

1005

Question Booklet Code

Question Booklet Sr. No.

A

Roll No.

OMR Sheet No.

1607-O

Ph. D. ELECTRONICS

(First Paper)

(Objective Type Questions)

Time : 60 Minutes

Maximum Marks : 100

Number of Pages in this Booklet : 12

Number of Questions in this Booklet : 50

Instructions for the Candidates

- (i) Check this booklet carefully for the sequence of pages and questions. If it is defective due to pages/questions missing or not in serial order or any other discrepancy it should be got replaced immediately from the invigilator within the period of 5 minutes. Afterwards neither the Question Booklet will be replaced nor any extra time will be given.
- (ii) After this verification write your Roll No. and OMR Sheet Number on this Question Booklet.
- (iii) **Use only Black or Blue** ball point pen.
- (iv) This paper consists of **50** multiple-choice type questions. Each question has four alternative responses (a), (b), (c) and (d). **Only one of these alternative responses is correct.** You are required to darken completely the circle of correct answer in the OMR Sheet.
- (v) There is **no negative marking.**
- (vi) Do not write anything other than relevant entries or put any mark on any part of the OMR Sheet, which may disclose your identity, otherwise you will render yourself liable to disqualification.
- (vii) Use of electronic gadgets such as pager, cell phone, calculator and log table etc. is prohibited.
- (viii) Rough Work may be done in the end of this booklet.
- (ix) You have to **return the Original OMR Sheet** to the invigilator at the end of the examination compulsorily.
- (x) In case of any discrepancy in English and Hindi version English version should be taken as final.

SEAL

Ph. D: Entrance Test, July 2017

ELECTRONIC SCIENCE

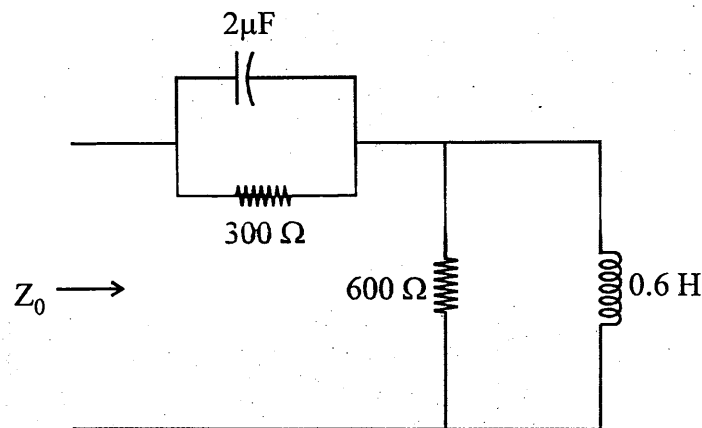
First Paper

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1. In the following circuit, the value of impedance Z_0 for $\omega = 800$ rad/s is :



- (a) $(58.7.6 - j119.79)\Omega$. (b) $(587.6 + j119.79)\Omega$
(c) $(478 + j175.55)\Omega$ (d) $(487 - j175.55)\Omega$
2. A series RLC circuit has a resonant frequency of 1 kHz and a quality factor $Q = 100$, if each R, L, C value is doubled from its original value, the value of 'Q' factor is :
- (a) 25 (b) 50
(c) 100 (d) 200
3. A 2nF capacitor having initial charge of 5.1 μC is discharged through a 1.3 k Ω resistor. The maximum current through the resistor is given by :
- (a) 1.78 A (b) -1.78 A
(c) 1.96 A (d) -1.96 A

9. Ebers-Moll model is applicable to :
- (a) BJT only (b) NMOS transistors
(c) UJT's (d) JFETs
10. The transverse mode that is associated with the least beam divergence is :
- (a) TEM₀₀ mode (b) TEM₀₁ mode
(c) TEM₁₀ mode (d) TEM₀₃ mode
11. A certain He-Ne laser emitting at 633 nm has a line width of 0.002 nm. The coherence length of laser in cm is given by :
- (a) 1 cm (b) 100 cm
(c) 5 cm (d) 10 cm
12. Which one of the following solid state laser host materials is particularly suitable for diode pumping ?
- (a) Yttrium Aluminium Garnet (YAG) (b) Yttrium Lithium Fluoride (YLF)
(c) Yttrium Vanodate (YV₀₄) (d) Phosphate Glass
13. For CB-BJT configuration having $I_E = 5$ mA and $\alpha = 0.97$, an ac signal of 3 mV is applied between the base and the emitter terminal, what is the value of input impedance ?
- (a) 5.2 Ω (b) 6 Ω
(c) 4.9 Ω (d) 5.7 Ω
14. Octal equivalent of hexadecimal number $(2E.C1)_{16}$ is :
- (a) 212.602 (b) 56.602
(c) 56.623 (d) 6F.CA

15. The expression :

$$A + A\bar{B} + A\bar{B}\bar{C} + A\bar{B}\bar{C}\bar{D}$$

is simplified to :

- (a) 1 (b) 0
(c) A + B (d) A
16. How many programmable interconnections does a $1k \times 4$ PROM have ?
(a) 1024 (b) 10
(c) 12 (d) 4096
17. A 4-bit shift register is clocked by a 10 MHz clock. What is the value of duty cycle at the output of the output flip-flop ?
(a) 25% (b) 100%
(c) 50% (d) 75%

18. Given that $L|f(t)| = \frac{s+4}{s^2-1}$ and $L|g(t)| = \frac{s^2-1}{(s+4)(s+2)}$ and $h(t) = \int_0^t f(z)g(t-z)dz$,

then the value of $L|h(t)|$ is given by :

- (a) $\frac{s^2-1}{s+4}$ (b) $\frac{1}{(s+2)}$
(c) $\frac{s^2-1}{(s+4)(s+2)} + \frac{s+4}{s^2-1}$ (d) $\frac{s^2-1}{(s+4)(s+2)} - \frac{(s+4)}{(s^2-1)}$

19. The Fourier signal of a voltage signal $x(t)$ is $X(jf)$. The unit of $|X(jf)|$ is given by :

- (a) volt (b) volt-second
(c) volt/second (d) volt-amp.

20. The amplitude spectrum of a Gaussian pulse is :

- (a) uniform (b) sine function
(c) impulse function (d) Gaussian

21. The 3-dB bandwidth of a low pass signal $e^{-t}u(t)$, where $u(t)$ is unit step function is given by :

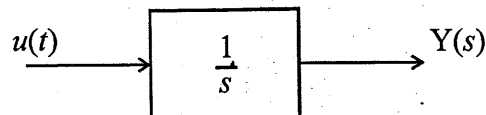
- (a) $\frac{1}{2\pi}$ Hz (b) $\frac{1}{2\pi}\sqrt{\sqrt{2}-1}$ Hz
(c) ∞ (d) 10 Hz

22. The open loop transfer function of a unity feedback system is $G(s) = \frac{K}{s(s^2 + s + 2)(s + 3)}$.

The range of 'K' for which the system is stable is :

- (a) $\frac{21}{4} > K > 0$ (b) $13 > K > 0$
(c) $\frac{21}{4} < K < \infty$ (d) $-6 < K < \infty$

23. Assuming zero initial conditions, the response $y(t)$ of the system given below to a unit step $u(t)$ is :



- (a) $u(t)$ (b) $t.u(t)$
(c) $\frac{t^2}{2}u(t)$ (d) $e^{-t}u(t)$

28. The Maxwell equation in free space is true :

(a) $\nabla \times \vec{H} = 0$

(b) $\nabla \times \vec{H} = \vec{J}$

(c) $\nabla \times \vec{H} = \frac{\partial \vec{D}}{\partial t}$

(d) $\nabla \times \vec{E} = 0$

29. If the electric field intensity is $\vec{E} = (x\hat{i} + y\hat{j} + z\hat{k})$ V/m, the potential difference between two points X(2, 0, 0) and Y(1, 2, 3) is given by :

(a) +1 V

(b) -1 V

(c) +5 V

(d) +6 V

30. The depth of penetration of EM wave in a medium having conductivity ' σ ' at a frequency of 1 MHz is 25 cm. The depth of penetration at a frequency of 4 MHz will be :

(a) 6.25 cm

(b) 12.50 cm

(c) 50.00 cm

(d) 100.00 cm

31. For a BJT, the common base current gain $\alpha = 0.98$, and $I_{CO} = 0.6\mu\text{A}$. The BJT is connected in common emitter mode, $I_B = 20\mu\text{A}$. The value of I_C in CE mode is :

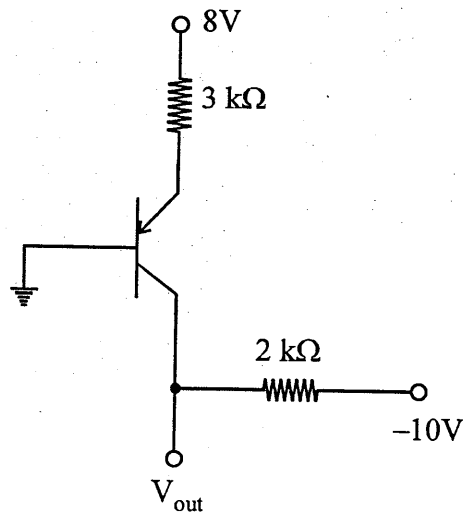
(a) 0.98 mA

(b) 0.99 mA

(c) 1.0 mA

(d) 1.01 mA

32. For the circuit shown below, calculate V_{out} :



- (a) +5.14 V
- (b) -5.14 V
- (c) -6.14 V
- (d) +6.14 V

33. For an op-amp CMRR (in dB) is given by :

- (a) $10 \log_{10} \frac{A_c}{A_d}$
- (b) $10 \log_2 \frac{A_d}{A_c}$
- (c) $20 \log_{10} \frac{A_d}{A_c}$
- (d) $20 \log_{10} \frac{A_c}{A_d}$

38. The directive gain of an antenna is 15. If the antenna were uniformly illuminated, the gain would have been 25. The Antenna aperture efficiency will be :

- (a) 0.36 (b) 0.5
(c) 0.78 (d) 0.6

39. The dot product of two vectors is equal to the magnitude of its cross product. The value of angle between the vectors is :

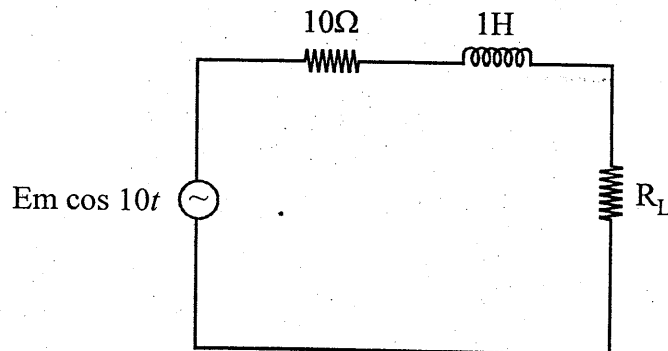
- (a) 0° (b) 30°
(c) 45° (d) 60°

40. The bilateral Laplace transform of a function :

$$f(t) = \begin{cases} 1 & \text{if } a \leq t \leq b \\ 0 & \text{otherwise} \end{cases}$$

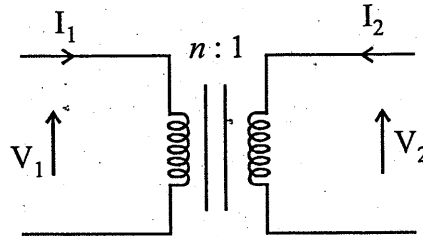
- (a) $\frac{a-b}{s}$ (b) $\frac{e^s(a-b)}{s}$
(c) $\frac{e^{-as} - e^{-bs}}{s}$ (d) $\frac{e^{s(a-b)}}{s}$

41. In the circuit shown, what should be the value of R_L for maximum power transfer :



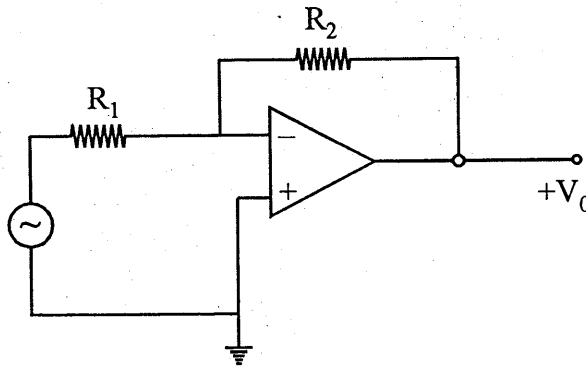
- (a) 14.14Ω (b) 10Ω
(c) 200Ω (d) 28.28Ω

42. The ABCD parameter for an ideal $n : 1$ transformer are $\begin{bmatrix} n & 0 \\ 0 & X \end{bmatrix}$. The value of X is :



- (a) n (b) $1/n$
(c) n^2 (d) $1/n^2$
43. The band gap of GaAs is :
(a) 0.7 V (b) 0.4 V
(c) 1.43 V (d) 0.18 V
44. Which of the following is *not* associated with a P-N junction ?
(a) Junction capacitance (b) Charge storage capacitance
(c) Depletion capacitance (d) Channel length modulation
45. For a transistor amplifier to be inherently stable against thermal stability, the condition is :
(a) $V_{CE} < \frac{V_{CC}}{2}$ (b) $V_{CE} > \frac{V_{CE}}{2}$
(c) $V_{CE} = \frac{V_{CE}}{2}$ (d) $V_{CE} = \frac{V_{CC}}{2}$
46. Total harmonic distortion in an amplifier is given by expression $D =$
(a) $D_1 + D_2 + D_3 + \dots$ (b) $D_1 - D_2 + D_3 - D_4 + \dots$
(c) $\sqrt{D_1^2 + D_2^2 + D_3^2 + \dots}$ (d) $\sqrt{D_1^2 - D_2^2 + D_3^2 - \dots}$

47. For the following circuit having slew rate = 0.5 V/ μ s. If $R_1 = 10 \text{ k}\Omega$, $R_2 = 100 \text{ k}\Omega$ and input signal is varying from 100 to 300 mV, what is the maximum value of frequency which can be applied :



- (a) 26.5 kHz
 (b) 500 kHz
 (c) 1 MHz
 (d) 10 kHz
48. In power supplies, percentage load regulation is given by expression :

- (a) $\frac{V_{FL} - V_{NL}}{V_{NL}} \times 100$
 (b) $\frac{V_{NL} - V_{FL}}{V_{NL}} \times 100$
 (c) $\frac{V_{NL} - V_{FL}}{V_{FL}} \times 100$
 (d) $\frac{V_{NL}}{V_{NL} - V_{FL}} \times 100$

49. In ECL worst core noise margin is of the order of :

- (a) 0.4 V
 (b) 0.8 V
 (c) 2 V
 (d) 0.2 V

50. What are the minimum number of 2 : 1 multiplexers required to generate a 2-input AND gate and a 2-input XOR gate :

- (a) 1 & 2
 (b) 2 & 1
 (c) 1 & 1
 (d) 2 & 2