clamphook

Weekly Model Test
Based on
IOE Entrance Syllabus

In collaboration with

Acme Engineering College
(Affiliated to Purbanchal University)

Programs Offered:

Computer Electronics and Communication Engineering
Civil Engineering
Architecture

Set A/B

27th Shrawan, 2080

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGENEERING
B.E. / B.Arch. Entrance Examination
Set A

Full Marks: 140 Time: 2hrs.

SECTION-I

Select the best alternatives: (60×1 = 60)

1. The domain of the real function $f(x) = \sqrt{x^2 + x - 6} + \sqrt{4 + 3x - x^2}$ is

a. [2,4] b. [1,4]
c. [–3,1] d. $(-\infty,-3) \cup [4,\infty]$

for the two components to be meaningful:

(i) $x^2 + x - 6 \geq 0 \Rightarrow (x + 3)(x - 2) \geq 0 \Rightarrow x \leq -3$ or $2 \leq x$……..(i)

(ii) $4 + 3x - x^2 \geq 0 \Rightarrow x^2 - 3x - 4 \leq 0 \Rightarrow (x - 4)(x + 1) \leq 0 \Rightarrow -1 \leq x \leq 4$…….(ii)

Combining (i) and (ii)

$2 \leq x \leq 4 \Rightarrow x \in [2,4]$

2. If $f(x) = \log\left(\frac{1+x}{1-x}\right)$ then $f\left(\frac{2x}{1+x^2}\right)$ equals

a. f(x) b. 2f(x)
c. 3f(x) d. 4f(x)

$$f\left(\frac{2x}{1+x^2}\right) = \log\left(\frac{1+\frac{2x}{1+x^2}}{1-\frac{2x}{1+x^2}}\right)$$

$$\log\left(\frac{(1+x)^2}{(1-x)^2}\right) = 2\log\left(\frac{1+x}{1-x}\right) = 2f(x)$$

3. Inequality $-6 \leq x \leq 1$ by using absolute value sign is

a. $|x + 3| \leq 4$ b. $|3x + 1| \leq 2$
c. $|2x + 5| \leq 7$ d. $|x - 5| \leq 1$

$-6 \leq x \leq 1 \left[\frac{-6+1}{2} = \frac{-5}{2}\right]$

$\Rightarrow -6 + \frac{5}{2} \leq x + \frac{5}{2} \leq 1 + \frac{5}{2}$ [subtract $-\frac{5}{2}$ from all]

$\Rightarrow -7 \leq 2x + \leq 7 \Rightarrow |2x + 5| \leq 7$

4. If $\begin{vmatrix} -a^2 & ab & ac \\ ab & -b^2 & bc \\ ac & bc & -c^2 \end{vmatrix} = \lambda a^2b^2c^2$ then λ equals

a. 1 b. 2
c. 3 d. 4

$$abc\begin{vmatrix} -a & b & c \\ a & -b & c \\ a & b & -c \end{vmatrix} =$$

$$\lambda a^2b^2c^2 \Rightarrow \begin{vmatrix} -1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{vmatrix} = \lambda \Rightarrow \lambda = 4$$

5. The true statement is

a. $1 - i < 1 + i$ b. $1 + 2i > 1 - 2i$
c. $2i > 1$ d. none

there is no natural ordering of the complex numbers. They are either equal or unequal.

6. If the roots of the quadratic $x^2 + ax + c = 0$ differ by 1, then a^2 is always equal to

a. $4c + 1$ b. $4c - 1$
c. $4c$ .d $4c \pm 1$

$\alpha + \beta = -a$, $\alpha.\beta = c$, $\alpha - \beta = -1$

$$\therefore \alpha = \frac{1-a}{2} \text{ and } \beta = -\left(\frac{1+a}{2}\right)$$

$$\therefore \left(\frac{1-a}{2}\right)\left(\frac{1+a}{2}\right) = c \Rightarrow a^2 = 1 + 4c$$

7. If ${}^nC_{r-1} = 36$, ${}^nC_r = 84$ ${}^nC_{r+1} = 126$ then the value of n and r are respectively equal to

a. 9,3 b. 3,9
c. 2,7 d. 7,2

${}^nC_{r-1} = 36$, ${}^nC_r = 84$ and ${}^nC_{r+1} = 126$

put the value of n and r from option and check , only option

(a) satisfies the above condition.

8. If the 21st and 22nd terms in the expansion of $(1 + x)^{44}$ are equal then the value of x must be

a. 7/8 b. 9/8
c. 11/8 d. 13/8

In expansion of $(a + x)^n$, $t_{r+1} = (r + 1)^{th}$ terms = $C(n,r)\, a^{n-r}x^r$

In $(1 + x)^{44}$, $t_{20+1} = 21^{st}$ term $= C(44, 20)\, x^{20}$

$t_{21+1} = 22^{nd}$ term $= C(44, 21)x^{21}$

$\therefore\ C(44, 20)\, x^{20} = C(44, 21)x^{21} \Rightarrow x = \frac{7}{8}$

9. The general values of x in the equation $2\sin 2x = \sin x$ is

a. $n\pi + \frac{\pi}{2}$ b. $\frac{n\pi}{4}$

c. $2n\pi + \frac{\pi}{2}$ d. $n\pi$

$4\sin x \cos x - \sin x = 0 \Rightarrow \sin x(4\cos x - 1) = 0$

$\therefore \sin x = 0 \Rightarrow x = n\pi + (-1)^n.0$

$[\sin x = \sin\alpha \Rightarrow x = n\pi + (-1)^n.\alpha]$

$\therefore x = n\pi$

10. The circumcenter of a right-angled triangle lies

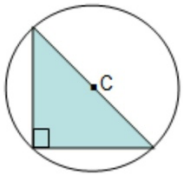
a. in hypotenuse of triangle

b. inside triangle

c. outside triangle

d. on vertex of triangle

The circumcenter of right-angled triangle is at midpoint of hypotenuse.



11. $\lim_{n\to\infty}\left(\frac{1}{n^2} + \frac{2}{n^2} + \frac{3}{n^2} + \ldots\ldots + \frac{n}{n^2}\right) =$

a. $\frac{1}{3}$ b. $\frac{1}{4}$

c. $\frac{1}{2}$ d. 1

$\lim_{n\to\infty}\left(\frac{1}{n^2} + \frac{2}{n^2} + \frac{3}{n^2} + \ldots.. + \frac{n}{n^2}\right)$

$= \lim_{n\to\infty}\frac{1}{n^2}\left(\frac{n(n+1)}{2}\right) = \lim_{n\to\infty}\frac{n(1+\frac{1}{n})}{2n} = \frac{1+0}{2} = \frac{1}{2}$

12. If $y = \frac{1-\tan x}{\sec x}$ then the value of $\frac{dy}{dx}$ =

a. $-\sin x - \cos x$ b. $\frac{2\sec x}{1-\tan x}$

c. $\sin x + \cos x$ d. $2\sec x(1 + \tan^2 x)$

$y = \frac{1-\tan x}{\sec x} = \cos x - \sin x$

$\Rightarrow \frac{dy}{dx} = -\sin x - \cos x$

13. If $y = \sec^{-1}\left(\frac{1}{\sqrt{1-x^2}}\right)$ then $\frac{dy}{dx}$ =

a. $-\frac{2}{\sqrt{1-x^2}}$ b. $\frac{2x}{\sqrt{1+(1-x^2)^2}}$

c. $\frac{2}{1+x}$ d. $\frac{1}{\sqrt{1-x^2}}$

$y = \cos^{-1}\sqrt{1-x^2}$, put $x = \sin\theta$

$y = \theta = \sin^{-1}x \Rightarrow \frac{dy}{dx} = \frac{d}{dx}\sin^{-1}x \Rightarrow \frac{dy}{dx}$

$= \frac{1}{\sqrt{1-x^2}}$

14. Value of $\int \frac{e^{ax}}{e^{ax}+1}\,dx =$

a. $\frac{2(e^{ax}+1)}{a} + c$ b. $\frac{1}{a}\log(e^{ax}+1)$

c. $2a(e^{ax}+1) + c$ d. $a\frac{\log(e^{ax})}{2} + c$

$\int \frac{e^{ax}}{e^{ax}+1}dx = \frac{1}{a}\int \frac{a.e^{ax}}{e^{ax}+1}dx = \frac{1}{a}\log(e^{ax}+1)$

15. If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $(\vec{a} + 2\vec{b})$ and $(5\vec{a} - 4\vec{b})$ are perpendicular to each other then the angle between $\vec{a}$ and $\vec{b}$ is

a. $\frac{\pi}{2}$ b. $\frac{\pi}{3}$

c. $\frac{\pi}{4}$ d. $\frac{\pi}{6}$

$(\vec{a} + 2\vec{b}).(5\vec{a} - 4\vec{b}) = 0$

[Two vectors are $\perp^r$]

$\Rightarrow 5a^2 - 4\vec{a}.\vec{b} + 10\vec{a}.\vec{b} - 8b^2 = 0$

$\Rightarrow \vec{a}.\vec{b} = \frac{1}{2}$ [$\vec{a}$ & $\vec{b}$ are unit vectors]

$\Rightarrow ab\cos\theta = \frac{1}{2} \Rightarrow \theta = \frac{\pi}{3}$

16. The projection of $(\mathbf{i} + \mathbf{j} - \mathbf{k})$ on $(2\mathbf{i} + \mathbf{j} + \mathbf{k})$ is

a. $\frac{1}{\sqrt{3}}$ b. $\frac{2}{\sqrt{3}}$

c. $\frac{2}{\sqrt{6}}$ d. $\frac{1}{\sqrt{6}}$

The projection of $|\vec{a}|\cos\theta = |\vec{a}| \frac{\vec{a}\cdot\vec{b}}{|\vec{a}||\vec{b}|} = \frac{\vec{a}\cdot\vec{b}}{|\vec{b}|}$

17. Equation of a plane parallel to xz plane at unit distance is
a. x=1 b. y=1
c. xz=1 d. x=z=1

A plane parallel to the x-z-plane has equation y = d, where d = distance of a plane from xz plane.

18. If the direction ratios of the line are –1, 2, 2 then its direction cosines are
a. $-\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$ b. $\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}$
c. $\frac{1}{3}, -\frac{2}{3}, -\frac{2}{3}$ d. none

If a, b, c are the direction ratio & *l*,m,n are the direction cosines. Then
$\frac{l}{a} = \frac{m}{b} = \frac{n}{c} = \frac{1}{\sqrt{a^2+b^2+c^2}}$
Given, a, b, c = –1, 2, 2 . Then *l*, m, n $= -\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$

19. The equation of the st. line passing through the point (–1,3) and x– intercept is thrice the y–intercept is
a. x + 3y = 8 b. 3x – y = 4
c. 2x + 3y = 7 d. x + y = 12

$\frac{x}{3a} + \frac{y}{a} = 1$.....(i) $\Rightarrow -\frac{1}{3a} + \frac{3}{a} = 1$
[passes through (–1,3)]
$\therefore a = \frac{8}{3}$ (put is (i))
$\therefore$ x + 3y = 8

20. The eccentricity of parabola $(y-k)^2 = 4a(x-h)$ is
a. e = a b. e=1
c. $e = \frac{1}{a}$ d. $e = \sqrt{1+a^2}$

Parabola has eccentricity e=1.

21. The phonemic transcription of the word 'piety' is _____
a. /paItI/
b. /paIətI/
c. /pItI/
d. /ˈpaɪəti/

22. The word ' Influential' has its primary stress on the _____ syllable.
a. 1st b. 2nd
c. 3rd d. 4th

Primary syllable stress: in-flu-**en**-tial

23 The synonym of the word 'brevity' is _____
a. conciseness b. sharpness
c. quickness d. confidence

24. The antonym of the word 'serene' is _____.
a. complicated b. showy
c. impure d. agitated

25. Which is the wrong sentences?
a. Never does she arrive in time
b. Black as she is, she is beautiful.
c. Will she come to school supposing it rains heavily?
d. If he had left home early, he would be with us now.

26. I am considering _____ home tomorrow.
a. to go b. to have gone
c. to going d. going

27. Like humans, zoo animals must have dentists_____ their teeth.
a. fill b. filled
c. filling d. to be filled

Here, to fill (Inf. with to) is the right usage.

28. Were you disappointed _____ your examination result?
a. by b. from
c. with d. at

Disappointed (Verb) agrees with Prep. With Here, with is the right usage.

29. The correct passive of "He let them scold him" is _____ .
a. He let himself to be scolded.
b. He let himself be scolded.
c. They were let to scold him.
d. He let himself to have been scolded.

30. After eating lunch at The Cheesecake Factory, Tim went to the gym to exercise. It is a _____sentences.
a. simple b. complex
c. compound d. mixed

31. ' We congratulated him on his success' is based on the pattern_____.
a. $S + V_t + O_I$ + prep. + O_D
b. $S + V_t + O_I$ + prepositional phrase
c. $S + V_i + O_D$ + Prepositional phrase
d. $S + V_i + O_I$ + prep. + O_D

32. He did nothing but _____.
a. play b. to play
c. played d. playing

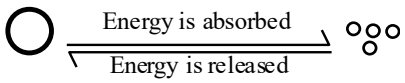
33. A passenger in a moving bus tosses a coin. If the coin falls behind him the bus must be moving with
a. acceleration
b. deceleration
c. unform speed
d. uniform velocity

as acceleration → falls behind him.
a deceleration → falls in front of him.
a uniform speed → falls on his hand.

34. Two bodies of masses m_1& m_2 have equal KE Their momenta shall in the ratio of
a) $m_1:m_2$ b) $m_2:m_1$
c) $\sqrt{m_1} : \sqrt{m_2}$ d) $\sqrt{m_2}: \sqrt{m_1}$

$\frac{1}{2} m_1v_1^2 = \frac{1}{2} m_2v_2^2 \Rightarrow \frac{(m_1v_1)^2}{(m_2v_2)^2} = \frac{m_1}{m_2} \therefore P_1:P_2 = \sqrt{m_1} :\sqrt{m_2}$

35. When a drop splits up into number of drops
a. area decreases b. volume increases
c. energy absorbed d. energy is liberated



36. The function which doesn't represent SHM is
a. $x=\sin^2 wt$
b. $x=\cos 2wt$
c. $x=\sin wt - \cos wt$
d. $x=\sin wt + 2\cos 2wt$

For SHM
$a \propto -x$

37. The inverse square law of intensity is valid for
a. plane wave front
b. cylindrical wave front
c. spherical wave front
d. conical wave front

38. A current I is flowing through a resistance connected to a source of small internal resistance. The resistance is reduced to half, The current through resistance will be
a. I b. 2I
c. <2I d. >2I

$I = E/(R + r)$, $I' = E/(R/2 + r) = \frac{2E}{R + 2r}$
$= 2\left(\frac{E}{R + 2r}\right)$
$\therefore I' < 2I$

39. A hollow metal sphere of radius 10cm is charged such that the potential on its surface is 80V. The potential at centre of sphere is
a. 0 b. 80V
c. 800V d. 8V

The potential is same as on its surface.

40. The magnification of plane mirror is
a. 0 b. 1
c. -1 d. >1

v=u but image is virtual so, m = -1

41. Mean free path of gas atom at a temp
a. directly proportional to square of pressure
b. inversely proportional to square of pressure
c. inversely proportional to pressure
d. directly proportional to pressure.

Average distance travelled by a gas molecule between two successive collisions is mean free path(λ) and is given by :
$\lambda = \frac{KT}{\sqrt{2}\,\pi\, d^2 p}) \Rightarrow \lambda \propto \frac{1}{p}$

42. Transverse elastic waves can propagate
a) both in a gas and a metal
b) in a gas but not in a metal
c) in a metal but not in a gas
d) neither in a gas nor in a metal

43. Equal charges are given to two surfaces of different radii. The potential will be
a) more on smaller sphere
b) more on bigger sphere
c) equal on both the spheres
d) dependent on nature of material of sphere

$$v = \frac{q^2}{4\pi\in_o r} \Rightarrow V \propto \frac{1}{r}$$

44. As the temperature of a conductor increases, its resistivity and conductivity changes. The ratio of resistivity to conductivity
a) increases
b) decreases
c) remain same
d) may increase or decrease depending on actual temperature

Resistivity and conductivity depend only on material of conductor and temperature
Resistivity (ρ) : Conductivity (σ) = ρ^2 :1
T ↑, ρ↑

45. An electric charge in uniform motion produces
a) an electric field only
b) a magnetic field only
c) both electric & magnetic field
d) no such field at all

When a charged particle is at rest then it only creates an electric field around it. When a charged particle is moving with a constant velocity creates both electric fields as well as the magnetic field around it.

46. When light waves interfere then the quantity that conserved is
a) intensity b) energy
c) mass d) amplitude

47. Wavelength of matter wave is independent of
a) mass b) velocity
c) momentum d) charge

$$\frac{1}{2}mv^2 = \frac{hc}{\lambda}$$

48. When we apply reverse bias to a junction diode, it
a) lower the potential barrier
b) raises the potential barrier
c) increases the majority carrier current
d) increases the minority carrier current

During reverse biasing condition majority charge carriers (Holes in p–type and electrons in N– type) are pulled away from junction. So, depletion layer increases and hence the potential barrier increases.

49. The largest wavelength of particle moving with same velocity will be for
a. α-particle b. proton
c. β-particle d. neutron

$$m_\beta < m_p < m_n < m_\alpha \Rightarrow \lambda_\beta > \lambda_p > \lambda_n > \lambda_\alpha$$

50. The impurity atom which should be doped in pure silicon to make p type of semiconductor is
a. phosphorus b. antimony
c. boron d. arsenic

BAG (Boron, Aluminium, Gallium) is used to make p type of semiconductor.

51. The equivalent weight of an element is 4. Its chloride has a vapor density 59.25. Then the valency of the element is
a) 4 b) 3
e) 2 d) 1

Valency of metal
$$= \frac{\text{Mol. we. of metal chloride}}{\text{Eq.wt. of metal} + 35.5} = \frac{2\times 59.25}{4 + 35.5}$$
= 3 [Mol. wt = 2× V.D.]

52. The maximum number of electrons present in a 3d orbital is
a) 2 b) 6
c) 10 d) 14

3d orbital → 2 and 3d-subshell →10

53. Which of this is non-polar molecule with polar covalent bond?
a) SO_2 b) NH_3
c) CO d) $BeCl_2$

For a non–polar molecule with polar covalent bond;

(i) the central atom must not have lone pair of electrons.
(ii) the surrounding atoms must be same.

54. In which of these compounds iron has least oxidation number
a) $Fe_2(SO_4)_3$ b) $[Fe(CN)_6]^{-3}$
c) $Fe(CO)_5$ d) Fe_3O_4

$Fe_2(SO_4)_3 \longrightarrow +3$
$[Fe(CN)_6]^{3-} \longrightarrow +3$
$Fe_2O_3 \longrightarrow 8/3$
$Fe(CO)_5 \longrightarrow 0$
In case of complex compounds having neutral ligands (H_2O, NH_3, PH_3, CO, NO) ON is O due to neutral ligands.

55. HNO_3 can be stored in vessels made up of
a) Fe b) Al
c) Zn d) Mg

HNO_3 makes a layer with Al and becomes passive

56. Bromine is manufactured from?
a) Sea-weeds b) Caliche
c) Carnallite d) Petroleum

Carnalite, sea water $\longrightarrow$ Bromine

57. Which of this is incorrect match of ore and metal?
a) Calamine -Zn b) Cinnabar- Hg
c) Siderite - Fe d) Bauxite – Cu

Copper $\longrightarrow$ Malachite($CuCO_3.Cu(OH)_2$), Cuperite (Cu_2O)
Aluminium $\longrightarrow$ Bauxite ($Al_2O_3.2H_2O$)

58. Who synthesized the first organic compound starting from elements
a) Wohler b) Kolbe
c) Berzelius d) Huckel

Wohler $\longrightarrow$ synthesized first organic compound (urea)
Kolbe $\longrightarrow$ Synthesized first organic compound starting from elements (acetic acid)

59. In carbocation, the hybridization of carbon atom is
a) Sp b) Sp^2
c) Sp^3 d) dSp^2

60. The product of electrolysis of potassium acetate is
a) Ethyne b) Ethene
c) Ethane d) Methane

Electrolysis of :
(i) Pot. acetate $\longrightarrow$ ethane
(ii) Pot. succinate $\longrightarrow$ ethene
(iii) Pot. maleate / funerate $\longrightarrow$ ethyne

SECTION -II

Select the best alternatives: [40 x 2=80]

Read the passage carefully and put the correct answer on the answer sheet given:

It is to progress in the human sciences that we must look to undo the evils which have resulted from a knowledge of the physical world hastily and superficially acquired by populations unconscious of the changes in themselves that the new knowledge has made imperative. The road to a happier world than any known in the past lies open before us if atavistic destructive passions can be kept in leash while the necessary adaptations are made. Fears are inevitable in our time, but hopes are equally rational and far more likely to bear good fruit. We must learn to think rather less of the dangers to be avoided than of the good that will lie within our grasp if we can believe in it and let it dominate our thoughts. Science, whatever unpleasant consequences it may have by the way, is in its very nature a liberator, a liberator of bondage to physical nature and in to come, a liberator from the weight of destructive passions. We are on the threshold of utter disaster or unprecedently glorious achievement. No previous age has been fought with problems so momentous; and it is to science that we must look to for a happy future.

Questions:

61. What does science liberate us from?
It liberates us from
a. bondage to physical nature
b. fears and destructive passions
c. idealistic hopes of a glorious future
d. slavery to physical nature and from passions

62. To carve out a bright future, a man should
a. try to avoid dangers

b. overcome fears and dangers
c. cultivate a positive outlook
d. analyse dangers that lie ahead

63. If man's bestial yearning is controlled
a. the present will be brighter than the future
b. the present will become tolerant
c. the future will be brighter than the present
d. the future will be tolerant

64. Fears and hopes, according to the author
a. can yield good results
b. can bear fruit
c. are irrational
d. are closely

65. In ΔABC, cosec A (sin B cos C + cos B sin C) is equal to
a. 2sin B
b. sin 2A
c. 1
d. none

cosecA (sinB cosC + cosB sinC) = cosecA. sin(B + C)
= cosecA . sinA = 1
Trick: Suppose the triangle is equilateral triangle
(i.e. A = B = C =60°) . Then, cosec60° (sin60°. cos60° + cos60°.sin60°) = 1

66. The value of $\frac{a + bw + cw^2}{b + cw + aw^2}$ =
a. w^2
b. w
c. w^3
d. 0

$\frac{w}{w}\left[\frac{a + bw + cw^2}{b + cw + aw^2}\right] = w\left[\frac{a + bw + cw^2}{bw + cw^2 + a}\right] = w$
$[w^3 = 1]$

67. If y= log (logx) then $e^y . \frac{dy}{dx}$ =
a. l/x
b. x
c. l
d. –l

$y = \log(\log x) \Rightarrow e^y = \log x \Rightarrow \frac{d}{dx}(e^y) = \frac{d}{dx}(\log x)$.
$\Rightarrow e^y . \frac{dy}{dx} = \frac{1}{x}$

68. The value of the $\lim_{x \to 0} \frac{e^{ax} - e^{bx}}{\sin x}$ =
a. $\frac{a - b}{2}$
b. $\frac{e^{ax} - e^{bx}}{2}$
c. (a + b)
d. (a – b)

Use L– Hospital rule (valid when the result is $\frac{0}{0}$ or $\frac{\infty}{\infty}$)
Which suggest differentiating numerator and denominator separately.
$\lim_{x \to 0} \frac{e^{ax} - e^{bx}}{\sin x}\left[= \frac{0}{0}\right] = \lim_{x \to 0} \frac{ae^{ax} - be^{bx}}{\cos x} = a - b$

69. Out of 8 questions, a candidate has to answer 4 questions. In how many ways can he answer if Q.N. 5 is compulsory?
a. $^8C_3$
b. $^7C_3$
c. $^8C_4$
d. $^7C_4$

Combination of n objects taking r at a time if q particular objects are always included is c(n – q, r – q).

70. In an ellipse the distance between its foci is 6 and its minor axis is 8, the eccentricity of the ellipse is
a. $\frac{4}{5}$
b. $\frac{3}{5}$
c. $\frac{3}{\sqrt{7}}$
d. $\frac{4}{\sqrt{7}}$

distance between two foci = 2ae $\therefore$ ae = 3 minor axis = 2b $\Rightarrow$ b = 4
$e = \sqrt{1 - \frac{b^2}{a^2}} \Rightarrow a = \sqrt{(ae)^2 + b^2} = 5$
$\therefore e = \frac{3}{5}$

71. Two parabolas $x^2 = 4y$ and $y^2 = 4x$ meet in two distinct points. One of them is origin then the other is
a. (2,–2)
b. (4, –2)
c. (3,1)
d. (4,4)

$x^2 = 4y$ and $y^2 = 4x$ — (i) are the given equations of parabola.
$(x^2/4)^2 = 4x$
$x^4 - 64x = 0$
$x = 0, x = 4$

Substitute the values of x in equation (i), y = 0 and y = 4, – 4

The points of intersection are (0, 0) and (4, 4).

The other point of origin is (4, 4).

72. Value of the integral $\int_{\pi/6}^{\pi/2} \frac{dx}{1-\cos 2x}$ =

a. $\frac{1}{2}$ b. $\frac{1}{\sqrt{3}}$

c. $-\frac{\sqrt{3}}{2}$ d. $\frac{\sqrt{2}}{3}$

$$\int_{\pi/2}^{\pi/6} \frac{dx}{1-\cos 2x} = \int_{\pi/2}^{\pi/6} \frac{dx}{2\sin^2 x} = \frac{1}{2}\int_{\pi/2}^{\pi/6} \operatorname{cosec}^2 x$$

$$= \frac{1}{2}[-\cot x]_{\pi/2}^{\pi/6} = -\frac{1}{2}[\cot \pi/6 - \cot \pi/2]$$

$$= -\frac{\sqrt{3}}{2}$$

73. A 6 ft. man walks away from a 10ft. lamp post at the rate of 5 miles per hour. How fast does the end of the shadow move?

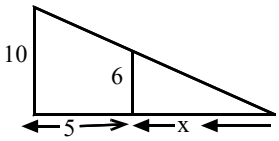
a. 12.5 miles/hr b. 10 miles/hr

c. 25 miles/hr d. 5miles/hr

Let the shadow move at the rate of x mph from man.

Then $\frac{10}{6} = \frac{5+x}{x}$

$\Rightarrow x = 7.5$



So the end of the shadow move at the rate of 12.5 mph (7.5 + 5) from the lamp post.

74. One root of the equation $x^2 - px + q = 0$ is twice the other then

a. $4p = 9q$ b. $p^2 + q = 4$

c. $pq = 1$ d. $2p^2 = 9q$

$\alpha + 2\alpha = p$, $\alpha.2\alpha = q \Rightarrow 2p^2 = 9q$

75. A function f: R→ R defined by f(x) = (3x –1) where R is the set of real no. is

a. one to one

b. onto only

c. one to one and onto

d. one to one into function

If the function is linear then it is one to one and onto for all R → R and some N → N.

76. $\int \frac{dx}{(2x+1)\sqrt{4x+3}}$ =

a. $\frac{1}{2}\log\frac{\sqrt{4x+3}-1}{\sqrt{4x+3}+1} + c$

b. $\sin^{-1}(2x+1) - \sqrt{4x+3} + c$

c. $\log\left(\frac{\sqrt{4x+3}}{2x+1}\right) + c$

d. $\tan^{-1}\frac{2x+1}{4} - \sqrt{4x+3} + c$

Let $z^2 = 4x + 3 \Rightarrow x = \frac{z^2-3}{4}$ $\therefore \frac{zdz}{2} = dx$

$$\therefore \int \frac{dx}{(2x+1)\sqrt{4x+3}}$$

$$= \frac{1}{2}\int \frac{z.dz}{\left[2\left(\frac{z^2-3}{4}\right)+1\right]z} = \int \frac{dz}{z^2-1}$$

$$= \frac{1}{2}\log\left(\frac{z-1}{z+1}\right) = \frac{1}{2}\log\left(\frac{\sqrt{4x+3}-1}{\sqrt{4x+3}+1}\right) + c$$

77. The distance between the parallel planes $2x - 2y + z + 1 = 0$ and $4x - 4y + 2z + 3 = 0$ is

a. 1/2 b. 1/3

c. 3/7 d. 1/6

The distance between two parallel planes $ax + by + cz + d_1 = 0$ & $ax + by + cz + d_2 = 0$ is $= \frac{|d_1 - d_2|}{\sqrt{a^2+b^2+c^2}}$

78. The product of length of perpendicular drawn from (1,2) to two lines of $x^2 - 5xy - 4y^2 = 0$ in square units is.

a. $\frac{5}{\sqrt{2}}$ b. $\frac{10}{\sqrt{2}}$

c. $\frac{25}{\sqrt{2}}$ d. $\frac{20}{\sqrt{2}}$

The product of length of $\perp^r$ drawn from (x_1,y_1) to the two lines of $ax^2 + 2hxy + by^2 = 0$ is $\left|\frac{ax_1^2 + by_1^2 + 2hx_1y_1}{\sqrt{(a-b)^2+4h^2}}\right|$ sq. unit.

79. The values of $\sec^2(\tan^{-1}2) + \operatorname{cosec}^2(\cot^{-1}3)$ =

a. 5 b. 10

c. 15 d. 20

$\sec^2(\tan^{-1}2) + \text{cosec}^2(\cot^{-1}3)$
$= 1 + \tan^2(\tan^{-1}2) + 1 + \cot^2(\cot^{-1}3)$
$= 1 + 4 + 1 + 9 = 15$

80. The speed of a man with water current and against water current is 15 km/hr and 5 km/hr then speed of water is

a. 15km/hr b. 10 km/hr
c. 5 km/hr d. 2.5km/hr

$x \rightarrow$ speed of man & $y \rightarrow$ speed of water
$x + y = 15$ ...(i) and $x - y = 5$.....(ii)
Solving equ. we get, $x = 10$ and $y = 5$

81. The height from the surface of earth at which acceleration due to gravity is the same at a depth of 160 km below the surface of earth is, if radius of earth is 6400 km.

a. 40km b. 60km
c. 80km d. 120km

$\left(1-\frac{2h}{R}\right) = \left(1-\frac{d}{R}\right)$

82. A small sphere which has a small hole in it is immersed in water to a depth of 40 cm before any water is penetrated into it. The radius of hole if the surface tension of water is 73×10^{-3} Nm^{-1}

a. 1.85×10^{-5} m b. 3.7×10^{-5} m
c. 5.4×10^{-5} m d. 7.2×10^{-5} m

$(\pi r^2) \times (\rho gh) = (2\pi r) \times T$

83. A rubber ball of mass l0g and volume 15 cc is dipped in water to a depth of 10m. The time taken to reach the surface is

a. 1sec b. 1.5 sec
c. 2sec d. 3 sec

$U - mg = ma \Rightarrow a = 0.5g$
$\text{time (t)} = \sqrt{\frac{2h}{a}}$

84. A room is at 20°C is heated by a heater of resistance 20Ω connected to 200 V. Heat is transmitted through window of 1 m^2 and thickness 0.2 cm. The temperature outside the room, if conductivity of glass is 0.2 cal/m °C sec

a. 12.12°C b. 14.5°C
c. 15.24°C d. 18.54°C

$\frac{v^2}{R} \times \text{time (t)} = \frac{KA(\theta_1 - \theta_2)}{\ell} \times t$

85. The equation of motion of an object is $x = 1.2 \cos(0.5\,t + \pi/4)$m. The maximum acceleration is

a. 0.05 m/s^2 b. 0.3 m/s^2
c. 2 m/s^2 d. 2.25 m/s^2

$x = 1.2\cos(0.5t + \pi/4)$
Compare this with $x = a\cos(wt + \phi)$
$\therefore$ amplitude, $a = 1.2$, $w = 0.5$, Accl^n max^m $= -w^2a = 0.3$

86. In a single slit experiment the first minimum of red light 660 nm coincides with first maxima for the wavelength

a. 660 nm b. 550 nm
c. 510 nm d. 440 nm

Single slit experiment $\rightarrow$ diffraction.
$\frac{n\lambda D}{d} = \frac{(2n+1)\lambda' D}{2d} \Rightarrow \lambda' = 440\text{nm}.$
(minima) (maxima)

87. A uniform copper wire of mass 2.23×10^{-3} kg carries a current of 1A . When 1.7 V is applies across it. The length of wire of density 8.92×10^3 kg/m^3& resistivity $1.7 \times 10^{-8}\Omega m$ is

a. 1.5m b. 2.5m
c. 5m d. 7.5m

$R = \frac{\rho\ell}{A} \Rightarrow R = \frac{\rho\ell}{\text{volume}}$
$\therefore \frac{V}{I} = \frac{\rho\ell^2 \times \text{density}}{\text{mass}}$

88. A circular coil of 500 turns has a radius of 2 m and carries a current of 2 A. The magnetic field at a point on axis of coil at a distance equal to radius of coil from centre is

a. 1.1×10^{-3}T b. 1.1×10^{-4} T
c. 1.1×10^{-5} T d. 1.1×10^{-6} T

$B = \frac{\mu_0 NIR^2}{2(R^2 + x^2)^{3/2}}$ [x = R]

89. A 20 V, 750 Hz source is connected to a series combination of R = 100Ω, C = 100μF and L =

0.1803 H. The time in which resistance of thermal capacity 2 J/°C is heated by 10°C is

a. 174 sec b. 274 sec

c. 348 sec d. 478 sec

$z = \sqrt{R^2 + (wL - 1/wC)^2} = 833.99$ [R = 100Ω]

$I = E/z = 0.024$ & $H = I^2Rt$

90. An object is placed 0.4 m from a convex mirror and a plane mirror is placed at a distance of 0.36 m from the object. The image formed in the two mirror coincide. The focal length of convex mirror is

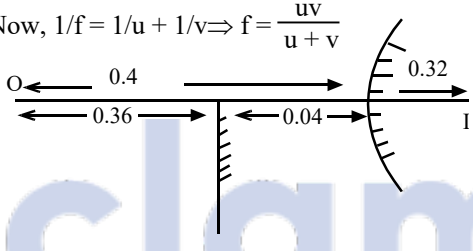
a. 0.2m b. 0.3m

c. 0.4m d. 0.6m

u = 0.4m

v = 0.32 m

Now, $1/f = 1/u + 1/v \Rightarrow f = \frac{uv}{u+v}$



91. A parallel beam of light is incident normally on a plane surface absorbing 40% of the light and reflecting rest. The incident beam is 10 W, then force exerted will be

a. 5.33×10^{-7} N b. 5.33×10^{-8} N

c. 1.33×10^{-9}N d. 1.33×10^{-11} N

Change in momentum (Δp) = P – (– 0.6P)

[60% of light is reflected]= 1.6P

Momentum(p) = Power /c

$[\therefore \lambda = \frac{h}{p}$ and power $\left(\frac{\text{Energy}}{t(1)}\right) = \frac{hc}{\lambda}]$

$\text{Force} = \frac{\Delta p}{t(1\text{sec})} = \frac{1.6P}{c} = \frac{1.6 \times 10}{c}$

$= \frac{16}{c} = 5.33 \times 10^{-8}$ N

92. The wavelength of 2nd line of Balmer series is 4861 Å, then wavelength of 1st line of same series is

a. 4861Å b. 5252Å

c. 6262Å d. 6562 Å

$\frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \Rightarrow \frac{1}{\lambda} = R\left[\frac{1}{2^2} - \frac{1}{4^2}\right]$

$\therefore R = \frac{16}{3\lambda}$ & $\frac{1}{\lambda'} = R\left[\frac{1}{2^2} - \frac{1}{3^2}\right]$

$\Rightarrow \lambda' = 6562$ Å.

93. A sample of radioactive material has an activity of 9×10^{12} Becquerel. The material has half life of 80 sec. The time after which activity fall to 2×10^{12} Becquerel is

a. 173.6 sec b. 133.4 sec

c. 95.8 sec d. 52 sec

$A = A_0 e^{-\lambda t} \Rightarrow \frac{2 \times 10^{12}}{9 \times 10^{12}} = e^{-\frac{0.693}{80} \times t}$

$\log\left(\frac{2}{9}\right) = -\frac{0.693}{80} \times t \Rightarrow t = 173.6$ sec.

94. 2gram of silver were deposited by passing 1A current through $AgNO_3$ solution for 35minutes. The efficiency of the current is

a. 78% b) 81%

c) 85% d) 91%

$W = zIt \Rightarrow z = \frac{108}{96500} \times \frac{x}{100} \times 1 \times 35 \times 60 \Rightarrow x =$ 85%

95. 3.55 grams of hydrated metal carbonate $M_2CO_3 . xH_2O$ was dissolved in 100cc of solution. 10cc of the solution required 8cc of 0.625N alkali for neutralization. The value of x is (At. wt. of M= 23)

a. 2 b. 5

c. 7 d. 10

96. The ksp of CaF_2 is 3.95×10^{-11}. The concentration of F^- ion in saturated solution of CaF_2 is

a. 2.14×10^{-4} mols/litre

b) 6.28×10^{-6} mols/litre

c. 4.24×10^{-4} mols/litre

d) 1.25×10^{5} mols/ litre

$CaF_2 \quad Ca^{++} + 2F^-$

s s 2s

For CaF_2: $K_{sp} = 4S^3 \therefore S = 2.1 \times 10^{-4}$ mol/litr

$[F^-] = 2 \times S = 4.2 \times 10^{-4}$ mols/litre.

97. The ratio of number of moles of sodium, calcium and aluminium formed by passing same amount of current through molten NaCl, $CaCl_2$& Al_2O_3 is

a. 1:1:1 b. 1:2:3

c. 3:2:1 d. 6:3:2

98. The gas formed by heating Cu with conc. H_2SO_4 is dehydrated using

a. P_2O_5 b. CaO

c. $CaCl_2$ d. conc.H_2SO_4

$Cu + conc.\ H_2SO_4 \rightarrow CuSO_4 + SO_2 + H_2O$

SO_2 is dehydrated using conc. H_2SO_4

99. The product formed by hydrolysis of calcium carbide on rxn with dil. H_2SO_4 in presence of $HgSO_4$ gives

a. acetaldehyde b. acetone

c. formic acid d. acetic acid

100. An alkene "X" on ozonolysis gave acetone and acetaldehyde. The product formed by reacting X with HBr in presence of peroxide is

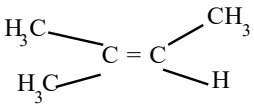
a. 2-bromo -2 -methyl butane

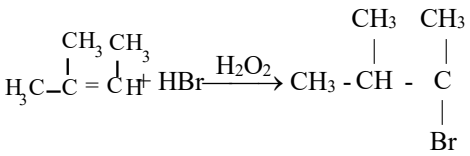
b. 2 -bromo - 3 - methyl butane

c. 2 - bromo -2 - methyl propane

d. 2- bromo pentane

To give acetone & acetaldehyde, the structure should be





(2 - bromo - 3 - methyl butane)