ATOMIC ENERGY EDUCATION SOCIETY

Anushaktinagar, Mumbai-400 094

2015 – Open Candidates Examination

Post – PGT (Mathematics)
Time – 1 Hour 30 Minutes

Date – 27.09.2015
Maximum Marks – 50

Instructions

1. There are 50 Multiple Choice Questions (MCQ) in this paper. Each question carries 1 mark. There will be negative marking of 0.25 per wrong answer.
2. Answer should be darkened/marked in the OMR answer sheet only.
3. Use of any electronic gadget (e.g. calculator, mobile phone, etc.) is not permitted, in the examination hall.
4. In case a candidate has not signed the Attendance Sheet or the OMR Answer Sheet is not signed by the Invigilator, it will be dealt with as a case of unfair means.
5. On completion of the test, the candidates MUST HAND OVER THE OMR ANSWER SHEET AND QUESTION PAPER TO THE INVIGILATOR in the room/hall.
6. The candidates should ensure that the OMR answer sheet is not folded or damaged.

To be filled by the candidate

Name of the Candidate: _____

Roll Number: _____

OMR Number: _____

No of printed pages –8

Q.1 Equivalent matrices are obtained by:

a) taking inverse
(b) taking transposes
c) taking adjoints
(d) taking finite number of elementary transformations

Q.2 In a homogenous system $\rho(A) <$ the number of unknowns then the system has:

(a) only trivial solution
(b) trivial solution and infinitely many solutions
(c) only non-trivial solutions
(d) no solution

Q.3 Let $\underset{u}{\rightarrow}, \underset{v}{\rightarrow}$ and $\underset{w}{\rightarrow}$ be vectors such that $\underset{u}{\rightarrow} + \underset{v}{\rightarrow} + \underset{w}{\rightarrow} = \underset{0}{\rightarrow}$. If $\left|\underset{u}{\rightarrow}\right| = 3$, $\left|\underset{v}{\rightarrow}\right| = 4$ and $\left|\underset{w}{\rightarrow}\right| = 5$ then $\underset{u \cdot v}{\rightarrow\rightarrow} + \underset{v \cdot w}{\rightarrow\rightarrow} + \underset{w \cdot u}{\rightarrow\rightarrow}$:

(a) 25
(b) -25
(c) 5
(d) $\sqrt{5}$

Q.4 The equation of the tangent to the curve $y = x^3$ at (1,1):

(a) $x - 10y + 50 = 0$
(b) $3x - y - 2 = 0$
(c) $x + 3y - 4 = 0$
(d) $x + 2y - 7 = 0$

Q.5 If $Z_1 = a + ib$, $Z_2 = -a + ib$ then $Z_1 - Z_2$ lies on:

(a) real axis
(b) imaginary axis
(c) the line $y = x$
(d) the line $y = -x$

Q.6 A matrix of order 3 X 3 has determinant. The value of $|3A|$:

(a) 36
(b) 12
(c) 108
(d) 432

Q.7 Which of the following statement is incorrect?

(a) Initial velocity means velocity at $t = 0$
(b) Initial acceleration means acceleration at $t = 0$
(c) If the motion is upward, at the same maximum height, the velocity is not zero.
(d) If the motion is horizontal $v = 0$ when the particle comes to rest.

Q.8 The value of $\int_0^{\pi} sin^4 x \, dx$:

(a) $\frac{3\pi}{16}$
(b) $\frac{3}{16}$
(c) 0
(d) $\frac{3\pi}{8}$

Q.9 The differential equation of the family of lines $y = mx$:

(a) $\frac{dy}{dx} = m$ (b) $y\,dx - x\,dy = 0$

(c) $\frac{d^2y}{dx^2} = 0$ (d) $y\,dx + x\,dy = 0$

Q.10 If $u = \sin^{-1}\left(\frac{x^4+y^4}{x^2+y^2}\right)$ and $f = \sin u$ then f is a homogenous function of degree

(a) 0 (b) 1

(c) 2 (d) 4

Q.11 The curve $ay^2 = x^2\,(3a - x)$ cuts the $y - axis$ at:

(a) $x = -3a,\ x = 0,$ (b) $x = 0, x = 3a$

(c) $x = 0, x = a$ (d) $x = 0$

Q.12 Which of the following curve is concave down?

(a) $y = -x^2$ (b) $y = x^2$

(c) $y = e^x$ (d) $y = x^2 + 2x - 3$

Q.13 The length of the semi major and length of the minor axis of the ellipse $\frac{x^2}{144} + \frac{y^2}{169} = 1$ are:

(a) 26, 12 (b) 13, 24

(c) 12, 26 (d) 13, 12

Q.14 The function $f(x) = x^2 - 5x + 4$ is increasing in:

(a) $(-\infty, 1)$ (b) $(1, 4)$

(c) $(4, \infty)$ (d) everywhere

Q.15 A particular integral of $(D^2 - 4D + 4)y = e^{2x}$ is:

(a) $\frac{x^2}{2}\ e^{2x}$ (b) xe^{2x}

(c) xe^{-2x} (d) $\frac{x}{2}\ e^{-2x}$

Q.16 If 2 cards are drawn from a well shuffled pack of 52 cards, the probability that they are of the same colour is:

(a) $\frac{1}{2}$ (b) $\frac{26}{51}$

(c) $\frac{25}{51}$ (d) $\frac{25}{102}$

Q.17 If x is normally distributed with mean 6 and standard deviation 5 and z is the corresponding normal variate. The $p(0 \leq x \leq 8)$:

(a) $P(-1.2 < z < .04)$ (b) $P(-0.12 < z < .4)$

(c) $P(-1.2 < z < 0.4)$ (d) $P(-0.12 < z < .04)$

Q.18 $\left(1 + i\sqrt{3}\right)^n + \left(1 - i\sqrt{3}\right)^n$:

(a) $2^{n+1}\, cos\frac{n\pi}{3}$ (b) $2^{n+1}\, sin\frac{n\pi}{3}$

(c) $2^{n-1}\, cos\frac{n\pi}{3}$ (d) $2^{n-1}\, sin\frac{n\pi}{3}$

Q.19 If A= [2 0 1], then rank of AA^T :

(a) 1 (b) 2

(c) 3 (d) 0

Q.20 The value of 'c' on Rolle's Theorem for the function $f(x) = cos\,\frac{x}{2}$ on $[\pi, 3\pi]$

(a) 0 (b) 2π

(c) $\frac{\pi}{2}$ (d) $\frac{3\pi}{2}$

Q.21 For any vector $\underset{a}{\rightarrow}$, $\vec{\imath} \times (\vec{a} \times \vec{\imath}) + \vec{\jmath} \times (\vec{a} \times \vec{\jmath}) + \vec{k} \times \left(\vec{a} \times \vec{k}\right)$ is:

(a) $2\vec{\imath}$ (b) $2\vec{\jmath}$

(c) $2\vec{k}$ (d) $2\vec{a}$

Q.22 An asymptote to the curve $y^2\,(a + 2x) = x^2(3a - x)$ is:

(a) $x = 3a$ (b) $x = -\frac{a}{2}$

(c) $x = \frac{a}{2}$ (d) $x = 0$

Q.23 In the set of real numbers R, an operation $*$ is defined by $a * b = \sqrt{a^2 + b^2}$. Then the value of $(3 * 4) * 5$:

(a) 5 (b) $5\sqrt{2}$

(c) 25 (d) 50

Q.24 The two positive numbers whose product is 100 and whose sum is minimum:

(a) 20,5 (b) 10,10

(c) 4, 25 (d) 2, 50

Q.25 The Cartesian equation of the plane passing through the points (2,2,-1), (3,4,2) and (7,0,6) is:

(a) $5x + 2y - 3z = 17$ (b) $5x + 3y - 2z = 17$

(c) $2x + 5y - 3z = 17$ (d) $-3x + 5y + 2z = 17$

Q.26 The centre and radius of the sphere $\left|2\vec{r} + (3\vec{\imath} - \vec{\jmath} + 4\vec{k})\right| = 4$:

(a) centre=$(\frac{3}{2}, \frac{-1}{2}, 2)$ and radius=2 (b) centre=$(\frac{-3}{2}, \frac{1}{2}, -2)$ and radius=2

(c) centre=$(\frac{3}{2}, \frac{-1}{2}, 2)$ and radius=1 (d) centre=$(\frac{-3}{2}, \frac{-1}{2}, 2)$ and radius=1

Q.27 If $x = a \sin pt$ and $y = b \cos pt$, then the value of $\frac{d^2y}{dx^2}$ at $t = 0$:

(a) $-\frac{b}{a^2}$ (b) $-\frac{a}{b^2}$

(c) $\frac{a}{b^2}$ (d) $\frac{b}{a^2}$

Q.28 If a, b, c are in A.P. then the determinant

$$\begin{vmatrix} x+2 & x+3 & x+2a \\ x+3 & x+4 & x+2b \\ x+4 & x+5 & x+2c \end{vmatrix}$$ is :

(a) 1 (b) 0

(c) x (d) $2x$

Q.29 The direction cosines of a line which makes equal angles with the coordinate axes are:

(a) $(0, \frac{-1}{\sqrt{2}}, \frac{1}{\sqrt{2}})$ (b) $(1, 0, 1)$

(c) $(\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}})$ or $(\frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}})$ (d) $(\frac{-9}{11}, \frac{6}{11}, \frac{-2}{11})$

Q.30 Let L_1 and L_2 be two parallel lines with equation $\vec{r} = \vec{a}_1 + \lambda\vec{b}$ and $r = \vec{a}_2 + \lambda\vec{b}$ respectively. The shortest distance between them is:

(a) $d = \left|\frac{\vec{b} \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|}\right|$ (b) $d = \left|\frac{\vec{b} \cdot (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|}\right|$

(c) $d = \left|\frac{\vec{a}_1 \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|}\right|$ (d) $d = \left|\frac{\vec{a}_2 \times (\vec{a}_2 - \vec{a}_1)}{|\vec{b}|}\right|$

Q.31 If A and B are two events such that $P(A) = \frac{1}{4}$, $P(B) = \frac{1}{3}$ and $P(A \cup B) = \frac{1}{2}$ then A and B are:

(a) *not independent events* (b) *mutually exclusive events*

(c) *independent events* (d) *complementry events*

Q.32 $\int_{\frac{-\pi}{2}}^{\frac{\pi}{2}} \sin^2 x \, dx$ is:

(a) $\frac{\pi}{4}$ (b) $\frac{\pi}{2}$

(c) π (d) 0

Q.33 The area under the given curve and given lines:
$y = x^4,\ x = 1,\ x = 5$ and $x - axis$

(a) $\frac{3124}{3}\ sq.units$ (b) $\frac{3124}{7}\ sq.units$

(c) $\frac{3124}{5}\ sq.units$ (d) $\frac{3124}{9}\ sq.units$

Q.34 The total length of the curve $x^{2/3} + y^{2/3} = a^{2/3}$:

(a) $3a$ (b) $4a$

(c) $6a$ (d) $8a$

Q.35 Let $f(x) = \tan^{-1}(\frac{1+\cos x}{\sin x})$ and $g(x) = \tan^{-1}(\frac{\sin x}{1-\cos x})$.
$\int (f(x) + g(x))dx =$

(a) $\frac{\pi x}{2} - \frac{x^2}{4} + c$ (b) $\pi x - \frac{x^2}{2} + c$

(c) $\pi x + \frac{x^2}{4} + c$ (d) $\pi x + \frac{x^2}{2} + c$

Q.36 Let a relation R on the Set A of real numbers be defined as
$(a, b) \in R \Rightarrow 1 + ab > 0$ for all $a, b \in A$. The Relation R is:

(a) $Reflexive$ (b) $Symmetric$

(c) $transitive$ (d) $Reflexive\ and\ Symmetric$

Q.37 A Parallelepiped is formed by planes drawn parallel to co-ordinate axes through the point A=(1, 2, 3) and B=(9, 8, 5). The volume of parallelepiped is equal to (in cubic units)

(a) 192 (b) 48

(c) 32 (d) 96

Q.38 There are n locks and n matching keys. If all the locks and keys are to be perfectly matched, then maximum number of trials is equal to:

(a) ${}^{n}C_2$ (b) ${}^{n-1}C_2$

(c) ${}^{n+1}C_2$ (d) $n!$

Q.39 The number of terms in $(a_1 + a_2 + a_3 + a_4)^3$ is:

(a) 64 (b) 81

(c) 30 (d) 20

Q.40 $\lim_{x\to 1} \frac{x^{n+1}-(n+1)x+n}{(x-1)^2}$

(a) $n(n+1)$ (b) $\frac{n(n+1)}{2}$

(c) $n+1$ (d) $\frac{3n}{2}$

Q.41 If f is an increasing function and g is a decreasing function such that $g(f(x))$ exist, then:

(a) $g(f(x))$ is an increasing function

(b) $g(f(x))$ is an decreasing function

(c) $g(f(x))$ is an constant function

(d) nothing can be said

Q.42 B and C are fixed points having co-ordinates $(3,0)$ and $(-3,0)$ respectively. If the vertical angle BAC is $90°$, then the locus of the centroid of the ΔABC has the equation:

(a) $x^2 + y^2 = 1$ (b) $x^2 + y^2 = 2$

(c) $9(x^2 + y^2) = 1$ (d) $9(x^2 + y^2) = 4$

Q.43 A vertical tower stands on a declivity which is inclined at $15°$ to the horizon from the foot of the tower a man ascends the declivity for 80 feet. And then finds that the tower subtends an angle of $30°$. The height of the tower in feet:

(a) 80 (b) 160

(c) $80\sqrt{3}$ (d) $40(\sqrt{6} - \sqrt{2})$

Q.44 If α and β are the roots of the equation $x^2 + x + 1 = 0$ then $\alpha^2 + \beta^2$ is equal to:

(a) 2 (b) 1

(c) -1 (d) -2

Q.45 The sum of all natural numbers lying between 100 and 1000 which are multiples of 5:

(a) 98450 (b) 179

(c) 8450 (d) 995

Q.46 The sum of the product of the corresponding terms of the sequence $2, 4, 8, 16, 32$ and $128, 32, 8, 2, \frac{1}{2}$:

(a) 946 (b) 496

(c) 649 (d) 780

Q.47 The points $(a, 0)$, $(0, b)$, and $(1, 1)$ are collinear if: $\frac{1}{a} + \frac{1}{b} =$

(a) 2 (b) 3

(c) 1 (d) 0

Q.48 $a_1, a_2, \ldots a_{24}$ are in A.P. and $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 300$ the sum of first 24 terms of the A.P.

(a) 1800 (b) 1200

(c) 600 (d) 900

Q.49 The equation of the curve passing through point $(0, \frac{\pi}{4})$ whose differential equation is $\sin x \cos y \, dy + \cos x \sin y \, dy = 0$:

(a) $\sin x \cos y = \sqrt{2}$ (b) $\sin x \sin y = c$

(c) $\cos x \cos y = 2$ (d) $\sec x \sec y = \sqrt{2}$

Q.50 A perpendicular distance of a corner of a unit cube from a diagonal not passing through it is:

(a) $\sqrt{\frac{3}{2}}$ (b) $\sqrt{\frac{2}{3}}$

(c) $\sqrt{\frac{3}{4}}$ (d) $\sqrt{\frac{4}{3}}$

*****

OPEN ADVERTISEMENT CANDIDATE EXAM-2015

PGT (MATHEMATICS)

ANSWERS KEY

1. D
2. B
3. B
4. B
5. A
6. C
7. C
8. D
9. B
10. C
11. D
12. A
13. B
14. C
15. A
16. C
17. C
18. A
19. A
20. B
21. D
22. B
23. B
24. B
25. A
26. B
27. A
28. B
29. C
30. A
31. C
32. B
33. C
34. C
35. B
36. D
37. D
38. C
39. D
40. B
41. B
42. D
43. D
44. C
45. A
46. B
47. C
48. B
49. A
50. B