MSc Degree Examination
Branch II Physics
PH 212 – Mathematical Physics

Duration: 3 hours **Maximum marks 75**

Part A

Answer any five questions. Each question carries 3 marks

1 Determine the scale factors in cylindrical polar coordinates.

2 Explain the fourier series representation of an even function.

3 Define Green's function. Where is it used and how?.

4 What is Chebechev's inequality and its importance.

5 Define covariant and contravariant tensors and explain their physical meanings.

6 Define 'classes' and 'invariant subgroups' of a group

7 What is meant by an exact differential equation

8 Write down equation of geodesic

5x3=15 marks

Part B

Answer three questions. Each question carries 15 marks

9

(a) What are orthogonal curvilinear coordinates? 5

(b) Obtain expressions for gradient, divergence and curl in spherical polar coordinates. 10

OR

10

(a) Deduce CR conditions for a function to be analytic. 5

(b) Stae and prove Cauchy Integral formula. 10

15 marks

11

(a) Explain Laplace transform 5

(b) Solve wave equation using Laplace transform 10

OR

12

(a) Discuss the occurrence of Hermite differential equation in physics. 5

(b) Derive its solution using power series method 10

15 marks

13

(a) Explain the construction of covariant derivative of a vector field. 5

(b) Deduce the transformation law of Christoffel symbols. 10

OR

14

(a) Distinguish between reducible and irreducible representation of groups. 5

(b) Explain the construction of the irreducible representations of SU(2) group 10

15 marks

Part C

Answer any three questions. Each question carries 5 marks

16 Determine the eigen values and eigen vectors of the matrix

17 Find the fourier transform of $f(x)=1$ for $1x1<a$
$=0$ for $1x1>a$

18 Determine the poles and residues at each pole of the function

19 Obtain the solution to the partial differential equation by separation of variables.

20 If A^{ij} are the components of II rank contravariant tensor and B_k that of a covariant vector, show that $A^{ij}B_k$ is a third rank mixed tensor.

21 Using power series method, solve

3x5=15 marks