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| **PB1/APMQP/1222/A 28-NOV-2022** | |
| **PRE-BOARD EXAMINATION-I (2022-2023)** | |
| **SUBJECT: APPLIED MATHEMATICS**  **GRADE: XII** | **Maximum Marks: 80****Time Allowed: 3 Hours** |
| ***General Instructions :***  1. This Question paper contains - five sections A, B, C, D and E. Each section is  compulsory. However, there are internal choices in some questions.  2. Section A has 18 VSA and 02 Assertion-Reason based questions of 1 mark each.  3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.  4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.  5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.  6. Section E has 3 case based integrated units of  assessment (4 marks each) with sub parts  7. All Questions are compulsory. However, an internal choice in 2 Questions of 2 marks, 2 Questions of 3 marks and 2 Questions of 5 marks has been provided. An internal choice has been provided in the 2 marks questions of Section E. | |

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| **SECTION A**  **Each question carries 1 mark** | |
| **1.** | Find the set of values satisfying x=12(mod5) |
| **2.** |  |
| **3.** | **Find (482×813) mod 7** |
| **4.** | Solve the following system of inequalities: 4x-5<11, -3x-4 |
| **5.** | Define Central Limit Theorem. |
| **6.** |  |
| **7.** | Define statistic |
| **8.** | Find the order and degree of the following D.E |
| **9.** | We want to test whether the mean GPA of students in American colleges is different from 2.0(out of 4.0). The null and alternative hypothesis are: |
| **10.** | |3x-4| |
| **11.** | If A is a matrix of order 3x3, and A.Adj.A= 3 I . Find the value of |
| **12.** | Find the intervals in which the following function is strictly increasing or decreasing  f(x)=10 – 6x – 2x2 |
| **13.** | Find the equation of the tangent line to the curve y = x 2 – 2x +7 which is parallel to X-axis. |
| **14.** | An unbiased coin is tossed 4 times. Find the mean and variance of the number of heads (P(X) follows binomial distribution). |
| **15.** | A=\_\_\_\_\_ |
| **16.** | Let X denote the number of hours you study during a randomly selected school day. The probability that X can take the values x, has the following form, where k is some unknown constant. Find the value of k. |
| **17.** | The rate of change of the area of a circle with respect to its radius r at r = 6 cm is |
| **18.** |  |
|  | **ASSERTION-REASON BASED QUESTIONS**  In the following questions, a statement of assertion (A) is followed by a statement of  Reason (R). Choose the correct answer out of the following choices.  (a) Both A and R are true, and R is the correct explanation of A.  (b) Both A and R are true, but R is not the correct explanation of A.  (c) A is true but R is false.  (d) A is false but R is true. |
| **19.** | Assertion (A) : Kuhu and Beena are two equally capable badminton players. Probability that Beena will beat Kuhu in 3 games out of 4 is 25%  Reason (R) : The probability of 𝑟 successes in 𝑛 trials, denoted by P(X = 𝑟) is given by  where 𝑝 denotes success and 𝑞 denotes failure in each trial.  (i)a (ii) b (iii) c (iv)d |
| **20.** | In a 250 m race, the ratio of speeds of A and B is 1 : 2, If A has a start of 140 m,  Assertion: A wins by 30m  Reasoning: To reach the winning post, A has to cover (250 - 140) m = 110 m  (i)a (ii) b (iii) c (iv)d |
| **SECTION B**  **This section comprises of very short answer type-questions (VSA) of 2 marks each** | |
| **21.** | **How many kg of sugar costing 45 per kg must be mixed with 30 kg sugar costing 35 kg so that there may be a gain of 12% by selling the mixture at 47.04 per kg?** |
| **22.** | **The cost function C(x) of a firm is given by C(x) = 2x2 – 4x + 5. Find.**  **(i) the average cost, and**  **(ii) the marginal cost when x = 10** |
| **23.** | **A dietician wishes to mix two types of foods in such a way that vitamin contents of the mixture contain at least 8 units of vitamin A and 10 units of vitamin C. Food ‘I’ contains 2 units/kg of vitamin A and 1 unit/kg of vitamin C. Food ‘II’ contains 1 unit/kg of vitamin A and 2 units/kg of vitamin C. It costs Rs 50 per kg to purchase Food ‘I’ and Rs 70 per kg to purchase Food ‘II’. Formulate this problem as a linear programming problem (No graphing)** |
| **24.** | A sample random sample of 50 items from a population with resulted in a sample mean of 32. Provide a 95% confidence interval for the population mean. (z) |
| **25.** | *y log y dx – x dy = 0* |
|  | **SECTION C**  **(This section comprises of short answer type questions (SA) of 3 marks each)** |
| **26.** | **A firm paid Rs.25000 as the rent of its office and Rs.15200 as the interest of the loan taken to produce x units of a commodity. If the cost of production per unit is Rs.8 and each item is sold at a price of Rs.75, find the profit function. Also, find the breakeven point.**  **OR**  **If the demand function is given by x = (600 – p)/8, where the price is Rs.p per unit and the manufacturer produces x units per week at the total cost of Rs., find the value of x for which the profit is maximum.** |
| **27.** |  |
| **28.** | In a certain culture of bacteria, the rate of increase is proportional to the number present. It is found that there are 10,000 bacteria at the end of 3 hours and 40000 at the end of 5 years. How many bacteria were present in the beginning?  OR  Ms. Renjini deposited Rs10000 in a bank at 4% interest compounded continuously. How much amount she gets after 10 years? ( |
| **29.** | **OR** |
| **30.** | **Two taps A and B can fill a tank in 4 and 6 hours respectively. The pipes are opened simultaneously, and it takes 6 minutes more to fill the tank due to leakage. If the tank is full, then find the time taken by the leakage to empty the tank.** |
| **31.** |  |
|  | **SECTION D**  **(This section comprises of long answer-type questions (LA) of 5 marks each)** |
| **32.** | **The monthly salaries of workers in a certain factory are normally distributed. The mean salary is Rs. 4000 and the standard deviation is Rs.450. If 668 workers are getting salary less than Rs. 3325, find the total number of workers in the factory.**  **OR**  **The monthly salaries of workers in a certain factory are normally distributed. The mean salary is Rs. 4000 and the standard deviation is Rs.450. If 668 workers are getting salary less than Rs. 3325, find the total number of workers in the factory.** |
| **33.** | Consider the following hypothesis test  A sample of 48 provided a sample mean of 17 and a sample standard deviation S=4.5   1. Compute the value of the test statistic 2. Use the t-distribution to give a range of p-value 3. At , what is your conclusion using p-value? 4. What is the rejection rule using the critical value? |
| **34.** | A manufacturing company makes two models A and B of a product. Each piece of Model A requires 9 labour hours for fabricating and 1 labour hour for finishing. Each piece of Model B requires 12 labour hours for fabricating and 3 labour hours for finishing. For fabricating and finishing, the maximum labour hours available are 180 and 30 respectively. The company makes a profit of Rs 8000 on each piece of model A and Rs 12000 on each piece of Model B. How many pieces of Model A and Model B should be manufactured per week to realise a maximum profit? What is the maximum profit per week |
| **35.** | Two schools A and B decided to award prizes to their students for three games hockey (x), cricket (y) and tennis (z). School A decided to award a total of ₹ 11,000 for the three games to 5,4 and 3 students respectively, while school B decided to award ₹10,700 for the three games to 4,3 and 5 students respectively. Also, the three prizes together amount to ₹ 2,700    Using the information given above, answer the following:  (a) Represent the above situation using matrix equation.  (b) Find out the prize amount for hockey, cricket & tennis |
|  | **SECTION E**  **(This section comprises of 3 case study/passage -based questions of 4 marks each with two sub-parts. First two case study questions have three sub-parts (i),(ii),(iii) of marks 1,1,2 respectively. The third case study question has two sub-parts of 2 marks each.)** |
| **36.** | Case study A boat takes 6 hours to travel 16 km upstream and 24 km downstream; but it takes 13 hours to travel 36 km upstream and 48 km downstream. Find the speed of the boat in still water and the speed of the stream.   i)Equation representing the first case  ii) Equation representing the second case  iii) Find the speed of the boat in still water  OR  iii) Find speed of the stream |
| **37.** | Case study 2  The demand and supply functions for a commodity are and . Find the consumer’s surpus and producer’s surplus at equilibrium price.  i)Find the market demand at equilibrium ()  ii)Find the price per unit at equilibrium (  iii)Find the consumer surplus  **OR**  iii)Find the producer surplus |
| **38.** | Case study 3  An urn contains 24 balls out of which 8 balls bear the mark X and the remaining bear a mark Y. A ball is drawn at random from the urn with its mark noted and replaced. In this way 6 balls are drawn. Based on the above information answer the following questions  i)Find the probability that all balls will bear X mark  ii)Find the probability that the number of balls with X mark and Y mark will be equal  iii) Find the probability that utmost 2 balls bear the mark Y  OR  iii) Find the probability that at least 2 balls bear the mark Y |
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