Roll. No. ....

Question Booklet Number

O.M.R. Serial No. | | | | | | | | |

M.A./M.Sc. (SEM.-III) (NEP) (SUPPLE.) EXAMINATION, 2024-25

MATHEMATICS

(Special Functions)

(Elective)

Paper Code							
B	0	3	0	9	0	4	T

Question Booklet Series

A

Time : 1 : 30 Hours **Max. Marks : 75**

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.
4. Four alternative answers are mentioned for each question as - A, B, C & D in the booklet. The candidate has to choose the correct / answer and mark the same in the OMR Answer-Sheet as per the direction :

(Remaining instructions on last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, उसे तुरन्त बदल लें।
4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर- A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

1. The Gamma function is defined as :

(A) $\Gamma(z) = \int_0^{\infty} e^{-t} t^{z-1} dt$, $\operatorname{Re}(z) > 0$

(B) $\Gamma(z) = \int_0^{\infty} e^{t} t^{z-1} dt$, $\operatorname{Re}(z) > 0$

(C) $\Gamma(z) = \int_0^{\infty} e^{t} t^{z+1} dt$, $\operatorname{Re}(z) > 0$

(D) None of the above

2. The value of Euler's constant (r) lying between :

(A) 0 to ½ (B) ½ to 1

(C) 1 to $3/2$ (D) $3/2$ to 2

3. The value of $\Gamma(n)$ when $n = 0$ is :

(A) 0

(B) 1

(C) ∞

(D) not defined

4. The value of $\Gamma\left(-\frac{1}{2}\right)$ is :

(A) $\sqrt{\pi}$

(B) $-\sqrt{\pi}$

(C) $-2\sqrt{\pi}$

(D) not defined

5. Euler's product for $\Gamma(z)$ is :

(A) $\Gamma(z) = \frac{1}{z}\prod_{n=1}^{\infty}\left\{\left(1+\frac{1}{n}\right)\left(1+\frac{z}{n}\right)^{-1}\right\}$

(B) $\Gamma(z) = \frac{1}{z}\prod_{n=1}^{\infty}\left\{\left(1+\frac{1}{n}\right)^{z}\left(1+\frac{z}{n}\right)^{-1}\right\}$

(C) $\Gamma(z) = \prod_{n=1}^{\infty}\left\{\left(1+\frac{1}{n}\right)^{z}\left(1+\frac{z}{n}\right)^{-1}\right\}$

(D) None of the above

6. The essential singularity of Gamma function is :

(A) $z = 0$ only

(B) $z = \infty$ only

(C) $z = 0, -1, -2, ...$

(D) $z = 1$ only

7. The value of

$\Gamma\left(\frac{1}{9}\right)\Gamma\left(\frac{2}{9}\right)\Gamma\left(\frac{3}{9}\right)..........\Gamma\left(\frac{8}{9}\right)$ is :

(A) $\frac{16}{3}\pi^4$ (B) $\frac{16}{5}\pi^4$

(C) $\frac{8}{3}\pi^4$ (D) $\frac{16}{3}\pi^2$

8. Relation between Beta and Gamma function is :

(A) $\beta(p,q) = \frac{\Gamma p \, \Gamma q}{\Gamma(p+q)}$

(B) $\beta(p,q) = \frac{\Gamma(p+q)}{\Gamma p \, \Gamma q}$

(C) $\beta(p,q) = \frac{\Gamma p \, \Gamma q}{2\Gamma(p+q)}$

(D) $\beta(p,q) = \Gamma p \, \Gamma q$

9. The value of $\Gamma(z)$ is given by :

(A) $\Gamma(z)=\lim\limits_{x\to\infty}\dfrac{n!\,n^z}{(z+1)(z+2)........(z+n)}$

(B) $\Gamma(z)=\lim\limits_{x\to\infty}\dfrac{(n-1)!\,n^z}{(z+1)(z+2)........(z+n)}$

(C) $\Gamma(z)=\lim\limits_{x\to\infty}\dfrac{n!\,n^z}{z(z+1)(z+2).....(z+n)}$

(D) None of the above

10. The value of $\Gamma(z)\,\Gamma(1-z)$ is :

(A) $\dfrac{\pi}{\sin z}$, where $0<\mathrm{Re}(z)<1$

(B) $\pi\operatorname{cosec} z$, where $0<\mathrm{Re}(z)<1$

(C) $\pi\operatorname{cosec} \pi z$, where $0<\mathrm{Re}(z)<1$

(D) $\pi\sin\pi z$, where $0<\mathrm{Re}(z)<1$

11. If α is any complex number and *n* is a non-negative integer, then the factorial function $(\alpha)_n$ is defined as :

(A) $(\alpha+1)(\alpha+2)...(\alpha+n-1)$; $n\geq 1$

(B) $\alpha(\alpha+1)(\alpha+2)...(\alpha+n-1)$; $n\geq 1$

(C) $\alpha(\alpha+1)(\alpha+2)...(\alpha+n)$; $n\geq 1$

(D) $(\alpha+2)(\alpha+3)...(\alpha+n)$; $n\geq 1$

12. For positive value of *n*, the value of Beta function $\beta(p,n+1)$ is :

(A) $\dfrac{n!}{(p)_n}$ (B) $\dfrac{n!}{(p)_{n+1}}$

(C) $\dfrac{(n-1)!}{(p)_n}$ (D) $\dfrac{(n-1)!}{(p)_{n+1}}$

13. The Beta function is defined as :

(A) $\beta(p,q)=\int_0^\infty x^{p-1}(1-x)^{q-1}\,dx$

(B) $\beta(p,q)=\int_0^1 x^{p}(1-x)^{q-1}\,dx$

(C) $\beta(p,q)=\int_0^1 x^{p-1}(1-x)^{q-1}\,dx$

(D) $\beta(p,q)=\int_0^1 x^{p+1}(1-x)^{q}\,dx$

14. If the product $\prod_{n=1}^{\infty}(1+a_n)$ converges, then $\lim\limits_{n\to\infty}a_n$ is equal to :

(A) 0

(B) 1

(C) ∞

(D) $-\infty$

15. The value of $\Gamma'(1)$ is :

(A) 0

(B) -*r* (where *r* is Euler's constant)

(C) *r* (*r* is Euler's constant)

(D) ∞

16. Laplace equation is :

(A) $\nabla^2\psi = 0$

(B) $\nabla^2\psi \neq 0$

(C) $\nabla^2 \times \psi = 0$

(D) $\nabla^2 \times \psi \neq 0$

17. The difference formula for Gamma function is :

(A) $\Gamma z = z\Gamma z$

(B) $\Gamma(z+1) = z\Gamma z$

(C) $\Gamma(z+1) = z\Gamma(z-1)$

(D) $\Gamma(z-1) = z\Gamma z$

18. If $k \geq 2$, then the value of $\prod_{s=1}^{k-1} \sin \pi \frac{s}{k}$ is :

(A $\frac{k}{2^k}$ (B) $\frac{k}{2^{k-1}}$

(C) $\frac{k-1}{2^k}$ (D) $\frac{k}{2^{k+1}}$

19. If n is a positive integer and z is neither zero nor a negative integer, then :

(A) $\Gamma(z) = \lim\limits_{n\to\infty} \frac{(n-1)!\, n^z}{(z)_{n+1}}$

(B) $\Gamma(z) = \lim\limits_{n\to\infty} \frac{n!\, n^z}{(z)_{n+1}}$

(C) $\Gamma(z) = \lim\limits_{n\to\infty} \frac{(n-1)!\, n^z}{(z)_n}$

(D) None of the above

20. If x is real, then the value of $\left|\Gamma(ix)\right|$ is :

(A) $\frac{\pi}{x \sinh \pi x}$

(B) $\sqrt{\frac{\pi}{x \sinh x}}$

(C) $\sqrt{\frac{\pi}{x \sinh \pi x}}$

(D) None of the above

21. Gauss's multiplication theorem reduces to Legendre's duplication formula when $m =$

(A) 1

(B) 2

(C) 3

(D) 0 or 1

22. The Gamma function has simple poles at which points?

(A) No poles

(B) Positive integers

(C) Non-positive integers $(0, -1, -2, -3, ...)$

(D) At $z = \infty$

23. Legendre duplication formula (one common form) is :

(A) $\Gamma(z)\,\Gamma(1-z) = \pi / \sin \pi z$

(B) $\Gamma(z)\,\Gamma(z+1) = \sqrt{\pi}\,\Gamma(2z) 2^{1-2z}$

(C) $\Gamma(z)\,\Gamma(z+½) = \sqrt{\pi}\ 2^{2z-1}\Gamma(2z)$

(D) $\Gamma(z)\,\Gamma(z+½) = \sqrt{\pi}\ 2^{1-2z}\Gamma(2z)$

24. For Hypergeometric function, correct statement is :

(A) Every hypergeometric series is geometric series

(B) Hypergeometric series is a generalisation of the geometric series

(C) There is no relation between geometric and hypergeometric function

(D) None of the above

25. The hypergeometric differential equation for ${}_2F_1$ is a linear ordinary differential equation of which order?

(A) Third order

(B) Second order

(C) First order

(D) Fourth order

26. The hypergeometric function ${}_2F_1[a,b;c;z]$ is equal to :

(A) $\sum_{n=0}^{\infty}\frac{(a)_n(c)_n}{(b)_n}\cdot\frac{z^n}{n!}$

(B) $\sum_{n=0}^{\infty}\frac{(a)_n(b)_n}{(c)_n}\cdot\frac{z^{n-1}}{n!}$

(C) $\sum_{n=0}^{\infty}\frac{(a)_n(b)_n}{(c)_n}\cdot\frac{z^n}{(n-1)!}$

(D) $\sum_{n=0}^{\infty}\frac{(a)_n(b)_n}{(c)_n}\cdot\frac{z^n}{n!}$

27. The hypergeometric function ${}_2F_1[a,b;c;z]$ is symmetric in :

(A) a and b

(B) b and c

(C) c and a

(D) All of the above

28. $\frac{d}{dz}\ {}_2F_1[a,b;c;z]$ is equal to :

(A) $\frac{a}{bc}\ {}_2F_1[a+1,b+1;c+1;z]$

(B) $\frac{ab}{c}\ {}_2F_1[a,b;c;z]$

(C) $\frac{ab}{c}\ {}_2F_1[a+1,b+1;c+1;z]$

(D) $\frac{ab}{c}\ {}_2F_1[a-1,b-1;c-1;z]$

29. The hypergeometric series reduces to simple geometric series by putting :

(A) $a=0,\ b=c$

(B) $a=1,\ b\neq c$

(C) $a=0$ or $1,\ b\neq c$

(D) $a=1,\ b=c$

30. Hypergeometric differential equation is :

(A) $z(1-z)\frac{d^2w}{dz^2}+\{c-z(1+a+b)\}\frac{dw}{dz}-abw=0$

(B) $z(1-z)\frac{d^2w}{dz^2}+\{c+z(1+a+b)\}\frac{dw}{dz}-abw=0$

(C) $z(1-z)\frac{d^2w}{dz^2}+\{c-z(1+a+b)\}\frac{dw}{dz}+abw=0$

(D) None of the above

31. The confluent hypergeometric differential equation is a linear differential equation of which order?

(A) First order

(B) Second order

(C) Third order

(D) Fourth order

32. The generalised hypergeometric function ${}_pF_q$ reduces to confluent hypergeometric function, if the value of p and q is :

(A) $p = 2,\ q = 1$

(B) $p = 3,\ q = 2$

(C) $p = 2,\ q = 2$

(D) $p = 1,\ q = 1$

33. $\frac{d^n}{dz^n}\ {}_2F_1[a,b;c;z]$ at $z = 0$ is equal to:

(A) $\frac{(a)_n}{(b)_n(c)_n}$

(B) $\frac{(a)_{n-1}(b)_{n-1}}{(c)_{n-1}}$

(C) $\frac{(a)_n(b)_n}{(c)_n}$

(D) $\frac{(a)_{n-1}(b)_{n-1}}{(c)_n}$

34. The generalised hypergeometric function ${}_pF_q$ reduces to hypergeometric function, if the value of p and q is :

(A) $p = 2,\ q = 1$

(B) $p = 3,\ q = 2$

(C) $p = 1,\ q = 2$

(D) $p = 1,\ q = 1$

35. The integral representation of ${}_2F_1[a;b;z]$ is :

(A) $\frac{\overline{|(b)}}{\overline{|(a)}\ \overline{|(b-a)}}\int_0^1 t^{a-1}(1-t)^{b-a-1}e^{-zt}dt$

(B) $\frac{\overline{|(b)}}{\overline{|(a)}\ \overline{|(b-a)}}\int_0^1 t^{a-1}(1-t)^{b-a-1}e^{zt}dt$

(C) $\frac{\overline{|(a)}}{\overline{|(b)}\ \overline{|(a-b)}}\int_0^1 t^{a-1}(1-t)^{b-a-1}e^{zt}dt$

(D) None of the above

36. Error function is defined as :

(A) $erf(x) = \frac{1}{\sqrt{\pi}}\int_0^x e^{-t^2}dt$

(B) $erf(x) = \frac{1}{\sqrt{\pi}}\int_0^x e^{t^2}dt$

(C) $erf(x) = \frac{2}{\sqrt{\pi}}\int_0^x e^{t^2}dt$

(D) $erf(x) = \frac{2}{\sqrt{\pi}}\int_0^x e^{-t^2}dt$

37. The Generalised Hypergeometric function ${}_pF_q$. If $p = q = 0$. reduce to:

(A) Binomial series for $|z| < 1$

(B) Exponential series

(C) Bessel's function

(D) Pochhommer-Bornes confluent hypergeometric function

38. The value of $\frac{2x}{\sqrt{\pi}}\ {}_1F_1\left(\frac{1}{2};\frac{3}{2};-x^2\right)$ is :

(A) Exponential series

(B) Binomial series

(C) $erf\left(x\right)$ (error function)

(D) Bessel's series

39. The result of Kummer's first theorem is :

(A) ${}_1F_1\left(a;b;z\right)=e^{-z}{}_1F_1\left(b-a;b;-z\right)$

(B) ${}_1F_1\left(a;b;z\right)=e^{z}{}_1F_1\left(a;b-a;-z\right)$

(C) ${}_1F_1\left(a;b;z\right)=e^{z}{}_1F_1\left(b-a;b;-z\right)$

(D) ${}_1F_1\left(a;b;z\right)=e^{z}{}_1F_1\left(a;b-a;z\right)$

40. If $K=\int_0^{\pi/2}\frac{d\theta}{\sqrt{1-z\sin^2\theta}}$ then the value of K is :

(A) $\frac{\pi}{2}\ {}_2F_1\left[\frac{1}{2},\frac{1}{2};1;z\right]$

(B) $\pi\ {}_2F_1\left[\frac{1}{2},\frac{1}{2};1;z\right]$

(C) ${}_2F_1\left[\frac{1}{2},\frac{1}{2};1;z\right]$

(D) $\frac{\pi}{2}\ {}_2F_1\left[1,\frac{1}{2};\frac{1}{2};z\right]$

41. The value of ${}_2F_1\left[a,b;c;1\right]$ is :

(A) $\frac{\overline{|(a)}\ \overline{|(b)}}{\overline{|(c-a)}\ \overline{|(c-b)}}$

(B) $\frac{\overline{|(c)}\ \overline{|(c-a-b)}}{\overline{|(c-a)}\ \overline{|(c-b)}}$

(C) $\frac{\overline{|(c-a)}\ \overline{|(c-b)}}{\overline{|(c)}\ \overline{|(c-a-b)}}$

(D) None of the above

42. The value of $\frac{\left(C-b\right)_n}{\left(c\right)_n}$ is :

(A) ${}_2F_1\left[-n,b;c;1\right]$

(B) ${}_2F_1\left[n,b;c;1\right]$

(C) ${}_2F_1\left[-n,b;c;\frac{1}{2}\right]$

(D) ${}_2F_1\left[-n,b;c;\frac{-1}{2}\right]$

43. The value of ${}_2F_1\left[1,1;1;z\right]$ is :

(A) $\left(1+z\right)^{-1}\ ;\ |z|<1$

(B) $\left(1+z\right)^{-1}\ ;\ |z|>1$

(C) $\left(1-z\right)^{-1}\ ;\ |z|<1$

(D) $\left(1-z\right)^{-1}\ ;\ |z|>1$

44. If $F_{a^+}=F\left[a+1,b;c;z\right]$ then F_{b^+} will be :

(A) $F\left[a,b;c+1;z\right]$

(B) $F\left[a,b;c;z+1\right]$

(C) $F\left[a,b+1;c;z\right]$

(D) $F\left[a,b;c;z\right]$

45. The value of $x\,{}_2F_1\left[1,1;2;-x\right]$ is :

(A) $\log\left(1-x\right)$

(B) e^x

(C) $\log\left(1+x\right)$

(D) $\left(1-x\right)^{-1};|x|<1$

46. The value of ${}_1F_1\left[a\,;a\,;x\right]$ is :

(A) e^{ax} (B) e^{x}

(C) e^{-x} (D) $(1-x)^{-a}$

47. The value of $x{}_2F_1\left[1,\frac{1}{2};\frac{3}{2};-x^2\right]$ is :

(A) $\sin^{-1}x$

(B) $\cos^{-1}x$

(C) $\tan^{-1}x$

(D) None of the above

48. The value of $z{}_2F_1\left[\frac{1}{2},\frac{1}{2};\frac{3}{2};z^2\right]$ is :

(A) $\sin^{-1}z$ (B) $\cos^{-1}z$

(C) $\tan^{-1}z$ (D) $\sec^{-1}z$

49. The value of ${}_1F_0\left[a;-;z\right]$ is equal to :

(A) $\sum_{n=0}^{\infty}(a)_n\frac{z^n}{(n-1)!}$

(B) $\sum_{n=0}^{\infty}\frac{1}{(a)_n}\frac{z^n}{n!}$

(C) $\sum_{n=0}^{\infty}(a)_n\frac{z^n}{n!}$

(D) None of the above

50. The value of ${}_0F_0\left[-;-;z\right]$ is equal to :

(A) $\sum_{n=0}^{\infty}\frac{z^{n-1}}{(n-1)!}$

(B) $\sum_{n=0}^{\infty}\frac{z^n}{n!}$

(C) $\sum_{n=0}^{\infty}\frac{n!}{z^n}$

(D) $\sum_{n=-\infty}^{\infty}\frac{z^n}{n!}$

51. The value of $(a-b)\ {}_2F_1\left[a,b;c;z\right]$ is:

(A) $a\ {}_2F_1(a)-b\ {}_2F_1(b)$

(B) $a\ {}_2F_1(a+)+b\ {}_2F_1(b-)$

(C) $a\ {}_2F_1(a+)-b\ {}_2F_1(b+)$

(D) $a\ {}_2F_1(a+)+b\ {}_2F_1(b+)$

52. ${}_2F_1(b-)$ is equal to :

(A) ${}_2F_1(a-,b-1;c-1;z)$

(B) ${}_2F_1(a,b-1;c-1;z)$

(C) ${}_2F_1(a,b-1;c;z)$

(D) ${}_2F_1(a,b;c;z)$

53. ${}_2F_1\left(\frac{1}{2},1;\frac{3}{2};z^2\right)$ is equal to :

(A) $\frac{1}{2z}\log\frac{1-x}{1+x}$

(B) $\sin^{-1}x$

(C) $\tan^{-1}x$

(D) None of the above

54. The generalised hypergeometric series ${}_pF_q$ is absolutely convergent infinite complex plane, if :

(A) $p\le q$

(B) $p>q$

(C) $p=q$

(D) None of the above

55. The Saalschutz's theorem is true for :

(A) ${}_pF_q$

(B) ${}_qF_p$

(C) ${}_{p+1}F_{q-1}$

(D) ${}_{q+1}F_p$

56. Whipples's theorem is used for hypergeometric series of the type :

(A) ${}_1F_1$ (B) ${}_2F_3$

(C) ${}_3F_2$ (D) ${}_2F_1$

57. Dixon's theorem is used for :

(A) Theta function

(B) Gamma function

(C) Elliptic function

(D) Hypergeometric function

58. Whipple theorem is for :

(A) Non-terminating hypergeometric series

(B) Terminating hypergeometric series

(C) Both (A) and (B)

(D) None of the above

59. If $2a$ is not an odd integer less than zero, then $e^{-z}{}_1F_1(a;2a;2z)$ is equal to :

(A) ${}_0F_1\left(-;a+\frac{1}{2};\frac{1}{4}z^2\right)$

(B) ${}_1F_1\left(a;a+\frac{1}{2};\frac{1}{4}z^2\right)$

(C) ${}_0F_1\left(-;a;\frac{1}{4}z^2\right)$

(D) ${}_1F_1\left(a;a;z^2\right)$

60. If b is neither zero nor a negative integer, then $e^{z}{}_1F_1(b-a;b;z)$ is equal to :

(A) ${}_1F_1(a;b;z+½)$

(B) ${}_1F_1(a;b;z)$

(C) ${}_0F_1(-;b;z)$

(D) ${}_1F_1(b;a;z^2)$

61. According to Dixon's theorem :

(A) $\gamma_{2n+1}=0$

(B) $\gamma_{2n}=0$

(C) $\gamma_n=0$

(D) $\gamma_{2n+1}=1$

62. Laplace transform of ${}_pF_q$ is :

(A) ${}_pF_q$

(B) ${}_pF_{q+1}$

(C) ${}_{p+1}F_q$

(D) ${}_{p+1}F_{q+1}$

63. ${}_0F_1\left(-;\frac{1}{2};-\frac{1}{4}z^2\right)$ is equal to :

(A) $\sin z$ (B) $\cos z$

(C) $\tan z$ (D) $\cos^2 z$

64. The correct statement is :

(A) Barnes' integral and ${}_pF_q$ are related

(B) Barnes' integral and ${}_pF_q$ are not related

(C) Both are incorrect

(D) Both (A) and (B) are correct

65. The hypergeometric series is a solution of :

(A) Bessel's differential equation

(B) Hypergeometric differential equation

(C) Partial differential equation

(D) Legendre's differential equation

66. $\frac{d}{dz}\ {}_pF_q\begin{bmatrix} a_1, & a_2, & ..... & ap \\ b_1, & b_2, & ..... & bq \end{bmatrix};z$ is equal to :

(A) ${}_pF_{q+1}$

(B) ${}_{p+1}F_q$

(C) ${}_{p+1}F_{q+1}$

(D) None of the above

67. The correct statement is :

(A) The geometric series is particular case of hypergeometric series.

(B) The hypergeometric series is particular case of geometric series

(C) Both (A) and (B)

(D) None of the above

68. ${}_pF_q$ is :

(A) Barnes function

(B) Geometric series

(C) Hypergeometric series

(D) Generalised hypergeometric series

69. Barnes' type integral connected with generalsied hypergeometric functions ${}_pF_q$ in two admissible cases :

(A) $p = q$ and $p = q - 1$

(B) $p = q + 1$ and $p = q - 1$

(C) $p = q + 1$ and $p = q$

(D) $p \neq q$ and $p \neq q + 1$

70. The incomplete Gamma function $\gamma(\alpha, x)$ is equal to :

(A) $\int_0^x e^t f^{\alpha-1} dt$, $\text{Re}(\alpha) > 0$

(B) $\int_0^x e^{-t} f^{1-\alpha} dt$, $\text{Re}(\alpha) > 0$

(C) $\int_0^x e^{-t} f^{\alpha-1} dt$, $\text{Re}(\alpha) > 0$

(D) $\int_0^x e^t f^{1-\alpha} dt$, $\text{Re}(\alpha) > 0$

71. $\frac{1}{\overline{|(a)}}\int_0^\infty e^{-t} t^{a-1}\ {}_0F_1(-;b;zt)\,dt$ is equal to :

(A) ${}_0F_1(-;b;z)$

(B) ${}_1F_1(a;b;z)$

(C) ${}_2F_0(a,b;-;z)$

(D) ${}_0F_2(-;a,b;z)$

72. The number of function configuous to hypergeometric function $F(a,b;c;z)$ is :

(A) 3 (B) 4

(C) 5 (D) 6

73. A function is periodic function of period *w*, if :

(A) $f(z + w) = f(z)$

(B) $f(z + 2w) = f(z)$

(C) $f(z - 2w) = f(w)$

(D) $f(z + 3w) = f(w)$

74. Doubly periodic functions have/has :

(A) One fundamental period

(B) Two fundamental period

(C) More than two fundamental period

(D) All of the above

75. Doubly peridic functions can be related to particular values of *m* and *n* by the relation :

(A) $\Omega m, n = mw_1 + nw_2$

(B) $\Omega m, n = mw_1 - nw_2$

(C) $\Omega m, n = 2mw_1 + 2nw_2$

(D) $\Omega m, n = 2mw_1 - 2nw_2$

76. An elliptic function has :

(A) Doubly periodic function

(B) Meromorphic function

(C) Both (A) and (B)

(D) None of the above

77. Primitive period parallelogram has vartices :

(A) $0, 2w_1, 2w_1 + 2w_2, 2w_2$

(B) $0, w_1, w_1 + w_2, w_2$

(C) $2w_1, 2w_1 + 2w_2, 2w_1 - 2w_2, 2w_2$

(D) $0, w_1, w_1 - w_2, w_2$

78. Let $2w_1$ and $2w_2$ are distinct fundamental periods then a cell has sides :

(A) Both $2w_1$

(B) Both $2w_2$

(C) 0 and $2w_1$

(D) $2w_1$ and $2w_2$

79. In any cell :

(A) There is poles or zero's on its boundary

(B) There is no poles or zero's on its boundary

(C) Some poles or zero's on the boundary and some poles or zero's are inside the cell

(D) None of the above

80. Order of an elliptic functions is defined as :

(A) Number of its poles in a cell

(B) Number of its distinct periods

(C) Can't defined the order of an elliptic functions

(D) None of the above

81. The number of poles and zeros of an elliptic function in any cell is/are :

(A) Can't be determined

(B) Infinite

(C) Finite

(D) Either finite or infinite

82. An elliptic function with no poles in a cell is :

(A) Constant

(B) Weierstrass function

(C) Theta function

(D) Always zero

83. The sum of residues of an elliptic function in a cell is :

(A) Finite

(B) Constant

(C) Zero

(D) Indeterminate

84. For an elliptic function in a cell :

(A) Number of zero's = Number of poles

(B) Number of zero's > Number of poles

(C) Number of zero's < Number of poles

(D) Number of zero's + Number of poles = 0 (zero)

85. An elliptic function of order less than two is :

(A) Hormonic function

(B) Constant

(C) Polynomial

(D) Exponential function

86. The Weierstrass Elliptic function $P(z)$ is :

(A) $\frac{1}{z^2}+\sum_{m,n=-\infty}^{\infty}{}^{1}\left\{\frac{1}{(z-\Omega m,n)^2}+\frac{1}{\Omega^2 m,n}\right\}$

(B) $\frac{1}{z^2}+\sum_{m,n=-\infty}^{\infty}\left\{\frac{1}{(z-\Omega m,n)^2}-\frac{1}{\Omega^2 m,n}\right\}$

(C) $\frac{1}{z^2}+\sum_{m,n=-\infty}^{\infty}{}^{1}\left\{\frac{1}{(z-\Omega m,n)^2}-\frac{1}{\Omega^2 m,n}\right\}$

(D) None of the above

87. Weierstrass Elliptic function $P(z)$ is:

(A) Odd function

(B) Even function

(C) Neither even nor odd function

(D) Either even or odd function

88. The derivative of Weierstrass elliptic function $P(z)$ is :

(A) Even function

(B) Odd function

(C) Either even or odd

(D) Prime function

89. Weierstrass Elliptic function $P(z)$ is:

(A) Jacobian elliptic function

(B) Theta function

(C) Elliptic function

(D) None of the above

90. Jacobian theta function is :

(A) $\theta_2(z,q)=2\sum_{n=0}^{\infty}q^{\left(n+\frac{1}{2}\right)^2}\cos(2n+1)z$

(B) $\theta_2(z,q)=\sum_{n=0}^{\infty}q^{\left(n+\frac{1}{2}\right)^2}\cos(2n+1)z$

(C) $\theta_2(z,q)=1+\sum_{n=0}^{\infty}q^{\left(n+\frac{1}{2}\right)^2}\cos(2n+1)z$

(D) $\theta_2(z,q)=1+2\sum_{n=0}^{\infty}q^{\left(n+\frac{1}{2}\right)^2}\cos(2n+1)z$

91. Value of $\theta_1(-z)$ is :

(A) $\theta_1(z)$

(B) $\theta_2(z)$

(C) $-\theta_1(z)$

(D) $\theta_3(z)$

92. Value of $\theta_3\left(z+\frac{\pi}{2}\right)$ is equal to :

(A) $\theta_3(z)$ (B) $\theta_4(z)$

(C) $\theta_1(z)$ (D) $\theta_2(z)$

93. $\theta_2(z+\pi)$ is equal to :

(A) $-\theta_2(z)$

(B) $\theta_2(z)$

(C) $\theta_1(z)$

(D) $-\theta_1(z)$

94. $\theta_2^{\ 4} + \theta_4^{\ 4}$ is equal to :

(A) θ_1^4 (B) θ_2^4

(C) θ_3^4 (D) θ_5^4

95. The one-dimensional heat equation is:

(A) $\dfrac{\partial u}{\partial t} = h^2 \dfrac{\partial u}{\partial x}$

(B) $\dfrac{\partial^2 u}{\partial t^2} = h^2 \dfrac{\partial^2 u}{\partial x^2}$

(C) $\dfrac{\partial^2 u}{\partial t^2} = h^2 \dfrac{\partial u}{\partial x}$

(D) $\dfrac{\partial u}{\partial t} = h^2 \dfrac{\partial^2 u}{\partial x^2}$

96. The functions $f(x)$ and $g(x)$ defined on $[a,b]$ is orthogonal, if :

(A) $\int_a^b f(x)\cdot g(x)dx = 1$

(B) $\int_a^b f(x)\cdot g(x)dx = 0$

(C) $\int_a^b f(x)\cdot g(x)dx = -k$
where $k \neq 0,1$

(D) None of the above

97. Let $f_1(x)=1$ and $f_2(x)=x$ are orthogonal on the interval (-1,1) and $f_3(x)=1+Ax+Bx^2$ is orthogonal to $f_1(x)$ and $f_2(x)$ both on that interval then the value of A is :

(A) -3

(B) 1

(C) -1

(D) 0

98. The Kroneeker delta function is defined as :

(A) $\delta_m^n = 0$

(B) $\delta_m^n = 1$

(C) $\delta_m^n = \begin{cases} 1 & , \text{ if } \ m = n \\ 0 & , \text{ if } \ m \neq n \end{cases}$

(D) $\delta_m^n = \begin{cases} 1 & , \text{ if } \ m \neq n \\ 0 & , \text{ if } \ m = n \end{cases}$

99. The inner product of two functions $f_1(x)$ and $f_2(x)$ over the interval $[a,b]$ is defined as :

(A) $\langle f_1, f_2 \rangle = \int_a^b [f_1(x) + f_2(x)]dx$

(B) $\langle f_1, f_2 \rangle = \int_a^b [f_1(x) - f_2(x)]dx$

(C) $\langle f_1, f_2 \rangle = \int_a^b f_1(x)\cdot f_2(x)dx$

(D) $\langle f_1, f_2 \rangle = \int_a^b \dfrac{f_1(x)}{f_2(x)}dx$

100. The norm of a real function $f(x)$ on the interval $[a,b]$ is defined as :

(A) $\|f\| = \int_a^b \{f(x)\}^2 dx$

(B) $\|f\| = \left[\int_a^b \{f(x)\}^2 dx\right]^{1/2}$

(C) $\|f\| = \int_a^b f(x)dx$

(D) None of the above

Rough Work

Example :

Question :

Q.1 Ⓐ ● Ⓒ Ⓓ

Q.2 Ⓐ Ⓑ ● Ⓓ

Q.3 Ⓐ ● Ⓒ Ⓓ

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.

6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.

7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.

8. After the completion of the examination, candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.

9. There will be no negative marking.

10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.

11. To bring and use of log-book, calculator, pager & cellular phone in examination hall is prohibited.

12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

उदाहरण :

प्रश्न :

प्रश्न 1 Ⓐ ● Ⓒ Ⓓ

प्रश्न 2 Ⓐ Ⓑ ● Ⓓ

प्रश्न 3 Ⓐ ● Ⓒ Ⓓ

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।

6. सभी उत्तर केवल ओ०एम०आर० उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।

7. ओ०एम०आर० उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।

8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।

9. निगेटिव मार्किंग नहीं है।

10. कोई भी रफ कार्य, प्रश्न-पुस्तिका में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।

11. परीक्षा-कक्ष में लॉग-बुक, कैल्कुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।

12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्णः प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।