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Reg. No. :

Code No. : 7140

Sub. Code : PPHM 21

M.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2019.

Second Semester

Physics – Core

MATHEMATICAL PHYSICS – II

(For those who joined in July 2017 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL the questions.

Choose the correct answer :

1. The sum of two complex number is a
 - (a) Real number
 - (b) Complex number
 - (c) Constant
 - (d) Variables
2. A function $f(z)$ is said to analytic at a point $z = z_0$ if it is
 - (a) Single valued
 - (b) Multiple valued
 - (c) Constant
 - (d) Variable

3. The factor group of an abelian group is necessarily
 - (a) an abelian group
 - (b) cyclic group
 - (c) non-abelian group
 - (d) permutation group
4. The group of order 4 is
 - (a) always a cyclic group
 - (b) never a cyclic group
 - (c) may or may not be cyclic group
 - (d) does not contain identity element
5. Legendre differential equation has singular point
 - (a) $(0, \infty)$
 - (b) $(-\infty, \infty)$
 - (c) $(-1, 1)$
 - (d) None of these
6. $P_n(-x)$ has the value
 - (a) $P_n(x)$
 - (b) $(-1)^n P_n(x)$
 - (c) $-P_n(x)$
 - (d) 0



7. Which one of the following is Poisson's equation

- (a) $\nabla^2 u = 0$ (b) $\nabla^2 u = \frac{-\rho}{\epsilon_0}$
 (c) $\rho \nabla^2 u = \epsilon_0$ (d) $\nabla^2 u - \frac{\partial^2}{\partial t^2} = \frac{\rho}{\epsilon_0}$

8. In heat flow equation $\nabla^2 u = \frac{1}{h^2} \frac{\partial u}{\partial t}$, the quantity h is called

- (a) Planck's constant
 (b) Conductivity
 (c) Heat flow constant
 (d) Diffusivity

9. Moment of inertia is a

- (a) Scalar
 (b) Vector
 (c) A tensor of rank 2
 (d) A tensor of high rank

10. A tensor of rank 2 in n dimensional space has components

- (a) n (b) $2n$
 (c) n^2 (d) 2^n

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PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) Check whether $\frac{1}{z}$ is analytic or not.

Or

(b) State and prove the Cauchy's integral theorem.

12. (a) What do you understand by subgroups and cosets? Whether they are one and the same?

Or

(b) What are reducible and irreducible representation?

13. (a) Show that $P_n(1) = 1$.

Or

(b) Obtain the generating function of Hermite polynomials.

14. (a) Obtain the solution of heat flow equation using the method of separation of variables.

Or

(b) Obtain the equation of motion of a vibrating string if a vertical force " f " per unit length acts on the string in addition.

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15. (a) Write down the forward and obtain the reverse transformation of contra variant vectors.

Or

- (b) Show that $g_{\mu\nu}$ is a covariant tensor of rank 2.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Obtain the Cauchy-Riemann equation in polar form.

Or

- (b) State and prove Cauchy's integral theorem.

17. (a) Prove the Schur's lemma.

Or

- (b) State and prove the great orthogonality theorem.

18. (a) Derive the Rodrigue's formula for Legendre polynomials.

Or

- (b) Prove the following :

(i) $H_n(x) = 2nH_{n-1}(x)$

(ii) $2xH_n(x) = 2nH_{n-1}(x) + H_{n+1}(x)$.

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19. (a) Solve the partial differential equation for a variable linear flow of heat in an infinite bar.

Or

- (b) Solve the partial differential equation for heat flow in circular plate on the basis of cylindrical coordinates.

20. (a) State and prove quotient law.

Or

- (b) Explain the ranking and lowering of Indices.

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