PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION DECEMBER 2017
(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 If $\vec{A}$ and $\vec{B}$ are irrotational, show that $\vec{A} \times \vec{B}$ is solenoidal.

2 Give the vector $\vec{F} = xz\vec{i} + yz\vec{j} + z^2\vec{k}$, evaluate $\int_c \vec{F}d\vec{r}$ along c, where c is the straight line joining the points (0, 0, 0) to (1, 1, 1).

3 Find the eigen values of $\begin{bmatrix} a & h & g \\ 0 & b & 0 \\ 0 & 0 & c \end{bmatrix}$.

4 Define unitary matrix and give an example.

5 If $y = e^{2x}$, prove that $y_2 - 4y = 0$.

6 If $y = -x^3\log^x$, prove that $x\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + 3x^2 = 0$.

7 Define Laplace Transform.

8 Find $L(t^2 + 2t + 3)$.

9 Define Analytic function.

10 Writ CR equation in polar coordinates.

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

11 a Find the directional derivative of $\phi(x,y,z) = xy^2 + yz^3$ at the point (2, -1, 1) in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$.

OR

b Prove that $\nabla.(\phi u) = \phi(\nabla.u) + (\nabla\phi).u$.

12 a Find the characteristic equation of the matrix $A = \begin{pmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$ and hence find A^{-1}.

OR

b Verify Cayley – Hamilton theorem and hence find A^{-1} if $A = \begin{pmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{pmatrix}$.

13 a Find the n^{th} derivative of $\dfrac{2x+1}{(2x-1)(2x+3)}$.

OR

b Verify Euler's theorem for $u = x^3 + y^3 + 3x^2y - 3xy^2$.

14 a Find (i) $L(e^{at}t^n)$ (ii) L (t sinat).

OR

b Find (i) $L^{-1}\left(\dfrac{1}{(s^2+6s+13)^2}\right)$ (ii) $L^{-1}\left(\dfrac{2s+3}{(s-3)5}\right)$.

Cont...

15 a State and prove Cauchy's fundamental theorem.

OR

b If f(z) is regular function of z, prove that $\left[\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right]|f(z)|^2 = 4|f'(z)|^2$.

SECTION - C (30 Marks)

Answer any **THREE** Questions

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

16 Prove that $\vec{F} = yz^2\vec{i} + (xz^2 - 1)\vec{j} + 2(xyz - 1)\vec{k}$ is irrotational and find its scalar potential.

17 Find all the characteristics roots and the associated characteristic vectors of the matrix $A = \begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}$.

18 If y = a cos (log x) + b sin (log x), show that $x^2y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$

19 i) Solve $y'' + 5y' + 6y = 2$, given $y(0) = y'(0) = 0$.

ii) Find $L^{-1}\left(\frac{s+2}{(s^2+4s+5)^2}\right)$.

20 Derive Cauchy Riemannian equations.

Z-Z-Z END