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Date:

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NORTHWEST ACCREDITATION COMMISSION, USA
SR. SECONDARY/12TH
2017-2018

Subject- MATHEMATICS

Question Paper No. :

M	T	4	5
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Subject Code : ME1207

Question Paper Code:

M	S	7	1
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Total Time: 03.00 Hours.

Total Marks: 100

GENERAL INSTRUCTIONS

1. OPENING AND CHECKING OF THE QUESTION-BOOKLET

Break open the seal of the Question-Booklet only when the announcement is made by the Invigilator. After breaking the seal and before attempting the questions, student should immediately check for:

- a) The number of the printed page in the Question-Booklet is the same as mentioned on the cover page of the Booklet and
- b) Any printing error in the Booklet pages, if any.
Any discrepancy or error should be brought to the notice of the Invigilator who will then replace the Booklet. No additional time will be given for this.

2. No student, without the permission of the Superintendent or the Invigilator concerned, is to leave his/ her seat or the Examination Room.

3. FILLING UP THE REQUIRED INFORMATION ON QUESTION-BOOKLET AND ANSWER SHEET

After breaking open the seal and checking the Booklet, student should:

- a) Fill up the **Question Paper No.** and **Question Paper Code** (mentioned on the cover of Question-Booklet) in the space provided on the First Answer Sheet.
- b) Fill up his/her Roll Number on the First Answer Sheet and on each Supplementary Answer Sheet, if taken.
- c) Student should mention the total number of **Supplementary Answer Sheet**, if taken, in the space provided on the First Answer Sheet and also fill up the Serial Number mentioned on each **Supplementary Answer Sheet** along with his/her Roll Number in the register maintained by the Invigilator. Student must tie all the Answer Sheets with the thread provided by the Invigilator.

4. INSTRUCTIONS ABOUT QUESTION PAPER

This Question Paper is divided into three Sections – A, B and C. All Sections are compulsory. Attempt all Sections as per instructions.

- a) Section A question No. 1 to 8 are very short questions carrying 3 marks each.
- b) Section B question No. 9 to 18 are short questions carrying 4 marks each.
- c) Section C question No. 19 to 24 are long questions carrying 6 marks each.

5. Student found in possession of Cellular Phone / Mobile Phone / Pager or any other Communication Device and/or any Book/Note whether using or not, will be liable to be debarred for taking examination(s) either permanently or for specified period or/and dealt with as per law or/and ordinance of the School/SERI according to the nature of offence, or/and he/she may be proceeded against and shall be liable for prosecution under the relevant provision of the Statutory Law.

THE ANSWER SHEET IS TO BE RETURNED ON COMPLETION OF THE TEST

This Question Paper MUST be attached with Answer Sheet

SECTION A

Total number of questions: 8	Marks allocated to each question: 3	Total marks: 24
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Question 1. If $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$ show the $A^2 - 6A + 17I = 0$. Hence find A^{-1} .

Question 2. Solve the following differential equation: $\frac{dy}{dx} - \frac{y}{x} = 2x^2$.

Question 3. Using properties of determinants prove the following:

$$\begin{vmatrix} 3a & -a+b & -a+c \\ a-b & 3b & c-b \\ a-c & b-c & 3c \end{vmatrix} = 3(a+b+c)(ab+bc+ca)$$

Question 4. There are two bags. The first bag contains 4 white and 2 black balls, while the second bag contains 3 white and black balls. A bag is picked up at random and a ball is drawn out. Find the probability that it is a white ball.

Question 5. Using integration, find the area of the triangle ABC, the coordinates of whose vertices are A (2, 0), B (4, 5) and C (6, 3).

Question 6. If $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \begin{pmatrix} 3 & 1 \\ 2 & 5 \end{pmatrix} \begin{pmatrix} 7 & 11 \\ k & 23 \end{pmatrix}$, then write the value of k.

Question 7. If $a - xi + 2j - zk$ and $b - 3i - yj + k$ are two equal vectors, then write the value of $x+y+z$.

Question 8. Evaluate: $\int \cos 4x \cos 3x \, dx$

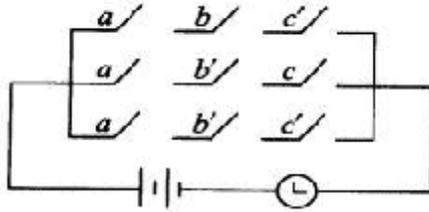
SECTION B

Total number of questions: 10	Marks allocated to each question: 4	Total marks: 40
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Question 9. Find the intervals in which the function $f(x) = x^3 - 12x^2 + 36x + 17$ is (a) increasing, (b) decreasing.

Question 10. Evaluate: $\int \frac{\sin(x-a)}{\sin(x+a)} \, dx$

Question 11. Write the Boolean expression representing the following circuit:



Simplify the Boolean expression.

Question 12. Differentiate $\sin(x^2+1)$ with respect to x from first principle.

Question 13. Find the shortest distance between the lines

$$\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} - \hat{j} + \hat{k}) \text{ and}$$

$$\vec{r} = (2\hat{i} - \hat{j} - \hat{k}) + \mu(2\hat{i} + \hat{j} + 2\hat{k})$$

Question 14. Find: $\int (x+3)\sqrt{3-4x-x^2} dx$

Question 15. Differentiate $\sqrt{\tan x}$ w.r.t. x from first Principle.

Question 16. Using properties of determinants prove the following:

$$\begin{vmatrix} x^2+1 & xy & xz \\ xy & y^2+1 & yz \\ xz & yz & z^2+1 \end{vmatrix} = 1+x^2+y^2+z^2$$

Question 17. Show that $y = \log(1+x) - \frac{2x}{2+x}$ is an increasing function of x for all values of $x > -1$.

Question 18. If $\cos y = x \cos(a+y)$, with $\cos a \neq \pm 1$, prove that $\frac{dy}{dx} = \frac{\cos^2(a+y)}{\sin a}$

SECTION C

Total number of questions: 6

Marks allocated to each question: 6

Total marks: 36

Question 19 A dealer wishes to purchase a number of fans and sewing machines. He has only Rs. 5,760 to invest and has space for at most 20 items. A fan and sewing machine cost Rs. 360 and Rs. 240 respectively. He can sell a fan at a profit of Rs. 22 and sewing machine at a profit of Rs. 18. Assuming that he can sell whatever he buys, how should he invest his money in order to maximize his profit? Translate the problem into LPP and solve it graphically.

OR

Using integration, find the area bounded by the curve $2x^2y = 4$ and the line $x + y = -4$.

- Question 20.** A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn at random and are found to both clubs. Find the probability of the lost card being of clubs.

OR

In answering a question on a MCQ test with 4 choices per question, a student knows the answer, guesses or copies the answer. Let $\frac{1}{2}$ be the probability that he knows the answer, $\frac{1}{4}$ be the probability that he guesses and $\frac{1}{4}$ that he copies it. Assuming that a student, who copies the answer, will be correct with the probability $\frac{3}{4}$, what is the probability that the student knows the answer, given that he answered it correctly?

- Question 21.** Using properties of determinants prove the following:

$$\begin{vmatrix} x & x^2 & 1 + px^3 \\ y & y^2 & 1 + py^3 \\ z & z^2 & 1 + pz^3 \end{vmatrix} = (1 + pxyz)(x - y)(y - z)(z - x)$$

OR

Using matrices solve the following system of equation:

$$\begin{aligned} x + y + z &= 6 \\ x + 2z &= 7 \\ 3x + y + z &= 12 \end{aligned}$$

- Question 22.** Let $A = \{a, b\}$ and $*$ be the binary operation on A defined by $(a, b) * (c, d) = (a + c, b + d)$. Show that $*$ is commutative and associative. Find the identity element for $*$ on A .

OR

Solve the differential equation $x^2 dy + (xy + y^2) dx = 0$ given $y = 1$, when $x = 1$

- Question 23.** A tank with rectangular base and rectangular sides open at the top is to be constructed so that its depth is 3 m and volume is 75 m³. If building of tank costs ` 100 per square meter for the base and ` 50 per square meters for the sides, find the cost of least expensive tank.

OR

Find the equation of the plane passing through the point $(1, 1, 1)$ and containing the line $\vec{r} = (-3\hat{i} + \hat{j} + 5\hat{k}) + \lambda(4\hat{i} - \hat{j} + 5\hat{k})$. Also, show that the plane contains the line $\vec{r} = (-\hat{i} + 2\hat{j} + 5\hat{k}) + \lambda(1 - 2\hat{j} - 5\hat{k})$

Question 24. Evaluate $\int_0^\pi \frac{x \sin 2x \sin \left(\frac{\pi}{2} \cos x\right)}{2x - \pi} dx$

OR

Evaluate $\int_{-1}^{3/2} |x \sin \pi x| dx$

END OF THE QUESTION PAPER

Sample Paper

Sample Paper