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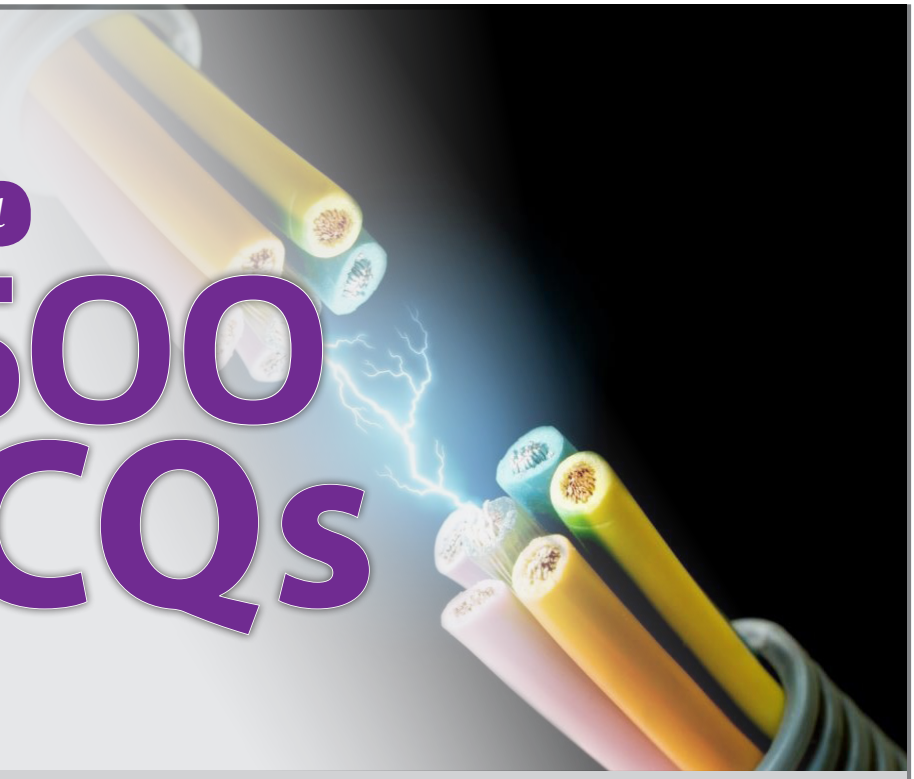

Useful For

ESE | GATE | PSUs

Electrical Engineering

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PREFACE

B. Singh (Ex. IES)

It gives me great happiness to introduce the **Revised Edition** on Electrical Engineering containing nearly 3500 MCQs which focuses in-depth understanding of subjects at basic and advanced level which has been segregated topicwise to disseminate all kind of exposure to students in terms of quick learning and deep apt. The topicwise segregation has been done to align with contemporary competitive examination pattern. Attempt has been made to bring out all kind of probable competitive questions for the aspirants preparing for ESE, GATE & PSUs. The content of this book ensures threshold level of learning and wide range of practice questions which is very much essential to boost the exam time confidence level and ultimately to succeed in all prestigious engineer's examinations. It has been ensured from MADE EASY team to have broad coverage of subjects at chapter level.

While preparing this book utmost care has been taken to cover all the chapters and variety of concepts which may be asked in the exams. The solutions and answers provided are upto the closest possible accuracy. The full efforts have been made by MADE EASY Team to provide error free solutions and explanations.

I have true desire to serve student community by way of providing good sources of study and quality guidance. I hope, this book will be proved an important tool to succeed in competitive examinations. Any suggestions from the readers for the improvement of this book are most welcome.

B. Singh (Ex. IES)
Chairman and Managing Director
MADE EASY Group

CONTENTS

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UNIT 1

Electromagnetic Theory

1. Vector Analysis

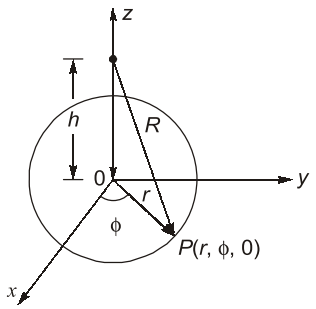
Q.1 If $\vec{P} = x^2y^2\,\vec{i} + (x - y)\,\vec{k}$, $\vec{Q} = zx\vec{i}$ and $\phi = xy^2z^3$, then match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I	List-II
A. Div. $\vec{Q}$	1. $y^2z^3\,\vec{i} + 2yxz^3\,\vec{j} + 3z^2y^2x\vec{k}$
B. Grad ϕ	2. $-\vec{i} + \vec{k}x^2$
C. Curl $\vec{P}$	3. z

Codes:

	A	B	C
(a)	1	2	3
(b)	2	1	3
(c)	3	1	2
(d)	3	2	1

Q.2 The unit vector $\vec{a}_R$ which points from $z = h$ on the z-axis towards $(r, \phi, 0)$ in cylindrical co-ordinates as shown below is given by



(a) $\dfrac{h\vec{a}_r - r\vec{a}_z}{\sqrt{r^2 + h^2}}$ (b) $\dfrac{r\vec{a}_r - h\vec{a}_z}{\sqrt{r^2 + h^2}}$

(c) $\dfrac{h\vec{a}_\phi - r\vec{a}_z}{\sqrt{r^2 + h^2}}$ (d) $\dfrac{r\vec{a}_z - h\vec{a}_\phi}{\sqrt{r^2 + h^2}}$

Q.3 If the vector V given below is irrotational, then the values of a, b and c will be respectively

$V = (x + 2y + az)\,\vec{i} + (bx - 3y - z)\,\vec{j} + (4x + cy + 2z)\,\vec{k}$

(a) $a = 4$, $b = 2$ and $c = -1$
(b) $a = 2$, $b = -1$and $c = 4$
(c) $a = 4$, $b = -1$ and $c = 2$
(d) $a = 2$, $b = 4$ and $c = -1$

Q.4 Match **List-I (Vector Identities)** with **List-II (Equivalent expression)** and select the correct answer using the codes given below the lists:

List-I

A. $(\vec{A} \times \vec{B}) \cdot (\vec{C} \times \vec{D})$

B. $\vec{A} \times (\vec{B} \times \vec{C})$

C. $(\vec{A} \times \vec{B}) \times (\vec{C} \times \vec{D})$

List-II

1. $(\vec{A} \cdot \vec{C} \cdot \vec{D})\vec{B} - (\vec{B} \cdot \vec{C} \cdot \vec{D})\vec{A}$
2. $[(\vec{A} \cdot \vec{C})(\vec{B} \cdot \vec{D}) - (\vec{A} \cdot \vec{D})(\vec{B} \cdot \vec{C})]$
3. $(\vec{A} \cdot \vec{C})\vec{B} - (\vec{A} \cdot \vec{B})\vec{C}$

Codes:

	A	B	C
(a)	1	3	2
(b)	3	1	2
(c)	2	1	3
(d)	2	3	1

Q.5 The vector differential operator, Del(∇) in spherical co-ordinate system is given by

(a) $\nabla = \vec{a}_r \dfrac{\partial}{\partial r} + \vec{a}_\theta \dfrac{1}{r}\dfrac{\partial}{\partial \theta} + \vec{a}_\varphi \dfrac{1}{r\sin\theta}\dfrac{\partial}{\partial \varphi}$

(b) $\nabla = \vec{a}_r \dfrac{1}{r}\dfrac{\partial}{\partial r} + \vec{a}_\theta \dfrac{1}{r\sin\theta} + \vec{a}_\varphi \dfrac{\partial}{\partial \varphi}$

(c) $\nabla = \vec{a}_r \dfrac{\partial}{\partial r} + \vec{a}_\theta \dfrac{\partial}{\partial \theta} + \vec{a}_\varphi \dfrac{1}{r\cos\theta}\dfrac{\partial}{\partial \varphi}$

(d) $\nabla = \vec{a}_r \dfrac{1}{r}\dfrac{\partial}{\partial r} + \vec{a}_\theta \dfrac{1}{r}\dfrac{\partial}{\partial \theta} + \vec{a}_\varphi \dfrac{1}{r\cos\theta}\dfrac{\partial}{\partial \varphi}$

Q.6 **Assertion (A):** Divergence of a vector function $\vec{A}$ at each point gives the rate per unit volume at which the physical entity is issuing from that point.

Reason (R): If some physical entity is generated or absorbed within a certain region of the field, then that region is known as source or sink respectively and if there are no sources or sinks in the field, the net outflow of the incompressible physical entity over any part of the region is zero. However, the net outflow is said to be positive, if the total strength of the sources are greater than the total strength of sink and vice-versa.

(a) Both A and R are true and R is a correct explanation of A.
(b) Both A and R are true but R is not a correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q.7 Which of the following identity is not true?

(a) $\vec{A}(\vec{B}\cdot\vec{C}) = (\vec{A}\cdot\vec{C})\vec{B} - (\vec{A}\cdot\vec{B})\vec{C}$

(b) $\nabla\cdot(\nabla\times\vec{A}) = 0$

(c) $\nabla\times\nabla\varphi \neq 0$

(d) None of the above

Q.8 The vector $\vec{A}$ directed from $(2, -4, 1)$ to $(0, -2, 0)$ in Cartesian coordinates is given by

(a) $-2\vec{a}_x + 2\vec{a}_y + \vec{a}_z$ (b) $-2\vec{a}_x + 2\vec{a}_y - \vec{a}_z$

(c) $-\vec{a}_x - 2\vec{a}_y + 2\vec{a}_z$ (d) $\vec{a}_x - 2\vec{a}_y - \vec{a}_z$

Q.9 What is the value of $\iint_s \vec{F}\cdot d\vec{s}$, where $\vec{F} = 4xz\vec{i}_1 - y^2\vec{i}_2 + yz\vec{i}_3$?

Here, s is the surface bounded by $x = 0$, $x = 1$, $y = 0$, $y = 1$, $z = 0$, $z = 1$ and $\vec{i}_1, \vec{i}_2, \vec{i}_3$ are unit vectors along x, y and z axes respectively.

(a) 1/2 (b) 5/2
(c) 2 (d) 3/2

Q.10 The vector field given by

$$\vec{A} = yz\vec{a}_x + xz\vec{a}_y + xy\vec{a}_z \text{ is}$$

(a) rotational and solenoidal
(b) rotational but not solenoidal
(c) irrotational and solenoidal
(d) irrotational but not solenoidal

Q.11 If $\vec{A} = \dfrac{\vec{a}_x}{\sqrt{x^2 + y^2}}$, then the value of $\nabla\cdot\vec{A}$ at (2, 2, 0) will be

(a) –0.0884 (b) 0.0264
(c) –0.0356 (d) 0.0542

Q.12 If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, then the value of $\vec{i}\times(\vec{r}\times\vec{i}) + \vec{j}\times(\vec{r}\times\vec{j}) + \vec{k}\times(\vec{r}\times\vec{k})$ is

(a) $\vec{r}$ (b) $2\vec{r}$
(c) $3\vec{r}$ (d) $6\vec{r}$

Q.13 What is the value of constant b so that the vector

$$\vec{V} = (x + 3y)\vec{i} + (y - 2x)\vec{j} + (x + bz)\vec{k}$$

is solenoidal?

(a) 2 (b) –1
(c) 3 (d) –2

Q.14 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

A. Gauss's divergence theorem
B. Stroke's theorem
C. The divergence
D. The curl

List-II

1. $\nabla\cdot\vec{A}$
2. $\oint_L \vec{A}\cdot d\vec{l} = \iint_s (\nabla\times\vec{A})\cdot d\vec{s}$
3. $\iint_s \vec{A}\cdot d\vec{s} = \iint_s \vec{A}\cdot\vec{e}\, ds$ ($\vec{e}$ - An unit vector)
4. $\nabla\times\vec{A}$

Codes:

	A	B	C	D
(a)	3	2	4	1
(b)	2	3	1	4
(c)	3	2	1	4
(d)	2	3	4	1

Q.15 **Assertion (A):** Vector differential operator is a vector quantity and it signifies that certain operations of a differentiation are to be carried out on the scalar function following it.

Reason (R): Vector differential operator posses properties similar to ordinary vectors.

(a) Both A and R are true and R is a correct explanation of A.
(b) Both A and R are true but R is not a correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Answers Electromagnetic Theory

1.	(c)	2.	(b)	3.	(a)	4.	(d)	5.	(a)	6.	(a)	7.	(c)	8.	(b)
9.	(d)	10.	(c)	11.	(a)	12.	(b)	13.	(d)	14.	(c)	15.	(d)	16.	(b)
17.	(c)	18.	(a)	19.	(c)	20.	(d)	21.	(c)	22.	(b)	23.	(a)	24.	(d)
25.	(d)	26.	(a)	27.	(d)	28.	(a)	29.	(c)	30.	(a)	31.	(d)	32.	(b)
33.	(b)	34.	(a)	35.	(c)	36.	(d)	37.	(a)	38.	(c)	39.	(a)	40.	(b)
41.	(d)	42.	(a)	43.	(c)	44.	(c)	45.	(c)	46.	(c)	47.	(c)	48.	(b)
49.	(a)	50.	(a)	51.	(c)	52.	(d)	53.	(a)	54.	(b)	55.	(d)	56.	(a)
57.	(c)	58.	(b)	59.	(a)	60.	(b)	61.	(c)	62.	(b)	63.	(d)	64.	(a)
65.	(d)	66.	(b)	67.	(a)	68.	(d)	69.	(a)	70.	(a)	71.	(c)	72.	(b)
73.	(d)	74.	(a)	75.	(d)	76.	(d)	77.	(b)	78.	(a)	79.	(b)	80.	(c)
81.	(d)	82.	(c)	83.	(b)	84.	(b)	85.	(a)	86.	(d)	87.	(c)	88.	(a)
89.	(b)	90.	(a)	91.	(b)	92.	(c)	93.	(b)	94.	(d)	95.	(a)	96.	(b)
97.	(a)	98.	(b)	99.	(a)	100.	(b)	101.	(c)	102.	(a)	103.	(c)	104.	(b)
105.	(b)	106.	(a)	107.	(d)	108.	(c)	109.	(b)	110.	(a)	111.	(c)	112.	(b)
113.	(c)	114.	(d)	115.	(a)	116.	(b)	117.	(c)	118.	(d)	119.	(a)	120.	(a)
121.	(b)	122.	(a)	123.	(a)	124.	(c)	125.	(b)	126.	(d)	127.	(c)	128.	(d)
129.	(a)	130.	(c)	131.	(a)	132.	(c)	133.	(a)	134.	(b)	135.	(d)	136.	(b)
137.	(a)	138.	(c)	139.	(d)	140.	(a)	141.	(c)	142.	(b)	143.	(d)	144.	(a)
145.	(c)	146.	(b)	147.	(d)	148.	(c)	149.	(c)	150.	(b)	151.	(c)	152.	(d)
153.	(a)	154.	(d)	155.	(c)	156.	(c)	157.	(a)	158.	(b)	159.	(d)	160.	(c)
161.	(c)	162.	(b)	163.	(b)	164.	(a)	165.	(b)	166.	(b)	167.	(a)	168.	(c)
169.	(d)	170.	(b)	171.	(b)	172.	(a)	173.	(d)	174.	(d)	175.	(b)	176.	(b)
177.	(c)	178.	(a)	179.	(c)	180.	(c)	181.	(b)	182.	(d)	183.	(a)	184.	(b)
185.	(c)	186.	(a)	187.	(d)	188.	(a)	189.	(a)	190.	(b)	191.	(a)	192.	(c)
193.	(d)	194.	(c)	195.	(a)	196.	(b)	197.	(a)	198.	(d)	199.	(a)	200.	(a)
201.	(c)	202.	(b)	203.	(c)	204.	(c)	205.	(b)	206.	(b)	207.	(d)		

Explanations

1. (c)

Here, $\text{Div. } \vec{Q} = \nabla \cdot \vec{Q} = \left(\vec{i}\frac{\partial}{\partial x} + \vec{j}\frac{\partial}{\partial y} + \vec{k}\frac{\partial}{\partial y}\right) \cdot (\vec{i}\, zx)$

$= (\vec{i} \cdot \vec{i})\left(\frac{\partial}{\partial x} \cdot zx\right) = 1 \cdot z = z$

Also, $\text{Grad}\,\phi = \nabla\phi = \left(\frac{\partial}{\partial x}\vec{i} + \frac{\partial}{\partial y}\vec{j} + \frac{\partial}{\partial z}\vec{k}\right)(xy^2z^3) = (y^2z^3\,\vec{i} + 2yxz^3\,\vec{j} + 3z^2y^2x\vec{k})$

And, $\text{Curl } \vec{P} = \nabla \times \vec{P} = \begin{vmatrix} \vec{i} & 0 & \vec{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2y & 0 & (x-y) \end{vmatrix}$

$= \vec{i}\left[\frac{\partial}{\partial y}(x-y) - 0\right] + \vec{k}\left[0 - \frac{\partial}{\partial y}(x^2y)\right]$

$= \vec{i}\,[-1] + \vec{k}\,[x^2] = -\vec{i} + x^2\,\vec{k}$

2. (b)

Let the unit vector be given by $\vec{a}_R$.

Now, $\vec{R}$ = Difference of two vectors

$= r\vec{a}_r - h\vec{a}_z$

$\therefore$ Unit vector, $\vec{a}_R = \frac{\vec{R}}{|\vec{R}|} = \frac{r\,\vec{a}_r - h\vec{a}_z}{\sqrt{r^2 + h^2}}$

3. (a)

Since the given vector V is irrotational, therefore curl $V = 0$ or , $\nabla \times V = 0$.

Now, $\nabla \times V = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ (x+2y+az) & (bx-3y-z) & (4x+cy+2z) \end{vmatrix}$

$= \left\{\frac{\partial}{\partial y}(4x+cy+2z) - \frac{\partial}{\partial z}(bx-3y-z)\right\}\vec{i} + \left\{\frac{\partial}{\partial z}(x+2y+az) - \frac{\partial}{\partial x}(4x+cy+2z)\right\}\vec{j}$

$+ \left\{\frac{\partial}{\partial x}(bx-3y-z) - \frac{\partial}{\partial y}(x+2y+az)\right\}\vec{k}$

$= (c+1)\vec{i} + (a-4)\vec{j} + (b-2)\vec{k}$

Since, $\nabla \times V = 0$, therefore, $a = 4$, $b = 2$, and $c = -1$

4. (d)

- $(\vec{A} \times \vec{B}) \cdot (\vec{C} \times \vec{D})$ is called "product of four vectors".

UNIT 2

Electrical Materials

1. Introduction to Engineering Materials

Q.1 Match **List-I (Engineering materials)** with **List-II (Uses)** and select the correct answer using the codes given below the lists:

List-I

A. Ferrous metals
B. Non-ferrous metals
C. Ceramics
D. Metal- metal composites

List-II

1. Semiconductors making
2. Conductors in HV transmission
3. Alloy making
4. Refractories

Codes:

	A	B	C	D
(a)	3	1	2	4
(b)	3	1	4	2
(c)	1	2	4	3
(d)	2	4	3	1

Q.2 Match **List-I (Properties of engineering materials)** with **List-II (Examples)** and select the correct answer using the codes given below the lists:

List-I	List-II
A. Physical	**1.** Malleability
B. Mechanical	**2.** Reluctivity
C. Magnetic	**3.** Passivity
D. Chemical	**4.** Density

Codes:

	A	B	C	D
(a)	3	4	2	1
(b)	4	1	3	2
(c)	1	4	3	2
(d)	4	1	2	3

Q.3 Material science deals with
(a) solid materials
(b) molten metals
(c) gases and liquids
(d) solids and vapours

Q.4 Which of the following is/are mechanical property of a material?
(a) Specific heat and thermal fatigue
(b) Passivity and pH-value
(c) Proof resilience and creep
(d) Susceptibility and retentivity

Q.5 A unit cell is
(a) an agglomerated structure.
(b) the basic building block of crystal.
(c) the smallest group of atoms which when regularly repeated forms the crystal.
(d) a cube containing the largest number of atoms.

Q.6 **Assertion (A) :** A unit cell is analogous to a brick used in the building construction.
Reason (R) : A unit cell is defined as the basic structural part in the composition of materials.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q.7 Consider the following statements:
1. The crystal directions of a family must be parallel to one another.
2. Crystal directions and crystal plane are denoted by the Miller indices.
3. In cubic crystals, a crystal plane and a crystal direction normal to it have different indices.
4. The effective number of lattice points in unit cell is highest in case of face centered cubic space lattice.

Which of the statements given above is/are correct?
(a) 2, 3 and 4 (b) 2 and 4
(c) 1, 2 and 3 (d) 4 only

Q.8 The number of Bravais space lattices with two lattice points are

(a) Silicon monoxide (b) Silicon dioxide
(c) Tin oxide (d) Chromium oxide

Q.202 In an integrated circuit, the SiO_2 layer provides
(a) electrical connection to external circuit
(b) physical strength
(c) isolation
(d) conducting path

Q.203 German silver is an alloy of
(a) Copper, Silver and aluminium
(b) Silver, tin and tungsten
(c) Copper, manganese and nickel
(d) Copper, zinc and nickel

Q.204 Dielectric materials are used primarily for
(a) insulation
(b) charge storage
(c) reducing dielectric loss
(d) none of the above

Q.205 In metals, resistivity is composed of two parts: one part is characteristic of the particular substance. The other part is due to
(a) applied voltage
(b) crystal imperfections
(c) applied magnetic field
(d) supplied thermal energy

Q.206 A dielectric material has the real part of the dielectric constant (ε_r') as 4 and its loss tangent is 0.004. What is the complex dielectric constant (ε_r^*) represented by?
(a) $4 + j0.016$ (b) $4 - j0.016$
(c) $4 + j0.001$ (d) $4 - j0.001$

Q.207 Which of the following materials has the highest dielectric strength?
(a) Polystyrene (b) Marble
(c) Cotton (d) Transformer oil

■■■■

Answers Electrical Materials

1.	(b)	2.	(d)	3.	(a)	4.	(c)	5.	(c)	6.	(a)	7.	(b)	8.	(d)				
9.	(a)	10.	(c)	11.	(c)	12.	(d)	13.	(a)	14.	(a)	15.	(a)	16.	(b)				
17.	(b)	18.	(d)	19.	(b)	20.	(a)	21.	(c)	22.	(a)	23.	(c)	24.	(d)				
25.	(d)	26.	(d)	27.	(b)	28.	(c)	29.	(b)	30.	(a)	31.	(c)	32.	(b)				
33.	(b)	34.	(b)	35.	(d)	36.	(a)	37.	(d)	38.	(c)	39.	(a)	40.	(d)				
41.	(a)	42.	(a)	43.	(b)	44.	(a)	45.	(d)	46.	(d)	47.	(c)	48.	(c)				
49.	(a)	50.	(b)	51.	(d)	52.	(a)	53.	(b)	54.	(d)	55.	(c)	56.	(b)				
57.	(c)	58.	(c)	59.	(c)	60.	(b)	61.	(c)	62.	(c)	63.	(d)	64.	(b)				
65.	(b)	66.	(d)	67.	(b)	68.	(c)	69.	(a)	70.	(d)	71.	(d)	72.	(a)				
73.	(b)	74.	(a)	75.	(b)	76.	(d)	77.	(a)	78.	(b)	79.	(c)	80.	(a)				
81.	(a)	82.	(d)	83.	(c)	84.	(d)	85.	(b)	86.	(a)	87.	(b)	88.	(a)				
89.	(c)	90.	(c)	91.	(a)	92.	(b)	93.	(d)	94.	(c)	95.	(a)	96.	(d)				
97.	(c)	98.	(b)	99.	(c)	100.	(b)	101.	(a)	102.	(d)	103.	(b)	104.	(c)				
105.	(d)	106.	(d)	107.	(b)	108.	(b)	109.	(d)	110.	(d)	111.	(a)	112.	(c)				
113.	(a)	114.	(a)	115.	(d)	116.	(b)	117.	(c)	118.	(d)	119.	(d)	120.	(a)				

121. (b)	122. (d)	123. (c)	124. (c)	125. (a)	126. (b)	127. (b)	128. (a)
129. (d)	130. (b)	131. (a)	132. (c)	133. (d)	134. (b)	135. (c)	136. (a)
137. (d)	138. (a)	139. (c)	140. (c)	141. (a)	142. (a)	143. (d)	144. (d)
145. (d)	146. (a)	147. (d)	148. (d)	149. (c)	150. (c)	151. (d)	152. (a)
153. (c)	154. (d)	155. (a)	156. (c)	157. (d)	158. (a)	159. (d)	160. (b)
161. (b)	162. (c)	163. (c)	164. (d)	165. (a)	166. (c)	167. (d)	168. (b)
169. (a)	170. (c)	171. (b)	172. (c)	173. (a)	174. (d)	175. (c)	176. (a)
177. (a)	178. (a)	179. (d)	180. (d)	181. (b)	182. (c)	183. (a)	184. (b)
185. (a)	186. (a)	187. (d)	188. (c)	189. (c)	190. (d)	191. (b)	192. (c)
193. (b)	194. (a)	195. (d)	196. (b)	197. (b)	198. (d)	199. (d)	200. (c)
201. (d)	202. (c)	203. (d)	204. (b)	205. (b)	206. (b)	207. (a)	

Explanations

2. (d)

Table below shows various properties of engineering materials with their examples:

Properties	Examples
Physical	Density, Colour, Shape, Size, Melting point etc.
Mechanical	Ductility, Malleability, Brittleness, Hardness etc.
Magnetic	Hysteresis, Retentivity, Permeability, Reluctivity etc.
Chemical	Atomic number, Passivity, Acidity etc.

3. (a)

The scope of material science is generally restricted to the study of solid materials, and that too only to those which are useful as engineering materials.

4. (c)

- Specific heat and thermal fatigue are thermal properties.
- Passivity and pH-value are chemical properties.
- Proof resilience and creep are mechanical properties.
- Susceptibility and retentivity are magnetic properties.

5. (c)

When many unit cells repeat in a three-dimensional space, a crystal is obtained. The structure of a crystal is same as that of a repeating unit cell.

7. (b)

- The crystal directions of a family are not necessarily parallel to one another. Hence, statement-1 is not correct.
- Statement-2 is correct.
- In cubic crystals, a crystal plane and a crystal direction normal to it have the same indices. Hence, statement-3 is not correct.
- The effective number of lattice points in unit cell is highest i.e. 4 in case of face-centered cubic space lattice. In case of simple cubic it is 1 and in case of BCC it is 2. Hence, statement-4 is correct.

9. (a)

In FCC crystal, diagonal of each face

$$= 4r = \sqrt{2}a$$

(Where, r = radius of each atom)

The atomic diameter of an FCC crystal

$$= 2r = \frac{\sqrt{2}a}{2} = \frac{a}{\sqrt{2}}$$

10. (c)

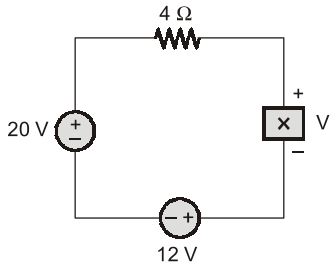
- The sharing of electrons between neighbouring atoms results in a covalent bond, which is directional. Hence, statement-1 is not correct.
- The metallic bond is non-directional and generally weaker than ionic and covalent bonds. Thus, statement-2 is not correct.

UNIT 3

Electrical Circuits

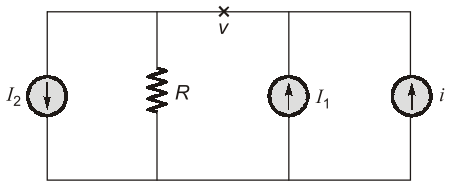
1. Basic and Electric Circuits

Q.1 If the power supplied by the 20 V voltage source shown in figure below is 60 W then, the power supplied by the unknown circuit element (×) will be



(a) –12 W (b) 3 W
(c) 12 W (d) –3 W

Q.2 In the network of figure shown below, $I_1 = 0.05$ A, $I_2 = 0.1$ A, $R = 50\ \Omega$. The unknown current source has strength of i. If 100 J of energy is delivered to I_2 in 1 min, the magnitude of i will be

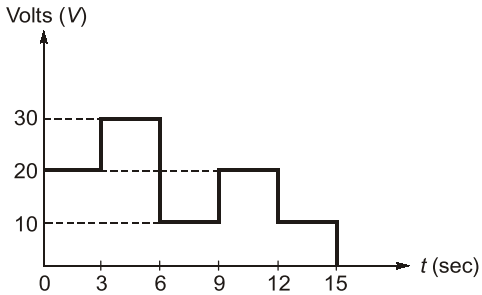


(a) 0.38 A (b) 0.50 A
(c) –0.25 A (d) 0.05 A

Q.3 The energy required to move 120 C charge through 3 V is
(a) 540 J (b) 25 mJ
(c) 360 J (d) 2.78 mJ

Q.4 For a given voltage, four heating coils will produce maximum heat, when connected
(a) all in parallel
(b) all in series
(c) with two parallel pairs in series
(d) one pair in parallel with the other two in series

Q.5 Given figure shows a plot of d.c. voltage applied to a resistor of 5 Ω for 15 seconds. The total energy consumed by the resistor is



(a) 540 J (b) 625 J
(c) 1220 J (d) 1140 J

Q.6 The charge in a capacitor is given by

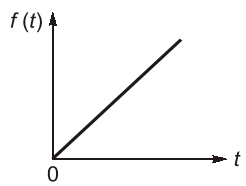
$$q = \left(v + \frac{1}{3}v^3\right)$$

If the voltage across this capacitor be $v(t) = \sin t$, the current $i(t)$ through the capacitor is
(a) $(1 + \sin^2 t)\cos t$ (b) $(1 + \sin^2 t)$
(c) $(1 + \cos^2 t)\sin t$ (d) $\sin^2 t \cos t$

Q.7 The unit of reactive power is
(a) Watt (b) Kilo-Watt
(c) Var (d) Volt ampere

Q.8 The unit of electrical energy is
(a) Watt (b) Kilo-Watt
(c) Kilo-watt-hour (d) Joule

Q.9 The given signal is



(a) a power signal
(b) an energy signal
(c) an energy and a power signal
(d) neither an energy nor a power signal

Answers Electrical Circuits

1. (c)	2. (a)	3. (c)	4. (a)	5. (d)	6. (a)	7. (c)	8. (c)
9. (d)	10. (c)	11. (c)	12. (c)	13. (d)	14. (c)	15. (d)	16. (d)
17. (b)	18. (c)	19. (a)	20. (d)	21. (c)	22. (d)	23. (b)	24. (d)
25. (c)	26. (d)	27. (a)	28. (a)	29. (a)	30. (b)	31. (a)	32. (a)
33. (d)	34. (d)	35. (a)	36. (d)	37. (c)	38. (d)	39. (b)	40. (a)
41. (a)	42. (c)	43. (b)	44. (d)	45. (c)	46. (a)	47. (c)	48. (b)
49. (d)	50. (c)	51. (c)	52. (b)	53. (d)	54. (b)	55. (c)	56. (c)
57. (d)	58. (c)	59. (a)	60. (d)	61. (b)	62. (d)	63. (c)	64. (a)
65. (b)	66. (d)	67. (c)	68. (b)	69. (a)	70. (d)	71. (c)	72. (a)
73. (b)	74. (a)	75. (d)	76. (d)	77. (b)	78. (a)	79. (b)	80. (a)
81. (a)	82. (c)	83. (b)	84. (c)	85. (b)	86. (c)	87. (c)	88. (d)
89. (d)	90. (b)	91. (c)	92. (b)	93. (d)	94. (a)	95. (d)	96. (d)
97. (c)	98. (d)	99. (b)	100. (c)	101. (b)	102. (c)	103. (d)	104. (c)
105. (d)	106. (c)	107. (a)	108. (b)	109. (d)	110. (c)	111. (a)	112. (b)
113. (c)	114. (d)	115. (c)	116. (b)	117. (c)	118. (a)	119. (b)	120. (a)
121. (d)	122. (a)	123. (c)	124. (d)	125. (d)	126. (c)	127. (d)	128. (b)
129. (d)	130. (b)	131. (a)	132. (c)	133. (a)	134. (b)	135. (d)	136. (c)
137. (d)	138. (c)	139. (d)	140. (d)	141. (a)	142. (b)	143. (a)	144. (c)
145. (a)	146. (d)	147. (b)	148. (b)	149. (c)	150. (d)	151. (c)	152. (a)
153. (b)	154. (a)	155. (a)	156. (b)	157. (c)	158. (c)	159. (b)	160. (d)
161. (d)	162. (a)	163. (c)	164. (d)	165. (a)	166. (c)	167. (c)	168. (b)
169. (a)	170. (d)	171. (b)	172. (c)	173. (a)	174. (b)	175. (d)	176. (c)
177. (a)	178. (a)	179. (d)	180. (a)	181. (b)	182. (c)	183. (d)	184. (a)
185. (b)	186. (c)	187. (d)	188. (a)	189. (c)	190. (a)	191. (d)	192. (b)
193. (c)	194. (b)	195. (c)	196. (d)	197. (b)	198. (a)	199. (d)	200. (b)
201. (c)	202. (a)	203. (c)	204. (d)	205. (c)	206. (b)	207. (d)	208. (a)
209. (b)	210. (c)	211. (a)	212. (d)	213. (c)	214. (d)	215. (a)	216. (b)
217. (d)	218. (b)	219. (a)	220. (b)	221. (b)	222. (b)	223. (d)	224. (b)
225. (c)	226. (c)	227. (c)	228. (b)	229. (c)	230. (b)	231. (d)	232. (a)
233. (c)	234. (d)	235. (c)	236. (c)	237. (b)	238. (d)	239. (c)	240. (a)
241. (c)	242. (d)	243. (b)	244. (a)	245. (c)	246. (a)	247. (c)	248. (c)

UNIT 4

Electrical & Electronic Measurements

1. Introduction

Q.1 In present day measurement systems
(a) direct methods are commonly used
(b) use of direct methods is limited but indirect methods are commonly used
(c) both direct and indirect methods are commonly used
(d) none of the above

Q.2 The use of electronic instruments is becoming more extensive because they have
(a) the capability to respond to signals from remote places
(b) a fast response and compatibility with digital computers
(c) both (a) and (b)
(d) a high sensitivity but less reliability

Q.3 A thermometer is calibrated 150°C to 200°C. The accuracy is specified within ±0.25 percent of instrument span. The maximum static error is
(a) ± 0.225°C (b) ± 0.250°C
(c) ± 0.125°C (d) ± 0.175°C

Q.4 A set of independent current measurements were recorded as 10.03, 10.10, 10.08 and 10.11 A. The average range of error is
(a) ±0.04 (b) ±0.03
(c) ±0.05 (d) ±0.02

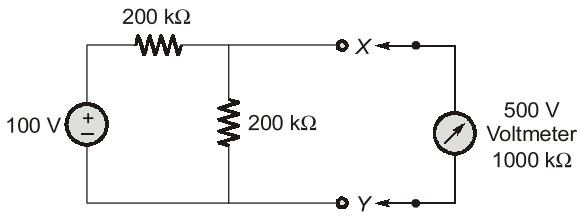
Q.5 Two resistors R_1 and R_2 are connected in series with R_1 = 28.7 Ω and R_2 = 3.624 Ω. The total resistance to the appropriate number of significant figures can be written as
(a) 32.324 Ω (b) 32.4 Ω
(c) 32.32 Ω (d) 32.3 Ω

Q.6 A wheatstone bridge requires a change of 8 Ω in the unknown arm of the bridge to produce a change in deflection of 3 mm of the galvanometer. The deflection factor (scale factor) is
(a) 0.375 mm/Ω (b) 2.67 Ω/mm
(c) 24 Ω-mm (d) can't be determined

Q.7 A moving coil voltmeter has a uniform scale with 100 divisions, the full scale reading is 200 V and 1/10 of a scale division can be estimated with a fair degree of certainty.
The resolution of the instrument in volt is
(a) 2 (b) 0.01
(c) 0.2 (d) 1

Q.8 A multimeter having a sensitivity of 2 kΩ/V is used for the measurement of voltage across a circuit having an output resistance of 10 kΩ. The open circuit voltage of the circuit is 6 volts. The percentage error in multimeter reading when it is set to 10 volt is given by
(a) 33% low (b) 22% high
(c) 33% high (d) 22% low

Q.9 A 50 V range voltmeter is connected across the terminals *X* and *Y* of the circuit shown in figure below. The voltage across the terminals are measured both under open circuit and loaded conditions.



The accuracy in the measurement of voltage across the terminals *X* and *Y* in percent is
(a) 9.1% (b) 90.9%
(c) 45.45% (d) 4.54%

Q.10 The number of significant figures in the two resistors having resistances 4×10^6 kΩ and 0.345 kΩ are respectively
(a) 6 and 3 (b) 2 and 4
(c) 1 and 4 (d) 1 and 3

Q.11 An ammeter reads 6.7 A and the true value of current is 6.5 A. The correction factor is
(a) 0.97 (b) 0.20
(c) 0.03 (d) none of these

Q.12 A pressure gauge is calibrated from 0 - 50 kN/m^2. It has a uniform scale with 100 scale divisions. One fifth of a scale division can be read with certainty. The gauge has a
(a) threshold of 0.1 kN/m^2
(b) dead zone of 0.2 kN/m^2
(c) resolution of 0.1 kN/m^2
(d) both (a) and (b)

Q.13 The resistance of a circuit is found by measuring current flowing and the power fed into the circuit. If the limiting errors in the measurement of power and current are respectively ±1.5% and ±1.0%, then the limiting error in the measurement of resistance will be
(a) ±4% (b) ±3.5%
(c) ±2.5% (d) ±0.5%

Q.14 A resistance is determined by voltmeter-ammeter method. The voltmeter reads 100 V with an uncertainty of ±12 V and the ammeter reads 10 A with an uncertainty of ±2 A. The uncertainty in the measurement of resistance is
(a) 1.56 Ω (b) 0.26 Ω
(c) 3.25 Ω (d) 2.33 Ω

Q.15 The resistance of an unknown resistor is determined by wheatstone bridge. The solution for the unknown resistance is stated as:

$$R_4 = \frac{R_1 R_2}{R_3}$$

where limiting values of various resistances are:

R_1 = 500 Ω ± 1%,
R_2 = 615 Ω ± 1%,
R_3 = 100 Ω ± 0.5%

The limiting error of the unknown resistor in ohm is
(a) ± 76.88 Ω (b) ± 66.66 Ω
(c) ± 3.07 Ω (d) ± 98.76 Ω

Q.16 A Wattmeter has a full scale range of 2500 W. It has an error ±1% of true value. What would be the range of reading if true power is 1250 W?
(a) 1225 W – 1275 W
(b) 1245 W – 1255 W
(c) 1200 W – 1300 W
(d) 1237.5 W – 1262.5 W

Q.17 In a permanent magnet moving coil ammeter, the deflection of the pointer is proportional to product of flux density of magnetic field produced by the permanent magnet and the current in the moving coil. If the strength of the permanent magnet becomes 95% of the original, the meter gives errorneous reading resulting into error. This error can be classified as:
(a) gross error (b) systematic error
(c) random error (d) none of these

Q.18 A 0 - 10 A ammeter has a guaranteed accuracy of 1 percent of full-scale deflection. The limiting error while reading 2.5 A is
(a) 1% (b) 2%
(c) 4% (d) none of these

Q.19 Dynamic response consists of
(a) two parts, one steady state and the other transient state response
(b) only transient state response
(c) only steady state response
(d) steady state and transient frequency response

Q.20 Match **List-I (Quantity)** with **List-II (Dimensions)** and select the correct answer using the codes given below the lists:

List-I	List-II
A. Emf	1. $[MT^{-2}I^{-1}]$
B. Magnetic flux density	2. $[M^{-1}L^{-2}T^2I^2]$
C. Magnetizing force	3. $[ML^2T^{-3}I^{-1}]$
D. Reluctance	4. $[L^{-1}I]$

Codes:

	A	B	C	D
(a)	2	1	3	4
(b)	3	1	2	4
(c)	3	2	4	1
(d)	3	1	4	2

Q.21 The symbol nano (n) and Giga (G) are respectively multiplied by a factor of
(a) 10^{-9} and 10^{12} (b) 10^{-9} and 10^{9}
(c) 10^{9} and 10^{-9} (d) 10^{12} and 10^{-9}