BSc DEGREE EXAMINATION DECEMBER 2017
(Fifth Semester)

Branch – **PHYSICS**

MATHEMATICAL PHYSICS

Time : Three Hours   Maximum : 75 Marks

SECTION-A (20 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** marks   (10 x 2 = 20)

1 Show that $\vec{\nabla}.\vec{r} = 3$.

2 State Stokes theorem.

3 Express grad ψ in curvilinear coordinates.

4 Give the values of scale factors h_1, h_2, h_3 in cylindrical coordinate system.

5 What is meant by Einstein's summation convention?

6 Define contra variant tensor.

7 If Z = x + iy, show that |z| is not analytic.

8 Define 'Analytic function'.

9 State Cauchy's integral theorem.

10 Evaluate $\int_i^1 (z+1)^2 dz$.

SECTION - B (25 Marks)

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

11 a State and prove Green's theorem in a plane.

OR

b Show that $r^n \vec{r}$ is an irrotational vector for all values of n.

12 a Express curl of a vector V in curvilinear coordinates.

OR

b Express Laplace's equation and Helmholtz equation in orthogonal.

13 a Define Kronecker delta symbol and discuss its properties.

OR

b If A^μ and B_ν are the components of a contra variant and covariant tensor of rank one, show that $C_\nu^\mu = A^\mu B_\nu$ are the components of mixed tensor of tank two.

14 a Determine the analytic function f(z) = u + iv where v = 6xy – 5x + 3. Express the result as a function of Z.

OR

b Show that the real and imaginary parts of an analytic function f(z) are harmonic.

Cont ....

15 a What is meant by the line integral of a complex function? Discuss the basic properties of complex line integrals.

OR

b Use Cauchy's integral theorem to evaluate $\oint_c \frac{dz}{z}$ where C is a simple closed curve.

SECTION - C (30 Marks)

Answer any **THREE** Questions

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

16 State and prove Gauss divergence theorem.

17 Obtain an expression for divergence of a vector in curvilinear coordinates and hence obtain the expression in spherical polar coordinates.

18 a What are symmetric and anti symmetric tensors?

b Show that any tensor of rank 2 can be expressed as a sum of a symmetric and an anti symmetric tensor, both of rank 2.

19 Explain the necessary and sufficient conditions for a function f(z) to be analytic and deduce Cauchy's Riemann equations.

20 State and prove Cauchy's integral formula.

Z-Z-Z END