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**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**  
**FIRST SEMESTER 2022-2023**  
**Comprehensive Examination**  
**Part-A & B (Closed Book)**

Course No. : <b>ECON F213</b>	Maximum Marks : <b>30</b>
Course Title : <b>Mathematical &amp; Statistical Methods</b>	Duration (Max) : <b>90 Minutes</b>
Date : <b>27/Dec/2022</b>	Weightage : <b>15%</b>

***Instructions:***

1. Write your *Name* and *ID Number* clearly in the answer sheet.
2. There are two parts, Part-A & B. Part A carries a total of 15 questions and Part B carries 4 questions.
3. Answer to Part A (MCQ Type) to be given in the appropriate box given in this page only in Capital Letters as, A, B, C, or D. There will be no negative marking.
4. Part B contains five short answer-type questions. You will be given one supplementary answer book to write your answers to Part B.
5. Answer the questions once only. No rewriting is allowed and will not be evaluated.
6. At the end, submit both the question paper and the answer sheet.
7. Calculator is allowed; however, exchange of calculator is not permitted.
8. All the questions are compulsory. Use of pencil is not allowed.

PART-A										
Question	1	2	3	4	5	6	7	8	9	10
Answer										
Question	11	12	13	14	15	Marks Scored → (for the evaluator)				
Answer										

**Part A**  
**Multiple Choice Questions (1 Mark Each)**

**Q1:** In a non-cooperative setup, each player in a prisoners' dilemma game has a dominant strategy that leaves \_\_\_\_\_ than if they could cooperate.

- A) them both worse off
- B) them both better off
- C) the first player to confess is better off and the other player is worse off
- D) the first player to confess is worse off and the other player is better off

**Q2:** Consider the following game between two Car sellers. The payoffs are the profits in INR million:

		Maruti	
		Offer discount	No Discount
Tata	Offer discount	20,10	30,0
	No Discount	12,16	20,4

Which of the following is true about the game given above? Choose one best answer.

- A) Maruti's dominant strategy is to offer a discount
- B) Maruti's dominant strategy is not to offer a discount

- C) Tata's dominant strategy is to offer a discount.
- D) Both sellers have a dominant strategy to offer discount

**Q3:** Which kind of graphical representation is the most suitable to draw the mid-points of the class intervals for a continuous frequency distribution?

- A) Histogram
- B) Frequency polygon
- C) Cumulative frequency polygon
- D) Bar chart

**Q4:** Which value of the cumulative frequency column is to be used in the numerator while calculating the median in case of continuous series?

- A) Cumulative Frequency value of the class next to median class
- B) Cumulative Frequency value of the class corresponding to the median class
- C) Cumulative Frequency value of the class preceding to the median class
- D) None of these

**Q5:** For a two-way ANOVA, the value of mean square between samples, between rows and between errors are: 14, 18.25, 23.25 respectively. What would be the value of F-Statistic between samples and between rows?

- A) Between samples = 0.502; Between rows = 0.685
- B) Between samples = 0.602; Between rows = 0.785
- C) Between samples = 1.661; Between rows = 1.274
- D) None of the above

**Q6:** Which one of the following statement is true?

- A) Geometric mean would always be less than or equal to arithmetic mean
- B) Arithmetic mean gives different weightage to each item in a series
- C) In case, data is given in percentages, weighted arithmetic mean is the best method to calculate average
- D) For any series, there is only and only one mode exist

**Q7:** Identify the false statement from the following

- A) Square of multiple correlation coefficient provides the coefficient of multiple determination
- B)  $R_{1.23} \neq R_{1.32}$
- C) If  $R_{1.23} = 0$  then  $r_{12} = 0$   $r_{13} = 0$
- D) The value of  $R_{1.23}$  is non-negative

**Q8:** Your statistics professor has decided that your class will not be graded on a curve but on an absolute scale. Therefore, every student in the class can get an "A." Your grade will not depend in any way on your classmates' performance. Based on this information, you decide that you should study statistics for three hours each day, regardless of what your classmates do. In the language of game theory, your decision to study three hours each day is:

- A) a dominant strategy.
- B) a minimax strategy.
- C) a maximin strategy.
- D) a Prisoner's dilemma.

**Q9:** Consider a coefficient matrix A for n-sector economy. What does the coefficient A(1,2) indicate?

- A. Units of sector 1 purchased by sector 2 for each unit produced by sector 2
- B. Units of sector 2 purchased by sector 1 for each unit produced by sector 1
- C. Units of sector 1 purchased by sector 2 per unit production of sector 1
- D. Units of sector 2 purchased by sector 1 for per unit production of total output of all sectors

**Q10:** In a regression model  $y=a+bx$  where  $\bar{X} = 2.50$  and  $\bar{Y} = 5.50$  and  $a = 1.50$

( $\bar{X}$  and  $\bar{Y}$  denote the mean of variable  $x$  and  $y$  and  $a$  is constant ), which one of the following values of parameter 'b' of the model is correct?

- A. 1.75
- B. 1.60
- C. 2.00
- D. 2.50

**Q11:** Regression modelling is a statistical framework for developing a mathematical equation that describes how

- A. one explanatory and one or more response variables are related
- B. several explanatory and several response variables response are related
- C. one response and one or more explanatory variables are related
- D. All of these are correct.

**Q12:** If two variables,  $x$  and  $y$ , have a very strong linear relationship, then

- A. there is evidence that  $x$  causes a change in  $y$
- B. there is evidence that  $y$  causes a change in  $x$
- C. there might not be any causal relationship between  $x$  and  $y$
- D. None of the above

**Q13:** For the function  $Q = AK^aL^b$  which of the following statements are NOT true?

- A.  $\frac{dQ}{dL} = AbK^aL^{b-1}$
- B. Marginal Product of Labour (MPL) =  $AaK^{a-1}L^b$
- C. Marginal Product of Capital (MPK) =  $aQ / K$
- D. Marginal rate of substitution of capital for labour (MRS) =  $dK / dL$

**Q14:** Which of the following statements are (in general) true?

- A. Marginal cost (MC) is minimised where  $MC = \text{Average Variable Cost (AVC)}$
- B. Average Total Cost (ATC) is minimised where  $MC = ATC$
- C. Average Variable Cost (AVC) is minimised where  $MC = AVC$
- D. Total revenue is maximised where  $MC = \text{Marginal Revenue (MR)}$

**Q15:** Which of the following functions have unit elasticity at  $P = 6$ ?

- A. Demand:  $Q_d = 5/P$
- B. Demand:  $\log Q_d = 100 - 3 \log P$
- C. Demand:  $Q_d = 24 - 2 P$
- D. Supply:  $Q_s = 5 P$

**Part B**  
**Short Answer Type Questions**  
**(Write your answer in the Supplementary Answer Book)**

**Q16:** Consider the utility function as  $U = \alpha_1 \ln(q_1 - \gamma_1) + \alpha_2 \ln(q_2 - \gamma_2)$  subject to budget constraint as  $y = p_1 q_1 + p_2 q_2$ . Obtain the optimal quantities. Where notations are having their usual meaning. **[3 Marks]**

**Q17:** Let the demand curve is given by  $q = \frac{1}{(16p)^2}$

- a) If  $p=0.05$  and  $q=25$ . Find the consumer's surplus
- b) Let government impose the tax as  $0.02$ , then evaluate the new consumer surplus.
- c) What are the economic interpretation of before-tax and after-tax on consumer surplus?

**[2+1+2=5 Marks]**

**Q18:** In a factory, there are 100 skilled, 250 semi-skilled, and 150 are unskilled workers. It has been observed that on an average a unit length of a particular fabric is woven by a skilled worker in 3 hours by a semi-skilled worker in 4 hours and by an unskilled worker in 5 hours. After a training of 2 years, the semi-skilled workers are expected to become skilled and the unskilled are expected to become semi-skilled. How much less time will be required after 2 years of training for weaving the unit length of fabric by an average worker? **[3 Marks]**

**Q19:** Given the following game played between two firms selling toothpaste in United States. Both firms have two strategies: either to raise price or Don't. Calculate the Nash equilibrium and comment on the solution.

		<b>Firm B</b>	
		<b>Raise Price</b>	<b>Don't Raise Price</b>
<b>Firm A</b>	<b>Raise Price</b>	A's profit \$6,000 B's profit \$6,000	A's profit \$20,000 B's profit \$30,000
	<b>Don't Raise Price</b>	A's profit \$30,000 B's profit \$20,000	A's profit \$10,000 B's profit \$10,000

**[4 Marks]**

\*\*\*\*\*All the Best\*\*\*\*\*