BSC. PART - II EXAMINATION - 2009

MATHEMATICS SUB/GEN

Answer eight questions in all, selecting at least one from each Group in which Q. No. 1 is compulsory

1. Select the correct answers of the following :

(i) The solution of diff. equation $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$ is.

(a) $xc = \sin\frac{y}{x}$ (b) $xc = \cos\frac{y}{x}$ (c) $xy = c\sin\frac{y}{x}$ (d) None of these

(ii) The value of $\frac{1}{D^2}C^{-x}$ is :

(a) e^x (b) e^{2x} (c) e^{-x} (d) None of these

(iii) The equation of normal at ϕ - point is :

(a) $ax\sec\phi + by\,\text{cosec}\,\phi = a^2 - b^2$ (b) $ax\sec\phi - by\,\text{cosec}\,\phi = a^2 - b^2$

(c) $ax\cos\phi - by\sin\phi = a^2 - b^2$ (d) None of these

(iv) The shortest distance between the lines $\frac{x-1}{2} = \frac{y+8}{-7} = \frac{z-4}{5}$ is :

(a) 4 (b) $\frac{4}{\sqrt{3}}$ (c) $4\sqrt{3}$ (d) None of these

(v) The intrinsic equation of common catenary is :

(a) $S = C\tan\psi$ (b) $S = C\cos h\frac{x}{c}$ (c) $Y = C\sec\psi$ (d) None of these

(vi) Transverse acceleration of a particle moving in a curve in a plane is :

(a) $r^2\theta$ (b) $\frac{d}{dt}(r^2\theta)$ (c) $\frac{1}{r}\frac{d}{dt}(r^2\theta)$ (d) None of these

(vii) If $f = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$ then $x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y}$ is :

(a) f (b) 2f (c) tan f (d) None of these

(viii) The value of the function $x = x^3 + y^3 - 3axy$ is maximum at $x = a$, $v = a$ if :

(a) $a > 0$ (b) $a < 0$ (c) $a = 0$ (d) None of these

GROUP - A

2. Solve any two of the following :

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(i) $\log\left(\frac{dy}{dx}\right) = ax + by$ (ii) $\frac{dy}{dx} + 1 = e^{x-y}$ (iii) $\frac{dy}{dx} = \sqrt{y-x}$

3. Solve any two of the following :

(i) $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$ (ii) $(1+xy)y\,dx + (1-xy)x\,dy = 0$ (iii) $\frac{dy}{dx} + \frac{1-2x}{x^2}y = 1$

4. Solve any two of the following :

(i) $P^2 + 2xp - 3x^2 = 0$ (ii) $y = 2px + p^2$ (iii) $y = px + p - p^2$

5. Solve any two of the following :

(i) $\frac{d^2y}{dx} + 4y = \sin 2x$ (ii) $\frac{d^2y}{dx^2} + a^2y = 0$

(iii) $(D^2 - 5D + 6)y = x + e^{mx}$ (iv) $(D^2 - 4D + 4)y = e^{2x} + \sin 2x$

GROUP - B

6. (a) Find the equation of an ellipse in standard form.

(b) Find the condition for tangency of the line. $y = mx + c$ to the parabola $y^2 = 4ax$

7. Find the conditions for the general equation of the second degree in x and y to represent parabola, ellipse and hyperbola.

8. (a) Find the magnitude and the equation of the shortest distance between two straight lines

(b) A line makes angle $\alpha, \beta, \gamma, \sigma$ with the diagonals of a cube, then prove that

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\sigma = \frac{4}{3}$$

9. (a) A plane passes through a fixed point (a, b, c) and cuts the axes in A, B, C if O be the origin, then prove that the locus of the centre of the sphere OABC is $\frac{a}{x} + \frac{b}{y} + \frac{c}{z} = 2$

(b) Find the equation of the right circular cylinder whose radius is r and axis is the line $\frac{x-\alpha}{\ell} = \frac{y-\beta}{m} = \frac{z-\gamma}{n}$

GROUP - C

10. (a) Prove that any system of coplanar forces acting on a rigid body is equivalent to a single force acting at an arbitrary point in the plane of the forces together with a couple.

(b) A uniform beam of length 2a, rests against a smooth vertical plane over a smooth peg at a distance b from the plane. If θ be the inclination of the beam to the vertical, show that $\sin^3\theta = \frac{b}{a}$

11. (a) Find the equation of the common catenary in cartesian coordinates.

(b) Prove that for the catenary $y = C\cosh\frac{x}{c}$, the length of the perpendicular from the ordinate is of constant length.

12. Define S. H. M. and find its periodic time, amplitude and frequency.

13. (a) A particle falls under gravity in a resisting medium whose resistance varies as the square of the velocity. Find the motion if the particle starts from the rest.

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(b) A particle starts from rest at the highest point of a smooth vertical circle and moves down along the outside of the arc. Discuss the motion.

GROUP - D

14. (a) Test the continuity of the function f(x) at

$x = 0$, where $f(x) = \frac{1}{1 - e^{-1/x}}$, $x \neq 0$

$= 0$ $x = 0$

(b) Test the differentiability of the function f (x)

Where $f(x) = \begin{cases} -1, -2 \leq x \leq 0 \\ x - 1, 0 < x \leq 2 \end{cases}$

15. (a) State and prove Lagrange's Mean value Theorem.

(b) Verify Rolle's theorem for the function $f(x) = 2x^3 + x^2 - 4x - 2$.

16. (a) Define limit and continuity of functions of two variables with suitable examples.

(b) State and prove Euler's theorem on homogeneous function in two variables.

17. (a) Discuss the necessary and sufficient conditions for f(x, y) to have extreme value at (a, b).

(b) Find the maxima and minima of the function
$f(x, y) = x^3 + y^3 - 3x - 12y + 20$.

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