BSC. PART - II EXAMINATION - 2013

MATHEMATICS SUB/ GEN

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

1. Choose the correct answer of the following :

(a) Order of differential equation $\frac{d^3y}{dx^3}-6\frac{d^2y}{dx^2}+11\frac{dy}{dx}-6y=0$ is :

(i) 1 (ii) 2 (iii) 0 (iv) 3

(b) I. F of the equation $\frac{dy}{dx}+y\cot x=2\cos x$ is :

(i) Log sin x (ii) sin x (iii) $e^{\sin x}$ (iv) None of the above

(c) The value of $\frac{1}{D^2}(e^{ax})$ is :

(i) ae^{ax} (ii) $\frac{e^{ax}}{a^2}$ (iii) $\frac{e^x}{a^2}$ (iv) e^{ax}

(d) Eccentricity of hyperbola $x^2-9y^2=9$ is :

(i) $\frac{\sqrt{10}}{9}$ (ii) $\frac{\sqrt{10}}{3}$ (iii) $\frac{10}{3}$ (iv) $\frac{5}{\sqrt{3}}$

(e) Condition that $y=mx+c$, touches the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ is

(i) $c=\sqrt{a^2m^2+b^2}$ (ii) $c=-\sqrt{a^2m^2+b^2}$

(iii) $c=\pm\sqrt{a^2m^2+b^2}$ (iv) $c=\pm\sqrt{a^2m^2+b}$

(f) The direction cosines of a line that makes equal angles with the axes is :

(i) $\left(\pm\frac{1}{\sqrt{3}},\pm\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$ (ii) $\left(\pm\frac{1}{\sqrt{3}},\pm\frac{1}{\sqrt{3}},\pm\frac{1}{\sqrt{3}}\right)$

(iii) $\left(\frac{1}{\sqrt{3}},0,\frac{1}{\sqrt{3}}\right)$ (iv) $\left(\pm\frac{1}{\sqrt{3}},\pm\frac{1}{\sqrt{3}},0\right)$

(g) C. F. (Complementary Function) of equation $(D^2-4D+4)y=xe^{2x}$ is :)

(i) $(C_1+C_2)e^{2x}$ (ii) $(C_1+C_2x)e^x$ (iii) $(C_1+C_2x)e^{2x}$ (iv) None of the above

(h) The intrinsic equation of the catenary is :

(i) $s=c\sec\psi$ (ii) $y=c\tan\psi$ (iii) $s=c\tan\psi$ (iv) None of the above

GROUP-A

2. (a) Find the standard equation of ellipse.

(b) Prove that the straight liney $y=mx+c$ touches the parabola $y^2=4a(x+a)$ if $c=ma+\frac{a}{m}$

3. Find the condition that general equation of second degree is x and y may represent a parabola, an ellipse or a hyperbola.

4. (a) Find the equation of the plane in normal form.

(b) Find the shortest distance between the lines $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$

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

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(b) Find the equation to the cone whose vertex is the origin and which passes through the curve of intersection of the plane $lx + my + nz = p$ and the surface $x^2 + y^2 + z^2 + 2ax + b = 0$.

GROUP-B

6. Solve any two of the following :

(a) $(x + y)^2 \frac{dy}{dx} = a^2$ (b) $\frac{dy}{dx} = \frac{4x+6y+5}{3y+2x+4}$ (c) $(1+y^2)dx = (\tan^{-1} y - x)dy$

7. Solve any two of the following :

(a) $p^2 - p(e^x + e^{-x}) + 1 = 0$ (b) $y = 2px + p^2$ (c) $p^2y = -2px + y$

8. (a) Prove that the system of confocal conics $\frac{x^2}{a^2+\lambda} + \frac{y^2}{b^2+\lambda} = 1$ is self orthogonal.

(b) Solve any one of the following :

(i) $(x + y - 1)\, dy = (x + y)\, dx$ (ii) $\tan x \frac{dy}{dx} = 1 + y^2$ when $x = \frac{\pi}{2}$ and $y = 1$

9. Solve any two of the following :

(a) $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = \sin 2x$ (b) $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = xe^{2x}$ (c) $\frac{d^2y}{dx^2} + y = \cos 2x$

GROUP - C

10. (a) Prove that a system of coplanar forces acting on a rigid body can be reduced either to a single forces or to a couple.

(b) Three forces P, Q, R act along the sides of triangle formed by the lines $x + y = 1$, $y - x = 1$ and $y = 2$. Find the equation to the line of action of resultant.

11. (a) Find the Cartesian equation of the common catenary.

(b) If T be the tension at any point P of a catenary and T_0 that at lowest point C, prove that $T^2 - T_0^2 = W^2$, W being the weight of the arc of the catenary.

12. (a) A particle is moving in a plane curve. Find the components of its velocity along the tangent and normal to the curve.

(b) Find the work done in extending a light string to double its length..

13. A particle falling under gravity in a medium whose resistance varies as the velocity find the motion of the particle.

GROUP - D

14. (a) Prove that a function differentiable at a point must be continuous at that point.

(b) Show that $f(x) = x \sin\frac{1}{x}$ when $x \neq 0$

$= 0$ when $x = 0$

is not differentiable at $x = 0$.

15. State and prove Lagrange's mean value theorem. What is its geometrical interpretation.

16. (a) If $u = \tan^{-1}\frac{x^3+y^3}{x-y}$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$.

(b) If $f(x, y) = \frac{xy}{x^2+y^2}$, where $x^2 + y^2 \neq 0$

$f(0, 0) = 0$

Examine whether $f(x, y)$ is continuous at $(0,0)$ or not ?

17. Discuss the Lagrange's method of undetermined multipliers.