Booklet Serial No. 30077

DO NOT BREAK THE SEAL OF THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

SERIES : I

QUESTION BOOKLET

Subjects : General English, General Knowledge & Aptitude and Mathematics/Statistics/Economics

Full Marks : 300 **Time Allowed : 2½ Hours**

Read the following instructions carefully before you begin to answer the questions.

INSTRUCTIONS TO CANDIDATES

1. This Booklet contains 150 Questions to be answered in a separate OMR Answer Sheet using Black Ballpoint Pen in the following three Parts :

Part—A : General English	:	**25 questions**
Part—B : General Knowledge & Aptitude	:	**25 questions**
Part—C : [Select any ONE subject from the following]		
Mathematics/Statistics/Economics	:	**100 questions**

2. **All** questions are compulsory.
3. You will be supplied the Answer Sheet separately by the Invigilator. You must complete the details of particulars asked for.
4. Answers must be shown by completely blackening the corresponding circles in the Answer Sheet against the relevant question number by Black Ballpoint Pen. OMR Answer Sheet without marking Series shall not be evaluated.

   Example :

   Suppose the following question is asked :

   The Capital of Meghalaya is

   (A) Guwahati
   (B) Kohima
   (C) Shillong
   (D) Delhi

   You will have four alternatives in the Answer Sheet for your response corresponding to each question of the Question Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Shillong, then the same should be marked on the Answer Sheet by blackening the relevant circle with a Black Ballpoint Pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.
5. Answer the questions as quickly and as carefully as you can. Some questions may be difficult and others easy. Do not spend too much time on any one question.
6. There will NOT be any negative marking for wrong answers.
7. The Answer Sheet must be handed over to the Invigilator before you leave the Examination Hall.
8. No Rough Work is to be done on the Answer Sheet. Space for Rough Work has been provided in the Question Booklet.

SEAL

PART—A : GENERAL ENGLISH

(*Marks* : 50)

Each question carries **2** marks

Directions **(Q. Nos. 1–5) : In these questions, out of four alternatives given, choose the one which best expresses the meaning of the given idioms.**

1. To jump on the bandwagon

(A) To become popular

(B) To become rich

(C) To become first

(D) To become angry

2. To go to the dogs

(A) To participate in a race

(B) To become extremely wild

(C) To be ruined

(D) To be cautious

3. To carry the day

(A) To travel

(B) To carry a heavy load

(C) To help someone

(D) To win

4. To keep an ear to the ground

(A) To be alert and active

(B) To read the signs

(C) To listen carefully

(D) To be informed and updated

5. To take a rain check

(A) To postpone a plan

(B) To carry an umbrella

(C) To gain money

(D) To make a plan

Directions **(Q. Nos. 6–10) : In these questions, out of four alternatives given, choose the one which best expresses the similar meaning of the given words.**

6. TEMPERANCE

(A) Indulgence

(B) Forbearance

(C) Speculation

(D) Affirmation

7. OMEN

(A) Universal

(B) Historical

(C) Common

(D) Portent

8. MARINE

(A) Nautical

(B) Aquatic

(C) Terrestrial

(D) Aerial

9. ESTABLISH

(A) Confine

(B) Disapprove

(C) Confirm

(D) Demolish

10. CALAMITY

(A) Distress

(B) Prosperity

(C) Fortune

(D) Disturb

***Directions* (Q. Nos. 11–15) : In these questions, out of four alternatives given, choose the one which best expresses the opposite meaning of the given words.**

11. AUSPICIOUS

(A) Successful

(B) Reasonable

(C) Forbid

(D) Unfortunate

12. INFERENCE

(A) Reality

(B) Consequence

(C) Judgement

(D) Transient

13. ROGUE

(A) Miscreant

(B) Gentleman

(C) Knave

(D) Knight

14. LIBERTY

(A) Emancipation

(B) Freedom

(C) Permission

(D) Captivity

15. ACROSS

(A) Beside

(B) Crosswise

(C) Navigate

(D) Traverse

***Directions* (Q. Nos. 16–20) : In these questions, out of four alternatives given, choose the one which best expresses the meaning of the underlined words.**

16. The district administration has issued a slew of advisories for the public in the wake of the recent floods.

(A) A note

(B) A large number

(C) An advice

(D) A notice

17. The recent arrest of a youth has precipitated an imbroglio in the already tense areas in Delhi.

(A) Entanglement

(B) Increase

(C) Fight

(D) Tension

18. The women said that the case has been falsely implicated against them.

(A) Absolved

(B) Guided

(C) Granted

(D) Connected

19. A programme was held on the school premises as the venue was too congested.

(A) Clear

(B) Clean

(C) Crowded

(D) Empty

20. One person succumbed to his injuries due to the accident that occurred last night.

(A) Accept

(B) Surrender

(C) Died

(D) Critical

***Directions* (Q. Nos. 21–25) : Fill in the blanks with the correct answer out of four alternatives given for the following sentences.**

21. James was accused of _____ the riot by the police.

(A) raising

(B) swindling

(C) staging

(D) instigating

22. The inconvenience caused to the customers is highly _____.

(A) regretted

(B) anticipated

(C) rejected

(D) expected

23. The students had to attend the extra classes to be held sometime during _____ week.

(A) last

(B) that

(C) the

(D) next

24. Rajuman was very _____ about building institutions for excellence.

(A) excited

(B) caring

(C) passionate

(D) understanding

25. It is _____ that many students have missed out on their education due to the pandemic.

(A) unlucky

(B) unfortunate

(C) unlikely

(D) untimely

PART—B : GENERAL KNOWLEDGE & APTITUDE

(*Marks* : 50)

Each question carries **2** marks

26. Who proposed the Preamble before the Drafting Committee of the Constitution?

(A) Jawaharlal Nehru

(B) B. R. Ambedkar

(C) B. N. Rau

(D) Mahatma Gandhi

27. Who among the following constitutes a Finance Commission for a State in India?

(A) The President of India

(B) The Governor of the State

(C) The Union Finance Minister

(D) The Union Cabinet

28. The Supreme Court was set up under

(A) the Pitt's India Act

(B) the Regulating Act

(C) the Indian Councils Act, 1861

(D) the Indian Councils Act, 1892

29. Fundamental Freedoms under Article 19 are suspended during emergency caused by

(A) wars or external aggressions

(B) failure of constitutional machinery of a State

(C) internal armed rebellion

(D) financial crisis

30. The Saturn rings were discovered by

(A) Copernicus

(B) Newton

(C) Galileo

(D) None of them

31. A sudden fall in the barometric reading indicates

(A) rain

(B) storm

(C) fine weather

(D) extreme cold

32. 'Parsec' is the unit measurement of

(A) density of stars

(B) astronomical distance

(C) brightness of heavenly bodies

(D) orbital velocity of giant stars

33. To what name is the Ganga known in Bangladesh?

(A) Padma

(B) Bhagirathi

(C) Rupnarayan

(D) Nubra

34. The last of the 24th Jain Tirthankaras was

(A) Parshvanatha

(B) Mahavira

(C) Rishabhanatha

(D) Arishtanemi

35. Which language was used in the literature of Sangam period?

(A) Sanskrit

(B) Tamil

(C) Telugu

(D) Kannada

36. Among the following, which Mughal Emperor introduced the policy of Sulh-i kul?

(A) Babur

(B) Humayun

(C) Akbar

(D) Aurangzeb

37. Which Indian king requested Napoleon for the help to drive the British from India?

(A) Rani of Jhansi

(B) Jai Singh

(C) Shivaji

(D) Tipu Sultan

38. The concept of Five-Year Plans in India was introduced by

(A) Lord Mountbatten

(B) Jawaharlal Nehru

(C) Indira Gandhi

(D) Lal Bahadur Shastri

39. India had a plan holiday

(A) after the China-India War of 1962

(B) after the Drought of 1966

(C) after the Liberation of Bangladesh in 1971

(D) after the India-Pakistan War in 1965

40. Hard currency is defined as currency

(A) which can hardly be used for international transactions

(B) which is used in times of war

(C) which loses its value very fast

(D) traded in foreign exchange market for which demand is persistently relative to the supply

41. Select the odd number from the given alternatives.

(A) 2378 (B) 7562

(C) 6662 (D) 1155

42. If 'K' means 'minus', 'L' means 'divided by', 'M' means 'plus' and 'D' means 'multiplied by', then

117L3K5M12D8 = ?

(A) 150 (B) 125

(C) 130 (D) 145

43. Deepak has a brother named Aditya. Deepak is the son of Kuldeep. Bunty is Kuldeep's father. How is Aditya related to Bunty?

(A) Uncle

(B) Brother

(C) Grandson

(D) Grandfather

44. Forty boys are standing in a row facing the North. Amit is eleventh from the left and Deepak is thirty-first from the right end of the row. How far will Shreya, who is third to the right of Amit in the row, be from Deepak?

(A) 2nd (B) 3rd

(C) 4th (D) 5th

45. There are deer and peacocks in a zoo. By counting heads they are 80. The number of their legs is 200. How many peacocks are there?

(A) 20 (B) 30

(C) 50 (D) 60

46. Choose the conclusion which logically follows from the given statement :

"Many creative persons become artist."

(A) A creative person will certainly become an artist.

(B) It is not possible to become an artist without creativity.

(C) A high level of creativity is needed to become an artist.

(D) Some artists are creative persons.

47. Which of the following interchanges of signs would make the given equation correct?

$24 + 6 \times 3 \div 3 - 1 = 14$

(A) + and × (B) × and −

(C) ÷ and + (D) − and ÷

48. If 'South-East' is called 'East', 'North-West' is called 'West', 'South-West' is called 'South' and so on, what will 'North' be called?

(A) East (B) North-East

(C) South (D) North-West

49. Ravi walks 10 km towards North. From there, he walks 6 km towards South. Then, he walks 3 km towards East. How far and in which direction is he with reference to his starting point?

(A) 5 km West

(B) 5 km North-East

(C) 7 km East

(D) 7 km West

50. If A = 26, SUN = 27, then CAT is equal to

(A) 24 (B) 27

(C) 57 (D) 58

PART—C : OPTIONAL

(*Marks* : 200)

[Select any ONE subject from the following]

MATHEMATICS

Each question carries **2** marks

51. The value of

$$\lim_{n\to\infty} \frac{1+2^{10}+3^{10}+\ldots+n^{10}}{n^{11}}$$

is

(A) $\frac{1}{8}$ (B) $\frac{1}{9}$

(C) $\frac{1}{10}$ (D) $\frac{1}{11}$

52. If

$$f(x) = \int_a^x \sqrt{2+t+t^2+t^3}\, dt$$

where $x > a$, then $f'(2)$ is equal to

(A) 0 (B) 2

(C) 4 (D) 6

53. The improper integral

$$\int_0^\infty e^x\, dx$$

(A) converges to 0

(B) converges to 1

(C) diverges to $+\infty$

(D) is oscillatory

54. The value of

$$\int_{-\pi/2}^{\pi/2} \frac{x\cos x}{2\sin^2 x + 3\cos^2 x}\, dx$$

is

(A) 0

(B) $\frac{\pi}{2}$

(C) 1

(D) $-\frac{\pi}{2}$

55. The largest subset of $\mathbb{R}$, on which the function $y = (\sqrt{x})^2$ is defined, is

(A) $(-\infty, 0)$

(B) $[0, \infty)$

(C) $(0, \infty)$

(D) $(-\infty, \infty)$

56. If $f(x) = \cot^{-1}\sqrt{x}$, then $f'(4)$ is

(A) $-\frac{1}{20}$

(B) $\frac{1}{20}$

(C) $-\frac{1}{5}$

(D) $\frac{1}{5}$

57. The derivative of $\sec x$ with respect to $\tan x$ is

(A) $\cos x$

(B) $\sin x$

(C) $\sec x \tan x$

(D) $\cot x$

58. $\lim_{x \to \infty} \frac{x + \cos x}{x + 1}$ is

(A) 0

(B) 1

(C) $\frac{1}{2}$

(D) None of the above

59. The n th derivative of $\sin(ax + b)$ is

(A) $a^n \cos\left(\frac{n\pi}{2} + ax + b\right)$

(B) $a^n \sin\left(\frac{n\pi}{2} + ax + b\right)$

(C) $a^n \cos(n\pi + ax + b)$

(D) $a^n \sin(n\pi + ax + b)$

60. The value of

$$\lim_{x \to 0} \frac{e^x - (1 + x)}{x^2}$$

is

(A) 0

(B) $\frac{1}{2}$

(C) 2

(D) e

61. If

$$\int_0^2 f(x)\,dx = -4 \quad \text{and} \quad \int_0^4 f(y)\,dy = 4$$

then the value of $\int_2^4 3f(z)\,dz$ is

(A) 0

(B) 8

(C) 16

(D) 24

62. If A and B be the subsets of X, then

(A) $B \subseteq X - A$

(B) $(B - A) \cap (A - B) \neq \varnothing$

(C) $A - (A - B) = A \cap B$

(D) $A - (A - B) = B$

63. The adjoint matrix of

$$A = \begin{bmatrix} a & 0 & 0 \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$$

is

(A) $\begin{bmatrix} ca & 0 & 0 \\ 0 & ba & 0 \\ 0 & 0 & ac \end{bmatrix}$

(B) $\begin{bmatrix} bc & 0 & 0 \\ 0 & ca & 0 \\ 0 & 0 & ab \end{bmatrix}$

(C) $\begin{bmatrix} -bc & 0 & 0 \\ 0 & -ca & 0 \\ 0 & 0 & -ab \end{bmatrix}$

(D) None of the above

64. If R is a relation on the set of natural numbers $\mathbb{N}$ defined by aRb if and only if 'a divides b', then

(A) R is reflexive and symmetric

(B) R is reflexive and transitive

(C) R is symmetric and transitive

(D) R is an equivalence relation

65. If A is a square matrix of order 10, then

(A) $5 \det(A) = \det(5A)$

(B) $\det(5A) = 50\det(A)$

(C) $\det(5A) = 10^5 \det(A)$

(D) $\det(5A) = 5^{10} \det(A)$

66. Let $\mathbb{C}$ be the set of complex numbers. The map $f : \mathbb{C} \to \mathbb{R}$ given by

$$f(z) = |z|, \quad z \in \mathbb{C}$$

is

(A) one-one

(B) onto

(C) neither one-one nor onto

(D) both one-one and onto

67. If a is an element of order n and p is prime to n, then the order of a^p is

(A) n

(B) p

(C) n^p

(D) p^n

68. Which of the following ideals of the ring $Z[i]$ of Gaussian integers is not maximal?

(A) $\langle 3+i \rangle$

(B) $\langle 2+i \rangle$

(C) $\langle 1-i \rangle$

(D) $\langle 1+i \rangle$

69. Let V be the vector space of all 2×2 matrices over the field $\mathbb{R}$ of real numbers and

$$B=\begin{bmatrix}1 & 2\\ 0 & 3\end{bmatrix}$$

If $T: V \to V$ is a linear transformation defined by $T(A) = AB - BA$, then what is the dimension of the kernel of T?

(A) 1 (B) 2

(C) 3 (D) 4

70. Let $(R, +)$ be an Abelian group. If multiplication '.' is defined on R by setting $a \cdot b = 0$ for all $a, b \in R$, then which one of the following statements is correct?

(A) $(R, +, .)$ is not a ring.

(B) $(R, +, .)$ is a ring but not commutative.

(C) $(R, +, .)$ is a field.

(D) $(R, +, .)$ is a commutative ring but has no unity.

71. Consider the vector space V over the field of real numbers spanned by the set

$S = \{(0, 1, 0, 0), (1, 1, 0, 0), (1, 0, 1, 0),$
$(0, 0, 1, 0), (1, 1, 1, 0), (1, 0, 0, 0)\}$

The dimension of V is

(A) 4 (B) 3

(C) 2 (D) 1

72. Let R be a ring. Then the necessary condition, for which an ideal I of R is a principal ideal, is

(A) R is a ring with unity

(B) R is a commutative ring with unity

(C) R is a commutative ring

(D) R is without zero divisor

73. The differential equation

$$x\,dy - y\,dx = \sqrt{x^2 + y^2}\,dx$$

is

(A) a differential equation of variable separable type

(B) a differential equation of homogeneous type

(C) an exact equation

(D) a linear equation

74. The differential equation formed from the relation $x = a\cos t + b\sin t$, where a and b are arbitrary constants, is given by

(A) $\frac{d^2x}{dt^2} = x$

(B) $\frac{d^2x}{dt^2} = -t$

(C) $\frac{d^2x}{dt^2} = t$

(D) $\frac{d^2x}{dt^2} = -x$

75. The particular integral of the equation

$$(D^2 + 1)y = \sin 2x$$

is

(A) $\frac{1}{3}\sin 2x$

(B) $\frac{1}{3}\cos 2x$

(C) $-\frac{1}{3}\sin 2x$

(D) $-\frac{1}{3}\cos 2x$

76. The degree of the differential equation

$$\sqrt[3]{y + x\left(\frac{dy}{dx}\right)^2} = \frac{d^2y}{dx^2}$$

is

(A) 1

(B) 2

(C) 3

(D) not defined

77. If $\frac{dv}{dt} = -\frac{v^2}{100}$ and $v = 15$ when $t = 0$, then the value of t, when $v = 10$, is

(A) $\frac{3}{10}$

(B) $-\frac{3}{10}$

(C) $-\frac{10}{3}$

(D) $\frac{10}{3}$

78. An integrating factor of

$$y(1 + xy)dx - x\,dy = 0$$

is

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

(C) $\frac{1}{y^3}$ (D) $\frac{1}{\sqrt{y}}$

79. The general solution of the differential equation

$$y = px + \frac{a}{p}$$

where $p = \frac{dy}{dx}$, is

(A) $x = cy - \frac{a}{c}$

(B) $x = cy + \frac{a}{c}$

(C) $y = cx - \frac{a}{c}$

(D) $y = cx + \frac{a}{c}$

80. The general solution of the differential equation

$$\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 15y = 0$$

is

(A) $y = c_1e^{3x} + c_2e^{5x}$

(B) $y = e^{3x}(c_1 + c_2e^{x})$

(C) $y = c_1e^{x} + c_2e^{8x}$

(D) $y = c_1e^{8x} + c_2e^{15x}$

81. The equation of the curve where the slope at any point (x, y) on it is xy and which passes through $(0, 1)$, is

(A) $y = e^{x^2}$ (B) $y = e^{\frac{x^2}{2}}$

(C) $y = e^{2x^2}$ (D) $y = e^{\frac{x^2}{3}}$

82. The orthogonal trajectories of the family of straight lines $y = mx$ are

(A) $y^2 = 4ax$

(B) $x^2 - y^2 = c$

(C) $x^2 + y^2 = c$

(D) $xy = c$

83. Which of the following transformations reduces the differential equation

$$\frac{dy}{dx} = \frac{x - y + 1}{x + 2y - 3}$$

into homogeneous one?

(A) $x = X - 3,\ y = Y - 4$

(B) $x = X + 3,\ y = Y + 4$

(C) $x = X - \frac{1}{3},\ y = Y - \frac{4}{3}$

(D) $x = X + \frac{1}{3},\ y = Y + \frac{4}{3}$

84. The minimum value of

$$\frac{(x+1)(x+4)}{(x-1)(x-4)}$$

is

(A) $-\frac{1}{9}$

(B) $\frac{1}{9}$

(C) -9

(D) 9

85. The series

$$\sum \frac{(-1)^{n-1}}{n^p},\ p > 0$$

(A) is divergent

(B) is convergent

(C) oscillates finitely

(D) oscillates infinitely

86. The series

$$\frac{x}{1.2} + \frac{x^2}{2.3} + \frac{x^3}{3.4} + \cdots$$

is convergent, if

(A) $|x| \leq 0$

(B) $|x| \geq 0$

(C) $|x| \leq 1$

(D) $|x| \geq 1$

87. For what value(s) of x is the series

$$x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

convergent?

(A) $x \geq 0$

(B) $x \leq 0$

(C) $x = 0$

(D) For all values of x

88. If

$$5f(x) + 3f\left(\frac{1}{x}\right) = x + 2$$

and $y = xf(x)$, then $\left(\frac{dy}{dx}\right)_{x=1}$ is equal to

(A) $\frac{7}{8}$

(B) 1

(C) $\frac{8}{7}$

(D) 14

89. If $f(z)$ is a real-valued function such that

$$2f(x) + 3f(-x) = 15 - 4x$$

for every $x \in \mathbb{R}$, then $f(2)$ is

(A) -15

(B) 22

(C) 11

(D) 3

90. The improper integral

$$\int_a^b \frac{dx}{(x-a)^n}$$

converges if and only if

(A) $n < 0$ (B) $n > 0$

(C) $n < 1$ (D) $n > 1$

91. The sequence $\{f_n\}$, where

$$f_n(x) = \frac{nx}{1 + n^2x^2}$$

is not uniformly convergent in any interval

(A) $[a, b]$ containing 0

(B) $[a, b]$ not containing 0

(C) $[a, b]$ containing 1

(D) $[a, b]$ not containing 1

92. The value of

$$\lim_{x \to 0}\left(\frac{1}{x^2} - \frac{1}{\sin^2 x}\right)$$

is

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

(B) $-\frac{1}{3}$

(C) $\frac{1}{2}$

(D) $-\frac{1}{2}$

93. The function $f(x) = \frac{1}{x}$ is not uniformly continuous on

(A) $[0, 1]$

(B) $]0, 1]$

(C) $[0, 1[$

(D) None of the above

94. If by rotation of the rectangular axes, the equation

$$17x^2 + 18xy - 7y^2 = 1$$

reduces to the form $x^2 + by^2 = 1$, then the angle through which the axes are rotated, is

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

(B) $\tan^{-1}\frac{3}{4}$

(C) $\frac{\pi}{2}$

(D) $\frac{\pi}{4}$

95. The value of k so that the equation

$$kx^2 + 3xy - 5y^2 + 7x + 14y + 3 = 0$$

may represent a pair of straight lines is

(A) 2

(B) 1

(C) 3

(D) $\frac{1}{3}$

96. The equation of the polar of the point (2, 3) with respect to the conic

$$x^2 + 3xy + 4y^2 - 5x + 3 = 0$$

is

(A) $4x - 15y + 2 = 0$

(B) $4x + 15y + 2 = 0$

(C) $4x - 15y - 2 = 0$

(D) $4x + 15y - 2 = 0$

97. The equation of the parabola whose focus is the origin and whose directrix is the line $2x + y = 1$, is

(A) $(x + 2y)^2 + 4x + 2y - 1 = 0$

(B) $(x + 2y)^2 - 4x + 2y + 1 = 0$

(C) $(x - 2y)^2 + 4x - 2y + 1 = 0$

(D) $(x - 2y)^2 + 4x + 2y - 1 = 0$

98. The equation of the cone whose vertex is the origin and guiding curve is given by

$$x + 2y + 3z = 4$$
$$5x^2 + 7y^2 - 3z + 2 = 0$$

is

(A) $41x^2 + 60y^2 - 9z^2 = 0$

(B) $41x^2 - 60y^2 + 4xyz = 0$

(C) $41x^2 + 60y^2 - 9z^2 + 4xy = 0$

(D) $41x^2 + 60y^2 + 9z^2 + 4xyz = 0$

99. The lines

$$\frac{x+3}{2} = \frac{y+5}{3} = \frac{z-7}{-3}$$

$$\frac{x+1}{4} = \frac{y+1}{5} = \frac{z+1}{-1}$$

(A) do not intersect each other

(B) are coplanar

(C) are parallel

(D) None of the above

100. The angle between the two planes

$$2x+2y-z+7=0$$

$$3x+6y+2z+11=0$$

is

(A) $\cos^{-1}\frac{16}{21}$

(B) $\cos^{-1}\frac{7}{11}$

(C) $\frac{\pi}{6}$

(D) $\frac{\pi}{4}$

101. The plane $lx+my+nz=p$ is a tangent plane to the sphere $x^2+y^2+z^2=a^2$, if

(A) $p^2(l^2+m^2+n^2)=a^2$

(B) $(l^2+m^2+n^2)=p^2a^2$

(C) $a^2(l^2+m^2+n^2)=p^2$

(D) $(l^2+m^2+n^2)=ap$

102. The equation of the directrix of the conic $\frac{l}{r}=1+e\cos\theta$ corresponding to the focus at the origin is

(A) $\frac{l}{r}=e\cos\theta$

(B) $\frac{r}{l}=e\cos\theta$

(C) $\frac{l}{r}=1-e\cos\theta$

(D) $\frac{r}{l}=1-e\cos\theta$

103. The centre of the sphere

$$x^2+y^2+z^2-4x+5y-6z-1=0$$

is

(A) $\left(-2, \frac{5}{2}, 3\right)$

(B) $\left(-2, -\frac{5}{2}, 3\right)$

(C) $\left(2, -\frac{5}{2}, 3\right)$

(D) $\left(2, \frac{5}{2}, -3\right)$

104. The resultant of two equal forces P, P acting at an angle $120°$ is

(A) $2P$

(B) equal to P

(C) less than P

(D) greater than P

105. If the resultant of two forces acting on a particle be at right angles to one of them, and its magnitude be one-third of the magnitude of the other, then the ratio of the larger force to the smaller force is

(A) 3 : 2

(B) 2 : 3

(C) 2 : $3\sqrt{2}$

(D) 3 : $2\sqrt{2}$

106. Two men, X and Y, are carrying a straight uniform bar 6 m long and weighing 30 kg. X supports it at a distance of 1 m from one end, and Y at a distance of 2 m from the other end. What weight does X bear?

(A) 40 kg

(B) 10 kg

(C) 30 kg

(D) 20 kg

107. If three forces acting upon a rigid body is represented in magnitude, direction, sense and line of action by the sides of a triangle taken in order, then they are equivalent to a couple whose moment is equal to

(A) twice the area of the triangle

(B) the area of the triangle

(C) half the area of the triangle

(D) None of the above

108. If a system of coplanar forces reduces to a couple, then the algebraic sum of the moments of the forces about any point in their plane is constant and

(A) greater than the moment of the couple

(B) equal to the moment of the couple

(C) less than the moment of the couple

(D) None of the above

109. A relation between a and b in order that

$$(2x^4 - 7x^3 + ax + b)$$

may be exactly divisible by $(x - 3)$ is

(A) $a + 3b = 27$

(B) $3a + b = 27$

(C) $a + b = 21$

(D) $a - b = 20$

110. The equation whose roots are 1, –2, 3, –4 is

(A) $x^4 + 2x^3 - 13x^2 - 14x + 24 = 0$

(B) $x^4 - 13x^2 - 14x - 24 = 0$

(C) $x^4 - x^3 - 13x^2 - 10x + 24 = 0$

(D) $24x^4 + x^3 - 10x^2 - 2x + 15 = 0$

111. The roots of the equation

$$x^3 - 3x^2 + 4 = 0$$

where two of its roots are equal, are

(A) 2, 2, 1

(B) −2, 1, 1

(C) 2, 1, 1

(D) 2, 2, −1

112. If α, β, γ be the roots of the equation

$$x^3 + px + q = 0$$

then the value of $\sum \frac{1}{\alpha + \beta}$ is

(A) $p + q$

(B) pq

(C) $\frac{p}{q}$

(D) $\frac{q}{p}$

113. The rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 4 & 6 & 8 \end{bmatrix}$$

is

(A) 0

(B) 1

(C) 2

(D) 3

114. The system of equations

$$2y + 4z + 5 = 0$$
$$8x - y + 4z = 12$$
$$16x - y + 10z = 1$$

is

(A) consistent and have unique solution

(B) consistent and have infinite number of solutions

(C) inconsistent and have no solution

(D) None of the above

115. The value of $[\hat{i} \times \hat{j},\ \hat{j} \times \hat{k},\ \hat{k} \times \hat{i}]$ is

(A) −1

(B) 0

(C) 1

(D) 3

116. The divergence of

$$x^2 z\hat{i} - 2y^3 z^2 \hat{j} + xy^2 z\hat{k}$$

at (1, − 1, 1) is

(A) −2

(B) 0

(C) 1

(D) −3

117. If $\vec{a}\cdot\vec{b}=\vec{a}\cdot\vec{c}$ and $\vec{a}\times\vec{b}=\vec{a}\times\vec{c}$, and $\vec{a}\neq\vec{0}$, then

(A) $\vec{b}=\vec{c}$

(B) $\vec{b}\neq\vec{c}$

(C) $\vec{b}=\vec{a}$

(D) None of the above

118. If $\vec{a}$ be any vector, then

$$|\vec{a}\cdot\hat{i}|^2+|\vec{a}\cdot\hat{j}|^2+|\vec{a}\cdot\hat{k}|^2$$

is equal to

(A) 0

(B) $2\vec{a}^2$

(C) $3\vec{a}^2$

(D) $\vec{a}^2$

119. Divergence of the three-dimensional radial vector field $\vec{r}$ is

(A) 2

(B) 3

(C) $\frac{1}{\vec{r}}$

(D) $\hat{i}+\hat{j}+\hat{k}$

120. The directional derivative of $f(x, y, z)=r^2$, where $r^2=x^2+y^2+z^2$ along the x-axis is

(A) $2x$

(B) $2y$

(C) $2z$

(D) $x+y$

121. If

$$\vec{r}=5t^2\hat{i}+t\hat{j}-t^3\hat{k}$$

$$\vec{s}=\sin t\hat{i}-\cos t\hat{j}$$

then the value of $\frac{d}{dt}(\vec{r}\cdot\vec{s})$ is

(A) $(5t^2-1)\sin t+11t\cos t$

(B) $(5t^2-1)\cos t+11\sin t$

(C) $5t^2\sin t+11t\cos t$

(D) $(5t^2-1)\cos t+11t\sin t$

122. The values of the constants a, b, c so that the vector

$$\vec{w}=(x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x+cy+2z)\hat{k}$$

becomes irrotational are

(A) $a=-4,\ b=-2,\ c=1$

(B) $a=-4,\ b=2,\ c=1$

(C) $a=4,\ b=2,\ c=-1$

(D) $a=4,\ b=-2,\ c=1$

123. The value of x such that the vectors $\vec{a}=2\hat{i}-\hat{j}+\hat{k}$, $\vec{b}=x\hat{i}+2\hat{j}-3\hat{k}$ and $\vec{c}=3\hat{i}-4\hat{j}+5\hat{k}$ are coplanar, is

(A) -2 (B) 0

(C) 1 (D) 3

124. If C be a closed curve, then $\oint_C \vec{r} \cdot d\vec{r}$ is equal to

(A) r (B) r^2

(C) $\frac{1}{r}$ (D) 0

125. The radius of convergence of the power series $\sum \frac{z^n}{n!}$, where $z = x + iy$, is

(A) 1 (B) e

(C) $\frac{1}{e}$ (D) ∞

126. The fixed points of the transformation

$$w = \frac{2z - 5}{z + 4}$$

where $z = x + iy$, is given by

(A) $2 \pm i$ (B) $-2 \pm i$

(C) $1 \pm 2i$ (D) $-1 \pm 2i$

127. For what value of z, the function w defined by

$$z = e^{-v}(-\cos u + i \sin u), \; w = u + iv$$

ceases to be analytic?

(A) $z = -1$

(B) $z = 0$

(C) $z = 1$

(D) $z = 2$

128. The function $f(z) = |z|^2$ is

(A) differentiable everywhere

(B) not differentiable anywhere

(C) differentiable only at the origin

(D) differentiable on real x-axis

129. The bilinear transformation which maps the points $z_1 = 2, z_2 = i$ and $z_3 = -2$ into the points $w_1 = 1, w_2 = i$ and $w_3 = -1$ is

(A) $w = \frac{3z + 2i}{6 + iz}$

(B) $w = \frac{3z - 2i}{6 + iz}$

(C) $w = \frac{3z + 2i}{6 - iz}$

(D) $w = \frac{3z - 2i}{6 - iz}$

130. The residue of

$$\frac{1}{(z^2 + 1)^3}$$

at $z = i$, where $z = x + iy$, is

(A) $-\frac{3}{16i}$

(B) $\frac{3}{16i}$

(C) $-\frac{1}{3i}$

(D) $\frac{1}{3i}$

131. The resultant of two simultaneous velocities $\vec{u}$ and $\vec{v}$ acting at right angles to each other is of magnitude

(A) $u+v$

(B) $\sqrt{u+v}$

(C) $\sqrt{u^2+v^2}$

(D) u^2+v^2

132. A man rows directly across a flowing river in time t_1 and rows an equal distance down the stream in time t_2. If u be the speed of the man in still water and v be that of the stream, then $t_1 : t_2$ is equal to

(A) $\sqrt{u+v} : \sqrt{u-v}$

(B) $\sqrt{u-v} : \sqrt{u+v}$

(C) $\sqrt{u^2+v^2} : \sqrt{u^2-v^2}$

(D) $\sqrt{u^2-v^2} : \sqrt{u^2+v^2}$

133. An aeroplane is moving due North at 200 km/hr relative to a train travelling due East at 60 km/hr. Then the magnitude of the true velocity of the aeroplane is

(A) 260 km/hr

(B) 140 km/hr

(C) $20\sqrt{109}$ km/hr

(D) $10\sqrt{140}$ km/hr

134. A train travelling at 30 km/hr is brought to rest uniformly at a station in $1\frac{1}{2}$ minutes. At what distance from the station were the brakes applied?

(A) 300 m

(B) 325 m

(C) 350 m

(D) 375 m

135. What acceleration must be imparted to a load hanging from a cord passing over a pulley in order that the tension in the cord may be twice the weight of the load? [Take $g = 9{\cdot}8$ m/s^2]

(A) 4·9 m/s^2

(B) 19·6 m/s^2

(C) 9·8 m/s^2

(D) None of the above

136. A partial differential equation formed by eliminating a, b from $z = (x+a)(y+b)$ $\left(\text{where } p = \frac{\partial z}{\partial x},\ q = \frac{\partial z}{\partial y}\right)$, is

(A) $z = p$

(B) $z = q$

(C) $z = p+q$

(D) $z = pq$

137. The general integral of the partial differential equation $yzp + zxq = xy$ $\left(\text{where } p = \frac{\partial z}{\partial x},\ q = \frac{\partial z}{\partial y}\right)$, is

(A) $f(x^2 + y^2,\ y^2 + z^2) = 0$

(B) $f(x^2 - y^2,\ y^2 - z^2) = 0$

(C) $f(x^2 + y^2,\ x^2 + z^2) = 0$

(D) $f(x^2 - y^2,\ x^2 - z^2) = 0$

138. Which of the following is the solution of the partial differential equation

$$2r + 5s + 2t = 0?$$

(A) $z = f_1(2y - x) + f_2(y - 2x)$

(B) $z = f_1(2y + x) + f_2(y + 2x)$

(C) $z = f_1(y - 2x) + f_2(y - 2x)$

(D) $z = f_1(y + 2x) + f_2(y + 2x)$

139. Given

$f(0) = 3,\quad f(1) = 12,\quad f(2) = 81,$
$f(3) = 200,\ f(4) = 100$ and $f(5) = 8$

Using the difference table, the value of $\Delta^5 f(0)$ (where the operator Δ is called the forward difference operator), is

(A) 227

(B) 8

(C) 755

(D) 496

140. Consider the linear programming problem

Maximize $\quad Z = 3x + 9y$

subject to

$$x + 4y \le 8$$
$$x + 2y \le 4$$
$$x,\ y \ge 0$$

The maximum value of Z is

(A) 6 (B) 15

(C) 18 (D) 21

141. In regular simplex method

(A) the iterations move towards feasibility maintaining optimality

(B) the iterations move towards optimality maintaining feasibility

(C) the iterations maintain both feasibility and optimality

(D) None of the above

142. The hexadecimal equivalent of the decimal number 5280 is

(A) $(12)_{16}$ (B) $(ABC)_{16}$

(C) $(14A0)_{16}$ (D) $(13A)_{16}$

143. The binary equivalent of the decimal number .3125 is

(A) $(.0101)_2$ (B) $(.0011)_2$

(C) $(.101)_2$ (D) $(.1011)_2$

144. The maximum value of $\left(\frac{1}{x}\right)^x$ is

(A) e (B) $\frac{1}{e}$

(C) $\left(\frac{1}{e}\right)^e$ (D) $e^{(1/e)}$

145. The point on the curve $2y = (3 - x^2)$ at which the tangent is parallel to the line $x + y = 0$, is

(A) $\left(0, \frac{3}{2}\right)$ (B) $(-1, 1)$

(C) $(1, 1)$ (D) $(2, 3)$

146. A die is rolled. If the outcome is an odd number, what is the probability that it is prime?

(A) $\frac{1}{2}$ (B) $\frac{2}{3}$

(C) $\frac{3}{4}$ (D) $\frac{4}{5}$

147. There are three urns containing 3 white and 2 black balls, 2 white and 3 black balls, 4 white and 1 black balls respectively. There is equal probability of each urn being chosen. One ball is drawn from an urn chosen at random. What is the probability that a white ball is drawn?

(A) 0 (B) $\frac{2}{5}$

(C) $\frac{3}{5}$ (D) $\frac{5}{6}$

148. An insurance company insured 2000 scooter drivers, 400 car drivers and 6000 truck drivers. The probability of an accident involving a scooter, a car and a truck is $\frac{1}{100}$, $\frac{3}{100}$ and $\frac{3}{20}$ respectively. One of the insured persons meets with an accident. What is the probability that he is scooter driver?

(A) $\frac{3}{47}$

(B) $\frac{5}{41}$

(C) $\frac{3}{57}$

(D) $\frac{1}{52}$

149. The area of the region bounded by the parabola $y^2 = 16x$ and the line $x = 4$ is

(A) $\frac{64}{3}$ sq. unit

(B) $\frac{128}{3}$ sq. unit

(C) $\frac{123}{2}$ sq. unit

(D) $\frac{76}{5}$ sq. unit

150. The coordinates of the foot of the perpendicular from the point (7, 14, 5) to the plane $2x + 4y - z = 2$ is

(A) (1, 8, 2)

(B) (8, 1, 2)

(C) (1, 2, 8)

(D) (2, 1, 8)

STATISTICS

Each question carries **2** marks

51. The algebraic sum of deviations of a set of n values from their arithmetic mean is

(A) n

(B) 0

(C) 1

(D) None of the above

52. The mean of the distribution, in which the values of x are 1, 2, 3, ..., n, the frequency of each being unity is

(A) $\frac{n(n+1)}{2}$

(B) $\frac{n}{2}$

(C) $\frac{(n+1)}{2}$

(D) None of the above

53. The point of intersection of the less than and more than ogive corresponds to

(A) the mean

(B) the median

(C) geometric mean

(D) None of the above

54. A car travels 100 km at a speed of 40 km/h and another 400 km at a speed of 30 km/h. So, the average speed of the whole journey is

(A) 31 km/h

(B) 31·6 km/h

(C) 32 km/h

(D) 32·6 km/h

55. Which is the only average that can be used while dealing with qualitative data?

(A) Arithmetic mean

(B) Geometric mean

(C) Median

(D) Mode

56. The AM, GM and HM in any series are equal when the distribution is

(A) positively skewed

(B) unimodal

(C) symmetric

(D) None of the above

57. The measure of the convexity of a curve is

(A) $\beta_2 = 0$

(B) $\beta_2 = 3$

(C) $\beta_2 = 4$

(D) $\beta_2 = 1$

58. The limits of quartile coefficient of skewness are

(A) ± 3

(B) 0 and 3

(C) ± 1

(D) 0 and 1

59. The statement that the variance is equal to the second central moment is

(A) never true

(B) sometimes true

(C) ambiguous

(D) always true

60. In a frequency curve of scores, the mode was found to be higher than the mean. This shows that the distribution is

(A) symmetric

(B) negatively skewed

(C) positively skewed

(D) None of the above

61. The probability of drawing any one spade card from a standard pack of cards is

(A) $\frac{1}{52}$

(B) $\frac{1}{13}$

(C) $\frac{4}{13}$

(D) $\frac{1}{4}$

62. If A and B are mutually exclusive events, then

(A) $P(A \cup B) = P(A) \cdot P(B)$

(B) $P(A \cup B) = P(A) + P(B)$

(C) $P(A \cup B) = 0$

(D) None of the above

63. A has 28 elements, B has 32 elements and $(A \cup B)$ has 40 elements. How many elements does $(A \cap B)$ have?

(A) 12

(B) 8

(C) 10

(D) 20

64. The sample space of 4 coins tossed together is

(A) 8

(B) 64

(C) 32

(D) 16

65. A team has 6 girls and 6 boys. Three students have to be selected for a project. The probability that two girls and one boy are selected is

(A) $\frac{19}{22}$

(B) $\frac{7}{22}$

(C) $\frac{9}{22}$

(D) $\frac{7}{23}$

66. Two letters from the word 'DIFFICULTY' are chosen. What is the probability that both letters are same?

(A) $\frac{1}{25}$

(B) $\frac{2}{45}$

(C) $\frac{3}{50}$

(D) $\frac{4}{45}$

67. The probability of passing an exam for A and B are 0·7 and 0·8 respectively. The probability that at least one of them passes the exam is

(A) 0·6

(B) 0·64

(C) 0·94

(D) None of the above

68. A numerical value used as a summary measure for a sample, such as sample mean, is known as a

(A) population parameter

(B) sample parameter

(C) sample statistic

(D) population mean

69. The sum of the percent frequencies of all classes will always be

(A) one

(B) the number of classes

(C) one hundred

(D) the number of items in study

70. Which of the following is ***not*** based on all the observations?

(A) Arithmetic mean

(B) Mode

(C) Harmonic mean

(D) Weighted mean

71. Which of the following methods is used to examine inflation rate, anticipation, unemployment rate and capacity utilization to produce products?

(A) Data exporting technique

(B) Data importing technique

(C) Forecasting technique

(D) Data supplying technique

72. Specialized processes such as graphical and numerical methods are utilized in which of the following?

(A) Descriptive statistics

(B) Educational statistics

(C) Business statistics

(D) Social statistics

73. Which of the following is true for the correlation coefficient?

(A) It is independent of the change of scale

(B) It is independent of the change of origin

(C) It is independent of both the change of origin and change of scale

(D) None of the above

74. Which of the following techniques is an analysis of the relationship between two variables to help provide the prediction mechanism?

(A) Correlation

(B) Regression

(C) Standard error

(D) None of the above

75. What is the meaning of the testing of hypothesis?

(A) It is a significant estimation of the problem

(B) It is a rule for the acceptance or rejection of the hypothesis of the research problem

(C) It is a method of making a significant statement

(D) None of the above

76. The original hypothesis is known as

(A) alternative hypothesis

(B) null hypothesis

(C) Both (A) and (B)

(D) Neither (A) nor (B)

77. Which of the following is true about the type–II error?

(A) Type–II error means to accept an incorrect hypothesis

(B) Type–II error means to reject an incorrect hypothesis

(C) Type–II error means to accept a correct hypothesis

(D) Type–II error means to reject a correct hypothesis

78. Which of the following statements is true about the regression line?

(A) It is also known as the line of the average relationship.

(B) It is also known as the estimating equation.

(C) It is also known as the prediction equation.

(D) All of the above

79. A region in the sample space which amounts to the rejection of the null hypothesis is known as

(A) the acceptance region

(B) the critical region

(C) level of significance

(D) All of the above

80. If σ is the population standard deviation and n is the size of the random sample, then the standard error of the sample mean of the random sample is

(A) $\frac{\sigma^2}{n}$

(B) $\frac{\sigma}{\sqrt{n}}$

(C) $\frac{\sigma^2}{2n}$

(D) $\frac{\sigma}{\sqrt{2n}}$

81. The p.d.f. of a normal variate X with parameters μ and σ^2 is

(A) $\frac{1}{\sigma\sqrt{2\pi}} \exp\left[\frac{-(x-\mu)}{2\sigma}\right]$

(B) $\frac{1}{\sigma\sqrt{2\pi}} \exp\left[\frac{-(x-\mu)^2}{2\sigma^2}\right]$

(C) $\frac{1}{\sigma\sqrt{2\pi}} \exp\left[\frac{-(x-\mu)^2}{2\sigma}\right]$

(D) None of the above

82. For a normal probability curve

(A) $\beta_1 = 0,\ \beta_2 = 0$

(B) $\beta_1 = 3,\ \beta_2 = 0$

(C) $\beta_1 = 3,\ \beta_2 = -3$

(D) $\beta_1 = 0,\ \beta_2 = 3$

83. If r is the correlation coefficient, then $\sqrt{1=r^2}$ is termed as

(A) coefficient of regression

(B) coefficient of determination

(C) probable error

(D) None of the above

84. If the two lines of regression are coincident, then the relation between the two regression coefficients is

(A) $\beta_{yx} = \beta_{xy}$

(B) $\beta_{yx} \leq \beta_{xy}$

(C) $\beta_{yx} \cdot \beta_{xy} = 1$

(D) None of the above

85. Probable error is used for

(A) measuring the error in r

(B) testing the significance of r

(C) Both (A) and (B)

(D) Neither (A) nor (B)

86. Which of the following measures is used to study the nature and degree of association between two attributes?

(A) Correlation coefficient

(B) Spearman's rank correlation coefficient

(C) Yule's coefficient

(D) Regression coefficient

87. Association is meant for

(A) attributes

(B) variables

(C) Both (A) and (B)

(D) Neither (A) nor (B)

88. The independent variate values in interpolation and extrapolation are termed as

(A) entries

(B) arguments

(C) attributes

(D) None of the above

89. The relations between the operators E and Δ within its usual sense in interpolation is

(A) $E \equiv 1 + \Delta$

(B) $E \equiv 1 - \Delta$

(C) $E \equiv 1 - \Delta^2$

(D) None of the above

90. A method of estimating approximately the population for the year 1988 on the basis of the population census figures relating to 1951, 1961, 1971, 1981, 1991 and 2001 is

(A) correlation

(B) interpolation

(C) extrapolation

(D) None of the above

91. Index numbers reveal the state of

(A) inflation

(B) deflation

(C) Both (A) and (B)

(D) Neither (A) nor (B)

92. In the computation of index numbers, most preferred type of average is

(A) arithmetic mean

(B) median

(C) geometric mean

(D) harmonic mean

93. For cost of living index, the price data should be collected from

(A) wholesalers

(B) retailers

(C) Both (A) and (B)

(D) Neither (A) nor (B)

94. The gross national product value is deflated through

(A) index of industrial production

(B) price index number

(C) quantity index number

(D) None of the above

95. The components of a time series which is attached to short term fluctuation is

(A) seasonal variation

(B) cyclical variation

(C) irregular variation

(D) All of the above

96. The decline in birthrate is attached to which component of a time series?

(A) Secular trend

(B) Seasonal variation

(C) Random variation

(D) None of the above

97. Linear trend of a time series indicates towards

(A) change in arithmetic progression

(B) change in geometric progression

(C) constant rate of growth

(D) All of the above

98. Method of least squares to fit in the trend is applicable if trend is

(A) linear

(B) parabolic

(C) Both (A) and (B)

(D) Neither (A) nor (B)

99. Which component of a time series is applicable in case of a fire in a factory?

(A) Secular trend

(B) Seasonal variation

(C) Random variation

(D) Cyclical variation

100. A method of smoothing a time series by averaging successive groups of data points is

(A) semi-average method

(B) moving average method

(C) least squares method

(D) None of the above

101. The unsystematic sequence which follows irregular pattern of variations is called

(A) noise

(B) signal

(C) linear

(D) non-linear

102. A complete cycle passes through

(A) two stages

(B) three stages

(C) four stages

(D) Difficult to tell

103. Most frequently used mathematical model in a time series is

(A) additive model

(B) multiplicative model

(C) mixed model

(D) regression model

104. The best fitting trend is when the sum of squares of residuals is

(A) zero

(B) least

(C) maximum

(D) negative

105. A second degree parabola has

(A) one constant

(B) two constants

(C) three constants

(D) no constant

106. For even number of years, when the origin is at the centre and the unit of X being half year, then X can be coded as

(A) X = Year – Average of years

(B) X = 2(Year – Average of years)

(C) X = (Year – Average of years)/2

(D) None of the above

107. Which is the control chart for fraction defective?

(A) V-chart

(B) P-chart

(C) X-chart

(D) C-chart

108. An $\overline{X}$-chart uses which of the following data?

(A) Count data

(B) Attribute measurement data

(C) Variable measurement data

(D) None of the above

109. An operating characteristic curve (OC-curve) is a plot between

(A) consumer's risk and producer's risk

(B) probability of acceptance and probability of rejection

(C) percentage of defectives and probability of acceptance

(D) average outgoing quality and probability of acceptance

110. For the purpose of sampling inspection, the maximum percent defective that can be considered satisfactory as a process average is

(A) rejectable quality level

(B) acceptable quality level

(C) average outgoing quality limit

(D) lot tolerance percent defective

111. A basic feasible solution in a linear programming problem with m constraints and n variables will have

(A) at the most m variables with non-zero values

(B) at least m variables with non-zero values

(C) at the most n variables with non-zero values

(D) at least n variables with non-zero values

112. Statistical quality control techniques are based on the theory of

(A) probability

(B) quality

(C) statistics

(D) set theory

113. Which one of the following control charts is used for the number of defects per unit?

(A) *C*-chart

(B) *P*-chart

(C) Range

(D) Mean

114. The producer's risk means the probability that the consumer will

(A) accept a good lot

(B) accept a bad lot

(C) reject a bad lot

(D) reject a good lot

115. In acceptance sampling, when there is a finite probability that the lot may be rejected even if the quality is actually good, is called as

(A) consumer's risk

(B) operator's risk

(C) producer's risk

(D) owner's risk

116. Simplex method of solving linear programming problem uses

(A) all the points in the feasible region

(B) only the corner points of the feasible region

(C) intermediate points within the infeasible region

(D) only the interior points in the feasible region

117. In a linear programming problem, the restrictions or limitations under which the objective function is to be optimized are called

(A) constraints

(B) objective function

(C) decision variables

(D) None of the above

118. In a linear programming model, if a redundant constraint is added, then what will be its effect on existing solution?

(A) The solution space will get further constrained

(B) The solution space becomes concave

(C) The problem no longer remains solvable

(D) There will be no effect

119. A set of values of decision variables that satisfies the linear constraints and non-negatively conditions of an LPP is called its

(A) unbounded solution

(B) optimum solution

(C) feasible solution

(D) None of the above

120. The maximum value of $Z = 3x + 4y$ subjected to constraints $x + y \leq 4$, $x \geq 0$ and $y \geq 0$ is

(A) 12

(B) 14

(C) 16

(D) None of the above

121. In ANOVA we use

(A) t-distribution

(B) χ^2-distribution

(C) F-distribution

(D) None of the above

122. In a one-way ANOVA, given SSB = 2580, SSE = 1656, $k = 4$, $n = 20$, then the value of the test statistic is

(A) 7·3

(B) 8·3

(C) 9·3

(D) 10·3

123. In a two-way ANOVA with m rows and n columns, the error degrees of freedom is

(A) $m - 1$

(B) $(n - 1)m$

(C) $(m - 1)n$

(D) $(m - 1)(n - 1)$

124. ANOVA is used to test

(A) means of three or more populations

(B) variance of three or more populations

(C) difference between two means

(D) difference between two variances

125. In a one-way ANOVA with total number of observations 15 and 5 treatments, the total degrees of freedom is

(A) 75

(B) 3

(C) 10

(D) 14

126. In designs of experiments, why do we perform experiments in a random order?

(A) To maximize the effect of unknown variables including environmental factors

(B) To separate the main effects from interaction

(C) To minimize the effect of unknown variables

(D) To enhance the factor interactions

127. A controlled independent variable whose levels are set by the experimenter is called

(A) level

(B) treatment

(C) factor

(D) response

128. A specific combination of factor levels whose effect is to be compared with other treatment is called

(A) treatment

(B) permutation

(C) effect

(D) factor

129. What is meant by a replication of an experiment?

(A) Every treatment possibility is applied

(B) A few of the treatments are applied

(C) Only one treatment is applied

(D) None of the above

130. Under which circumstances is a randomized block experiment appropriate?

(A) In a completely uniform environment

(B) For a questionnaire of public opinion

(C) When the treatment and controls are set up in pairs

(D) Where there are two kinds of gradient and there is a need to keep the experiment small

131. Under which circumstance would you use a two-way ANOVA?

(A) When you have two treatment variables and a scalar response variable

(B) When you have two scalar response variables

(C) When you have two groups of nominal treatment variables, and each case is categorized under both groups

(D) When you have two nominal response variables and two nominal treatment variables

132. Why is the normal distribution so important in classical statistical method?

(A) It is non-parametric

(B) The mean, the median and the mode are identical

(C) Its mathematical properties make calculations of statistical properties easier

(D) None of the above

133. Which of the following distributions applies to rare random events?

(A) Binomial

(B) Normal

(C) Negative binomial

(D) Poisson

134. Which of the following is the non-parametric equivalent of one-way ANOVA with three treatments?

(A) Chi-square

(B) Kruskal-Wallis

(C) Wilcoxon

(D) Mann-Whitney

135. The selection of cricket team for the World Cup is an example of

(A) purposive sampling

(B) cluster sampling

(C) systematic sampling

(D) random sampling

136. In sampling with replacement, standard error of the sample proportion $\hat{p}$ is equal to

(A) $\sqrt{\frac{p+q}{2}}$

(B) $\sqrt{\frac{p(1-p)}{n}}$

(C) $\frac{p(1-p)}{n}$

(D) $\frac{p+q}{2}$

137. If $E(\overline{X}) = \mu$, then bias is

(A) positive

(B) negative

(C) zero

(D) one

138. The mean of sampling distributions of means is equal to

(A) sample mean

(B) combined mean

(C) population mean

(D) weighted mean

139. A population has N items. Samples of size n are selected without replacement. What will be the number of possible samples?

(A) ${}^{N}C_{n}$

(B) ${}^{n}C_{N}$

(C) 2^{n}

(D) 2^{N}

140. Given that the standard deviation of a population of 16 items is 8. Find the value of the standard error in a sampling distribution with replacement.

(A) 3

(B) 4

(C) 2

(D) 5

141. The graph of a normal distribution depends on

(A) mean and standard deviation

(B) harmonic mean and standard deviation

(C) mean and median

(D) standard deviation only

142. The graph showing the paired points (x_i, y_i) is called a

(A) pie diagram

(B) histogram

(C) scatter diagram

(D) None of the above

143. Frequency curve is

(A) asymptotic to x-axis

(B) asymptotic to y-axis

(C) non-asymptotic to y-axis

(D) None of the above

144. For geographical-based data, the bars used are

(A) vertical

(B) horizontal

(C) diagonal

(D) zig-zag

145. Does a frequency curve touch x-axis?

(A) Yes

(B) No

(C) Sometimes

(D) None of the above

146. Which of the following is ***not*** a probability sampling?

(A) Simple random sampling

(B) Stratified sampling

(C) Cluster sampling

(D) None of the above

147. Which of the following would generally require the largest sample size?

(A) Cluster sampling

(B) Simple random sampling

(C) Systematic sampling

(D) Purposive sampling

148. If X is a Poisson variate satisfying the condition $P(3) = P(4)$, then find the mean of X.

(A) 2

(B) 8

(C) 4

(D) 16

149. Find the expected value of a random variable which has the following probability distribution :

x	2	4	6	8
$p(x)$	0·1	0·3	0·4	0·1

(A) 4·1

(B) 4·3

(C) 4·5

(D) 4·6

150. X and Y are independent normal variates with mean 50 and 80 respectively and standard deviation as 4 and 3 respectively. What is the distribution of $X + Y$?

(A) $N(130, 7)$

(B) $N(130, 3)$

(C) $N(130, 5)$

(D) $N(130, 4)$

ECONOMICS

Each question carries **2** marks

51. The total production will be maximum when

(A) marginal production is minimum

(B) marginal production is maximum

(C) marginal production is zero

(D) marginal production is equal to average production

52. Occupational structure refers to the

(A) number of workers living in a country

(B) size of the working population in industrial sector

(C) distribution of working population among different occupations

(D) nature of different occupations in the country

53. Capital accumulation

(A) facilitates capital-widening

(B) makes capital-deepening possible

(C) encourages introduction of new technology

(D) results in all of the above effects

54. The expansion path identifies

(A) the least costly combination of inputs required to produce various levels of output

(B) the firm's demand curves for the inputs

(C) the various combinations of inputs that can be used to produce a given level of output

(D) the least-cost combination of outputs

55. The revealed preference approach can be described by

(A) strong ordering and lexicographic preference pattern

(B) rationality, consistency and transitivity

(C) rationality and weak ordering

(D) transitivity and weak ordering

56. In which types of market do you have the largest number of firms?

(A) Perfect competition and oligopoly

(B) Perfect competition and differentiated competition

(C) Perfect competition and monopoly

(D) Differentiated competition and oligopoly

57. Price discrimination involves

(A) firms selling different products at different prices to different consumers

(B) firms selling the same product at different prices to different consumers

(C) consumers discriminating between different sellers on the basis of the different prices they quote for different products

(D) consumers discriminating between different sellers on the basis of the different prices they quote for the same product

58. A cartel is

(A) a market structure with a small number of large firms

(B) a market structure with a large number of small firms

(C) a group of firms acting together to raise price, decrease output, and increase economic profit

(D) a market with only three firms

59. Which of the following is ***not*** a government transfer payment?

(A) Welfare payments

(B) Government's spending on education

(C) Unemployment insurance benefits

(D) Public pensions

60. The main source of India's national income is

(A) industry

(B) forestry

(C) services

(D) agriculture

61. Keynes argued that the level of economic activity is predominantly determined by the level of

(A) aggregate demand

(B) aggregate supply

(C) unemployment

(D) interest rates

62. MPC + MPS must always equal to

(A) 1

(B) the APC

(C) zero

(D) the slope

63. The consumption function implies that

(A) consumption increases as disposable income increases

(B) autonomous consumption changes when people have low incomes

(C) disposable income inversely influences consumption

(D) consumption directly influences disposable income

64. According to the multiplier theory, the economy operates at

(A) full employment level

(B) over full employment level

(C) below full employment level

(D) None of the above

65. The velocity of money is

(A) the number of times per year a rupee is used to buy goods and services produced in India

(B) the rate of which new rupee note can be printed

(C) the number of times per year a rupee is used to pay wages

(D) the same as the inflation rate

66. The demand for money is

(A) the willingness of people to hold money at different interest rates

(B) not determined by the precautionary motive

(C) the amount of money banks are willing to lend at various interest rates

(D) None of the above

67. When the Reserve Bank of India announced an increased Cash Reserve Ratio (CRR), what does it mean?

(A) The commercial banks will have less money to lend

(B) The Reserve Bank of India will have less money to lend

(C) The Union Government will have less money to lend

(D) None of the above

68. Fiscal policy is concerned with

(A) industries

(B) agriculture

(C) population

(D) public revenue and expenditure

69. The opportunity cost curve is also called as

(A) transformation curve

(B) production possibility curve

(C) production frontier curve

(D) All of the above

70. The theory of absolute cost was given by

(A) Adam Smith

(B) Paul Samuelson

(C) A. P. Lerner

(D) J. E. Meade

71. According to the theory of comparative advantage

(A) countries are similar in their ability to produce goods efficiently

(B) international trade is rarely beneficial to a country

(C) potential world production is greater with unrestricted free trade than it is with restricted trade

(D) trade is a zero-sum game

72. The term 'tariff', as used in international trade, refers to

(A) the price of goods when they leave the producing country

(B) a limit on the quantity of a good that can be imported into a country

(C) a government payment to encourage exports

(D) a tax on imports

73. The terms of trade refer to

(A) the excess of import expenditures over export earnings

(B) trade agreements

(C) the ratio between export prices and import prices

(D) the terms and conditions on which a country is offered loan in the event of balance of payments difficulties

74. In the Heckscher-Ohlin theory of international trade, the most important source of difference in relative commodity prices between nations is a difference in

(A) factor endowments

(B) technology

(C) tastes

(D) demand conditions

75. The scope of international trade and division of labour is limited by

(A) availability of technology

(B) size of the international market

(C) availability of capital

(D) surplus production for exports

76. The exchange rate is

(A) the price of one currency relative to gold

(B) the value of a currency relative to inflation

(C) the change in the value of money over time

(D) the price of one currency relative to another

77. Which of the following is a feature of Balance of Payments (BoP) account?

(A) It includes economic transactions

(B) It has a given period of time

(C) Trade between resident of a country and rest of the world

(D) All of the above

78. Devaluation, will improve the balance of payments deficit, if sum of elasticity of exports and imports of the devaluing country is

(A) greater than unity

(B) less than one

(C) equal to zero

(D) negative

79. Brexit is related to

(A) Italy

(B) Ireland

(C) UK

(D) USA

80. The World Trade Organization (WTO) officially commenced on

(A) 1st January, 1995

(B) 1st March, 1995

(C) 1st October, 1995

(D) 1st November, 1995

81. Which of the following are covered under TRIPS agreement?

(A) Patents, designs, trademarks, copyrights

(B) Geographical appellations of origin

(C) Trade secrets and layout of integrated chips

(D) All of the above

82. When two or more countries enter into an agreement to eliminate import quota and tariffs and promote trade among themselves, such a group of countries are said to form a

(A) free trade area

(B) custom union

(C) common market

(D) cartel

83. Members of the World Trade Organization are required to

(A) eliminate all tariffs

(B) allocate quotas on a first come first basis

(C) prevent their firms from dumping

(D) enforce patent rights for patent holders from other countries

84. Pollution is an example of market failure because

(A) the market price is less than the efficient price

(B) the market price is higher than the efficient price

(C) property rights are poorly distributed

(D) those who suffer from pollution are compensated outside the market

85. The principal source of revenue for the government is

(A) tax

(B) non-tax

(C) earnings from abroad

(D) interest

86. GST was implemented by the Indian Government on

(A) 1st July 2016

(B) 1st July 2017

(C) 1st July 2018

(D) 1st July 2015

87. The rate at which banks lend to the RBI is known as

(A) bank rate

(B) repo rate

(C) reverse repo rate

(D) interest rate

88. Interest rates on which of the following deposit schemes are fixed by the Reserve Bank of India?

(A) Fixed deposits above 5 years maturity

(B) Recurring deposits

(C) Savings bank

(D) Flexi deposit scheme

89. The currency notes issued by the RBI have a cent percent cover in

(A) approved assets

(B) gold

(C) foreign exchange

(D) trustee securities

90. The main function of EXIM bank is

(A) to help the RBI in the regulation of foreign exchange

(B) to prevent unlicensed transactions

(C) to promote exports and curtail imports

(D) to conserve foreign exchange

91. Vicious circle of poverty theory was developed by

(A) Friedman

(B) J. E. Meade

(C) Ragnar Nurkse

(D) J. Robinson

92. Disguised unemployment means

(A) marginal productivity of labour is zero

(B) marginal productivity of labour is positive

(C) marginal productivity of labour is negative

(D) None of the above

93. High density of population in India is most probably found in

(A) Deccan Plateau

(B) Ganga-Yamuna Plains

(C) Hilly Regions

(D) None of the above

94. Who is known as the father of the 'White Revolution' in India?

(A) M. S. Swaminathan

(B) B. P. Pal

(C) K. N. Bahl

(D) V. Kurien

95. The Green Revolution in India has contributed to

(A) inter-regional inequality

(B) inter-class inequality

(C) inter-crop inequality

(D) None of the above

96. The impact of the Green Revolution was felt most in the production of

(A) rice

(B) pulses

(C) oilseeds

(D) wheat

97. The food for work programme was subsumed in

(A) IRDP

(B) MGNREGA

(C) RLEGP

(D) JRY

98. Mid-Day Meal scheme is financed and managed by

(A) Food and Civil Supply Department of State Governments

(B) Department of Consumer Affairs and Welfare

(C) Ministry of Programme Implementation

(D) Ministry of Education

99. The National Rural Health Mission was launched in the year

(A) 1991

(B) 1998

(C) 2005

(D) 2009

100. On which one among the following subjects is the State's Excise Duties imposed in India?

(A) Alcoholic drinks

(B) Opium

(C) Hemps

(D) All of the above

101. Expansion path in the theory of production corresponds to

(A) Engel's curve

(B) price consumption curve

(C) income consumption curve

(D) budget constraint

102. Which one of the following is an example of joint supply?

(A) Wool and Mutton

(B) Diesel and Bus

(C) Ink and Fountain Pen

(D) Sugar and Tea

103. A locus of constant utility is called the

(A) expansion path

(B) utility function

(C) indifference curve

(D) demand function

104. The production function $Y = LK$ is

(A) homogeneous of degree 2

(B) homogeneous of degree 1

(C) homogeneous of degree 0

(D) non-homogeneous

105. If two factors are perfect substitutes, the isoquant will be

(A) a straight line

(B) a parabola

(C) a rectangular hyperbola

(D) an L-shaped curve

106. The classical solution to unemployment is to

(A) increase deficit spending

(B) lower taxes

(C) lower money wages

(D) lower money supply

107. Structural unemployment arises due to

(A) deflationary conditions

(B) heavy industry bias

(C) shortage of raw materials

(D) inadequate productive capacity

108. Occupational structure refers to the

(A) number of workers living in a country

(B) size of the working population in industrial sector

(C) distribution of working population among different occupations

(D) nature of different occupations in the economy

109. Which one of the following agencies in India is responsible for computation of national income?

(A) NCARE

(B) CSO

(C) NSS

(D) RBI

110. Balanced growth means

(A) the growth of the different segments of an economy in a harmonious manner

(B) equal percentage growth in output

(C) a balanced rise in the resources allocated

(D) natural growth rate of different segments of the economy

111. A self-generating economy means

(A) a self-sufficient economy

(B) an economy which need not be a self-sufficient economy

(C) one in which the rate of investment need not be increased

(D) one in which there is lopsided development of industry and agriculture

112. Revenue equals expenditure in

(A) a balanced budget

(B) a deficit budget

(C) a surplus budget

(D) an ordinary budget

113. The first official estimate of national income for India was prepared by

(A) Dadabhai Naoroji

(B) Central Statistical Organization

(C) National Income Committee

(D) Dr. V. K. R. V. Rao

114. In India national income is computed by one of the following methods. Identify it.

(A) Product method

(B) Expenditure method

(C) Income method

(D) Combined method

115. Which of the following is included in national income estimates?

(A) A donation towards charity

(B) Purchase of a secondhand car

(C) Depreciation

(D) House rent for a building

116. In calculating national income, which of the following should be excluded?

(A) Rental incomes

(B) Interest payments

(C) Dividends

(D) Government transfer payments

117. Economic growth is measurable and directly related to

(A) real per capita income

(B) nominal national income

(C) real national income

(D) nominal per capita income

118. Trade in invisibles refers to

(A) unrecorded trade

(B) smuggling

(C) developing countries

(D) trade in services

119. A restrictive monetary-fiscal policy is a good way to deal with

(A) demand-pull inflation

(B) cost-push inflation

(C) demand-shift inflation

(D) any sort of inflation that occurs when the economy falls below full employment

120. The tariff which maximizes a country's economic welfare is called

(A) protective tariff

(B) discriminatory tariff

(C) non-discriminatory tariff

(D) optimum tariff

121. Opportunity cost in international trade means

(A) the cost incurred in availing certain opportunities

(B) loss of money due to not availing the opportunity

(C) how much of one commodity must be given up to get more of the other

(D) the cost on opportunistic item

122. Revenue realized from fees, tributes and indemnities is called

(A) contractual revenue

(B) gratuitous revenue

(C) compulsory revenue

(D) voluntary revenue

123. The balanced-budget multiplier is

(A) $\frac{1}{1-MPC}$

(B) $\frac{1}{MPC} \times 100$

(C) $1-\frac{1}{MPC}$

(D) $\frac{\Delta Y}{\Delta B}=\frac{1-b}{1-b}=1$

124. One of the tests of Maximum Social Advantage is that marginal utility is gained by people from an additional dose of public expenditure should be equal to

(A) marginal utility derived by the tax-payer

(B) income of the tax-payer

(C) total benefits of taxation

(D) marginal sacrifice on tax payments

125. If the elasticity of demand for imports is less than unity, then the value of

(A) exports will increase

(B) imports will increase

(C) imports will decrease

(D) exports will decrease

126. Devaluation works best when

(A) it is accompanied by a decline in short-term interest rates

(B) foreign demand for the devaluing country's export is elastic

(C) the devaluing country's demand for imports is inelastic

(D) it brings about price rises in the export industries of the devaluing country

127. All commercial bank demand deposit liabilities may decrease as a result of

(A) an inflow of cash

(B) a decrease in loans

(C) an increase in security holdings

(D) the cashing of a cheque by an individual or firm

128. When the economy is in the liquidity trap the interest elasticity of the demand for money is equal to

(A) unity

(B) zero

(C) infinity

(D) greater than unity

129. "Money is what money does." Who among the following gave this definition of money?

(A) Crowther

(B) Einzig

(C) Burstein

(D) Francis A. Walker

130. 'Zero base' budgeting means

(A) no deficit in the budget

(B) a fresh budget prepared from the root

(C) starting initially with zero resources

(D) no credit or no debit budget

131. A progressive tax aims more at

(A) an equitable distribution of sacrifice

(B) an increase in tax rate along with an increase in tax base

(C) maximizing revenue

(D) least aggregate sacrifice

132. "Essence of a tax is the absence of a quid pro quo." Who said this?

(A) Sir Josiah Stamp

(B) R. A. Musgrave

(C) H. Dalton

(D) F. W. Taussig

133. Statutory Liquidity Requirements (SLRs) is

(A) a method of credit control followed by the RBI

(B) a method of compelling the limited companies to keep minimum cash reserve

(C) a law under which the Unit Trust of India and other mutual funds must declare a minimum amount of dividend

(D) another name for Cash Reserve Ratio

134. In order to control inflation, the central bank should

(A) sell government securities and lower the bank rate

(B) sell government securities and raise the bank rate

(C) purchase government securities and raise the bank rate

(D) purchase government securities and lower the bank rate

135. India is over-populated because

(A) there are too many people

(B) there is too much unemployment

(C) natural resources remain idle

(D) number of children to be fed is great

136. Which of the following is the cause of urbanization in India?

(A) Pressure of population on agriculture

(B) Absence of subsidiary occupations in rural areas

(C) Lure of town life

(D) All of the above

137. Savings is

(A) the major determinant of growth

(B) the only determinant of growth

(C) one of the determinants of growth

(D) not concerned with growth

138. The principle of mixed economy adopted by India means

(A) mixed growth of capital and consumer industry

(B) integrated economic growth

(C) combined welfare of the capitalist and labour class

(D) monopolising some industries by the government and leaving others to private enterprise

139. Indicative planning is a feature of

(A) communist countries

(B) mixed democratic economies

(C) capitalist economies

(D) socialist economies

140. The Rolling Plan emphasises on

(A) total change in the methods of production

(B) complete eradication of poverty

(C) providing employment to the unemployed within ten years

(D) annual review of progress in the implementation of plans

141. Rent control leads to

(A) shortage of accommodation

(B) black market

(C) reluctance of existing tenants to vacate

(D) All of the above

142. Social welfare function

(A) ranks various social states

(B) is a function performed by factors of production

(C) tells about equilibrium of an economy

(D) None of the above

143. Walras model of general equilibrium is

(A) long-run model

(B) short-run model

(C) continuous model

(D) non-continuous model

144. Pareto criterion is

(A) completely free from value judgements

(B) not completely free from value judgements

(C) independent of value judgements

(D) None of the above

145. Consumption is defined as expenditure

(A) of business on final goods and services

(B) on consumption of final goods and services

(C) of government on final goods and services

(D) None of the above

146. Phillips curve sets up a relation between

(A) taxes and inflation

(B) inflation and unemployment

(C) money supply and aggregate demand

(D) price and cost of production

147. David Ricardo's theory in favour of free trade uses the idea of

(A) multilateral advantage

(B) absolute advantage

(C) mutual advantage

(D) comparative advantage

148. The main tenet of mercantilism was that it was in a country's best interest to maintain a trade

(A) balance

(B) embargo

(C) surplus

(D) deficit

149. Which tax is imposed by the union government?

(A) Professional tax

(B) Wealth tax

(C) Stamp duty

(D) All of the above

150. Government budget is prepared with the planning of

(A) one year

(B) two years

(C) three years

(D) five years