Maximum Marks : 100

Time Allowed : 3 hours

INSTRUCTIONS FOR CANDIDATES

Candidates must read carefully the following instructions before attempting the Question Paper :

(i)   Write your Name and Registration Number in the space provided for the purpose on the first page of this Question Paper and in the OMR Answer Sheet.

(ii) **Please darken the appropriate circle of the Question Paper Series Code on the OMR Answer Sheet** with a BALLPOINT PEN. Any overwriting or alteration will be treated as wrong answer.

(iii) The question paper has three Sections : Section—A1, Section—A2 and Section—B.

(iv) Section—A1 has 15 questions (Q. Nos. 1 to 15), each carrying 2 marks. Section—A2 has 10 questions (Q. Nos. 16 to 25), each carrying 1 mark. All questions in Section—A1 and Section—A2 have to be answered. There are no negative marks for wrong answers.

(v)   Answer ALL the questions of Section—A1 and Section—A2 in the OMR Answer Sheet provided for the purpose by darkening the correct choice, i.e., (a) or (b) or (c) or (d) with a BALLPOINT PEN only against the corresponding circle. Any overwriting or alteration will be treated as wrong answer.

(vi) Section—B has 12 questions (Q. Nos. 26 to 37). Question Nos. 26 to 36 carry 5 marks each and Question No. 37 carries 15 marks. Answer Question No. 37, answer any four questions among Question Nos. 26 to 30 and answer any five questions among Question Nos. 31 to 36.

(vii) Answers for Section—B should be written in the Question Paper itself in the space provided with each question.

(viii) Pages at the end have been provided for Rough Work.

(ix) Return the Question Paper and OMR Answer Sheet to the Invigilator at the end of the Entrance Examination. **DO NOT FOLD THE OMR ANSWER SHEET.**

INSTRUCTIONS FOR MARKING ANSWERS

1.   Use only Blue/Black Ballpoint Pen (do not use pencil) to darken the appropriate Circle.

2.   Please darken the whole Circle.

3.   Darken ONLY ONE CIRCLE for each question as shown in example below :

Wrong	Wrong	Wrong	Wrong	Correct
● ⓑ © ●	⊘ ⓑ © ⓓ	⊘ ⓑ © ⓓ	⊙ ⓑ © ●	ⓐ ⓑ © ●

4.   Once marked, no change in the answer is allowed.

5.   Please do not make any stray marks on the OMR Answer Sheet.

6.   Do rough work only on the pages provided for this purpose.

7.   Mark your answer only in the appropriate space against the number corresponding to the question.

8.   **Ensure that you have darkened the appropriate Circle of Question Paper Series Code on the OMR Answer Sheet.**

Answer all questions in this Section. Each question carries 2 marks. There are no negative marks for wrong answers.

Direction : Answer Question Nos. 1 and 2 on the the basis of the following :

You have a data set with three variables : y, x and z. You run three regressions and discover the following :

I. You run an OLS (ordinary least squares) regression of variable y on a column of 1's. In this *first* regression, the coefficient on the column of 1's is 1/2.

II. You run an OLS regression of variable y on a column of 1's and variable x. In this *second* regression, the coefficient on x is 2 and the R^2 value is 0·6.

III. You run an OLS regression of variable y on a column of 1's, variable x and variable z. In this *third* regression, the coefficient on x is 1.

1. Which of the following statements is certainly true?

   (a)   The mean of y in your data set is 2

   (b)   The mean of y in your data set is 1/2

   (c)   The mean of y cannot be determined from the information given

   (d)   None of the above

2. Which of the following statements is certainly true?

   (a)   The R^2 value of the third regression is equal to 0·6

   (b)   The R^2 value of the third regression is strictly greater than 0·6

   (c)   The R^2 value of the third regression is strictly less than 0·6

   (d)   None of the above

3. A, B and C are three clubs with 200, 250 and 300 members respectively and nobody can be a member of more than one club. The arithmetic means of the ages of club members are 25, 10 and 15 for A, B and C respectively. What is the arithmetic mean of ages of all persons who are members of at least one of the three clubs?

   (a)   14

   (b)   15

   (c)   16

   (d)   None of the above

4. Three separate draws of a single card with replacement are made from a complete deck of 52 cards. What is the probability that cards of the same colour will not appear in any two consecutive draws?

   (a)   1/4

   (b)   1/8

   (c)   2/13

   (d)   1/13

5. Suppose random variable X has a standard normal distribution. Let $Y = 2X + 4$. Which of the following statements is true?

   (a) $E(Y) = 4$; variance $(Y) = 4$

   (b) $E(Y) = 6$; variance $(Y) = 8$

   (c) $E(Y) = 6$; variance $(Y) = 16$

   (d) None of the above

6. Suppose random variable X has a uniform distribution on the interval $[0, 1]$. If random variable $Y = 3X + 1$, then what is the probability density of Y at $Y = 2$?

   (a) $1/7$

   (b) $1/5$

   (c) $1/3$

   (d) None of the above

7. Let $\{x_n\}$ and $\{y_n\}$ be any two divergent sequences of real numbers. Which of the following is true?

   (a) Every subsequence of $\{x_n\}$ is divergent

   (b) $\{x_n + y_n\}$ is a divergent sequence

   (c) For any real number k, $\{kx_n\}$ is a divergent sequence

   (d) None of the above

8. Consider the following system of equations in variables x and y: $x + 2y = c_1$; $4x + 8y = c_2$; c_1, c_2 are positive constants. When does this system of equations have a solution?

   (a) $c_1 = c_2$

   (b) $c_1 = 4c_2$

   (c) $4c_1 = c_2$

   (d) The system of equations does not have a solution

9. The R^2 for an estimated regression equation is calculated and found to be equal to $1 \cdot 21$. How do we know that there must be an error in the calculation?

   (a) R^2 is never greater than 1

   (b) R^2 is always an even number

   (c) $1 \cdot 21$ has two square roots

   (d) R^2 is always an integer

10. What is the derivative of $\int_0^y 2x\, dx$ with respect to y?

   (a) 0

   (b) y^2

   (c) $2y$

   (d) None of the above

11. For any real number x, it is true that $[x] = n$ if and only if n is an integer such that $n \leq x \leq n+1$. What is $\left[-\dfrac{23}{6}\right]$ equal to?

    (a) -3

    (b) -4

    (c) -5

    (d) None of the above

12. A fixed effects estimator is used in econometric analyses involving which of the following kinds of data?

    (a) Panel data

    (b) Cross-section data

    (c) Time series data

    (d) None of the above

13. Suppose

    $$f(x) = x+2, \quad \text{for all real numbers } x \leq 0$$
    $$= 2-x, \quad \text{for all real numbers } x \geq 0$$

    Which of the following statements is true?

    (a) f is not a continuous function

    (b) f is a concave function

    (c) f is a convex function

    (d) f is not a function

14. The real-valued function f is continuous on $[0, 1]$. Which of the following statements is necessarily true?

    (a) f has a maximum on $[0, 1]$

    (b) f has a maximum on $(0, 1)$

    (c) There is exactly one point in $[0, 1]$ where f has a maximum

    (d) There is exactly one point in $(0, 1)$ where f has a maximum

15. Suppose the vector $y = (-2 \ \ 2)$. What is the determinant of $y^T y$?

    (a) 0

    (b) -16

    (c) 16

    (d) 32

Answer all questions in this Section. Each question carries 1 mark. There are no negative marks for wrong answers.

16. Which of the following is a property of the Cobb-Douglas production function $Q = AL^{0.8}K^{0.3}$?

    (a) Decreasing returns to scale

    (b) Constant returns to scale

    (c) Increasing returns to scale

    (d) All of the above

17. Data on which of the following variables is most useful in calculating the value of the fiscal deficit in an economy?

    (a) Merchandise exports

    (b) M1

    (c) Household savings

    (d) Tax revenues

18. The demonetization exercise carried out in India in 2016 had an *immediate* effect on the value of which of the following variables in the economy?

    (a) Fiscal deficit

    (b) Currency-deposit ratio

    (c) Repo rate

    (d) Balance of trade

19. What is the full form of GST?

    (a) General Sales Tax

    (b) Goods Sales Tax

    (c) Goods and Services Tax

    (d) General Services Tax

20. GST is an example of which of the following?

    (a) Direct tax

    (b) Indirect tax

    (c) Import tariff

    (d) Export subsidy

21. Which of the following crops has the largest gross area under cultivation in India?

   (a) Cotton

   (b) Pulse

   (c) Rice

   (d) Wheat

22. Public sector employment in India is largest in which of the following sectors?

   (a) Community, social and personal services

   (b) Mining and quarrying

   (c) Manufacturing

   (d) Transport, storage and communications

23. What is the full form of TRIPS?

   (a) Trade Relations and the International Property System

   (b) Trade-Related Aspects of Intellectual Property Rights

   (c) Tariff Restrictions and the International Patent System

   (d) Trade Relations and the International Policy System

24. The amendments to the RBI Act, 1934, which came into effect on June 27, 2016, specify that the primary objective of the monetary policy operations of the Reserve Bank of India is to

   (a) defend the external value of the rupee as specified by the Government of India

   (b) ensure an adequate rate of growth of employment in the economy

   (c) maintain price stability while keeping in mind the objective of growth

   (d) regulate the rate of growth of the money supply

25. Which among the following is currently the largest sector in the Indian economy in terms of its contribution to GDP?

   (a) Agriculture

   (b) Manufacturing

   (c) Industry

   (d) Services

In this Section, you have to (i) answer any four questions from among Question Nos. 26 to 30, (ii) answer any five questions from among Question Nos. 31 to 36 and (iii) answer to Question No. 37. Question Nos. 26–36 carry 5 marks each and Question No. 37 carries 15 marks.

Direction : Answer any *four* questions from among Question Nos. 26 to 30.

26. You have a data set regarding the behaviour and performance of 6 students. Specifically, for each student, you know the number of hours per day studied (variable x) and the test score obtained (variable y). This data set is shown below :

Test score (y)	Hours studied (x)
30	6
50	6
10	6
40	12
40	12
10	12

You assume that the following linear model captures the relationship between y and x

$$y = \alpha + \beta x + u$$

where α and β are regression coefficients, u is an error term which is uncorrelated with x and has mean zero. In order to estimate α and β, you run an OLS (ordinary least squares) regression of y on a column of 1's and x. Let $\hat{\alpha}$ be the estimate of α. Let $\hat{\beta}$ be the estimate of β.

Given your data set, what is the value of $\hat{\beta}$?

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27. Suppose you choose at random a real number X from the interval $[0, 4]$ with a density function of the form

$$f(x) = \frac{1}{4} \text{ if } x \in [0, 4]$$
$$f(x) = 0 \text{ if } x \notin [0, 4]$$

Find the probability that $(X-2)(X-3) > 0$.

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28. Random variable X can take two values : $x \in \{-1, 1\}$. Random variable Y can take three values : $y \in \{0, 1, 2\}$. The values of the joint probability distribution of X and Y are given in the table below :

		X	
		-1	1
	0	0	1/2
y	1	1/4	0
	2	1/8	1/8

(a) What is the probability that random variable X takes the value 1?

(b) Compute $E(Y|X = -1)$, the conditional mean of random variable Y given $X = -1$.

5

29. Find the value of the following ratio :

$$\frac{\sum_{n=1}^{\infty} \dfrac{2}{3^n}}{\sum_{n=1}^{\infty} \dfrac{\sqrt{n+1}-\sqrt{n}}{\sqrt{n^2+n}}}$$

30. Suppose $f(x) = (x^5 - 1)/(1 - x)$, for all real numbers $x < 1$

    $= 2x + a$, for all real numbers $x \geq 1$

    where a is a real constant. What is the value of a for which $f(x)$ is continuous at 1?   5

31. Consider the following two-player game in which Player 1 can play any one of three strategies, T, M and B, and Player 2 can simultaneously play any one of three strategies, L, M and R. The payoff matrix for the game is as follows :

$\downarrow 1$ $2\rightarrow$	L	M	R
T	3, 2	4, 0	1, 1
M	2, 0	3, 3	0, 0
B	1, 1	0, 2	2, 3

Find all Nash equilibria in pure strategies of the above game.

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32. Consider a closed economy with an unlimited supply of labour. There is no government expenditure or taxation. A single good is produced which can be used for consumption or can be used as a capital good for the production of the good itself. Suppose l units of labour and v units of capital are required for production of each unit of the good in any period (l and v are positive constants). Let $K(t)$ denote the capital stock in the economy at the beginning of any period t. Suppose in any period t, equilibrium output $Y(t)$ in the economy is determined by the equality of net saving $S(t)$ and net investment $I(t)$. Suppose

$$\frac{S(t)}{K(t)} = 0\cdot 4\,\frac{Y(t)}{K(t)}; \quad \frac{I(t+1)}{K(t+1)} = 0\cdot 02 + 0\cdot 3\,\frac{Y(t)}{K(t)}.$$

What is the value of the rate of growth of capital stock which, once attained, is ceteris paribus going to be repeated in the economy period after period?   5

33. The relationship of investment expenditure I with the real interest rate per cent r in a demand-constrained economy is given by $I = 500 - r$. The central bank successfully targets an inflation rate of 5% by keeping the nominal rate of interest at 5%. Assuming that autonomous consumption expenditure (A) in the economy is equal to 100, government expenditure (G) is equal to 50, all income is taxed at a proportional rate of 10% and the post-tax Keynesian multiplier is 2, solve for the equilibrium level of income (Y) and the real rate of interest.

34. The first two equations of the following system describe the determination of the output gap y and the inflation rate π in an economy, given the real rate of interest r, a targeted rate of inflation π_0 and a supply shock e. The third equation describes a process whereby the central bank effectively sets the real interest rate through a Taylor rule to target an inflation rate π_0 and an output gap equal to zero :

$$y = a - br, \qquad a > 0,\ b > 0$$

$$\pi = \pi_0 + cy + e, \qquad c > 0$$

$$r = \frac{a}{b} + d(\pi - \pi_0) + fy, \qquad d > 0,\ f > 0$$

Assuming a positive supply shock e, calculate the values of the real rate of interest and the output gap in the economy.

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35. In a two-good world, a consumer's utility function is given by $U(x, y) = x + 2y$, where x and y are the amounts consumed of the first and second goods respectively. The price of each of the two goods is 3 rupees per unit. The consumer's income is 30 rupees. Draw the consumer's indifference curves and find out his utility-maximizing consumption bundle(s).

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36. Suppose in an economy, the function relating the income tax liability T of any household to its level of income Y is as follows :

$$T = 0 \quad, \quad Y \leq 500$$
$$T = 0 \cdot 25(Y - 500) \quad, \quad 500 \leq Y \leq 1000$$
$$T = 125 + 0 \cdot 5(Y - 1000) \quad, \quad Y \geq 1000$$

(a) What are the marginal tax rates at $Y = 375$ and $Y = 1250$?

(b) What are the average tax rates at $Y = 800$, $Y = 1000$ and $Y = 1200$?

5

37. Answer any *one* of the following questions in not more than *500* words : 15

(a) "Harrodian knife-edge instability is a result of an artificially restrictive assumption of a rigid capital-output ratio. Once that is removed, the knife-edge instability disappears." Comment.

(b) Explain what Keynes meant by 'involuntary unemployment'. Does it arise as a result of wage rigidity in the labour market? Comment.

(c) "The multilateral trading system under the World Trade Organization serves the interests of developing countries." Comment.

(d) Give the salient features of the analytical framework explaining trade between countries that is based on the assumption of imperfectly competitive markets.