PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2018
(First Semester)

Branch – **ELECTRONICS**

MATHEMATICS – I

Time : Three Hours   Maximum : 75 Marks

SECTION-A (20 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks   (10 x 2 = 20)

1 Find the magnitude and the direction of the greatest change of $u=xyz^2$ at (1,0,3).

2 State Gauss Divergence theorem.

3 Find the eigen values of the matrix $\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 0 \\ 0 & 0 & 5 \end{bmatrix}$.

4 Prove that the matrix $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ is orthogonal.

5 If $y=\log(ax+b)$ then find y_n.

6 If $xy=ae^x+be^{-x}$ Prove that $x\frac{d^2y}{dx^2}+\frac{2dy}{dx}-xy=0$.

7 Find the laplace transform of $(t+2t^2)^2$

8 Find the inverse laplace transform of $\frac{1}{(s+2)^{20}}$.

9 Express the function $w=\frac{1}{z}$ in the form u(x,y)+iv(x,y).

10 Prove that the function f(z)=Rez is nowhere differentiable.

SECTION - B (25 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 5 = 25)

11 a Evaluate $\iiint_\upsilon \nabla \vec{F} dv$ where $\vec{F}=x^2\vec{i}+y^2\vec{j}+z^2\vec{k}$ and υ is the volume enclosed by the cube $0 \le x,y,z \le 1$.

OR

b If $\vec{F}=2xy\vec{i}+yz^2\vec{j}+xz\vec{k}$ and S is a rectangular parallelepiped bounded x=0, y=0, z=0, x=2, y=1, z=3 then evaluate $\iint_s \vec{F}.\hat{n}ds$.

12 a Find the characteristic equation of $A=\begin{bmatrix} 1 & 1 & 3 \\ 5 & 2 & 6 \\ -2 & -1 & -3 \end{bmatrix}$ and show that the matrix A satisfies the equation.

OR

b Show that the matrix $\begin{pmatrix} 0 & c & -b \\ -c & 0 & a \\ b & -a & 0 \end{pmatrix}$ satisfies Cayley- Hamilton theorem.

13 a Find the nth derivative of sin2x sin4x sin6x.

OR

b If $u=\tan^{-1}\frac{y}{x}$. Using Euler's theorem, show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=0$.

14 a (i) Find $L(e^{-at}\sin bt)$ (ii) Find $L^{-1}\left(\frac{s-3}{s^2+4s+13}\right)$.

OR

b Find $L^{-1}\left\{\frac{1}{(s+1)(s+2)(s+3)}\right\}$.

15 a Prove that an analytic function in a region with constant modulus is constant.

OR

b State and prove Cauchy's Residue theorem.

SECTION - C (30 Marks)

Answer any **THREE** Questions
ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

16 Verify Stoke's theorem when $\vec{F}=(2x-y)\vec{i}-yz^2\vec{j}-y^2z\vec{k}$ where S is the upper hemisphere of the unit sphere $x^2+y^2+z^2=1$ and c is its boundary.

17 Find the eigen value and eigen vectors of the matrix $A=\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$.

18 If $y=\sin(m\sin^{-1}x)$ prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-(m^2-n^2)y_n=0$.

19 Solve given $\frac{d^2y}{dx^2}-\frac{3dy}{dx}+2y=e^{3x}$, given $y(0)=y'(0)=0$ using laplace transforms.

20 Find the analytic function $f(z)=u+iv$ if $u+v=\frac{\sin 2x}{\cosh 2y-\cos 2x}$.

Z-Z-Z END