SUBJECT CODE	SUBJECT	PAPER
B-15-17	**MATHEMATICAL SCIENCES**	**II**

HALL TICKET NUMBER	QUESTION BOOKLET NUMBER
	202992

OMR SHEET NUMBER

DURATION	MAXIMUM MARKS	NUMBER OF PAGES	NUMBER OF QUESTIONS
1 Hour 15 Minutes	100	12	50

This is to certify that, the entries made in the above portion are correctly written and verified.

Candidate's Signature

Name and Signature of Invigilator

INSTRUCTIONS FOR THE CANDIDATES

1. Write your Hall Ticket Number in the space provided on the top of this page.
2. This paper consists of fifty multiple-choice type of questions.
3. At the commencement of examination, the question booklet will be given to you. In the first 5 minutes, you are requested **to open the booklet and compulsorily examine it as below :**
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal and do not accept an open booklet.
   (ii) **Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to pages/questions missing or duplicate or not in serial order or any other discrepancy should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.**
   (iii) After this verification is over, the Test Booklet Number should be entered in the OMR Sheet and the OMR Sheet Number should be entered on this Test Booklet.
4. Each item has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : (A) (B) ● (D)
   where (C) is the correct response.
5. Your responses to the items are to be indicated in the OMR **Answer Sheet given to you.** If you mark at any place other than in the circle in the OMR Answer Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done in the end of this booklet.
8. If you write your name or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, you will render yourself liable to disqualification.
9. **The candidate must handover the OMR Answer Sheet to the invigilators at the end of the examination compulsorily** and must not carry it with you outside the Examination Hall. The candidate is allowed to take away the carbon copy of OMR Sheet and used Question Paper Booklet at the end of the examination.
10. **Use only Blue/Black Ball point pen.**
11. **Use of any calculator or log table etc., is prohibited.**
12. **There is no negative marks for incorrect answers.**

అభ్యర్థులకు సూచనలు

1. ఈ పుట పై భాగంలో ఇవ్వబడిన స్థలంలో మీ హాల్ టికెట్ నంబరు రాయండి.
2. ఈ ప్రశ్న పత్రము యాభై బహుళైచ్ఛిక ప్రశ్నలను కలిగి ఉంది.
3. పరీక్ష ప్రారంభమున ఈ ప్రశ్నాపత్రము మీకు ఇవ్వబడుతుంది. మొదటి ఐదు నిమిషములలో ఈ ప్రశ్నాపత్రమును తెరిచి కింద తెలిపిన అంశాలను తప్పనిసరిగా సరిచూసుకోండి.
   (i) ఈ ప్రశ్న పత్రమును చూడడానికి కవర్‌పేజి అంచున ఉన్న కాగితపు సీలును చించండి. స్టిక్కర్ సీలులేని మరియు ఇదివరకే తెరిచి ఉన్న ప్రశ్నాపత్రమును మీరు అంగీకరించవద్దు.
   (ii) కవరు పేజి పై ముద్రించిన సమాచారం ప్రకారం ఈ ప్రశ్నపత్రములోని పేజీల సంఖ్యను మరియు ప్రశ్నల సంఖ్యను సరిచూసుకోండి. పేజీల సంఖ్యకు సంబంధించి గానీ లేదా సూచించిన సంఖ్యలో ప్రశ్నలు లేకపోవుట లేదా నిజప్రతి కాకపోవుట లేదా ప్రశ్నలు క్రమపద్ధతిలో లేకపోవుట లేదా ఏవైనా లేదాలుండుట వంటి దోషపూరితమైన ప్రశ్న పత్రాన్ని వెంటనే మొదటి ఐదు నిమిషాల్లో పరీక్షా పర్యవేక్షకునికి తిరిగి ఇచ్చివేసి దానికి బదులుగా సరిగ్గా ఉన్న ప్రశ్నపత్రాన్ని తీసుకోండి. తదనంతరం ప్రశ్నపత్రము మార్చబడదు అదనపు సమయం ఇవ్వబడదు.
   (iii) పై విధంగా సరిచూసుకొన్న తర్వాత ప్రశ్నాపత్రం సంఖ్యను OMR పత్రము పై అదేవిధంగా OMR పత్రము సంఖ్యను ఈ ప్రశ్నాపత్రము పై నిర్దిష్టస్థలంలో రాయవలెను.
4. ప్రతి ప్రశ్నకు నాలుగు ప్రత్యామ్నాయ ప్రతిస్పందనలు (A), (B), (C) మరియు (D) లుగా ఇవ్వబడ్డాయి. ప్రతి ప్రశ్నకు సరైన ప్రతిస్పందనను ఎన్నుకొని కింద తెలిపిన విధంగా OMR పత్రములో ప్రతి ప్రశ్నా సంఖ్యకు ఇవ్వబడిన నాలుగు వృత్తాల్లో సరైన ప్రతిస్పందనను సూచించే వృత్తాన్ని బాల్ పాయింట్ పెన్‌తో కింద తెలిపిన విధంగా పూరించాలి.
   ఉదాహరణ : (A) (B) ● (D)
   (C) సరైన ప్రతిస్పందన అయితే
5. ప్రశ్నలకు ప్రతిస్పందనలను ఈ ప్రశ్నపత్రముతో ఇవ్వబడిన OMR పత్రము పైన ఇవ్వబడిన వృత్తాల్లోనే పూరించి గుర్తించాలి. అలాకాక సమాధాన పత్రంపై వేరొక చోట గుర్తిస్తే మీ ప్రతిస్పందన మూల్యాంకనం చేయబడదు.
6. ప్రశ్న పత్రము లోపల ఇచ్చిన సూచనలను జాగ్రత్తగా చదవండి.
7. చిత్తుపనిని ప్రశ్నపత్రము చివర ఇచ్చిన ఖాళీస్థలములో చేయాలి.
8. OMR పత్రము పై నిర్దిష్ట స్థలంలో సూచించవలసిన వివరాలు తప్పించి ఇతర స్థలంలో మీ గుర్తింపును తెలిపే విధంగా మీ పేరు రాయడం గానీ లేదా ఇతర చిహ్నాలను పెట్టడం గానీ చేసినట్లయితే మీ అనర్హతకు మీరే బాధ్యులవుతారు.
9. పరీక్ష పూర్తయిన తర్వాత మీ OMR పత్రాన్ని తప్పనిసరిగా పరీక్ష పర్యవేక్షకుడికి ఇవ్వాలి. వాటిని పరీక్ష గది బయటకు తీసుకువెళ్లకూడదు. పరీక్ష పూర్తయిన తరువాత అభ్యర్థులు ప్రశ్న పత్రాన్ని, OMR పత్రం యొక్క కార్బన్ కాపీని తీసుకువెళ్లవచ్చు.
10. నీలి/నల్ల రంగు బాల్ పాయింట్ పెన్ మాత్రమే ఉపయోగించాలి.
11. లాగరిథమ్ టేబుల్స్, క్యాలిక్యులేటర్‌లు, ఎలక్ట్రానిక్ పరికరాలు మొదలగునవి పరీక్షగదిలో ఉపయోగించడం నిషేధం.
12. తప్పు సమాధానాలకు మార్కుల తగ్గింపు లేదు.

SEAL

MATHEMATICAL SCIENCES

Paper - II

1. I : $(3+\sqrt{2})^{2/3}$ is not a rational number

   II : $x^6 - 22x^3 + 49 = 0$ has no rational roots

   Then :

   (A) I is true, II is false

   (B) I is true, II is true but II is not a reason for I

   (C) I is true, II is true and II is a reason for I

   (D) I is false, II is false

2. If $S = \{n^{\{(-1)^n\}} : n = 1, 2, 3, ...\}$ then inf S =

   (A) $-\infty$ (B) 1

   (C) 0 (D) -1

3. If $s_n = \sin\left(\frac{n\pi}{3}\right)$ for n = 1, 2, 3, ... then the set of all subsequential limits of $\{s_n\}$ is :

   (A) $\{0\}$

   (B) $\left\{\frac{\sqrt{3}}{2}\right\}$

   (C) $\left\{-\frac{\sqrt{3}}{2}\right\}$

   (D) $\left\{0, \frac{\sqrt{3}}{2}, -\frac{\sqrt{3}}{2}\right\}$

4. Every sequence $\{s_n\}$ of real numbers has a subsequence which is :

   (A) bounded (B) monotonic

   (C) convergent (D) divergent

5. If S' denotes the set of all limit points of a set $S \subseteq \mathbf{R}$ then $\mathbf{Z}'$, where $\mathbf{Z}$ is the set of all integers, is :

   (A) $\mathbf{R}$

   (B) Q, the set of all rational numbers

   (C) $\emptyset$

   (D) $\mathbf{Z}$

6. The infinite series $\sum_{n=1}^{\infty} \frac{(-1)^n}{\sqrt{2n+1}}$ is :

   (A) absolutely convergent

   (B) conditionally convergent

   (C) diverges to infinity

   (D) oscillates finitely

7. If $\mathbf{R}$, $\mathbf{C}$ denote the sets of all real, complex numbers respectively, then the dimension of the vector space $(\mathbf{C}^{14}, +, -)$ over the field $\mathbf{R}$ is :

   (A) 14 (B) 7

   (C) 28 (D) 21

8. If $\phi : \mathbf{R}^3 \to \mathbf{R}^2$ be a linear transformation defined by $\phi(x, y, z) = (x-y, y-z)$ for all $(x, y, z) \in \mathbf{R}^3$, then rank of $\phi =$

(A) 0 (B) 1

(C) 2 (D) 3

9. The rank of the matrix $\begin{bmatrix} 1 & 2 & 3 & 5 \\ 0 & 1 & 4 & 1 \\ 2 & 5 & 10 & 8 \\ 1 & 4 & 11 & 7 \end{bmatrix}$ is :

(A) 1 (B) 2

(C) 3 (D) 4

10. The radius of convergence of the power series $\sum_{n=0}^{\infty} \frac{Z^{2n}}{2^n}$ is :

(A) 0 (B) $\frac{1}{\sqrt{2}}$

(C) $\sqrt{2}$ (D) 1

11. Let C be the circle $|z-2i|=5$ positively oriented. Then $\int_C e^{\frac{8}{z}}\, dz =$

12. Let $\frac{3}{2} < r < 2$ and $C : |z| = r$ be the positively oriented circle. Then,

$$\int_C \frac{12z - 19}{(2z-3)(3z-5)} dz =$$

(A) $\frac{\pi i}{2}$ (B) πi

(C) $4\pi i$ (D) $2\pi i$

13. Let $C : |z| = 2$ be the circle positively oriented. Then $\int_C |z-2|\,|dz| =$

(A) 4 (B) 16

(C) 32 (D) 64

14. Let C be the circle $|z| = 3$ positively oriented. Then $\int_{|z|=3} \frac{z^2 + e^z}{z^2 - e^2} dz =$

(A) $\frac{2\pi i}{e} \sinh e$

(B) $\frac{\pi i}{e} \sinh e$

(C) $\frac{2\pi i}{e} \cosh e$

15. If ϕ is Euler's function, then $\phi(\phi(2700)) =$

(A) 720 (B) 384

(C) 360 (D) 192

16. If a set A has 7 elements, then the number of bijections 'f' from A to A such that $f(x) \neq x$ for any $x \in A$, is :

(A) 2520 (B) 5040

(C) 1854 (D) 2737

17. The degree of the extension of the splitting field of $x^3 - z \in Q[x]$ is :

(A) 6 (B) 8

(C) 4 (D) 3

18. If Z_n denote the set of all residue classes of integers modulo n, then the multiplicative inverse of $\overline{6}$ in the field $(Z_{13}, +_{13}, \times_{13})$ is :

(A) $\overline{4}$ (B) $\overline{7}$

(C) $\overline{9}$ (D) $\overline{11}$

19. A topological space with a countable dense subset is called a :

(A) Regular space

(B) Second countable space

(C) Normal space

(D) Separable space

20. Let **Z** be the set of all integers, $\tau = \{A \subseteq X | A = \phi \text{ or } X - A \text{ is finite}\}$ and **E** be the set of all even integers. Then in the topological space $(\mathbf{Z}, \tau)$, the set **E** is :

(A) an open set

(B) a closed set

(C) both open and closed

(D) neither open nor closed

21. The functions $f(x) = x^4$ and $g(x) = |x|x^3$ are :

(A) linearly dependent on $[-1, 1]$

(B) linearly independent on $[-1, 1]$

(C) linearly independent on $[-1, 2]$

(D) linearly independent on $[-2, 1]$

22. The differential equation $y''' = xy'' - 2x^2(y')^2$ is equivalent to the system of first order equations :

(A) $\frac{dy}{dx} = z$
$\frac{dz}{dx} = w$
$\frac{dw}{dx} = xz^2 - 2x^2z^2$

(B) $\frac{dy}{dx} = z$
$\frac{dz}{dx} = w$
$\frac{d^2w}{dx^2} = xw - 2x^2z$

(C) $\frac{dy}{dx} = z$
$\frac{dz}{dx} = w$
$\frac{dw}{dx} = xw - 2x^2w^2$

(D) $\frac{dy}{dx} = z$
$\frac{dz}{dx} = w$
$\frac{dw}{dx} = x^2w - 2xw^2$

23. The solution of $x^2y'' + 2xy' - 12y = 0$ is :

(A) $c_1x^2 + c_2x^3$

(B) $c_1x^{-3} + c_2x^2$

(C) $c_1x^3 + c_2x^{-4}$

(D) $c_1x^6 + c_2x^4$

24. If u is a function of x, y and z which satisfies the partial differential equation

$$(y - z)\frac{\partial u}{\partial x} + (z - x)\frac{\partial u}{\partial y} + (x - y)\frac{\partial u}{\partial z} = 0$$

then u is of the form :

(A) $u = f(xyz,\ x + y^2 + z)$

(B) $u = f(x - y - z,\ x^2 + y + z^2)$

(C) $u = f(x + y + z,\ x^2 + y^2 + z^2)$

(D) $u = f(x^2y^2z^2,\ x^2 + y^3 + z^2)$

25. The solution of the equation

$$z = \frac{1}{2}(p^2 + q^2) + (p - x)(q - y)$$

which passes through the x-axis is :

(A) $z = \frac{1}{2}y(4x - 3y)$

(B) $z = y^2(4x^2 - 3y)^2$

(C) $z = y^3(z^2 - 3y^2)$

(D) $z^2 = y^2(x^3 - 3y^4)$

26. The first order nonlinear partial differential equation which is formed from the set of all spheres of unit radius with centre in the xy-plane is :

(A) $1 + p^2 + q^2 = 1$

(B) $z(1 + p + q^2) = 1$

(C) $z^2(1 + p^2 + q^2) = 1$

(D) $z(1 + p + q) = 1$

27. The number of iterations necessary to solve $f(x) = x^3 + 4x^2 - 10 = 0$ with an accuracy 10^{-3} in [1, 2] is :

(A) 8 (B) 9

(C) 10 (D) 11

28. The solution $y = y(x)$ of the functional

$$J[y] = \int_1^2 \frac{\sqrt{1 + y'^2}}{x} dx, \quad y(1) = 0 \quad \text{and}$$

$y(2) = 1$ satisfies the equation :

(A) $(y-2)^2 + x^2 = 5$

(B) $y^2 + (x-2)^2 = 5$

(C) $(y-2)^2 = x^2 + 5$

(D) $y^2 = 5 + (x-2)^2$

29. Suppose $K(x, t) = xt$, $t \in [0, 1]$. Then the iterated kernel of $K(x, t)$ is :

(A) $\frac{xt}{2^n}$ (B) $\frac{xt}{3^n}$

(C) $\frac{xt}{3^{n-1}}$ (D) $\frac{xt}{2^{n-1}}$

30. If the Lagrangian is given by

$$L = -\sqrt{(1 - q\dot{q})} + q\dot{q},$$

where q and $\dot{q}$ are generalized coordinate and velocity respectively, the equation of motion is :

(A) $\ddot{q} + q\,\dot{q}^2 = 0$

(B) $\ddot{q} - q\,\dot{q}^2 = 0$

(C) $\ddot{q} + q^{-1}\,\dot{q}^2 = 0$

(D) $\ddot{q} - q^{-1}\,\dot{q}^2 = 0$

31. An appropriate average to find average rate of change is :

(A) Arithmetic mean

(B) Median

(C) Geometric mean

(D) Harmonic mean

32. A Real valued function F defined on $(-\infty, \infty)$ that is non decreasing, right continuous and satisfies $F(-\infty)=0$ and $F(+\infty)=1$ is called :

(A) Density function

(B) Distribution function

(C) Random variable

(D) Continuous function

33. If the measure of skewness is zero, then Q_3+Q_1 is :

(A) Q_2 (B) $2Q_2$

(C) $2Q_3$ (D) $2Q_1$

34. Let X be a random variable such that $P(X \geq 0)=1$ and let $t > 0$ and $a \geq 0$ be fixed, then the inequality $P\{X \geq t\} \leq E\left(\frac{X^a}{t^a}\right)$ is known as :

(A) Holder's inequality

(B) Schwartz's inequality

(C) Jensen's inequality

(D) Markov's inequality

35. The number of failures N(t), which occur in a computer network over the time interval [0, t), can be described by a poisson process $\{N(t), t \geq 0\}$. On an average there is a failure after every 4 hours, ie., the intensity of the process is equal to 0.25 $[\text{hour}]^{-1}$. What is the probability that the third failure occurs after 8 hours ?

(A) $e^{-0.25}$ (B) $8\, e^{-0.25}$

(C) e^{-2} (D) $5\, e^{-2}$

36. Suppose the random variable 'U' has a uniform distribution on (0, 1) and $x=-2 \log U$. The density of x is :

(A) $f(x) = \begin{cases} \exp(-x); \text{ if } x > 0 \\ 0 \quad ; 0.W \end{cases}$

(B) $f(x) = \begin{cases} 2\exp(-2x); \text{ if } x > 0 \\ 0 \quad ; 0.W \end{cases}$

(C) $f(x) = \begin{cases} \frac{1}{2}\exp\left(-x/2\right) \\ 0 \quad ; 0.W \end{cases}$

(D) $f(x) = \begin{cases} \frac{1}{2} \; ; \text{if } x \in (0, 2) \\ 0 \; ; 0.W \end{cases}$

37. Let $Z \sim N(0, 1)$. Then $P(|z| > 2)$ is :

(A) 0.318 (B) 0.002

(C) 0.046 (D) 0.645

38. Let $X_1, X_2 \ldots\ldots X_n$ be an i.i.d random sample from exponential distribution with mean μ. In other words, they have density :

$$f(x) = \begin{cases} \frac{1}{\mu}\exp\left(-X/\mu\right) & ; \text{if } X > 0 \\ 0 & ; 0.W \end{cases}$$

which of the following is not an u.b.e. of μ ?

(A) X_1

(B) $\frac{1}{n-1}\{X_1 + X_2 + \ldots\ldots + X_n\}$

(C) $n\{\text{Min}\{X_1, X_2 \ldots\ldots X_n\}\}$

(D) $\frac{1}{n}\text{Max}\{X_1, X_2 \ldots\ldots X_n\}$

39. The variance of the distribution of estimate obtained by the method of moments will be of the type :

(A) $C/\sqrt{n}$ (B) $C^2/\sqrt{n}$

(C) C^2/n (D) C/n

40. A Random sample of 16 housewives has an average body weight of 52 kgs and an s.d. of 3.6 kg. 99% central confidence limits for body weight in general are :

{Given $t_{15,0.01} = 2.95$}

(A) {54.66 ; 49.345}

(B) {52.66 ; 51.34}

(C) {55.28 ; 48.72}

(D) {49.66 ; 38.34}

41. The Neyman - Pearson lemma is a function of this statistic, if it exists :

(A) consistent (B) sufficient

(C) unbiased (D) biased

42. A hypothesis test is conducted to test whether the mean age of clients at a certain health spa is equal to 25 or not. It is known that the population s.d. of clients at the spa is 10.36. Clients are randomly selected, and their ages recorded, with the sample mean age being 29.8. What is your decision, at the 5% l.o.s., regarding the null hypothesis that the mean age is equal to 25 ?

(A) Reject the Null hypothesis at the 5% l.o.s and conclude that the mean age of clients at the spa is less than 25

(B) Reject the Null hypothesis at the 5% l.o.s. and conclude that the mean age of clients at the spa is not equal to 25

(C) Reject the Null hypothesis at the 5% l.o.s. and conclude that the mean age of clients at the spa is more than 25

(D) Do not Reject the Null hypothesis at the 5% l.o.s. and conclude that the mean age of clients at the spa is 25.

43. The number of runs in the sequence H T T H H H T H T T H H T H is :

(A) 6 (B) 4

(C) 9 (D) 5

44. All Bayes discriminant rules (including the ML rule) are :

(A) Misallocated

(B) Admissible

(C) Have strict Inequality

(D) Bayes risk

45. If $M_1 \sim W_p(\Sigma, m_1)$ and $M_2 \sim W_p(\Sigma, m_2)$, then $M_1 + M_2$ follows :

(A) $W_p(2\Sigma, m_1 + m_2)$

(B) $W_p(\Sigma, m_1 + m_2)$

(C) $W_p(\Sigma, 2(m_1 + m_2))$

(D) None of these

46. In the linear model $Y = X_{n \times k}\, \beta + \epsilon$ the likelihood ratio test for testing $H_0 : H_{r \times k}\, \beta = 0$, $r \leq k$ has F distribution with the degrees of freedom :

(A) $(k, n-r)$ (B) $(n-r, k)$

(C) $(r, n-k)$ (D) $(n-k, r)$

47. From the six letters A, B, C, D, E and F, 3 letters are chosen at random with replacement. What is the probability that either the word BAD or the word CAD can be formed from the chosen letters ?

(A) $\frac{1}{216}$ (B) $\frac{3}{216}$

(C) $\frac{6}{216}$ (D) $\frac{12}{216}$

48. If the Responses for treatments in a factorial experiment with factors A and B each at 2 levels from 3 replications are, $a_0b_0 = 18$, $a_1b_0 = 17$, $a_0b_1 = 25$ and $a_1b_1 = 30$, the sum of square for interaction AB equal to :

(A) 4 (B) 675

(C) 6 (D) 3

49. In a 2^4 factorial to reduce the blocks to size of 2^2 units the number of confounding effects is :

(A) 14 (B) 13

(C) 15 (D) 12

50. The failure distribution which has I.F.R. is :

(A) Exponential

(B) Weibull

(C) Gamma

(D) Log normal

-o0o-

Space For Rough Work

SEAL