विभाग प्रमुख, अणुविद्युत, शास्त्रीय तंत्र निकेतन महाराष्ट्र तंत्रनिकेतन सेवा गट-अ
उच्च व तंत्र शिक्षण विभाग चाळणी परीक्षा-२०१३
परीक्षा दिनांक - ५ ऑक्टोबर, २०१४

A

2014 CODE : GO5

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका
चाळणी परीक्षा
अणुविद्युत

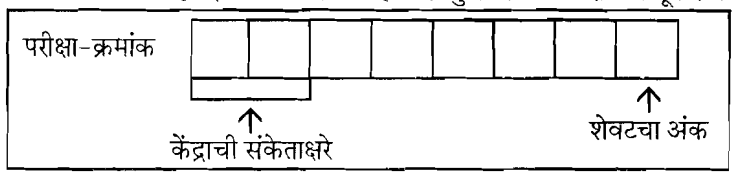
वेळ : 3 (तीन) तास

एकूण प्रश्न : 80
एकूण गुण : 200

सूचना

(1) सदर प्रश्नपुस्तिकेत **80** अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. असा तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.



(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तरक्रमांक नमूद करताना तो संबंधित प्रश्नक्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नाकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार पर्यायापैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील''.**

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या ''परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82'' यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.
तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरूद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. Following function is to be implemented using 8 : 1 MUX and few logic gates. The minimum number of 8 : 1 MUX required to implement function are :

$f(A, B, C, D) = \Sigma m\,(1, 3, 7, 11, 15) + d\,(0, 2)$

(1) one (2) two (3) three (4) four

---

2. When the modulation index is halved, it is found that the antenna current (RMS value) is also halved. The type of modulation used is :

(1) AM (carrier plus both side bands)

(2) Single side band plus carrier

(3) Single side band with suppressed carrier

(4) Vestigial side band

---

3. A causal LTI filter has the frequency response as shown in Fig. 53. If input signal to filter is $x(t) = e^{-jt}$, then filter output will be :

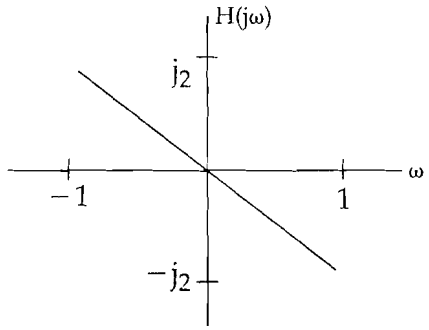


Fig. 53

(1) $-2\,j\,e^{-jt}$ (2) $2\,j\,e^{-jt}$ (3) $4\pi\,j\,e^{-jt}$ (4) $-4\pi\,j\,e^{-jt}$

---

4. Number of 1-bit full adders required to construct 5-bit serial full adder are :

(1) Five (2) Two (3) One (4) Four

---

5. In speech processing system, ADC is used to digitize human voice. Voice is converted into electrical signal by microphone which gives output in the range 0 – 5 V. It is desired that ADC should be able to detect amplitude variation of atleast 0.02 V. To achieve this the required resolution of ADC is :

(1) 5 bit (2) 7 bit (3) 8 bit (4) 10 bit

SPACE FOR ROUGH WORK

6. Transfer function $\frac{V_2(S)}{V_1(S)}$ of network shown in Fig. 16 is given by $\frac{V_2(S)}{V_1(S)} = \frac{1}{3+SCR}$ then value of resistance R_L is :

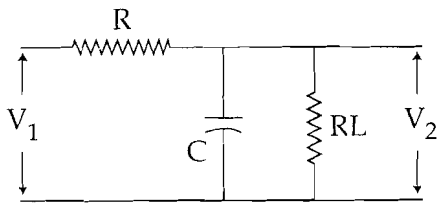


Fig. 16

(1) $R/4$ (2) $R/2$ (3) R (4) 2 R

---

7. The Black Box as shown in Fig. 10 contains resistors and independent sources. For R = 0 ohms and R = 2 ohms, the value of current I is 6 Amps and 3 Amps respectively. The value of current I for R = 1 ohms is :

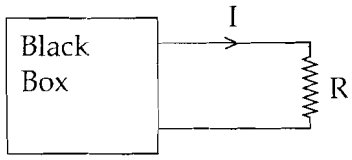


Fig. 10

(1) 10 Amp (2) 4 Amp (3) 2 Amp (4) 6 Amp

---

8. For 10 bit PCM system, the signal to quantization noise ratio is 62 dB. If number of bits is increased by 2, then signal to quantization noise will :

(1) increase by 6 dB (2) increase by 12 dB

(3) decrease by 6 dB (4) decrease by 12 dB

---

9. The skin depth at 10 MHz for a conductor is 2 cm. The phase velocity of electromagnetic wave in conductor at 1000 MHz is about :

(1) 6×10^6 m/sec (2) 6×10^{-7} m/sec

(3) 6×10^8 m/sec (4) 6×10^{-8} m/sec

SPACE FOR ROUGH WORK

10. 'h' parameters for two port network shown in Fig. 12 are given by :

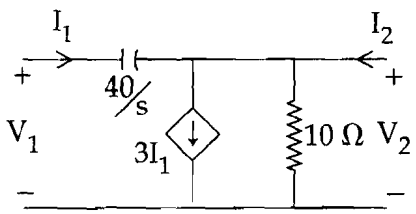


Fig. 12

(1) $\begin{bmatrix} \frac{40}{s}\,\Omega & 1 \\ 2 & 0.1\,s \end{bmatrix}$ (2) $\begin{bmatrix} \frac{50}{s}\,\Omega & 2 \\ 1 & 2\,s \end{bmatrix}$ (3) $\begin{bmatrix} 10\,s & 2 \\ 1 & 2\,s \end{bmatrix}$ (4) none of the above

---

11. A series RLC circuit has a resonance frequency of 1 kHz and Quality factor Q = 150. If each of R, L, and C is doubled from its original value, then new Q of circuit is :

(1) 50 (2) 75 (3) 150 (4) 200

---

12. The asymptotic approximation of the log-magnitude vs frequency plot of a system containing only real poles and zeros is shown in Fig. 58. Its transfer function is :

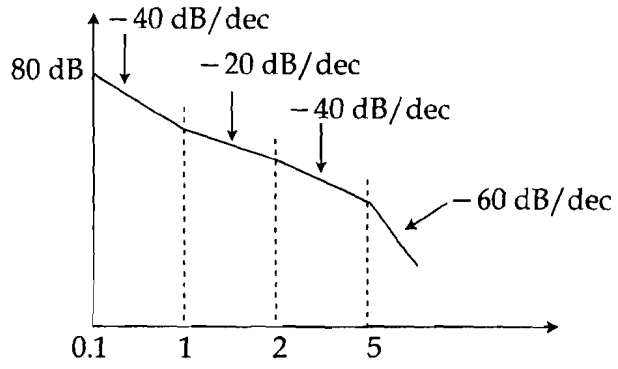


Fig. 58

(1) $\frac{10\,(s+5)}{s\,(s+2)\,(s+25)}$ (2) $\frac{1000\,(s+5)}{s^2\,(s+2)\,(s+25)}$

(3) $\frac{1000\,(s+1)}{s^2\,(s+2)\,(s+5)}$ (4) $\frac{80\,(s+1)}{s^2\,(s+2)\,(s+5)}$

SPACE FOR ROUGH WORK

13. The system is BIBO stable and causal if the poles of system function H(z) lie :

(1) Outside the unit circle of the z-plane

(2) Inside the unit circle of the z-plane

(3) On the unit circle of the z-plane

(4) Both (1) and (3)

---

14. The capacitance per unit length and the characteristic impedance of a lossless transmission line are C and Z_0 respectively. The velocity of a travelling wave on the transmission line is :

(1) $Z_0 C$ (2) $\frac{Z_0}{C}$ (3) $\frac{C}{Z_0}$ (4) $\frac{1}{Z_0 C}$

---

15. Auto correlation function of white noise is :

(1) a delta function (2) gaussian

(3) constant (4) normal

---

16. In astable multivibrator as shown in fig. 35, if $R_A = R_B = 10$ k and $C = 0.1$ μF, then duty cycle and frequency of oscillation is (select nearest values) :

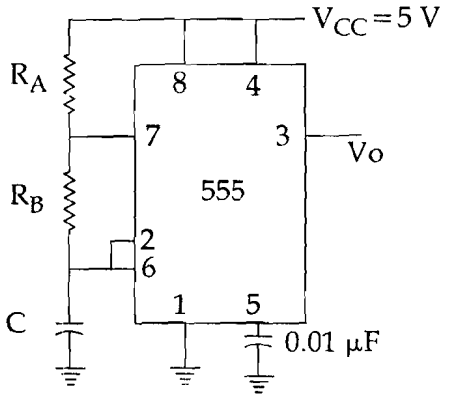


Fig. 35

(1) (50% and 300 Hz) respectively

(2) (66.66% and 350 Hz) respectively

(3) (66.66% and 476 Hz) respectively

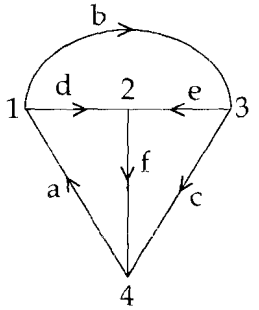
(4) (40% and 200 Hz) respectively

SPACE FOR ROUGH WORK

17. If $|z|=1$, then $\int_c \frac{z-3}{z^2+2z+5}\,dz$ where c is the circle is :

(1) 1 (2) 2 (3) 0 (4) none of the above

18. For the graph shown below, the incidence matrix A is given by :



(1) $\begin{bmatrix} -1 & -1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 & -1 & 1 \\ 0 & -1 & 1 & 0 & 1 & 0 \\ 1 & 0 & -1 & 0 & 0 & -1 \end{bmatrix}$ (2) $\begin{bmatrix} -1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 & -1 & 1 \\ 0 & -1 & 1 & 0 & 1 & 0 \\ 1 & 0 & -1 & 0 & 0 & -1 \end{bmatrix}$

(3) $\begin{bmatrix} -1 & 1 & 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 & -1 & 1 \\ 0 & -1 & 0 & 1 & 1 & 0 \\ 1 & 0 & -1 & 0 & 0 & -1 \end{bmatrix}$ (4) $\begin{bmatrix} 0 & 0 & 1 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 & 1 & -1 \\ 0 & -1 & 0 & 1 & 1 & 0 \\ 1 & 0 & -1 & 0 & 0 & -1 \end{bmatrix}$

19. The differential equation for the current i(t) in the circuit shown in Fig. 17 is :

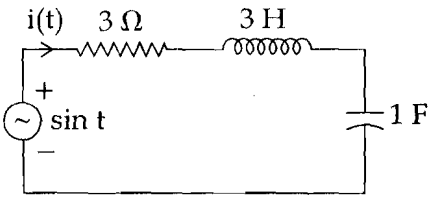


Fig. 17

(1) $\frac{d^2i}{dt^2}+3\frac{di}{dt}+3i(t)=\sin t$ (2) $3\frac{d^2i}{dt^2}+3\frac{di}{dt}+i(t)=\cos t$

(3) $\frac{d^2i}{dt^2}+3\frac{di}{dt}+3i(t)=\cos t$ (4) $3\frac{d^2i}{dt^2}+3\frac{di}{dt}+i(t)=\sin t$

SPACE FOR ROUGH WORK

20. The relationship between rank of matrix A and rank of matrix A^T is given by :

(1) rank (A) > rank (A^T)

(2) rank (A) < rank (A^T)

(3) rank (A) = rank (A^T)

(4) none of the above

where A^T is transpose of A.

---

21. For the block diagram shown in fig. 54, ratio C/R is given by :

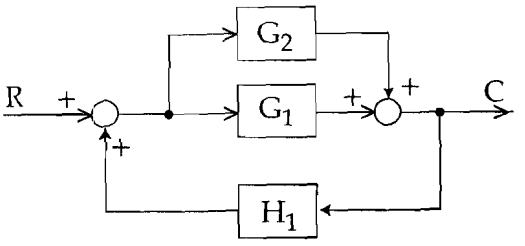


Fig. 54

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

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

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

(4) $\frac{G_1 + G_2}{H_1 - G_1 - G_2}$

---

22. Drift current is :

(1) directed movement of charged particles under the application of electric field.

(2) directed movement of charged particles due to concentration gradient.

(3) random movement of charged particles due to thermal energy.

(4) none of the above.

SPACE FOR ROUGH WORK

23. Probability density function of random variable x is :

(1) $\int_{-\infty}^{\infty} f_x(x)\,dx=1$ (2) $\frac{df_x}{dx}(x) = F_x(x)$

(3) $0 \le f_x(x) \le 1$ (4) $f_x(x) = \int_{-\infty}^{\infty} F_x(x)\,dx$

---

24. The bode plot is applicable to :

(1) minimum phase network (2) all phase network

(3) maximum phase network (4) none of the above

---

25. Which type of following biasing is used in case of JFET circuit to bias the device against device parameter variation ?

(1) Fixed bias circuit (2) Self bias circuit

(3) Voltage divider bias circuit (4) Drain to Gate bias circuit

---

26. In frequency modulation by a single-tone modulating signal, the frequency deviation constant and the modulating signal frequency are both doubled. The modulation index will be :

(1) quadrupled (2) doubled

(3) unchanged (4) 0.25 times the previous value

SPACE FOR ROUGH WORK

27. The inverse laplace transform of $x(s)=\frac{4}{s+5}$ for ROC Re{s}>-4 is :

(1) $4\,e^{-5t}\,u(-t)$ (2) $-4\,e^{-5t}\,u(t)$ (3) $4\,e^{-5t}\,u(t)$ (4) none of the above

---

28. Maxwell's divergence equation for the magnetic field is given by :

(1) $\nabla \times B = 0$ (2) $\nabla \times B = e$ (3) $\nabla \cdot B = 0$ (4) $\nabla \cdot B = e$

---

29. In BCD Adder _____ is added when sum is not valid BCD number :

(1) 1001 (2) 1010 (3) 1000 (4) 0110

---

30. Two sets of input voltages are applied to differential amplifier.

In set 1 $v_1 = 20$ mV and $v_2 = 10$ mV and in set 2 $v_1 = 25$ mV and $v_2 = 5$ mV are applied.

In case of set 1 output voltage of differential amplifier is 1 V while in case of set 2 output voltage of differential amplifier is 2 V. Common Mode Rejection Ratio of differential amplifier is :

(1) 1000 (2) 100 (3) ∞ (4) zero

---

31. The value of $\int_1^2 \left(\frac{1}{x}\right) dx$ computed using Simpson's rule with a step size of h = 0.25 is :

(1) 0.69430 (2) 0.69415 (3) 0.69385 (4) 0.69325

---

32. The open loop transfer function of a feedback control system is $\frac{k}{s(s^2+3s+6)}$. The break away point or points of its root-locus plot :

(1) exist at $\left(-\frac{3}{2} \pm \sqrt{\frac{15}{16}}\right)$ (2) exist at $(-1 \pm j\,1)$

(3) exist at origin (4) do not exist

SPACE FOR ROUGH WORK

33. In PN junction diode, P side is doped with acceptor concentration of 2×10^{16} cm^{-3}, N side is doped donor concentration of 5×10^{17} cm^{-3}. The contact potential of diode is :

(1) 0.82 V (2) 0.2 V (3) 1.2 V (4) 0 V

Assume thermal equivalent voltage equal to 26 mV and intrinsic carrier concentration equal to 1.45×10^{10} cm^{-3}.

---

34. The mathematical model of signal shown in fig. 45 is :

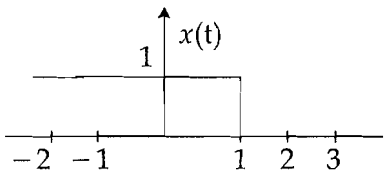


Fig. 45

(1) $x(t)=u(t+1)$ (2) $x(t)=u(t-1)$

(3) $x(t)=-u(t+1)$ (4) $x(t)=u(1-t)$

---

35. A RAM chip has capacity of 1024×1 bits. Number of such RAM chips required to construct a memory of 2048 bytes are :

(1) Two (2) Four (3) Eight (4) Sixteen

---

36. For a filter, if $|H(\omega)|=1$ in certain band of frequency, then this filter is :

(1) low pass filter (2) high pass filter (3) band pass filter (4) band stop filter

---

37. In the circuit shown in Fig. 14, the switch S is open for a long time and closed at $t=0$. The value of I at $t=0^+$ is :

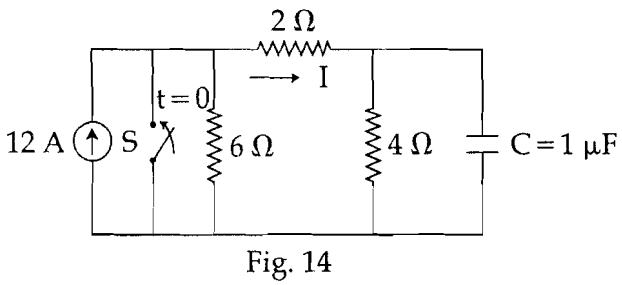


Fig. 14

(1) 9 A (2) −12 A (3) 12 A (4) −6 A

SPACE FOR ROUGH WORK

38. The general solution of differential equation $\frac{dy}{dt} + 7y = 0$ with $y(0) = 1$ is :

(1) e^{7t} (2) e^{-7t} (3) $5\,e^{-7t}$ (4) $e^{\sqrt{-7t}}$

---

39. In Common Emitter Amplifier, voltage gain is :

(1) independent of supply voltage V_{CC} and depends on collector resistance R_C

(2) directly proportional to collector resistance R_C and inversely proportional to supply voltage V_{CC}

(3) directly proportional to supply voltage V_{CC} and inversely proportional to collector resistance R_C

(4) directly proportional to both supply voltage V_{CC} and collector resistor R_C

---

40. The transfer function of a system is $\frac{10\,(1+0.2\,s)}{1+0.5\,s}$

The phase shift at $\omega = 0$ and $\omega = \infty$ will be :

(1) 90° and 0° respectively (2) $-180°$ and 180° respectively

(3) $-90°$ and 90° respectively (4) none of the above

---

41. Which type of negative feedback is used to improve performance of current amplifier ?

(1) Current shunt feedback (2) Voltage shunt feedback

(3) Current series feedback (4) Voltage series feedback

SPACE FOR ROUGH WORK

42. Z-transform of $nx[n]$ is :

(1) $\frac{dx(z)}{dz}$ (2) $z.\frac{dx(z)}{dz}$ (3) $\frac{d^2x(z)}{dz^2}$ (4) $-z\frac{dx(z)}{dz}$

---

43. In N-channel E-MOSFET if $V_{DS} < V_{GS} - V_T$ then MOSFET will operate in :

(1) cut off region (2) linear region

(3) saturation region (4) none of the above

---

44. The fourier series of an even function of time period T contains :

(1) cosine terms (2) sine terms

(3) sine and cosine terms (4) none of the above

---

45. Logic circuit shown in fig. 39 is :

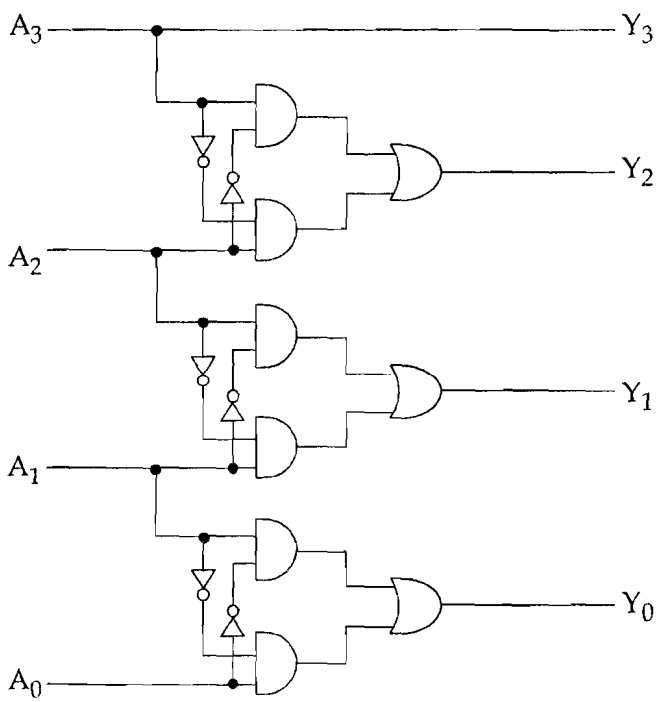


Fig. 39

(1) Binary to BCD converter (2) Gray code to Binary code converter

(3) Binary to Gray code converter (4) None of the above

SPACE FOR ROUGH WORK

46. System state equation is described by $\begin{bmatrix} \dot{q}_1(t) \\ \dot{q}_2(t) \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} q_1(t) \\ q_2(t) \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} x(t)$

where q(t) and $x(t)$ are state variable and input respectively. The state transition matrix is :

(1) $\begin{bmatrix} e^{-t} & 0 \\ 0 & e^{-t} \end{bmatrix}$ (2) $\begin{bmatrix} e^{t} & 0 \\ 0 & e^{t} \end{bmatrix}$ (3) $\begin{bmatrix} e^{t} & 0 \\ 1 & e^{t} \end{bmatrix}$ (4) $\begin{bmatrix} e^{t} & 1 \\ 1 & e^{t} \end{bmatrix}$

---

47. The sampling frequency of the following analog signal $x(t) = 10\sin 200\pi t + 2\cos 50\pi t$ should be :

(1) greater than 100 Hz (2) greater than 75 Hz

(3) greater than 150 Hz (4) greater than 200 Hz

---

48. In a rectangular wave guide dominant mode is :

(1) TE_{10} (2) TE_{01} (3) TE_{20} (4) TE_{11}

---

49. A causal discrete - time LTI system is described by

$$Y[n] - \frac{3}{4} Y[n-1] + \frac{1}{8} Y[n-2] = X[n].$$

Its system function $H(Z) = \dfrac{Y(Z)}{X(Z)}$ is given by :

(1) $H(Z) = \dfrac{1}{1 - \frac{3}{4} Z^{-1} + \frac{1}{8} Z^{-2}}$ (2) $H(Z) = \dfrac{Z^2}{\left(Z - \frac{1}{2}\right)\left(Z - \frac{1}{3}\right)}$

(3) $H(Z) = \dfrac{Z^2}{Z^2 - \frac{3}{4} Z + \frac{1}{4}}$ (4) none of the above

---

SPACE FOR ROUGH WORK

50. In an optical fiber, dispersion :

(1) decreases with the bandwidth of light source.

(2) increases with the bandwidth of light source.

(3) is independent of light source.

(4) proportional to intensity of light source.

---

51. The work 'W' done by the force $P = yzi + xzj + xyk$ in the displacement of a particle along the straight segment C from P : (1, 1, 1) to Q : (3, 3, 2) is :

(1) 20 (2) 17 (3) 0 (4) 27

---

52. For the circuit shown in Fig. 11 v_s represents voltage source and $v_2 = 15$ V, then values of v_s and i_s are :

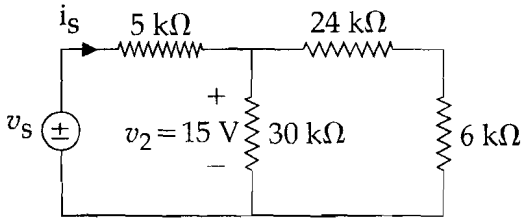


Fig. 11

(1) 20 V and 1 mA respectively (2) 10 V and 2 mA respectively

(3) 30 V and 1 mA respectively (4) 15 V and 0.5 mA respectively

---

SPACE FOR ROUGH WORK

53. In PN junction diode, if doping concentration of acceptor atoms in P-region is increased then :

(1) depletion width in N-region will increase and contact potential will decrease.

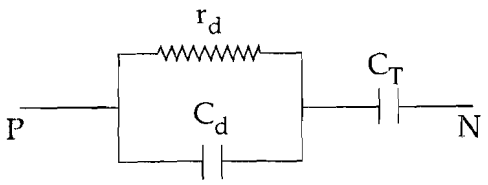
(2) depletion width in P-region and N-region will decrease while contact potential remains constant.

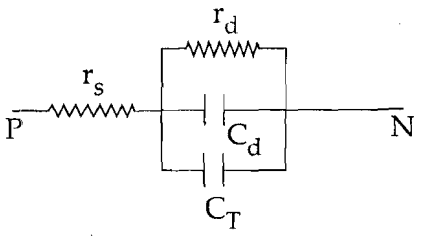
(3) depletion width in P-region will decrease and contact potential will increase

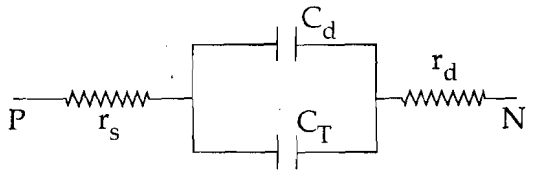
(4) none of the above

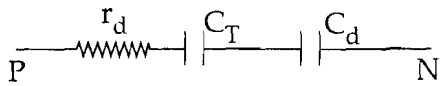
---

54. Small-signal equivalent circuit of PN junction is :

(1) 

(2) 

(3) 

(4) 

Where r_s is resistance of neutral region, r_d is dynamic resistance, C_d is diffusion capacitance and C_T is transition capacitance.

SPACE FOR ROUGH WORK

55. For a state space representation of a system $A=\begin{bmatrix}0 & 1\\ -3 & -2\end{bmatrix}$, $b=\begin{bmatrix}0\\1\end{bmatrix}$ and $c=[1\ \ 2]$

Then transfer function of system would be :

(1) $\frac{1}{s^2+2s+3}$ (2) $\frac{1}{s^2+5s+6}$ (3) $\frac{2s+1}{s^2+2s+3}$ (4) $\frac{3s}{s+5}$

---

56. Laurent's series of $f(z)=\frac{z}{\left(z^2+1\right)\left(z^2+4\right)}$ is :

Where $|z|<1$.

(1) $\frac{1}{2}+\frac{1}{2}z^2+\frac{3}{4}z^4+\frac{15}{8}z^6+\ldots\ldots\ldots$ (2) $\frac{1}{2}+\frac{1}{4}z^2+\frac{5}{16}z^4+\frac{21}{64}z^6\ldots\ldots\ldots$

(3) $\frac{1}{4}z-\frac{5}{16}z^3+\frac{21}{64}z^5$ (4) $\frac{1}{2}z-\frac{3}{4}z^3+\frac{15}{8}z^5$

---

57. The output voltage two stage amplifier as shown in Fig. 32 is :

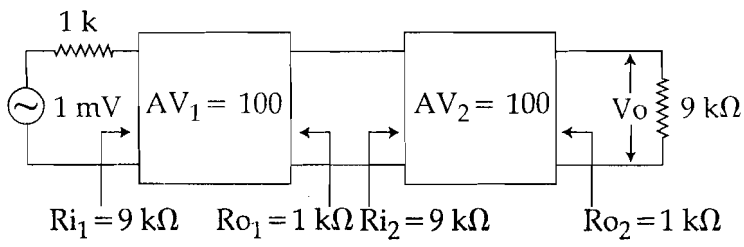


Fig. 32

(1) 10 V (2) 8.1 V (3) 9 V (4) 7.3 V

SPACE FOR ROUGH WORK

58. In BJT, collector current I_C in active region is :

(1) directly proportional to the width of base region.

(2) directly proportional to the doping of base region.

(3) directly proportional to the doping and width of base region.

(4) inversely proportional to the doping and width of base region.

---

59. For the circuit shown in Fig. 22, minimum current required to keep zener diode in reverse break down region is 4 mA. The maximum value of resistance R_s to keep zener diode in reverse break when Vz = 10 V is :

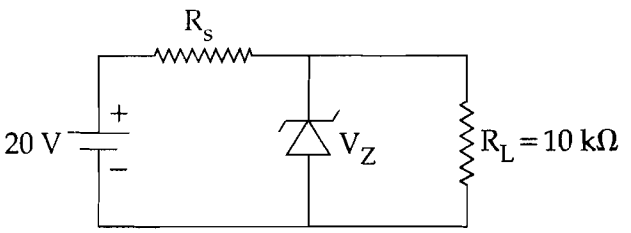


Fig. 22

(1) 7 kΩ (2) 5 kΩ (3) 1 kΩ (4) 2 kΩ

---

60. The group velocity of rectangular wave guide with TE_{10} mode in air dielectric with an inside cross section of 2 cm by 4 cm is :

(1) 300×10^6 m/sec (2) 198×10^6 m/sec

(3) 160×10^6 m/sec (4) 150×10^6 m/sec

---

61. The approximate dimensions for a square path antenna, for a frequency of 2 GHz on a substrate with a relative permittivity of 2 are :

(1) 50 mm × 50 mm (2) 100 mm × 100 mm

(3) 75 mm × 75 mm (4) 25 mm × 25 mm

SPACE FOR ROUGH WORK

62. The wavelength of the emitted light in LED depends on :

(1) voltage across LED

(2) energy band gap of material used to fabricate LED

(3) surrounding temperature

(4) none of the above

---

63. If discrete LTI system is represented by impulse response $h[n] = \left(\frac{1}{2}\right)^n u[n]$. Then the system is :

(1) causal and stable (2) non causal and stable

(3) causal and unstable (4) non causal and unstable

---

64. In a digital communication system employing Frequency Shift Keying (FSK), the 0 and 1 bit are represented by sine waves of 10 kHz and 25 kHz respectively. These wave forms will be orthogonal for a bit interval of :

(1) 45 μsec (2) 200 μsec (3) 50 μsec (4) 250 μsec

---

65. A superhetrodyne AM broadcast receiver has an IF of 455 kHz. If it is tuned to a frequency of 700 kHz, the image frequency is :

(1) 1155 kHz (2) 1610 kHz (3) 245 kHz (4) 210 kHz

---

66. If A and B are mutually exclusive events then P (A∪B) is :

(1) $P(A) - P(B)$ (2) $P(A) + P(B)$ (3) $P(A) \times P(B)$ (4) $P(A) \div P(B)$

SPACE FOR ROUGH WORK

67. The output of logic circuit as shown in fig. 37 is given by :

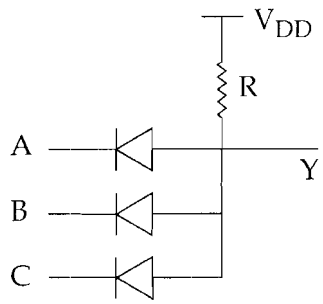


Fig. 37

(1) $Y = \overline{ABC}$ (2) $Y = ABC$ (3) $Y = A + B + C$ (4) $Y = \overline{A+B+C}$

---

68. Short-term fading of the channel :

(1) affects only a few message channels of an FDM system

(2) affects all the message channels of a TDM system

(3) affects all the message channels of an FDM system

(4) does not have much effect on both TDM and FDM systems.

---

69. The relationship between group velocity v_g and phase velocity v_p is given by :

(1) $\frac{v_g}{v_p} = C$ (2) $v_g.v_p = c^2$ (3) $v_g.v_p = C$ (4) $\frac{v_p}{v_g} = C$

Where C is velocity of light.

SPACE FOR ROUGH WORK

70. A process is controlled by a PID controller. The sensor has high measurement noise. How can this effect be reduced ?

(1) By use of a bandwidth limited derivative term.

(2) By use of proportional and derivative terms in the forward path.

(3) By use of high proportional band.

(4) By use of low integral gain.

---

71. In N-tub CMOS process :

(1) NMOS is fabricated in native substrate and PMOS is fabricated in N-tub.

(2) NMOS and PMOS both are fabricated in native substrate.

(3) PMOS is fabricated in native substrate and NMOS is fabricated in N-tub.

(4) NMOS and PMOS both are fabricated in N-tub.

---

72. A radio wave moves from air ($\epsilon_r = 1$) to glass ($\epsilon_r = 7.8$). Its angle of incidence is 30°. The angle of reflection is :

(1) 30° (2) 10.3° (3) 22.8° (4) 28°

---

73. Quantization noise occurs in :

(1) Pulse width modulation (2) Frequency division multiplexing

(3) Time division multiplexing (4) Pulse code modulation

SPACE FOR ROUGH WORK

74. In certain number system with base or radix x, if $(123)_x + (21)_x = (210)_x$ then base or radix x of number system is :

(1) 5 (2) 4 (3) 3 (4) 2

---

75. A fundamental relationship between the electron and hole concentrations in a semiconductor in thermal equilibrium is :

(1) $n_o\, p_o = ni^2$ (2) $n_o\, p_o = ni$ (3) $\frac{n_o}{p_o} = ni^2$ (4) $\frac{n_o}{p_o} = ni$

---

76. Input resistance of inverting amplifier as shown in fig. 34 with ideal OP_{Amp} is :

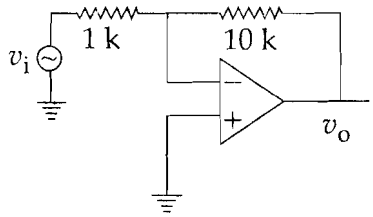


Fig. 34

(1) ∞ (2) zero (3) 1 kΩ (4) 10 kΩ

---

77. The characteristic equation of a system is $s^4 + 6\,s^3 + 11\,s^2 + 6s + K = 0$. The range of values of K to ensure that given system is stable is :

(1) $0 < K < 20$ (2) $10 < K < 30$ (3) $0 < K < 10$ (4) $0 < K < 50$

---

78. For 16-bit address-bus, if an 8 k RAM chip is selected when A_{13}, A_{14} and A_{15} address bit are all one, then the range of the memory address is :

(1) EOOOH – EFFFH (2) EOOOH – FFFFH

(3) FOOOH – FFFFH (4) FOOOH – FEEEH

SPACE FOR ROUGH WORK

79. For the JFET circuit shown below Q point (V_{GSQ}, V_{DSQ}, I_{DSQ}) is :

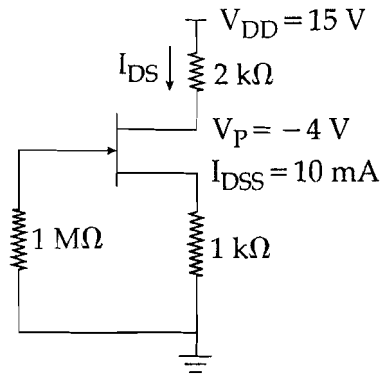


Fig. 28

(1) (2.15 V, 2.15 mA, 8.55 V) (2) (−2.15 V, 2.15 mA, 8.55 V)

(3) (−5 V, 1 mA, 12 V) (4) None of the above

---

80. The steady state output voltage corresponding to input voltage (3 + 4 sin 100 t) V for circuit shown in Fig. 15 is :

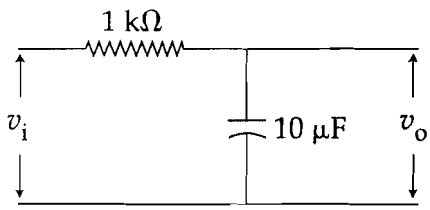


Fig. 15

(1) $3 + 4 \sin (100\,t - \pi/4)$ V (2) $\frac{3}{2} + \frac{4}{\sqrt{2}} \sin (100\,t + \pi/4)$ V

(3) $3 + 4\sqrt{2} \sin (100\,t - \pi/4)$ V (4) $3 + \frac{4}{\sqrt{2}} \sin (100\,t - \pi/4)$ V

- o 0 o -

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सूचना — (पृष्ठ 1 वरून पुढे....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षा कक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you _____ your grand success.

(1) for (2) at (3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. **यास्तव खालीलप्रमाणे** प्रश्न क्र. 201 समोरील उत्तर-क्रमांक "③" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. 201. ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तरक्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

कच्च्या कामासाठी जागा /SPACE FOR ROUGH WORK