

This question paper contains 4 printed pages]

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S. No. of Question Paper : 7084

Unique Paper Code : 2353010015

Name of the Paper : Research Methodology

Type of the Paper : DSE

Name of the Course : Hons./Prog. Mathematics (NEP-UGCF 2022)

Semester : VI

Duration : 3 Hours

Maximum Marks : 90

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *all* questions by selecting *two* parts from each question.

All questions carry equal marks.

1. (a) Analyze the following sentences for any flaws with respect to mathematical writing. Correct the flaws, if any.
 - (i) We claim if we multiply p and q we get a number less than 8.
 - (ii) Let $g(x, y, z, u, v) = (x^2 + y^2 + z^2)/(u^2 + v^2) \cdot (u + v)/(a + b + c)$.
Then g is a rational function of five variables.
 - (iii) There exists an integer m for every even integer n such that
 $n = 2m + 1$.

P.T.O.

(b) Express your views on significance of revision process in mathematical writing.

(c) Differentiate between theorem and lemma. Arrange the following terms in a general order, with justification, in which they appear in a mathematical document :

theorem, definition, corollary, lemma, keywords.

2. (a) Discuss any five points that should be considered while submitting a manuscript to the journal.

(b) Explain in detail the general format of a research paper.

(c) Discuss *three* mathematical softwares that are useful in mathematical research.

3. (a) What are the essential components of a good mathematical poster presentation ? Discuss layout, clarity and content balance.

(b) Write a LaTeX code to display the following multi-line equations :

$$\tan(\alpha + \beta + \gamma) = \frac{\tan(\alpha + \beta) + \tan \gamma}{1 - \tan(\alpha + \beta) \tan \gamma}$$

$$= \frac{\frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta} + \tan \gamma}{1 - \left(\frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta} \right) \tan \gamma}$$

$$= \frac{\tan \alpha + \tan \beta + (1 - \tan \alpha \tan \beta) \tan \gamma}{1 - \tan \alpha \tan \beta - (\tan \alpha + \tan \beta) \tan \gamma}$$

$$= \frac{\tan \alpha + \tan \beta + \tan \gamma - \tan \alpha \tan \beta \tan \gamma}{1 - \tan \alpha \tan \beta - \tan \alpha \tan \gamma - \tan \beta \tan \gamma}$$

Explain which environment is used and why ?

- (c) Explain the difference between inline and display math environments in LaTeX. Give *two* examples of each using LaTeX syntax.
4. (a) Describe the advantages of using LaTeX Beamer for presenting mathematical content over PowerPoint. Include any *three* LaTeX features specifically useful for mathematics.
- (b) Describe the purpose of the following LaTeX commands with examples :
- (i) `\begin{align}....\end{align}`
- (ii) `\frac{ }{ }`
- (c) What are the advantages of using the `\pause`, and `\alert{ }` commands in Beamer ? Give examples of when and why each would be used in a mathematical presentation.
5. (a) How does ResearchGate help researchers in networking and circulating their work ?
- (b) What is the Impact Factor of a journal according to the Journal Citation Reports (JCR) and how is it calculated ?

- (c) What is the American Mathematical Society (AMS) and what role does it play in context of research in mathematics ?
- 6.
- (a) What is plagiarism in academic writing and how do plagiarism detection tools help to prevent it ?
 - (b) What are Google Scholar Metrics ? Explain the h5-index and h5-median with suitable examples.
 - (c) What are the challenges associated with using journal metrics to evaluate the quality and impact of academic research ?