

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

Subject Code :

1 3

Test Booklet No. :

00590

**TEST BOOKLET**  
**ELECTRICAL ENGINEERING**

Time Allowed : 2 (Two) Hours

Full Marks : 200

**INSTRUCTIONS**

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Subject Code shall be written legibly and correctly in the space provided on the Answer Sheet with black ball pen.
2. **Space provided for Series in the Answer Sheet is not applicable for Optional Subject. So the space shall be left blank.**
3. All questions carry equal marks. Your total marks will depend only on the number of correct responses marked by you in the Answer Sheet.
4. No candidate shall be admitted to the Examination Hall/Room 20 minutes after commencement of distribution of the paper. The Supervisor of the Examination Hall/Room will be the time-keeper and his/her decision in this regard is final.
5. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
6. No Mobile Phone, Pager, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Pager, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
7. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected paper permitted by the Commission.
8. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
9. After you have completed filling in all your responses on the Answer Sheet and the Examination has concluded, you should hand over to the Invigilator *only the Answer Sheet*. You are permitted to take away with you the Test Booklet.
10. Violation of any of the above Rules will render the candidate liable to expulsion from the Examination Hall/Room and disqualification from the Examination, and according to the nature and gravity of his/her offence, he/she may be debarred from future Examinations and Interviews conducted by the Commission for appointment to Government Service.
11. Smoking inside the Examination Hall/Room is strictly prohibited.
12. **This Test Booklet contains one page for Rough Work at the end.**

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[ No. of Questions : 100 ]

SEAL

1. Inside a hollow conducting sphere

- (A) electric field is zero
- (B) electric field is non-zero constant
- (C) electric field changes with the distance from centre of the sphere
- (D) electric field changes with the magnitude of charge on the sphere

4. Three concentric conducting spherical surfaces of radii  $R_1$ ,  $R_2$  and  $R_3$  ( $R_1 < R_2 < R_3$ ) carry charges of  $-1$  coulomb,  $-2$  coulombs and  $4$  coulombs respectively. The charges on the inner and outer surfaces of the outermost sphere will be respectively [in coulomb(s)]

- (A) 0, 4
- (B) 3, 1
- (C)  $-3, -1$
- (D)  $-3, 1$

2. The magnetic flux density  $B$  and the vector magnetic potential  $A$  are related as

- (A)  $B = \nabla \times A$
- (B)  $A = \nabla \times B$
- (C)  $B = \nabla \cdot A$
- (D)  $A = \nabla \cdot B$

5. The Laplace transform of  $t$  is

- (A)  $s$
- (B)  $\frac{1}{s}$
- (C)  $\frac{1}{s^2}$
- (D)  $\frac{1}{(s-a)}$

3. The velocity of EM waves in free space is

- (A)  $3 \times 10^{11}$  m/sec
- (B)  $2 \times 10^8$  m/sec
- (C)  $3 \times 10^8$  m/sec
- (D)  $2 \times 10^{10}$  m/sec

6. Which of the following equations represents Gauss's law in homogeneous isotropic medium?

- (A)  $\int D \cdot ds = \iiint \rho dv$
- (B)  $\nabla \times H = D$
- (C)  $\nabla \cdot J + \rho = 0$
- (D)  $\nabla \cdot H = \frac{\rho}{\epsilon}$

7. The energy density in a static magnetic field is

(A)  $W_m = \frac{1}{2} LI^2$

(B)  $W_m = \mu H^2$

(C)  $W_m = \frac{1}{2} \mu H^2$

(D)  $W_m = \frac{1}{2} H\mu^2$

8. What causes electromagnetic wave polarization?

(A) Longitudinal nature of electromagnetic wave

(B) Transverse nature of electromagnetic wave

(C) Reflection

(D) All of the above

9. An electromagnetic field is radiated from

(A) conductor carrying a d.c. current

(B) a capacitor with d.c. voltage

(C) an oscillating dipole

(D) All of the above

10. Two incandescent light bulbs of 40 W and 60 W rating are connected in series across the mains. Then

(A) the bulbs together consume 100 W

(B) the bulbs together consume 50 W

(C) the 60 W bulb glows brighter

(D) the 40 W bulb glows brighter

11. Three resistors of  $6 \Omega$  each are connected as shown in the figure below :



The equivalent resistance between  $X_1$  and  $X_2$  is

(A)  $2 \Omega$

(B)  $4 \Omega$

(C)  $8 \Omega$

(D)  $12 \Omega$

12. An  $R-L-C$  series circuit has  $f_1$  and  $f_2$  as the half-power frequencies and  $f_0$  as the resonant frequency. The  $Q$ -factor of the circuit is given by

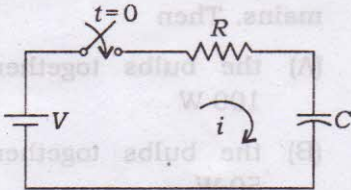
(A)  $\frac{f_1 + f_2}{2f_0}$

(B)  $\frac{f_1 - f_0}{f_2 - f_0}$

(C)  $\frac{f_0}{f_1 - f_2}$

(D)  $\frac{f_1 - f_2}{f_0}$

13. The transient response of the initially relaxed network shown in the figure below



(A)  $i = \frac{V}{R} e^{-t/CR}$

(B)  $i = \frac{V}{R} e^{1/CR}$

(C)  $i = \frac{V}{R} (1 - e^{-t/CR})$

(D)  $i = \frac{V}{R} (1 + e^{-t/CR})$

14. The difference between the indicated value and the true value of a quantity is

- (A) gross error  
 (B) absolute error  
 (C) dynamic error  
 (D) relative error

15. What capacitance must be placed in series with a  $15 \mu\text{F}$  capacitor to give a total capacitance of  $5 \mu\text{F}$ ?

- (A)  $5 \mu\text{F}$   
 (B)  $7.5 \mu\text{F}$   
 (C)  $10 \mu\text{F}$   
 (D)  $15 \mu\text{F}$

16. An indicating instrument is more sensitive if its torque to weight ratio is

- (A) much larger than unity  
 (B) of the order of unity  
 (C) much less than unity  
 (D) almost zero

17. The sine wave output of a function generator is fed to both the horizontal (X) and vertical (Y) inputs of a CRO. The pattern on the CRO screen is

- (A) a circle  
 (B) an ellipse  
 (C) a straight line with  $45^\circ$  slope  
 (D) a semicircle

18. Which one of the following bridges is used for measurement of dielectric loss and power factor of a capacitor?

- (A) Maxwell's bridge  
 (B) Anderson bridge  
 (C) De Sauty's bridge  
 (D) Schering bridge

