

EXAMINER'S REPORT**LEVEL I EXAMINATION - JULY 2022****(102) BUSINESS MATHEMATICS & STATISTICS**

This Question paper consists of **3 Sections A, B and C.**

Section A consisted of 15 compulsory Objective Test Questions (OTQs). The total of 40 marks allocated to **Section A** was distributed as follows: 30 marks at the rate of 03 marks each for the 10 multiple choice questions numbers **1.1** to **1.10**, 04 marks to question number **1.11**, 02 marks each to the 2 short questions **1.12** and **1.13**, and 01 mark each to questions number **1.14** and **1.15**.

A few shortcomings generally observed in the answers provided by candidates to part of **question 01** are set out below:

SECTION A**Question No. 01**

The weaknesses generally observed in the answers provided and observations thereon are shown below:

1.1 It was expected to correctly obtain the multiple factors of the given quadratic expression. Since factor x^2 in the given quadratic expression is a minus value, most candidates had failed to obtain the minus value out as a factor and arrive at,

$$-(5x^2 + 4x - 12) = (5x - 2)(x + 2)$$

If they had done so, out of the given answers out of coefficient x^2 and -5, they could have easily selected the answer with the coefficient 12.

1.2 This is a problem associated with compound interest. The answer could have easily be obtained through the use of formula $A = P(1 + r)^n$. But some candidates had selected Rs.10,500/- as interest erroneously using the simple interest formula, instead of the compound interest. The main reason for occurrence of these types of errors is the failure of candidates to study the Self-Study Text and work past question papers before the examination.

1.3 The linear regression equation was given as $y = 0.33 + 0.667x$ and it was that the amounts are in thousands. Accordingly, when the value of x is substituted, 250 should be stated instead of 250,000. But majority of candidates had stated $x = 250,000$ and selected Rs.166,750/- as the answer. The correct answer should be Rs.167,080/-.

The main reason for this was not reading and understanding the question properly.

- 1.4** It was expected to arrive at the quantity relative for 2021 considering 2020 as the base year. It is regrettable that some candidates had taken 2021 as the base year. In calculating such quantity relatives, taking the quantity related to the base year as the denominator and the quantity related to the current year as the numerator and it should be expressed as a percentage.

$$\text{Quantity relative} = \frac{q_1}{q_0} \times 100$$

- 1.5** A problem associated with probability. The probability of drawing a blue marble and a green marble respectively having replaced the ball taken out first was required to be stated. However, candidates who did not understand the question correctly had selected different incorrect answers.

- 1.6** It was expected to find the median in a given frequency distribution occurring in statistics. The formula for Median of a grouped data is,

$$M_d = L_1 + \left(\frac{\frac{n}{2} - F_c}{f_m} \right) \times C$$

In selecting L_1 of this formula since the class order is not clear, the median class has to be considered as the class boundary. Accordingly a frequency distribution chart has to be completed with its lower class boundary L_1 . But a large number of candidates had not done so. Here, the class that includes the median class should be identified as 27.5 - 35.5 Since all the 4 preferences given are relevant to that class, the correct answer cannot be obtained without interpolating the full formula.

- 1.7** A problem associated with geometric progression. When in a geometric progression in which the common proportion is “r”, the first term is “a”, term “n” is “ T_n ”, the answer could have easily been obtained through formula,

$$T_n = ar^{n-1}$$

But, probably due to lack of knowledge, candidates had selected different incorrect answers.

- 1.8** A problem to find effective interest associated with compound interest.

$$EIR = \{(1 + r)^n - 1\} 100\%$$

Effective interest rate based on quarterly basis was expected. Here (4) should be selected as the correct answer.

- 1.9** A problem associated with Time Series. Here, it was expected to state the sales value forecast when the trend value and quarterly index were given. Although it would have been possible for a candidate with simple knowledge on time series to easily answer such a question, most of the candidates had not been able to provide answers due to lack of awareness and knowledge related to Time Series.

1.10 This is a problem relating to calculation of the present value of an annuity. Although the present value could be easily found by interpolation of the formula,

$$\text{Present Value} = \text{Future Value} \times \frac{1}{(1+r)^n}$$

most of the candidates had not done so.

These 5 questions from **1.11** to **1.15** required writing of short answers.

1.11 The meanings of a few terms given on the left side have been explained on the right side changing their places. It is required to relate the meaning to the correct term. Almost all the candidates have written the correct answer for this.

1.12 This was the question that the least number of candidates had answered in this question paper. The limitations of index numbers were required to be stated and all the candidates had no idea about this question. It was abundantly clear by the fact that some candidates had written about the rules relating to index numbers found in mathematics. The marks of majority of the candidates remained at a very low level.

1.13 This is a problem associated with calculation of coefficient of skewness, using Carl Pearson's Coefficient of Skewness formula,

$$\text{Coefficient of Skewness} = \frac{3(\text{Mean} - \text{Median})}{\text{Standard Deviation}}$$

This could easily be found using the given mean, median and standard deviation. However, some candidates had given the answer as plus, forgetting the fact that the coefficient of skewness can be of minus value.

1.14 and **1.15**

It was expected to state whether the given statements are True or False. The two statements related to simple random sample and coefficient of correlation.

SECTION B

Question No. 02

(a) It was expected to solve the simultaneous equations and calculate the values of the 2 variables "a" and "b". It was expected to remove one variable from the given 2 simultaneous equations to arrive at the simple equation. Solve that in order to find the other variable. Most candidates had committed errors of simplification in the process of such multiplications, additions and subtractions. However, majority of the candidates had successfully attempted this question.

(b) It was expected to read carefully the given statement with conditions, write those down as 2 variables or 1 variable and solving those. Majority of the candidates had provided correct answers as this was a very easy question.

(c) A simple problem relating to proportions. But some candidates had been unsuccessful as the question had not been properly understood. It was observed that it was very difficult for many candidates to correctly formulate an algebraical equation with the conditions given in the statement.

Most of the candidates obtained very good marks for this question, out of the questions in **Section B**.

Question No. 03

- (a) A problem related to Total Cost (TC) function and Total Revenue (TR) function that comes under Financial Mathematics section. Study of past question papers reveal that such questions had been set frequently. Total cost can be obtained in association with the equation, Total Cost = Variable Cost (VC) + Fixed Cost (FC).

Total Revenue Function = Monthly Demand X No. of units per month

$$TR = P \times q$$

Here, since $P = (400 - q)$, in obtaining $TR = P \times q$, it is regrettable matter that majority of candidates had deleted the brackets as $TR = 400 - q \times q$ in simplifying the equation. Candidates should be careful when using brackets.

Break-even is achieved when $TC = TR$. Here, it was noted that simplification of mathematical equations had not been done carefully.

- (b) It is expected to calculate the quantity of units at which the cost is minimized, when the Total Cost Function is given. After obtaining the value of “q” by differentiating the Total Cost Function by the value of “q”, the “q” value which minimize the Total Cost (TC) could have been obtained.

Here, it was seen that candidates had been weak in correctly working out the differential calculus. As “q” had been given in thousands (‘000), most of the candidates had forgotten to multiply, the value of “q” by 1,000. Further, the maximizing “q” value could also have been obtained algebraically.

Question No. 04

This is a problem relating to least square regression line showing the correlation between 2 variables. Candidates would have obtained $\sum xy$ and $\sum x^2$ using the given table. Then to get “b” the value of following formula should be used.

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

Then the value of “a” should be found from the formula $a = \bar{y} - b\bar{x}$.

Although the equation relating to the regression line should have been stated as $y = a + bx$, only a very few of the candidates had correctly used “a” and “b” and obtained the regression line given by $y = a + bx$.

Because “x” in equation $y = a + bx$ should be shown in the value of thousands (1,000), although it has to be interpolated in part (b) as $x = 800$, because a large number of candidates having stated it as 800,000 scoring of marks had been reduced.

Question No. 05

It was expected to determine the mean, median and standard deviation using the given frequency distribution. First in calculating the mean (49.5 - 59.5) should be taken as class border of the mean class.

Mean: The frequency data : using the formula : $M_0 = L_1 + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times C$,

a gross value for mean could be obtained.

It was seen that most of the candidates had not been used to calculate the mean using the above formula correctly. In calculating median, they had totally been unsuccessful in correctly calculating the class mark or the mid-value.

SECTION C

Question No. 06

This section to which a total of 20 marks was allocated consisted of 4 parts.

(A) It was required to calculate the annual installment using the given information. It could be ascertained using the formula,

$$A = \frac{SR^n(R-1)}{\{R^n - 1\}}$$
 included in the formula sheet given.

However, majority of the candidates could not obtain the correct answer due to being unable to identify the correct formula, non-substitution of correct data into the formula and different short-comings in simplifications.

(B) In this question, it was expected to identify the best investment option out of 2 projects having ascertained the Net Present Value (NPV) using the relevant discounting factors of each of the 2 investment projects.

Although the correct NPV had been obtained by a considerable number of candidates, they had failed to compare the values and select the best project, with reasons.

(C) It was expected to calculate the probability from the data given in the table.

(a) Candidates had easily obtained the correct answer.

(b) A problem relating to non-random probability. Candidates should pay more attention to non-random probability related problems.

- (D) (a) Here, it was required to find the expected value with the help of the probability distribution given as follows:

$$E(x) = \frac{\sum_i^n x_i P(x - x_i)}{\sum f}$$

According to the interpretation of expected value, some candidates had simplified 0×0.125 and arrived at 0.125.

It is a matter for regret that some candidates had incorrectly simplified as,

$$E(x) = \frac{\sum_i^n x_i P(x - x_i)}{\sum f}$$

Candidates should get used to correct usage of sign \sum .

- (b) This was a problem relating to normal distribution of the weight of fish $x =$

$$X \sim N(7.5, 1.8^2)$$

$$P(X > 10) = P\left[\frac{(X - M)}{\sigma} > \frac{(10 - 7.5)}{1.8}\right]$$

$$= P(Z > 1.39)$$

Although Z value was correctly calculated, some candidates had failed to obtain the correct probability value using the standard normal table.

Here, candidates should practice to obtain correctly Z value from the given distribution and to calculate the correct probability.

General matters for attention to improve performance level of candidates:

- (1)** Study the full contents of the syllabus completely paying more attention to any newly introduced subject matter.
- (2)** Workings should be clearly shown along with answers where applicable.
- (3)** It is required to correctly apply the basic mathematical rules and simplifications in copying formulae and in substitutions. Use the most convenient formula when several formulae could be applied to answer certain questions. Further, when formulae are copied, it should be done without changing “+” and “-” signs.
- (4)** Some candidates may obtain final answer using calculators. However, it is appropriate to present the final answer showing the steps correctly, writing the formula and substituting the values in it. In doing so, there is a possibility of scoring the marks for steps even when the final answer may not be correct.
- (5)** It should be noted to correctly apply the mathematical principles in solving equations and calculus of functions.
- (6)** Handwriting should be legible and the numbers of questions should be correctly and clearly written.
- (7)** Follow the instructions given in the question paper'
- (8)** Perusal of past question papers and suggested answers would help sharpening knowledge and experience.
- (9)** Proper management of time is important.
- (10)** Re-check the question numbers before handing over the answer scripts.
- (11)** There were instances when answers to new questions had been started in a small space at the end of the previous answer without starting the next answer on a new page. Each answer should be started on a new page at all times for easy reference'
- (12)** Appear for the examination with a firm determination of passing the examination with due preparation.