) = e^{-3t}$ The system is

(A) unstable and causal (B) stable and non-causal

(C) stable and causal (D) unstable and non-causal.

56. The value of damping ratio is determined using ζ. $\therefore$ If $0 < \zeta < 1$ then the system to be

(A) overdamped (B) critically damped

(C) underdamped (D) undamped.

57. Gross errors are mainly due to

(A) instrumental errors (B) unknown causes

(C) environmental errors (D) human errors.

58. The resistance of thermistor at temperature T is given by

(A) $R_t = R_o \exp\left[\beta(T_o - T)/TT_o\right]$ (B) $R_t = R_o \exp\left[(T_o - T)/TT_o\right]$

(C) $R_t = R_o \exp\left[\beta(T - T_o)\right]$ (D) $R_t = R_o \exp\left[\beta(T - T_o)/TT_o\right]$.

59. Typical operating excitation of linear variable differential transformer (LVDT) is

(A) 6 V at 2·5 kHz (B) 5 V at 2·5 kHz

(C) 6 V at 5 kHz (D) 5 V at 5 kHz.

SPACE FOR ROUGH WORK

60. Film Gamma of an X-ray film is expressed as

(A) $\gamma = \dfrac{D_1 - D_2}{\log_{10} E_2 - \log_{10} E_1}$ (B) $\gamma = \dfrac{D_1 - D_2}{\log_{10} E_1 - \log_{10} E_2}$

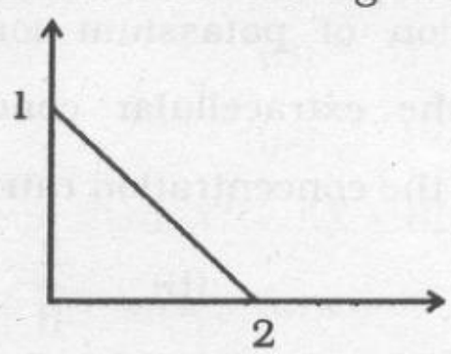
(C) $\gamma = \dfrac{D_2 - D_1}{\log_{10} E_2 - \log_{10} E_1}$ (D) $\gamma = \dfrac{D_2 - D_1}{\log_{10} E_1 - \log_{10} E_2}$.

61. Blood gas analysers are designed to measure

(A) pH (B) pH and pCO_2

(C) pCO_2 and pO_2 (D) pH, pCO_2 and pO_2.

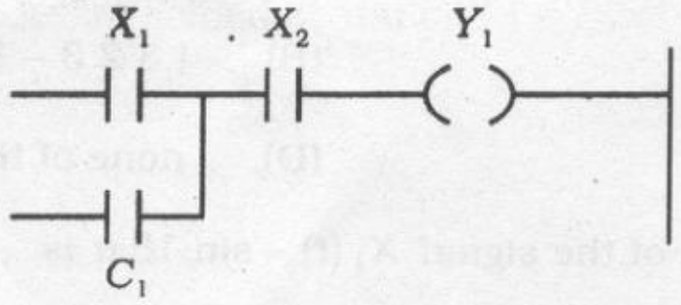
62. Identify the correct Laplace transform for the signal given in figure :



(A) $\dfrac{1}{T_2^2}\left[1 - e^{-TS}(1 + TS)\right]$ (B) $\dfrac{1}{T_2^2}\left[e^{-TS}(1 + TS)\right]$

(C) $\dfrac{1}{T_2^2}\left[e^{-TS} + (1 - TS)\right]$ (D) $\dfrac{1}{T_2^2}\left[1 - e^{-TS} + TS\right]$.

63. The function of the following circuit is



(A) $Y_1 = (X_1 \text{ OR } C_1) \text{ AND } X_2$ (B) $Y_1 = (X_1 \text{ OR } (\text{NOT } C_1)) \text{ AND } X_2$

(C) $Y_1 = (X_1 \text{ AND } X_2) \text{ OR } C_1$ (D) $Y_1 = (X_1 \text{ AND } X_2) \text{ OR } (\text{NOT } C_1)$.

64. The transfer function of Tachometer is of the form

(A) KS (B) $\dfrac{K}{S}$

(C) $\dfrac{K}{(S + 1)}$ (D) $\dfrac{K}{S(S + 1)}$.

65. The thermocouple used for temperature measurement may have

(A) only one junction (B) two junctions

(C) 2 to 20 junctions (D) no junction.

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SECTION – II

Each question carries *two* marks. $10 \times 2 = 20$

66. What is the output voltage of a transducer which has the excitation potential of 5 V D.C, applied force 15 g and a sensitivity of 10 μ V/V-g ?

(A) 750 mV (B) 750 μV

(C) 7·5 V (D) 75 V.

67. The intracellular concentration of potassium ions in a group of cells averages 150×10^{-6} moles/cm^3 and the extracellular concentration of potassium averages 6×10^{-6} moles/cm^3 . What is the concentration ratio ?

(A) $\frac{1}{4}$ (B) $\frac{2}{6}$

(C) $\frac{1}{8}$ (D) $\frac{2}{5}$.

68. Let two signals be $X_1(n) = [1 \ \ 2 \ \ -1 \ \ 2]$ and $X_2(n) = [-2 \ 1 \ 3 \ 1]$ and the addition of these two signals $Y(n)$ be equal to

(A) [– 1 3 2 3] (B) [3 2 3 – 1]

(C) [3 – 1 3 2] (D) none of these.

69. The fundamental period of the signal $X_1(t) = \sin 15\pi t$ is

(A) 0·13333 second (B) 1·3333 seconds

(C) 13·333 seconds (D) 0.013333 second.

70. The equation for critical damping is

(A) $B = \dot{x}(0) + \omega_0 x(0)$ (B) $B = \frac{-\gamma + x(0) - x(0)}{\gamma - - \gamma +}$

(C) $B = \frac{1}{\omega d}\left(\zeta \omega_0 x(0) + \dot{x}(0)\right)$ (D) none of these.

SPACE FOR ROUGH WORK

71. $f_1(t) = 4$ for $0 < t < 2$

$= 0$, otherwise

$f_2(t) = u(t-1)$ the convolution is $f = f_1 \times f_2$. The value of $f_3(t)$ is

(A) 0 (B) 4

(C) 8 (D) 12.

72. A resistance strain gauge has a gauge factor of 2. The change in resistance ΔR, of the strain gauge element due to applied stress (Assume strain (σ) = 5×10^{-4}) is

(A) 0·001% (B) 0·01%

(C) 0·1% (D) 1%.

73. A system described by state equation $X^1 = AX + BU$. The O/P is given by $Y = CX$ where $A = \begin{bmatrix} -4 & -1 \\ 3 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$, $C = [1 \;\; 0]$. Transfer function (TF) G (S) of system is

(A) $\dfrac{S}{S^2 + 5S + 7}$ (B) $\dfrac{1}{S^2 + 5S + 7}$

(C) $\dfrac{S}{S^2 + 3S + 2}$ (D) $\dfrac{1}{S^2 + 3S + 2}$.

74. Let $X(n) = n; -3 \le n \le 3$. The folded signal of $X(n)$ will be equal to

(A) $X_1(n) = -X(-n) = n; -3 \le n \le 3$

(B) $X_1(n) = X(-n) = -n + 1; -3 \le n \le 3$

(C) $X_1(n) = X(-n) = -n - 1; -3 \le n \le 3$

(D) $X_1(n) = X(-n) = -n; -3 \le n \le 3$.

75. The impulse response of an LTI system is e^{-2t}. If the input is a unit step with system initially at rest, the response is given by

(A) $1 - e^{-2t}$ (B) $\dfrac{1}{2} - \dfrac{1}{2}e^{-2t}$

(C) $\dfrac{1}{2} + \dfrac{1}{2}e^{-2t}$ (D) $-2e^{-2t}$.

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