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Total No. of Printed Pages: 2

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B.Sc. Hons. (AME) (Semester – 2nd)
APPLIED MATHEMATICS
Subject Code: BAME3211
Paper ID: 20131107

Time: 03 Hours

Maximum Marks: 60

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A

(2 marks each)

Q1. Attempt the following:

- a) Find the rank of the matrix $\begin{bmatrix} 4 & 2 & 3 & 8 & 5 & 2 & 12 \\ - & 4 & 5 \end{bmatrix}$.
- b) A wheel makes 360 revolutions in one minute. Through how many radians does it run in one second.
- c) Prove that $\frac{\sin x + \sin 3x}{\cos x + \cos 3x} = \tan 2x$.
- d) Differentiate $\sqrt{1 + x^2}$ w.r.t. 'x'.
- e) Evaluate $\frac{\sin ax}{\sin bx}$.
- f) Evaluate $\int_0^{\pi} \int_0^x \sin y \, dy \, dx$.
- g) Find the first order partial derivatives of $e^{ax} \sin by$.
- h) Show that the vector $3x^2y \hat{i} + (x^3 - 2yz^2) \hat{j} + (3z^2 - 2y^2z) \hat{k}$ is irrotational.
- i) Find the divergence of the vector $\vec{F} = (x + 3y) \hat{i} + (y - 2z) \hat{j} + (x + z) \hat{k}$.
- j) Without expanding prove that $\begin{vmatrix} 1 & a & bc & 1 & b & ca & 1 & c & ab \\ 1 & a & a^2 & 1 & b & b^2 & 1 & c & c^2 \end{vmatrix}$.

Section – B

(5 marks each)

Q2. Show that the equations $x + y + z = 9$, $2x + 5y + 7z = 52$ and $2x + y - z = 0$ are consistent and solve these.

Q3. If $y = a\cos(\log x) + b\sin(\log x)$, show that $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = 0$.

Q4. Change the order of integration and evaluate $\int_0^{4a} \int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dy dx$.

Q5. If $\vec{F} = (3xy)\hat{i} - y^2\hat{j}$, evaluate $\int \vec{F} \cdot d\vec{r}$ over the curve $y = 2x^2$ from $(0, 0)$ to $(1, 2)$.

Q6. The shadow of the tower standing on a level ground is found to be 40m longer when the Sun's altitude is 30° than when it is 60° . Find the height of the tower.

Section – C

(10 marks each)

Q7. (a) Find the eigen values and eigen vectors of the matrix $\begin{bmatrix} 3 & 1 & 1 & 2 & 4 & 2 & 1 & 1 & 3 \end{bmatrix}$.

(b) If $y = \log \log (\sin x)$, evaluate $\frac{d^3 y}{dx^3}$.

Q8. (a) The moon's distance from earth is 385000 Km and its diameter subtends an angle of 30° at the eye of an observer. Find the diameter of the moon.

(b) For $y = x^{\sin x}$, find $\frac{dy}{dx}$.

Q9. (a) Find the area of the circle $x^2 + y^2 = a^2$ using double integral.

(b) Verify Green's theorem in the plane for $\oint [(x^2 - xy^3)dx + (y^2 - 2xy)dy]$ over the square with vertices $(0, 0)$, $(2, 0)$, $(2, 2)$ and $(0, 2)$.