

# MADRAS SCHOOL OF ECONOMICS M.A. ENTRANCE TEST – MSEET-2024

## Entrance Test Pattern

<b>Number of parts</b>	<b>Two Parts</b> <b>Part-A (compulsory)</b> <b>Part-B (to choose between Mathematics/Statistics stream and Economics stream)</b>
<b>Total number of questions</b>	<b>100; Part-A: 60; Part-B: 40</b>
<b>Test duration</b>	<b>120 minutes (2 hours)</b>
<b>Coverage of topics and Number of Questions</b>	
<b>Part-A</b>	<b>Basic Mathematics &amp; Statistics – 30 questions</b> <b>Data Interpretation &amp; Logical Reasoning – 15 questions</b> <b>Language &amp; Reading Comprehension – 15 questions</b> <b>Total – 60 questions</b>
<b>Part-B (Mathematics/Statistics stream)</b>	<b>Advanced Mathematics – 20 questions</b> <b>Advanced Statistics – 20 questions</b> <b>Total – 40 questions</b>
<b>Part-B (Economics stream)</b>	<b>Microeconomics – 10 questions</b> <b>Macroeconomics – 10 questions</b> <b>Indian Economy &amp; Related Topics – 20 questions</b> <b>Total – 40 questions</b>

Note:

- (i) All questions MCQ type with four options.
- (ii) One mark for each correct answer.

*Sample questions are given below. Kindly note that these questions are for illustrative purposes only and not exhaustive. In the actual examination, you will find questions of a higher level on some or all of the types and also questions on the types not mentioned here.*

**PART-A (Basic Mathematics & Statistics)**

1. Sohanlal purchased 120 reams of paper at Rs.100 per ream. The expenditure on transport was Rs.480. He had to pay an octroi duty of 50 paise per ream and the coolie charges were Rs. 60. What should be the selling price of each ream if he wants a profit of 20%?

- a.Rs. 126
- b. Rs. 115.50
- c. Rs. 105
- d. None of the above

2. Students in a college have to choose at least two subjects from chemistry, mathematics and physics. The number of students choosing all three subjects is 18, choosing mathematics as one of their subjects is 23 and choosing physics as one of their subjects is 25. The smallest possible number of students who could choose chemistry as one of their subjects is

- a. 22
- b. 19
- c. 20
- d. 21

3. In May, John bought the same amount of rice and the same amount of wheat as he had bought in April, but spent 150 more due to price increase of rice and wheat by 20% and 12%, respectively. If John had spent 450 on rice in April, then how much did he spend on wheat in May?

- a. 590
- b. 580
- c. 560
- d. 570

4. The wheels of bicycles A and B have radii 30 cm and 40 cm, respectively. While traveling a certain distance, each wheel of A required 5000 more revolutions than each wheel of B. If bicycle B traveled this distance in 45 minutes, then its speed, in km per hour, was

- a.  $18\pi$
- b.  $16\pi$
- c.  $12\pi$
- d.  $14\pi$

5. If 10% of 'a' is b% of 200,  $a/b=?$

- a. 20

b.  $1/20$

c. 10

d.  $1/10$

6. Let  $a, b,$  and  $c$  be distinct integers.  $a$  and  $b$  are both odd and  $c$  is even. Which of the following expression is always false?

a.  $(a + c)^3 a$  is odd

b.  $(a + c)a^3$  is odd

c.  $(a + c)c$  is even

d.  $(a + b)a$  is odd

7. The equation of the circle with centre at  $(0, 0)$  and radius 3 units is

a.  $x^2 + y^2 = 3$

b.  $x^2 + y^2 = 9$

c.  $x^2 + y^2 = 3^{1/2}$

d.  $x^2 + y^2 = 3(3^{1/2})$

8. For matrices  $A, B,$  and  $C$  which of the following is not generally true

a.  $A(B+C) = AB+AC$

b.  $AB \neq BA$

c.  $A(BC) = (AB)C$

d.  $A(A+B)+B(A+B) = AA+2AB+BB$

9. The rank of the following matrix is:

$$\begin{pmatrix} 5 & 3 & 0 \\ 1 & 2 & -4 \\ -2 & -4 & 8 \end{pmatrix}$$

a. 1

b. 2

c. 3

d. 0

10. For what value of  $x,$  the following matrix is singular?

$$\begin{bmatrix} 5 - x & x + 1 \\ 2 & 4 \end{bmatrix}$$

a. 0

b. 5

c. 3

d. 1

11. Let  $A = \begin{bmatrix} 1 & -3 & -4 \\ 2 & 1 & 0 \\ 3 & -2 & 5 \end{bmatrix}$ . Which of the following is true?

a.  $\det(A) = 3$

b.  $\det(A) = 63$

c.  $\det(A) = 7$

d.  $\det(A)$  is undefined

12. The rank of a matrix is
- the maximum number of linearly independent rows or columns
  - the minimum number of linearly dependent rows or columns
  - the maximum number of linearly dependent rows or columns
  - the minimum number of linearly independent rows or columns
13. The value of  $x$  which satisfies  $\log_a x = 3\log_a 2 + \log_a 20 - \log_a 1.6$  is
- 10
  - 100
  - 1000
  - None of the above
14. The function  $f(x) = 1/(x - 3)^2$  is
- Continuous at  $x = 3$
  - Continuous but not differentiable at  $x = 3$
  - Not continuous but differentiable at  $x = 3$
  - Not differentiable at  $x = 3$
15. At  $x = 4$ , the function  $f(x) = x^4 - 6x^3 + 4x^2 - 13$  is
- decreasing
  - increasing
  - stationary
  - none of the above
16. If  $f(x) = \frac{x^2-9}{x+3}$  is continuous at  $x = -3$ , then  $f(-3) =$
- 3
  - 3
  - 6
  - 0
17. The minimum of  $f(x) = 2x^2 - \ln x - 2$  for  $x > 0$  occurs at:
- $x = 1/2$
  - $x = 2$
  - $x = e$
  - There is no minimum point
18. The total number of elements in the set  $X = \{x: x^3 > 0 \text{ and } x < 0\}$  is
- 0
  - 1
  - 2
  - 3
19. The function  $f(x) = 2x^3 + 3x^2 - 12x + 4$  has
- local maximum at  $x = -2$  and local minimum at  $x = 1$
  - global maximum at  $x = -2$  and global minimum at  $x = 1$
  - local maximum at  $x = 1$  and local minimum at  $x = -2$
  - global maximum at  $x = 1$  and global minimum at  $x = -2$

20.  $Y = a^x$  (and  $a > 0$ ) is:
- an exponential function
  - a straight line
  - a logarithmic function
  - a quadratic function
21. If the mean and median of a frequency distribution be 20 and 17, the mode of the distribution will be equal to:
- 11
  - 1
  - 10
  - None of the above
22. Two dice are thrown. The probability that at least one of the dice shows the number 5 is
- $25/36$
  - $5/6$
  - $11/36$
  - $7/36$
23. If the record of amounts spent by you on various evenings gives a coefficient of variation of 50% and a Standard Deviation of Rs.4, what was your average expenditure?
- Rs. 8
  - Rs. 80
  - Rs. 1.8
  - None of the above
24. Normal distribution is a symmetric distribution. It has:
- Positive skewness and it is Platykurtic.
  - Negative skewness and it is Mesokurtic.
  - Zero skewness and it is Leptokurtic.
  - Zero skewness and it is Mesokurtic.
25. Let A and B be two events such that  $P(A) = 1/5$ , while  $P(A \text{ or } B) = 1/2$ . Let  $P(B) = 'p'$ . For what values of 'p' are A and B independent?
- $1/10$  and  $3/10$
  - $3/10$  and  $4/5$
  - $3/8$  only
  - $3/10$  only
26. In how many different ways can a student club at a large university with 500 members choose its president and vice president?
- $500C_2$
  - $500 \times 500$
  - $500 \times 499$
  - None of the above
27. Statistical inference is:
- The process of drawing conclusions about a sample based on population data

- b. The process of drawing conclusions about a statistic based on a parameter
- c. The process of drawing conclusions about a population based on a parameter
- d. The process of drawing conclusions about a population based on sample data

28. A distribution is positively skewed if:

- a. Median > Mode
- b. Mean > Median > Mode
- c. Mode > Median
- d. Mode > Median > Mean

29. The mean and standard deviation are 54 and 18 respectively. The coefficient of variation is :

- a. 0.3333
- b. 0.2222
- c. 0.6666
- d. 0.4444

30. The Poisson distribution is:

- a. continuous
- b. decreasing
- c. straight line
- d. discrete

Study the following table carefully and answer the questions given below (31-33)

Distribution of 1000 candidates as regards their marks in written examination out of 300 and interview out of 100 in a selection examination

Written Examination Marks	INTERVIEW MARKS					
	Below 30	30-39	40-49	50-59	60-69	70 & above
260 & above	8	18	26	18	26	4
210 to 259	5	4	30	22	10	9
160 to 209	16	10	45	56	18	9
110 to 159	28	42	100	190	15	5
60 to 109	35	115	20	8	7	5
Below 60	32	32	20	4	6	2

31. How many candidates did obtain more than 69 percent marks and above in both written examination and interview?

- (1) 22
- (2) 49
- (3) 13
- (4) 9
- (5) Other than those given as options

32. If approximately 325 candidates were to be qualified in the written examination, what should be the percentage of the qualifying marks?

- (1) above 20
- (2) above 70
- (3) above 36
- (4) above 63
- (5) Other than those given as options

33. About 42 percent of the candidates fall in which of the following ranges of the interview marks?

- (1) 110-159                      (2) 110 & below                      (3) 50 to 70  
(4) 50 & above                      (5) Other than those given as options

34. In the final examination, Bishnu scored 52% and Asha scored 64%. The marks obtained by Bishnu is 23 less, and that by Asha is 34 more than the marks obtained by Ramesh. The marks obtained by Geeta, who scored 84%, is

- A. 399
- B. 439
- C. 357
- D. 417

35. Humans and robots can both perform a job but at different efficiencies. Fifteen humans and five robots working together take thirty days to finish the job, whereas five humans and fifteen robots working together take sixty days to finish it. How many days will fifteen humans working together (without any robot) take to finish it?

- A. 40
- B. 32
- C. 36
- D. 45

36. If among 200 students, 105 like pizza and 134 like burger, then the number of students who like only burger can possibly be

- A. 26
- B. 23
- C. 96
- D. 93

37. A trader sells 10 litres of a mixture of paints A and B, where the amount of B in the mixture does not exceed that of A. The cost of paint A per litre is Rs. 8 more than that of paint B. If the trader sells the entire mixture for Rs. 264 and makes a profit of 10%, then the highest possible cost of paint B, in Rs. per litre, is

- A. 20
- B. 16
- C. 22
- D. 26

38. A and B are two railway stations 90 km apart. A train leaves A at 9:00 am, heading towards B at a speed of 40 km/hr. Another train leaves B at 10:30 am, heading towards A at a speed of 20 km/hr. The trains meet each other at

A. 11:20 am

B. 11:00 am

C. 10:45 am

D. 11:45 am

39. Two alcohol solutions, A and B, are mixed in the proportion 1:3 by volume. The volume of the mixture is then doubled by adding solution A such that the resulting mixture has 72% alcohol. If solution A has 60% alcohol, then the percentage of alcohol in solution B is

A. 94%

B. 92%

C. 90%

D. 89%

40. In a car race, car A beats car B by 45 km, car B beats car C by 50 km, and car A beats car C by 90 km. The distance (in km) over which the race has been conducted is

A. 550

B. 475

C. 500

D. 450

41. The product of two positive numbers is 616. If the ratio of the difference of their cubes to the cube of their difference is 157:3, then the sum of the two numbers is

A. 50

B. 85

C. 95

D. 58

42. In an examination, Rama's score was one-twelfth of the sum of the scores of Mohan and Anjali. After a review, the score of each of them increased by 6. The revised scores of Anjali, Mohan, and Rama were in the ratio 11:10:3. Then Anjali's score exceeded Rama's score by

A. 26

B. 32

C. 24

D. 35



43. The salaries of Ramesh, Ganesh and Rajesh were in the ratio 6:5:7 in 2010, and in the ratio 3:4:3 in 2015. If Ramesh's salary increased by 25% during 2010-2015, then the percentage increase in Rajesh's salary during this period is closest to

- A. 7
  - B. 8
  - C. 9
  - D. 10
44. Raju and Lalitha originally had marbles in the ratio 4 : 9. Then Lalitha gave some of her marbles to Raju. As a result, the ratio of the number of marbles with Raju to that with Lalitha became 5 : 6. What fraction of her original number of marbles was given by Lalitha to Raju?

- A.  $\frac{1}{4}$
- B.  $\frac{1}{5}$
- C.  $\frac{6}{19}$
- D.  $\frac{7}{33}$

45. In an apartment complex, the number of people aged 51 years and above is 30 and there are at most 39 people whose ages are below 51 years. The average age of all the people in the apartment complex is 38 years. What is the largest possible average age, in years, of the people whose ages are below 51 years?

- A. 25
- B. 26
- C. 27
- D. 28

Read the following passage carefully and answer the given question (46-47)

Badal and Rajmal lived side by side and had their shops in a busy market place. Although his goods sold quickly Rajmal made just enough to sustain himself and his family as he often allowed the needy to buy goods and pay for them later. One day Rajmal decided to go on a pilgrimage with his family. However, he did not want to take the little money he had accumulated with him. "There may be thieves along the way. I shall also need some money to get my business running again when I return. I think I should leave my savings with Badal. He is a rich man so I can trust him." Rajmal went to Badal and requested him to keep his savings safely. Badal assured him that he would guard the savings with his life till Rajmal's return.

Six months later when Rajmal returned he went to Badal with some sweets and began to talk about the trip. Badal said, "I have no time to listen to your story now, I am too busy." "All right I will come another day but give me the savings I entrusted to you." "You gave me no money", Badal shouted "if you want me to pay for the sweets you bought, I will, but you did not leave any money with me." A small crowd gathered around. They knew Rajmal to be an honest person and he was well liked. On the other hand, he had just returned from his trip and may be being embarrassed to borrow money, he was trying to get money through this means. Unable to decide whom to believe, both men were taken before the king. He listened to everyone, one by one and

then closed his eyes and pondered deeply. "Who else was with you when you handed over your savings?", he asked Rajmal. "No one Sir", Rajmal replied. "But you must produce a witness" the king insisted. "There was no one there except a few parrots", Rajmal said in despair. "Then bring a parrot to me. One of my courtiers can understand their language. We shall learn the truth." Rajmal left to bring back a parrot. The crowd began to mutter. "How can anyone understand the language of a parrot?" But the king began to speak to Badal, "Rajmal is taking a long time to return", "Oh, he will take at least two hours each way although I am sure he has run away", was Badal's reply. The king said nothing. Five hours later Rajmal arrived in tears having been unable to capture a single parrot. The king however ordered his guards to imprison Badal, "How could you have known how long it would take him to return if you did not know the spot where Rajmal had entrusted the money to you? You will return your friend's money at once!" Rajmal bowed and praised the king for his wisdom.

46. Why was Rajmal not wealthy?

- (1) He could not sell many of his goods since they were of inferior quality.
- (2) The price of his goods was too high for the poor to afford.
- (3) He spent all his money buying his family expensive gifts.
- (4) He allowed poor customers to pay him when they could afford to.
- (5) He spent most of his money on going for pilgrimages.

47. Which of the following can be said about Badal?

- (1) He was a true friend to Rajmal.
- (2) He was greedy but poor.
- (3) He had a poor memory and forgot that Rajmal had left his savings with him.
- (4) He did not like sweets.
- (5) He was a shopkeeper.

Read the following passage carefully and answer the questions given below it. Certain words are underlined to enable you locate them while answering some of the questions (48-51)

Power and possession have been central pursuits of modern civilization for a long time. They blocked out or distorted other features of the Western Renaissance (revival) which promised so much for humanity. What people have been and are still being taught to prize are money, success, control over the lives of others, acquisition of more and more objects. Modern social, political and economic systems, whether capitalists, fascist or communist, reject in their working the basic principle that the free and creative unfoldment of every man, woman and child is the true measure of the worth of any society. Such unfoldment requires understanding and imagination, integrity and compassion, co-operation among people, and harmony between the human species and the rest of nature. Acquisitiveness and the pursuit of power have made the modern man an aggressor against everything that is non-human, an exploiter and oppressor of those who are poor, meek and unorganized, a pathological type which hates and distrusts the world and suffer from both acute loneliness and false pride.

The need for a new renaissance is deeply felt by those sensitive and conscientious men and women who not only perceive the dimensions of the crisis of our age but who also realise that only through conscious and co-operative human effort may this crisis be met and probably even overcome.

48. According to the passage, why has modern man turned out to be an enemy of everything that is non-human?

- (1) He has been dominated by drives of acquisitiveness and power.

- (2) He hates and distrusts other human beings
- (3) He consciously practises spirit of cooperation
- (4) Non-jumand have refused cooperation to human beings.
- (5) None of these

49. Which of the following is one of the requirements to bring out the best in man ?  
(1) Money (2) Success (3) Understanding (4) Power (5) Acquistiveness

50. The real attainment of any society can be adjudged by which of the following ?  
(1) The degree of freedom for pursuing more and more power.  
(2) The encouragement for acquisitive tendencies.  
(3) Strict adherence to authoritarian structure  
(4) Total vicitimisation of conscientious persons  
(5) None of these

51. The modern value systems encourage the importance of which of the following ?  
(1) Spiritual development of all individuals. (2) Recognition of freedom and equality  
(3) Craving for power and possession (4) Spirit of inquiry and knowlege  
(5) Basic respect for all individuals

52. She never visits any zoo because she is strong opponent of the idea of ----- (complete the sentence)

- A. setting the animals free into forest
- B. feeding the animals while others are watching
- C. going out of the house on a holiday
- D. holding the animals in captivity for our joy

53. I felt somewhat more relaxed ---- (complete the sentence)

- A. but tense as compared to earlier
- B. and tense as compared to earlier
- C. as there was already no tension at all
- D. and tension-free as compared to earlier

54. Choose the correct word order

- A. Why she did leave so early?
- B. Why did she leave so early?
- C. Why did so early she leave?
- D. Why so early did she leave?

55. If you call to him and explain your problem, he will help. (Substitute the underlined part)

- A. call at him
- B. call upon him
- C. call in him
- D. No improvement

56. Despite his best efforts to conceal his anger ..... (complete the sentence)

- A. he failed to give us an impression of his agony
- B. he succeeded in camouflaging his emotions
- C. he could succeed in doing it easily
- D. people came to know that he was annoyed

57. You need to come unless you want to (Correct the sentence)

- A. You don't need to come unless you want to
- B. You come only when you want to
- C. You come unless you don't want to
- D. You needn't come until you don't want to

58. We were still standing in the queue when the film was beginning (Correct the sentence)

- A. film began
- B. film had begun
- C. beginning of the film was over
- D. film begins

59. He very successfully ..... all the allegations levelled against him (Complete the sentence with correct choice)

- A. extricated
- B. retaliated
- C. rebutted
- D. Protected

60. Manpower is the ..... means of converting other resources to mankind's use and benefit (Complete the sentence with correct choice)

- A. insuperable
- B. inimitable
- C. indivisible
- D. indispensable

## Part-B (Mathematics & Statistics Stream)

1. At some point in the set  $S = \{(x_1, x_2) \in R_+ : x_1 > 2x_2\}$  the slope of the function  $f = \min\{x_1, 2x_2\}$  is
  - a. 1
  - b. 2
  - c. 0
  - d.  $\infty$
  
2. Consider a function  $f: \mathfrak{R} \rightarrow \mathfrak{R}$ , where  $\mathfrak{R}$  denotes the set of real numbers. If for any  $x$  and  $y, x \geq y \Rightarrow f(x) \geq f(y)$ , then  $f$  is
  - a. Continuous
  - b. Convex
  - c. Concave
  - d. Quasi-convex
  
3. Which of the functions  $f: \mathfrak{R} \rightarrow \mathfrak{R}$  given below are quasi-convex?
  - a.  $f(x) = \cos x$
  - b.  $f(x) = x^2$
  - c.  $f(x) = e^{-x}$
  - d.  $f(x) = x^{-1}, x \neq 0$  and  $f(x) = 0$  if  $x = 0$
  
4. For a  $n \times n$  singular matrix, interchanging the positions of a pair of adjacent columns
  - a. Does not change the value of the determinant
  - b. Changes the sign of the determinant of the matrix
  - c. Increases the value of the determinant
  - d. Decreases the value of the determinant
  
5. Defined over all positive real values of  $x$ , the graph of the function  $f(x) = (x^2 + 2x - 1)/x$  has
  - a. The line defined by  $2x + 2$  and the vertical axis as its asymptotes
  - b. The line defined by  $y = x + 2$  and the vertical axis as its asymptotes
  - c. The line defined by  $y = 2x + 1$  and the vertical axis as its asymptotes
  - d. One asymptote: the line defined by  $y = x + 2$
  
6. The system of equations given by
$$\begin{aligned}x_1 + 2x_2 + x_3 &= 0 \\x_1 - x_2 - 2x_3 &= 0 \\x_1 + 4x_2 &= 0\end{aligned}$$
has
  - a. No solution
  - b. infinitely many solutions
  - c. unique and non-trivial solution
  - d. trivial solution
  
7. Which of the following is an injective mapping?

- a.  $f(x) = \tan x$ , where  $x \in \mathfrak{R}$  and  $x \geq 0$
- b.  $f(x) = |x|$ , where  $x \in \mathfrak{R}$
- c.  $f(x) = 1/x$ , where  $x \in \mathfrak{R}$  and  $x \geq 0$
- d.  $f(x) = |x|$ , where  $x \in \mathfrak{R}$  and  $x \geq 0$

8. Consider the following expression

$$\underbrace{x + x + \dots + x}_{x \text{ times}} \equiv x \cdot x = x^2 \quad (1)$$

Differentiating both sides of (1) w.r.t.  $x$  we get in the LHS

$$\underbrace{1 + 1 + \dots + 1}_{x \text{ times}} = 1 \cdot x = x \quad (2)$$

and in the RHS we get,

$$\frac{d(x^2)}{dx} = 2x \quad (3)$$

Thus,

$$x = 2x$$

Which of the following is true?

- a. The LHS in (1) can't be differentiated w.r.t  $x$
  - b. Expressions (2)  $\neq$  (3) when  $x$  is known
  - c. Expressions (2) = (3) when  $x$  is unknown
  - d. None of the above
9. For the function  $f(x) = x^3 + 4x^2 - 3x - 18$ , which of the following is true?
- a. the  $x$ -axis is tangent to  $f(x)$  at  $x=2$
  - b.  $f(x)$  does not cross the  $x$ -axis
  - c.  $f(x)$  is convex for  $x \in [-3, 2]$
  - d.  $f(x)$  is concave for  $x \in (-\infty, 1\frac{1}{3}]$
10. For the functions  $f: \mathfrak{R} \rightarrow \mathfrak{R}$  and  $g: \mathfrak{R} \rightarrow \mathfrak{R}$ , the value of  $x$  for which the function  $f(x) = -3x^2 + 18x$  attains a maximum is also the point at which the function  $g(x) = x^2(9 - x) + 50$
- a. Attains its minimum
  - b. Has an inflection point
  - c. Crosses the  $x$ -axis
  - d. Attains its maximum
11. Consider an  $n \times n$  matrix  $A$  with real entries. If matrix  $B$  is derived by adding the first column of  $A$  to the last column of  $A$ , then
- a.  $\det A < \det B$
  - b.  $\det A > \det B$
  - c.  $\det A = \det B$

d. the sign of  $\det A$  is the opposite of the sign of  $\det B$

12. Given  $\mathbb{Z}_+$  is the set of positive integers, if set  $X = \{x \in \mathbb{Z}_+ : x \leq 20 \text{ and } \frac{x}{2} \in \mathbb{Z}_+\}$  and  $Y = \{x \in \mathbb{Z}_+ : 10 \leq x \leq 24 \text{ and } \frac{x}{2} \in \mathbb{Z}_+\}$

Then  $X \cap Y$  is:

- $\{x \in \mathbb{Z}_+ : 0 \leq x \leq 24 \text{ and } \frac{x}{2} \in \mathbb{Z}_+\}$
  - $\{x \in \mathbb{Z}_+ : 20 \leq x \leq 24 \text{ and } \frac{x}{2} \in \mathbb{Z}_+\}$
  - $\{x \in \mathbb{Z}_+ : 10 \leq x \leq 20 \text{ and } \frac{x}{2} \in \mathbb{Z}_+\}$
  - $\{x \in \mathbb{Z}_+ : x \leq 24 \text{ and } \frac{x}{2} \in \mathbb{Z}_+\}$
13. The value of the following integral

$$\int \left( \sum_{i=0}^n a_i x^i \right) dx$$

is:

- $\sum_{i=0}^n a_i \left[ \frac{x^{i+1}}{i+1} \right] + c$
  - $\sum_{i=1}^n a_i \left[ \frac{x^{i+1}}{i+1} \right] + c$
  - $\sum_{i=0}^n a_i \left[ \frac{x^i}{i+1} \right] + c$
  - $\sum_{i=0}^n (a_i + 1) \left[ \frac{x^{i+1}}{i+1} \right] + c$
14. The value of the following integral is

$$\int \frac{3x^2 + 2}{4x^3 + 8x} dx$$

- $-\frac{1}{(4x^3 + 8x)^2} + c$
  - $\frac{x}{(4x^3 + 8x)^3} + c$
  - $-\frac{1}{4} \ln|4x^3 + 8x| + c$
  - $\frac{1}{4} \ln|4x^3 + 8x| + c$
15. A matrix  $Q$  with the property that  $Q'Q = QQ' = I$  (where,  $Q'$  is the transpose of  $Q$ ) is known as
- a symmetric matrix
  - an idempotent matrix
  - an orthogonal matrix
  - a singular matrix
16. The population of a town increases at a rate proportional to its population. Its initial population is 1000. The correct initial value problem for the population,  $P(t)$ , as a function of time,  $t$  is
- $\frac{dP}{dt} = kP, P(0) = 1000$



- b.  $\frac{dP}{dt} = kP^2, P(0) = 100$
- c.  $\frac{dP}{dt} = P, P(0) = 1000$
- d.  $\frac{dP}{dt} = kP(1 - P), P(0) = 100$

17. The value of  $\lim_{x \rightarrow \infty} (\sqrt{x^2 + 1} - \sqrt{x^2 - 1})$  is
- a. -1
  - b. 1
  - c. 0
  - d. None of the above

18. Unboundedness is usually a sign that the linear programming problem
- a. has finite multiple solutions
  - b. is degenerate
  - c. contains too many redundant constraints
  - d. has been formulated improperly

19. A student has Rs.  $K$  in debt at the end of his studies. He wants to pay off the debt by making  $n$  yearly payments of Rs.  $a$  each, the first payment after one year. The rate of interest is  $r$ . Then  $a$  is:

- a.  $a = \frac{rk}{1 - (1+r)^{-n}}$
- b.  $a = \frac{1 - (1+r)^{-n}}{rk}$
- c.  $a = \frac{rk}{1 - (1+r)^n}$
- d.  $a = \frac{rk}{n}$

20. What is the order and degree of the following differential equation?

$$\left(\frac{d^2y}{dx^2}\right)^7 + \left(\frac{d^3y}{dx^3}\right)^5 = 75y$$

- a. second-order, third-degree
- b. seventh order, fifth-degree
- c. third-order, fifth degree
- d. third-order, seventh degree

21. Let  $f(x) = ke^{-3x}$ , for  $x > 0$   
 $= 0$ , otherwise

For the density function given above, find  $k$ .

- a. 2
- b. 3
- c. 1/3
- d. 1

22. Life expectancy (in days) of electronic component has density function  $p(x) = 1/x^2$ , for  $x \geq 1$ , and  $p(x) = 0$  for  $x < 1$ . Find the probability that, the component lasts between 0 and 1 day.
- 0
  - 0.1
  - 0.9
  - None of the above
23. The amount of saturated fat in a breakfast serving is normally distributed with mean 25 gm and standard deviation 4 gm. Find the probability that saturated fat intake on any day is below 27 gm. [Given  $\Phi(0.5) = 0.6915$ ,  $\Phi(1) = 0.8413$ ]
- 0.8413
  - 0.6915
  - 0.9332
  - 0.5398
24. Let  $X$  be a discrete random variable with the following probability mass function. Find the Probability  $P(0.25 < X < 0.75)$
- $$P_X(x) = 0.1 \quad \text{for } x = 0.2$$
- $$= 0.2 \quad \text{for } x = 0.4$$
- $$= 0.2 \quad \text{for } x = 0.5$$
- $$= 0.3 \quad \text{for } x = 0.8$$
- $$= 0.2 \quad \text{for } x = 1$$
- $$= 0 \quad \text{Otherwise}$$
- 0.9
  - 0.4
  - 0.7
  - 0.2
25. Let  $X$  be a continuous random variable with probability density function as follows. Find  $P[X < 1/2]$
- $$f_X(x) = x^2 + \frac{2}{3} \quad 0 \leq x \leq 1$$
- $$= 0 \quad \text{Otherwise}$$
- $3/8$
  - $10/24$
  - $6/8$
  - $3/4$
26. When Ravi plays chess against his favourite computer program, he wins with probability 0.60, loses with probability 0.10, and 30% of the games results a draw. Assume independence. Find the probability that Ravi's first win happens when he plays his third game.
- 0.096
  - 0.174

- c. 0.053
- d. 0.281

27. Independent random samples of 10 observations each are drawn from two normal populations. The parameters of these populations are:  $\mu_1 = 280$ ,  $\sigma_1 = 25$  and  $\mu_2 = 270$  and  $\sigma_2 = 30$ . The difference between the two sample means has a distribution which is equal to:
- a.  $N(10, 1525)$
  - b.  $N(20, 1525)$
  - c.  $N(10, 180)$
  - d.  $N(10, 185)$
28. What is the probability of getting at least one six in a single throw of three unbiased dice?
- a.  $1/6$
  - b.  $125/216$
  - c.  $80/216$
  - d.  $91/216$
29. You have decided you want a plant for your room. At the gardening store, there are 4 different kinds of plants (tulip, fern, cactus, and ficus) and 4 different kinds of pots to hold the plants (clay pot, plastic pot, metal pot, and wood pot). If you randomly pick the plant and the pot, what is the probability that you will end up with a tulip in a plastic pot?
- a.  $1/4$
  - b.  $1/16$
  - c.  $1/2$
  - d.  $1/8$
30. If,  $S = \{x: 0 \leq x \leq 10\}$ ;  $A = \{x: 0 \leq x < 5\}$ ;  $B = \{x: 3 \leq x \leq 7\}$ , characterize the event:  $A^c \cap B^c$
- a.  $7 \leq x \leq 10$
  - b.  $8 < x < 10$
  - c.  $7 < x \leq 10$
  - d.  $0 \leq x < 7$
31. A coin is tossed 4 times and the resulting sequence of H/T is recorded.  
A: exactly 2 heads appear  
B: heads and tails alternate  
C: first two tosses are heads  
Which events, if any, are mutually exclusive?
- a. A and C
  - b. A and B
  - c. B and C
  - d. All 3 are mutually exclusive

32. The probability that any one person attending a parade on a very hot day will suffer heat exhaustion is 0.005. To calculate the probability that 18 of 3,000 persons attending the parade will suffer heat exhaustion, we can use:
- Bernoulli Distribution
  - Binomial Distribution
  - Poisson Distribution
  - Uniform Distribution
33. In a process that manufactures aluminium cans, the probability that a can has a flaw on its side is 0.02, the probability that a can has a flaw on its top is 0.03, the probability that a can has a flaw on the sides and the top is 0.01. What is the probability that a randomly chosen can has a flaw?
- 0.04
  - 0.06
  - 0.05
  - None of the above
34. Suppose events  $A$  and  $B$  are such that  $P(A \cap B) = 0.1$  and  $P(A \cup B)^c = 0.3$ . If  $P(A) = 0.2$ , what does  $P[(A \cap B) | (A \cup B)^c]$  equal?
- $\frac{1}{2}$
  - $\frac{2}{3}$
  - 0
  - None of the above
35. If  $X$  is the number of points rolled with a balanced die, the expected value of  $X^2$  is
- $\frac{91}{6}$
  - $\frac{94}{6}$
  - $\frac{91}{3}$
  - Cannot be calculated
36. The CHI-SQUARE distribution is a special case of:
- Normal distribution
  - Exponential Distribution
  - Gamma Distribution
  - Uniform Distribution
37. For which distribution the following statement is true:  $P[(X \geq t + T) | (X \geq T)] = P(X \geq t)$
- Poisson
  - Exponential
  - Gamma
  - Beta
38. The normal distribution has its points of inflection at:
- $\pm \mu$
  - $\mu \pm \sigma$
  - $\mu \pm 2\sigma$

d.  $2\mu \pm \sigma$

39. Monthly sales of sugar in a shop ( $Y$ ), measured in tonnes, have a *pdf* given by

$$f(y) = a(8y - y^2) \quad 0 < y < 8$$

Which expression gives the probability that in a particular month the shop will sell more than two tonnes of sugar?

a.  $P(2 < Y < 8) = F(2) - F(8)$

b.  $P(Y < 2) = \int_0^2 a(8y - y^2) dy$

c.  $P(2 < Y < 8) = \sum_{x=2}^8 a(8y - y^2)$

d.  $P(2 < Y < 8) = \int_2^8 a(8y - y^2) dy$

40. What is the probability density function of the random variable whose *cdf* is  $F(x) =$

$$\frac{1}{1+e^{-x}} \quad -\infty < x < \infty$$

a.  $\frac{1}{(1+e^{-x})^2}$

b.  $\frac{e^{-x}}{(1+e^{-x})^2}$

c.  $\frac{e^x}{1+e^x}$

d. Does not exist

### Part-B (Economics Stream)

- Consider the demand curve of the form  $Q = a - 2bP$ . If “a” is a positive real number, and  $b = 0$ , then demand is:
  - Completely inelastic
  - inelastic, but not completely
  - unit elastic
  - elastic, but not infinitely
- If the production function is  $f(x_1, x_2) = x_1 x_2$ , then it exhibits
  - Constant Returns to Scale
  - Increasing Returns to Scale
  - Decreasing Returns to Scale
  - Diminishing Marginal Productivity
- The marginal cost of a firm is  $MC = 4Q$  (where  $Q$  stands for output). Then the variable cost function is:
  - square of  $MC$
  - $2Q^2$

- C)  $Q^2$
- D)  $4Q^2$

4. An individual prefers a certain income of \$20,000 to a gamble with a 0.5 probability of \$10,000 and a 0.5 probability of \$30,000. Based on this information:
- A) We can infer that he/she is risk neutral
  - B) We can infer that he/she is risk averse
  - C) We can infer that he/she is risk loving
  - D) We cannot infer risk preferences
5. The ..... elastic the demand curve faced by the monopolist, the greater is its .....
- A) Less; monopoly power
  - B) Less; output
  - C) More; monopoly power
  - D) More; costs
6. Determine the Nash-Equilibrium in pure strategies from the following game:

		Player B	
		U	V
Player A	X	1, 2	5, 0
	Y	3, 4	-6, 8

- A) X, U
  - B) X, V
  - C) Y, U
  - D) Does not exist
7. Consumer surplus measures:
- A) the extra amount that a consumer must pay to obtain a marginal unit of a good
  - B) the excess demand that consumers face because of a price ceiling
  - C) the benefit that consumers receive from a good or service beyond what they pay
  - D) gain or loss to consumers from the price fixing
8. Dead-weight loss ..... arises under 1<sup>st</sup> degree price discrimination under monopoly.
- A) Always
  - B) Never
  - C) Sometimes
  - D) Sometimes, but it depends on the price
9. Let the demand function faced by the monopolist be  $Q = 100 - p$ , where  $p$  is the price and let the marginal cost of production be 10 per unit. Then the output produced by the monopolist is:
- A) 55
  - B) 40
  - C) 35
  - D) None of the above

10. The leader will always produce a lower output than when the firms compete in quantities simultaneously. Assume that the firms are identical in terms of the output produced as well as the technology.
- A) True
  - B) False
  - C) Sometimes
  - D) True, but it depends on the market demand
11. Suppose a cattle rancher sells one-quarter pound of meat to McDonald's for \$0.50, and then McDonald's sells you a hamburger for \$1.50. GDP of this economy increases by:
- A) \$1.50
  - B) \$2.00
  - C) \$0.50
  - D) \$1.00
12. Suppose in the classical model the government finances additional expenditure by issuing debt (borrowing). This debt-financed expenditure causes a reduction in national saving because:
- A) investment increases
  - B) interest rate falls
  - C) private sector saving is unchanged
  - D) private sector saving falls
13. Suppose the economy's output is fixed by the factors of production. Imagine a tax cut that raises disposable income and causes consumption to go up. The reduction in saving \_\_\_\_\_ the equilibrium interest rate and crowds out investment.
- A) increases
  - B) decreases
  - C) marginally decreases
  - D) does not alter
14. A decrease in the nominal money supply, other things being equal, will shift the LM curve:
- A) upward and to the left
  - B) downward and to the right
  - C) downward and to the left
  - D) upward and to the right
15. Because of price-wage flexibility the aggregate supply curve in the classical model is vertical. As a result expansionary monetary policy
- A) is neutral
  - B) increases output and employment in the short run
  - C) does not affect wages
  - D) increases only output in the short run
16. Suppose a country devalues its currency like India did in the early 1990s. The rupee-dollar exchange rate moves from Rs20 for \$1 to Rs30 for \$1. Devaluation helps a country to
- A) import more and export less
  - B) fight inflation

- C) fight income inequality
  - D) stimulate aggregate demand in the short run
17. You read in the newspaper that the nominal interest rate is 12% in Canada and 8% in the US. Imagine that real interest rates are equal across countries. Using the Fisher equation, what can you infer about *expected inflation* in Canada compared to the US?
- A) - 4%
  - B) + 4%
  - C) + 12%
  - D) + 20%
18. World War II had destroyed much of the capital stock in Japan and Germany. In the decades after the war, however, these two countries experienced some of the most rapid growth rates on record. According to the Solow model this because of
- A) rapid growth in technology
  - B) population growth
  - C) investment exceeds the amount of depreciation when capital stock falls
  - D) pure luck
19. The slope of the LM curve in the Keynesian model depends on
- A) interest elasticity of money demand
  - B) the Keynesian multiplier
  - C) the central bank
  - D) speculative demand for money
20. In the Keynesian cross diagram when output supply (production) equals aggregate demand
- A) the economy is in dis-equilibrium
  - B) the economy is in a recession
  - C) planned saving equals planned investment
  - D) prices are stable
21. Multi fibre agreement is related to
- A) Textiles
  - B) Agriculture
  - C) Chemicals
  - D) Plastics
22. Economic planning in India is a subject in:
- A) Concurrent list
  - B) State list
  - C) Union list
  - D) Special list
23. Which type of economy can be termed as laissez – faire economy?
- A) Mixed economy
  - B) Socialist economy
  - C) Command economy
  - D) Capitalist economy



24. Competition Act 2002 replaced which act in India?
- A) MRTP Act
  - B) FERA Act
  - C) FEMA Act
  - D) Companies Act
25. India has introduced which of the following revolution?
- A) Green Revolution
  - B) White revolution
  - C) Blue Revolution
  - D) All the above
26. In India, GST is a matter of jurisdiction of
- A) Central Government
  - B) State Government
  - C) Both central and state government
  - D) None of the above
27. A wholesaler in Tirupati sends an agent to procure 100 bags of sugar from a factory in Vijayawada. The invoice and other documents are handed over to the agent in Hyderabad as directed by the wholesaler. Later the sugar bags are brought to Tirupati. Amount paid online from SBI branch Chennai. The place of supply is:
- A) Tirupati
  - B) Vijayawada
  - C) Hyderabad
  - D) Chennai
28. The managers of ITC Ltd., Kolkata (not registered under GST) are given one week training in Munnar, by Infosys Ltd. Bangalore, for a sum of Rs. 10 Lakhs. Payment given at Mumbai. The place of supply of service is:
- A) Mumbai
  - B) Kolkata
  - C) Munnar
  - D) Bangalore
29. JAY stands for \_\_\_\_\_ and is managed by \_\_\_\_\_
- A) Jan Arogya Yojana; NITI Aayog
  - B) Jan Ayushman Yojana; Prime Minister's Office
  - C) Jan Arogya Yojana; Ministry of Health and Family Welfare
  - D) Jan Ayushman Yojana; Ministry of Health and Family Welfare
30. Operation Barga is connected with
- A) Land reform movement in Bihar
  - B) Land reform movement in West Bengal
  - C) Land reform movement in Punjab
  - D) Terrorist operation in Punjab
31. It was envisaged in 2019 that India would become an economy of
- A) Rs. 5 trillion by 2024-25 in constant prices
  - B) Rs. 5 trillion by 2024-25 in current prices
  - C) US\$ 5 trillion by 2024-25 in current prices

- D) US\$ 5 trillion by 2024-25 in constant prices
32. Which of the following is not part of the economic reforms of 1991?
- A) Liberalisation of FDI and foreign equity
  - B) Liberalisation of gold imports
  - C) Liberalisation of Labour Laws
  - D) Trade Liberalisation from reduction in import tariffs
33. Global Hunger Index is based on:
- A) Under-nourished population, child wasting, child stunting, and child mortality
  - B) Child wasting and child mortality
  - C) Under-nourished population, food production, and average income
  - D) Child wasting, child stunting, child mortality, and adult mortality
34. The trend in India's Female labour force participation is considered a puzzle because
- A) The employment rate of urban married women is increasing and is now higher than many developed countries
  - B) With declining fertility rate and increasing education levels female employment rates are falling
  - C) Youth unemployment rate among women is much higher than that for men
  - D) With high number of children per adult woman and low levels of education the female employment rates in Uttar Pradesh and Bihar are higher than in Tamil Nadu and Kerala
35. Identify the scheme that is specific to the state in which it is implemented
- A) Rythu Bandhu Scheme-Madhya Pradesh
  - B) Yashaswini-Maharashtra
  - C) Kudumbashree-Kerala
  - D) Muthulakshmi Reddy Scheme-Andhra Pradesh
36. The so called 'Hindu rate of growth' refers to
- A) India's GDP growth of 2% before the Mughal period
  - B) India's average GDP growth of 3.5% before the British rule
  - C) India's average GDP growth of 3.5% in the 1950's-1970s
  - D) Population growth rate of those following Hindu religion in India
37. India's structural transformation in last three decades involved
- A) Increasing industrial sector share and a stagnant agriculture sector share in GDP
  - B) Substantial increase in share of service sector and a stagnant industrial sector share in GDP
  - C) Increasing service sector share and a declining construction sector share in GDP
  - D) Declining agricultural sector share and fast increasing industrial sector share in GDP
38. Which of the following statements is correct about labour market in recent years for India?
- A) About 10% of the employed are in formal sector jobs
  - B) Female labour force participation rate is about 50%
  - C) Youth employment rate is growing at a rapid rate
  - D) Rural and urban unemployment rates are nearly similar for men

39. Which statement is incorrect regarding the Minimum Support Price
- A) Commission for Agricultural Costs and Prices provides recommendations
  - B) The prices are fixed only for two crops - rice and wheat
  - C) The prices are fixed twice a year separately for kharif and rabi seasons
  - D) The prices are set on the basis of demand and supply considerations
40. India's recent problem of *Over-leveraged companies and bad-loan-encumbered banks* is referred as:
- A) Twin Deficit Problem
  - B) Double Burden in Credit Market
  - C) Twin Balance Sheet Problem
  - D) Doubly Stressed Balance Sheet