अधिव्याख्याता, गणित, शासकीय तंत्र निकेतन, ... परीक्षा-2014

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परीक्षा दि-9-3-2014

CODE :

प्रश्नपुस्तिका क्रमांक
BOOKLET NO.

प्रश्नपुस्तिका
चाळणी परीक्षा
गणित

वेळ : 3 (तीन) तास

एकूण प्रश्न : 80
एकूण गुण : 200

सूचना

(1) सदर प्रश्नपुस्तिकेत 80 अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. असा तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.

परीक्षा-क्रमांक

केंद्राची संकेताक्षरे — शेवटचा अंक

(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तरक्रमांक नमूद करताना तो संबंधित प्रश्नक्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नाकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच "उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार पर्यायांपैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चार चुकीच्या उत्तरांसाठी एका प्रश्नाचे गुण वजा करण्यात येतील".**

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82" यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरूद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

SEAL

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. Changing the order of the integration in the double integral

$I=\int_{0}^{8}\int_{x/4}^{2} f(x,y)\,dy\,dx$ leads to $I=\int_{r}^{s}\int_{p}^{q} f(x,y)\,dx\,dy$. What is q ?

(1) $4y$ (2) $16y^2$ (3) x (4) 8

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2. If $\int_{-a}^{b} f\,dx$ and $\int_{a}^{-b} f\,dx$ are lower and upper Riemann integrable on [a, b] then :

(1) $\int_{-a}^{b} f\,dx \geqslant \int_{a}^{-b} f\,dx$ (2) $\int_{-a}^{b} f\,dx = \int_{a}^{-b} f\,dx$

(3) $\int_{-a}^{b} f\,dx \leq \int_{a}^{-b} f\,dx$ (4) None of these

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3. The application of Gram Schmidt process of orthonormalisation to $u_1=(1, 1, 0)$ $u_2=(1, 0, 0)$ $u_3=(1, 1, 1)$ yields :

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

(3) (0, 1, 0) (1, 0, 0) (0, 0, 1) (4) None of these

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4. The value of the integral $\oint_C \frac{\sin\pi z^2+\cos\pi z^2}{(z-4)\,(z-2)}\,dz$ where C is circle $|z|=3$ traced anticlockwise :

(1) $-2i\pi$ (2) $i\pi$ (3) $-i\pi$ (4) $2i\pi$

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5. What is the value of n so that e^{ny^2} is an integrating factor of the differential equation

$$\left(e^{\frac{y^2}{2}}-xy\right)dy-dx=0\ ?$$

(1) -1 (2) 1 (3) $\frac{1}{2}$ (4) $-\frac{1}{2}$

SPACE FOR ROUGH WORK

P.T.O.

6. The number of 5 Sylow subgroups in a group of order 45 :
   (1) 1 (2) 2 (3) 3 (4) 4

7. The image of $|z-ai|=a$ under the transformation $\omega=\frac{1}{z}$ is :
   (1) Circle (2) Straight line
   (3) Lemniscate (4) Equiangular spiral

8. The close bounded sets are compact if :
   (1) A normed vector space is finite dimensional
   (2) A vector space is finite dimensional
   (3) $P'(x)=P(x)$
   (4) None of these

9. If x, y, z are positive real numbers then minimum value of $x^2+8y^2+27z^2$ where $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1$ is :
   (1) 108 (2) 216 (3) 405 (4) 1048

10. The probability that two friends share the same birth month is :
   (1) $\frac{1}{6}$ (2) $\frac{1}{12}$ (3) $\frac{1}{144}$ (4) $\frac{1}{24}$

11. The line integral $\int \bar{v}.d\bar{r}$ of the vector function $\bar{v}(\bar{r})=2xyz\,\hat{i}+x^2z\,\hat{j}+x^2y\,\hat{k}$ from the origin to the point p (1, 1, 1) is :
   (1) 1
   (2) 0
   (3) -1
   (4) Cannot be determined without specifying the path

12. What is the value of k if $\frac{1}{2}\log\left(x^2+y^2\right)+i\tan^{-1}\frac{kx}{y}$ is analytic ?
   (1) -2 (2) -1 (3) 1 (4) 2

SPACE FOR ROUGH WORK

13. Which of the following is an analytic function ?

(1) $\frac{Z}{1+Z^2}$ (2) $Z\bar{Z}$ (3) e^{-Z^2} (4) $e^{Z^{-2}}$

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14. The particular solution for the differential equation $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=5\cos x$ is :

(1) $0.5\cos x+1.5\sin x$ (2) $1.5\cos x+0.5\sin x$

(3) $1.5\sin x$ (4) $0.5\cos x$

---

15. The fixed points of mapping $f(z)=\frac{3iz+13}{z-3i}$ are :

(1) $3i\pm 2$ (2) $3\pm 2i$ (3) $2\pm 3i$ (4) $-2\pm 3i$

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16. For matrix $M=\begin{bmatrix} 2 & 3+2i & -4 \\ 3-2i & 5 & 6i \\ -4 & -6i & 3 \end{bmatrix}$ which of the following statements are correct :

P : M is skew Hermitian and iM is Hermitian

Q : M is Hermitian and iM is Skew Hermitian

R : eigen values of M are real

S : eigen values of iM are real

(1) P and R only (2) Q and R only (3) P and S only (4) Q and S only

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17. For which subspace $X\subseteq R$ with usual topology and with $[0,1]\subseteq X$ with a continuous function $f : X\rightarrow[0,1]$ satisfying $f(0)=0$ and $f(1)=1$ exist ?

(1) $X=[0,1]$ (2) $X=(-1,1)$ (3) $X=R$ (4) $[0,1]\not\subset X$

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18. If the dual of the problem has infeasible solution, then the value of objective function is :

(1) unbounded (2) bounded (3) no solution (4) none of these

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19. The stationary points of $f(x,y)=x^3+y^3-3x-12y+20$ are :

(1) $(1,2)\ (1,-2)\ (-1,2)\ (-1,-2)$ (2) $(-1,-2)\ (1,2)\ (3,1)\ (-1,3)$

(3) $(0,0)\ (1,2)\ (2,-3)\ (-3,1)$ (4) None of the above

SPACE FOR ROUGH WORK

P.T.O.

20. If $J_n(x)$ is the Bessel function of the first kind then $\int x^{-2} J_3(x)dx$ is :

(1) $x^{-2} J_2(x)+c$ (2) $x^2 J_2(x)+c$ (3) $-x^{-2} J_3(x)+c$ (4) $-x^{-1} J_3(x)+c$

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21. Consider wave equation $u_{tt}=4u_{xx}$ $0<x<\pi$ $t>0$ with $u(0,t) = u(\pi,t) = 0$ $u(x,0)=\sin x$ and $u_t=0$ at $t=0$ then $u\left(\pi/2, \pi/2\right)$ is :

(1) 2 (2) 1 (3) 0 (4) -1

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22. The extremum for the variational problem $\int_0^{\pi/8} \left[\left(y^1\right)^2 + 2yy^1 - 16y^2\right] dx$ with $y(0)=0$ $y\left(\pi/8\right) = 1$ occurs for the curve :

(1) $y=\sin(4x)$ (2) $y=\sqrt{2}\sin(2x)$

(3) $y=1-\cos(4x)$ (4) $y=\dfrac{1-\cos(8x)}{2}$

---

23. If u is an ideal of ring R then :

(1) u/R is a ring (2) R/u is a ring (3) Ru is a ring (4) None of these

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24. If A is an open subset of complete metric space of X then :

(1) A is complete (2) A is incomplete

(3) Complement of A is closed (4) None of these

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25. The singular points of $f(z) = \dfrac{1}{z^4+1}$ are given by :

(1) $-1, -1, -1, -1$

(2) 1, 1, 1, 1

(3) $\cos\dfrac{(2n+1)\pi}{4} - i\sin\dfrac{(2n+1)\pi}{4}$ $n=0, 1, 2, 3$

(4) $\cos\dfrac{(2n+1)\pi}{4} + i\sin\dfrac{(2n+1)\pi}{4}$ $n=0, 1, 2, 3$

SPACE FOR ROUGH WORK

26. The volume of solid obtained by revolving the area under $y = e^{-2x}$ about the x axis is :

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{4}$ (3) 2π (4) π

---

27. Let PID, ED, UFD denote set of all principal ideal domains, Euclidean domains, unique factorisation domains respectively then :

(1) UFD $\subset$ ED $\subset$ PID (2) PID $\subset$ ED $\subset$ UFD

(3) ED $\subset$ PID $\subset$ UFD (4) PID $\subset$ UFD $\subset$ ED

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28. The value of $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x \, dz \, dx \, dy$:

(1) $\frac{4}{35}$ (2) $\frac{3}{35}$ (3) $\frac{8}{35}$ (4) $\frac{6}{35}$

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29. If $f(z) = \frac{z}{8-z^3}$, $z = x + iy$ then $\operatorname*{Res}_{z \to 2} f(z)$ is :

(1) $\frac{-1}{8}$ (2) $\frac{1}{8}$ (3) $\frac{-1}{6}$ (4) $\frac{1}{6}$

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30. Maximize $3x - 4y$ subject to constraint $-2x + y \le 12$, $x - y \le 2$, $x \geq 0$, $y \geq 0$.

(1) infinitely many solutions (2) no solution

(3) unique solution (2, 0) (4) unique solution (0, 12)

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31. The 2 regression lines are $2x - 9y + 6 = 0$ and $x - 2y + 1 = 0$. What is the correlation co-efficient between x and y ?

(1) $\frac{-2}{3}$ (2) $\frac{2}{3}$ (3) $\frac{4}{9}$ (4) None of these

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32. Let G be a cyclic group of order 8, then its group of automorphisms has order :

(1) 2 (2) 4 (3) 6 (4) 8

SPACE FOR ROUGH WORK

P.T.O.

33. Using Euler's Method take step size $=0.1$, find approximate value of y obtained correspondi[ng] to $x=0.2$ for initial value problem $\frac{dy}{dx}=x^2+y^2$ and $y(0)=1$

(1) 1.322 (2) 1.222 (3) 1.122 (4) 1.110

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34. If F is a field its only ideals are A : F a field itself, B : (0) then :

(1) A and B are true (2) A false B true

(3) A true B false (4) A and B false

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35. Let V be a vector space and T a linear operator on V. If W is a subspace of V, W is invariant under T if :

(1) $T(W) \subset W$ (2) $W \subset T(W)$

(3) $T(W)=W$ (4) None of the above

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36. Let y be the solution of initial value problem $\frac{d^2y}{dx^2}+y=6\cos 2x$, $y(0)=3$ and $y'(0)=1$

Let Laplace transform of y be F(S) then value of F(1) is :

(1) $\frac{17}{5}$ (2) $\frac{13}{5}$ (3) $\frac{11}{5}$ (4) $\frac{9}{5}$

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37. The value of a, b, c is given by ________, if vector $\overline{F}$ is given by

$\overline{F}=(x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x+cy+2z)\hat{k}$ is conservative.

(1) 1, 4, 2 (2) $-1, 4, 2$ (3) $-1, -4, -2$ (4) $-1, 4, -2$

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38. For the L.P. problem Min $z=x_1+x_2$ such that $5x_1+10x_2 \le 0$, $x_1+x_2 \ge 1$, $x_2 \ge 1$, $x_2 \le 4$ and $x_1, x_2 \ge 0$ then :

(1) There is a bounded solution (2) There is no solution

(3) There is a infinite solution (4) None of these

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39. Neighbourhood of x is :

(1) an open set U containing x (2) an closed set U containing x

(3) a null set (4) none of these

SPACE FOR ROUGH WORK

40. A topological space X is compact if every open covering of X contains :

(1) a finite subcollection that covers X

(2) a infinite subcollection that covers X

(3) a finite subcollection that does not cover X

(4) none of these

41. Which of the following Banach Spaces is not separable ?

(1) L^1 [0, 1] (2) L^∞ [0, 1] (3) L^2 [0, 1] (4) C [0, 1]

42. The solution of the differential equation $y\,dx + (x + x^2 y)\,dy = 0$ is :

(1) $\frac{-1}{xy} = c$ (2) $\frac{-1}{xy} + \log y = c$ (3) $\frac{1}{xy} + \log y = c$ (4) $\log y = cx$

43. The function $f(z) = \left\{\sin\left(\frac{1}{z}\right)\right\}^{-1}$ has multiple poles all of which are isolated singularity.

(1) False (2) True (3) Partially true (4) None of these

44. Which of the following matrix is not diagonalisable ?

(1) $\begin{bmatrix} 1 & 1 \\ 1 & 2 \end{bmatrix}$ (2) $\begin{bmatrix} 1 & 0 \\ 3 & 2 \end{bmatrix}$ (3) $\begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$ (4) $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

45. Which one of the following does not satisfy the differential equation $\frac{d^3 y}{dx^3} - y = 0$?

(1) e^x (2) e^{-x}

(3) $e^{-x/2} \sin\left(\frac{\sqrt{3}}{2}\right) x$ (4) $e^{-x/2} \cos\left(\frac{\sqrt{3}}{2}\right) x$

SPACE FOR ROUGH WORK

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46. To ensure the following system of equations $2x_1+7x_2-11x_3=6$
$x_1+2x_2+x_3=-5$
$7x_1+5x_2+2x_3=17$
Converges using Gauss Seidal Method, one has to rewrite as :

(1) $\begin{bmatrix} 2 & 7 & -11 \\ 1 & 2 & 1 \\ 7 & 5 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ -5 \\ 17 \end{bmatrix}$

(2) $\begin{bmatrix} 7 & 5 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & -11 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 17 \\ -5 \\ 6 \end{bmatrix}$

(3) $\begin{bmatrix} 7 & 5 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & -11 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ -5 \\ 17 \end{bmatrix}$

(4) The equations cannot be rewritten in a form to ensure convergence

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47. Using Cayley Hamilton Theorem express $2A^5-3A^4+A^2-4I$ as a linear polynomial in A where $A=\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$

(1) 128 A $-$ 400 I (2) 138 A $-$ 403 I (3) 138 A + 403 I (4) 57 A + 403 I

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48. The Fourier transform of $e^{ax}\cos(\alpha x)$ is equal to :

(1) $\dfrac{\omega-\alpha}{(\omega-\alpha)^2+\alpha^2}$ (2) $\dfrac{\omega+\alpha}{(\omega-\alpha)^2+\alpha^2}$ (3) $\dfrac{1}{(\omega-\alpha)^2}$ (4) None of these

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49. The partial differential equation $5\dfrac{\partial^2 z}{\partial x^2}+6\dfrac{\partial^2 z}{\partial y^2}=xy$ is classified as :

(1) elliptic (2) parabolic (3) hyperbolic (4) none of these

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50. Hamilton's equation is :

(1) $q_k=\dfrac{\partial H}{\partial P_k}$ (2) $-P_k=\dfrac{\partial H}{\partial q_k}$

(3) Both (1) and (2) (4) None of these

SPACE FOR ROUGH WORK

51. If an assignment problem consists of 6 workers and 7 projects :
   (1) one worker will not get a project assignment
   (2) one worker will be assigned two projects
   (3) each worker will contribute work toward the seventh project
   (4) one project will not get a worker assigned

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52. If $z=a$ is an isolated singularity of f and $f(z) = \sum_{-\infty}^{\infty} a_n (z-a)^n$ in its Laurent expansion in ann(a ; 0, R). Also if $a_n \neq 0$ for infinitely many negative integers n then :
   (1) $z=a$ is a removable singularity
   (2) $z=a$ is a pole of order m
   (3) $z=a$ is an essential singularity
   (4) None of these

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53. The value of complex integral $\int_C \tan(2\pi z)\, dz$ where C is the curve $|z|=1$ is :
   (1) 0 (2) $2\pi i$ (3) $-2\pi i$ (4) πi

---

54. Which of the following statements is true in respect of the convergence of Newton Raphson procedure ?
   (1) It converges under all circumstances.
   (2) It does not converge to a root where the second differential co-efficient changes sign.
   (3) It does not converge to a root where second differential co-efficient vanishes.
   (4) None of these.

---

55. In Neumann condition :
   (1) μ is prescribed by each point of boundary ∂D of a domain D
   (2) where value of normal derivative $\frac{\partial \mu}{\partial n}$ on the boundary ∂D are specified
   (3) $\left(\frac{\partial \mu}{\partial n} + au\right)$ is specified on ∂D
   (4) none of these

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56. A decision maker wishes to choose at least 2 projects out of a total of five. The approp[...] constraint is :

(1) $x_1+x_2+x_3+x_4+x_5 \leq 2$ (2) $x_1+x_2+x_3+x_4+x_5<2$

(3) $x_1+x_2+x_3+x_4+x_5=2$ (4) $x_1+x_2+x_3+x_4+x_5 \geq 2$

57. Five jobs (A, B, C, D, E) are waiting to be processed. Their processing times and due dates are given below using the shortest processing time dispatching rule, in which order should the jobs be processed ?

Job	Process time (days)	Job due date (days)
A	4	7
B	7	4
C	8	11
D	3	5
E	5	8

(1) A, B, C, D, E (2) C, E, A, D, B

(3) B, D, A, E, C (4) D, A, E, B, C

58. To use the Hungarian Method a profit maximization assignment problem requires :

(1) converting all profits to opportunity losses

(2) a dummy agent or task

(3) matrix expansion

(4) find maximum number of lines to cover all the zeroes in a reduced matrix

59. $\dfrac{\partial^2 z}{\partial x^2}+\dfrac{\partial^2 z}{\partial y^2}=12\,(x+y)$ has the solution :

(1) $z=f_1\,(y+ix)+f_2\,(y-ix)$ (2) $z=f_1\,(y+ix)+f_2\,(y-ix)+(x+y)^3$

(3) $z=(x+y)^3$ (4) None of these

60. Let S be non empty Lebesque measurable subset of R such that every subset of S is measurable. Then the measure of S is equal to the measure of any :

(1) Subset of S (2) Countable Subset of S

(3) Bounded Subset of S (4) Closed Subset of S

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61. The eigen values of the Sturm Liouville System $y''+\lambda y=0$ $0\leq x\leq\pi$ $y(0)=0$, $y'(\pi)=0$ a

(1) $\frac{n^2}{4}$ (2) $\frac{(2n-1)^2\ \pi^2}{4}$ (3) $\frac{(2n-1)^2}{4}$ (4) $\frac{n^2\pi^2}{4}$

62. If $A=\begin{bmatrix} a+ic & -b+id \\ b+id & a-ic \end{bmatrix}$ is unitary matrix iff :

(1) $a^2+b^2+c^2=0$ (2) $b^2+c^2+d^2=0$

(3) $a^2+b^2+c^2+d^2=1$ (4) $a^2+b^2+c^2+d^2=0$

63. The probability that A speaks a truth is $\frac{4}{5}$ while the probability for B is $\frac{3}{4}$. What is the probability that they contradict each other when asked to speak on a fact ?

(1) $\frac{3}{20}$ (2) $\frac{1}{5}$ (3) $\frac{7}{20}$ (4) $\frac{4}{5}$

64. The completeness axiom states :

(1) every non empty set S of real number which is bounded above has supremum.

(2) every non empty set S of real number which is bounded has infimum.

(3) every non empty set S of real number which is bounded has no supremum.

(4) every non empty set S of real number which is bounded has no infimum.

65. The series $1+\frac{1}{2^2}+\frac{1}{3^3}+\ldots$ is :

(1) divergent (2) convergent (3) bounded (4) none of these

66. If T is a bounded linear operator on Hilbert space H, then :

(1) T is normal iff $\|T_x\|=\|T^* x\|$ for every $x \in H$

(2) T is normal iff $\|T_x\| > \|T^* x\|$ for every $x \in H$

(3) T is normal iff $\|T_x\| < \|T^* x\|$ for every $x \in H$

(4) None of these

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67. Which is incorrect among the following ?
 (1) $P_0(x)=1$ (2) $P_1(x)=x$
 (3) $P_n(-x)=(-1)^{n+1}\ P_n(x)$ (4) $(1-x^2)P_n''\ (x)-2x\ P_n'\ (x)+n\ (n+1)\ P_n(x)=0$

68. Let G be a group of order 15. Then the number of Sylow subgroups of G of order 3 is :
 (1) Zero (2) One (3) Three (4) Five

69. Let V, W and X be three finite dimensional vector spaces such that dim V = dim X. Suppose $S:V\to W$ and $T:W\to X$ are two linear maps such that to $S:V\to X$ is injective. Then :
 (1) S and T are surjective (2) S is surjective and T is injective
 (3) S and T are injective (4) S is injective and T is surjective

70. If matrix $A=\begin{bmatrix}2 & 3 & 4\\ 0 & 4 & 2\\ 0 & 0 & 3\end{bmatrix}$ then eigen values of adj A are :
 (1) 4, 16, 9 (2) 2, 4, 3 (3) 8, 12, 6 (4) $\frac{1}{2}, \frac{1}{4}, \frac{1}{3}$

71. The real part is $e^x \cos y$ then the analytic function is given by :
 (1) ze^z (2) $(1+z)\ e^z$ (3) e^z (4) $-e^z$

72. Fourier transforms of $f(x)$ exists :
 (1) if $f(x)$ is absolutely integrable on positive x axis
 (2) if $f(x)$ is piecewise continuous on finite interval
 (3) both (1) and (2)
 (4) none of these

73. Covariance (x, y) if $\Sigma x=15$, $\Sigma y=40$, $\Sigma xy=110$ and $n=5$ is :
 (1) 22 (2) 2 (3) -2 (4) none of these

74. The minimal polynomial associated with the matrix $\begin{bmatrix}0 & 0 & 3\\ 1 & 0 & 2\\ 0 & 1 & 1\end{bmatrix}$ is :
 (1) x^3-x^2-2x-3 (2) x^3-x^2+2x-3
 (3) x^3-x^2-3x-3 (4) x^3-x^2+3x-3

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75. Which of the following is not an integrating factor of $x\mathrm{d}y - y\mathrm{d}x = 0$:

(1) $\frac{1}{x^2}$ (2) $\frac{1}{x^2 + y^2}$ (3) $\frac{1}{xy}$ (4) $\frac{x}{y}$

---

76. For the $\mathrm{n^{th}}$ Legendre polynomial $C_n \cdot \frac{d^n y}{dx^n} \left(x^2 - 1\right)^n$, the value of C_n is :

(1) $\frac{1}{n!\,2^n}$ (2) $\frac{n!}{2^n}$ (3) $(n!)\,2^n$ (4) $\frac{2^n}{n!}$

---

77. Consider polynomial ring Q (x) the ideal of Q (x) generated by $x^2 - 3$ is :

(1) maximal but not prime (2) prime but not maximal

(3) both maximal and prime (4) neither maximal nor prime

---

78. Suppose an interval estimate for the population mean was 62.84 to 69.46. The population standard deviation was assumed to be 6.50, and a sample of 100 observations was used. The mean of the sample was :

(1) 56.34 (2) 62.96 (3) 6.62 (4) 66.15

---

79. The area enclosed between the parabola $y = x^2$ and the straight line $y = x$ is :

(1) $\frac{1}{8}$ (2) $\frac{1}{6}$ (3) $\frac{1}{3}$ (4) $\frac{1}{2}$

---

80. If and when we are using a simplex table to solve a maximization problem, we find the ratios for determining the pivot row are all negative, then, we know that the solution is :

(1) unbounded (2) infeasible (3) degenerate (4) optimal

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सूचना — (पृष्ठ 1 वरून पुढे....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या "परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82" यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षा कक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you ________ your grand success.

(1) for (2) at (3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर "(3) on" असे आहे. त्यामुळे या प्रश्नाचे उत्तर "(3)" होईल. यास्तव खालीलप्रमाणे प्रश्न क्र. 201 समोरील उत्तर-क्रमांक "3" हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. 201. 1 2 ● 4

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तरक्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

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