Avinashilingam Institute for Home Science and Higher Education for Women

(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with 'A+' Grade by NAAC. Recognised by UGC Under Section 12B
Coimbatore - 641 043, Tamil Nadu, India

Bachelor's Degree Examination –November 2019

III Semester

Class : II UG **Time: 3 Hours**
Major : Physics **Max. Marks : 100**

18BPHC08 – Mathematical Physics

Part A **10x1=10**

Choose the Correct Answer

1. Calculate div r, if $\vec{r} = xi + yj + zk$

(a) 0 (b) 3 (c) 1 (d) 2

2. Write $\nabla.(A + B) =$

(a) $\nabla.A + \nabla.B$ (b) $\nabla.B + \nabla.B$ (c) 0 (d) 1

3. The curvilinear co-ordinate system will be orthogonal if

(a) $\frac{\partial r}{\partial u}.\frac{\partial v}{\partial u} \neq \frac{\partial r}{\partial u}.\frac{\partial r}{\partial w} \neq \frac{\partial r}{\partial w}.\frac{\partial r}{\partial u} \neq 0$

(b) $\frac{\partial r}{\partial u}.\frac{\partial v}{\partial u} \neq \frac{\partial r}{\partial u}.\frac{\partial r}{\partial w} \neq \frac{\partial r}{\partial w}.\frac{\partial r}{\partial u} = 0$

(c) $\frac{\partial r}{\partial u} \neq \frac{\partial r}{\partial v} \neq \frac{\partial r}{\partial w} \neq 0$

(d) $\frac{\partial r}{\partial u} = \frac{\partial r}{\partial v} = \frac{\partial r}{\partial w} = 0$

4. The coordinates of three surfaces intersecting at P are called _____ co-ordinate

(a) orthogonal (b) curvilinear (c) cylindrical (d) Cartesian

5. Find the value of $\int_0^1 \frac{35\,x^2}{32\sqrt{1-x}}\,dx =$ _____

(a) 0 (b) 1 (c) π (d) $\pi/2$

6. Find the value of $\int_0^\alpha xe^{-x^3}dx$ x $\int_0^\alpha x^2 e^{-x^4}dx$

(a) π (b) $\frac{\pi}{16\sqrt{2}}$ (c) 2π (d) 0

7. Type of constraints for the Rigid body is

(a) Scleronomic, holonomic, bilateral, conservative (b) Scleronomic only
(c) holonomic, bilateral (d) holonomic & conservative

8. The associated generalized momenta for Linear Momentum is,

(a) $P_r = \frac{\partial T}{\partial r} = mr$ (b) $Po = mr\,\theta$ (c) 1 (d) 0

9. Maxwell-Boltzmann statistics are applicable to

(a) identical particles (b) distinguishable particles
(c) both (a) & (b) (d) indistinguishable particle

10. Example for fermions is

(a) Electrons (b) photon (c) Deutron (d) gravitor

PART-B

Answer All the Questions **5 x 6 = 30**

11. (a) Derive ∇r, where r is the position vector

(Or)

11. (b) Verify Green's theorem in the plane for $\int [(xy + y^2)dx + x^2 dy \ ]$

12. (a) Write a short note on orthogonal curvilinear coordinates

(Or)

12. (b) Transform the wave function $\frac{\partial^2 u}{\partial r^2} = c^2 \nabla^2 u$ in spherical co-ordinates if u is independent of ϕ .

13. (a) Prove that $\lceil n+1 = n \lceil (n)$

(Or)

13. (b) Find the value of $\lceil \left(\frac{1}{2}\right)$

14. (a) Explain the principle of Least Action

(Or)

14. (b) Explain the generalized coordinates

15. (a) Derive Fermi Dirac statistics

(Or)

15. (b) Derive Maxwell-Boltzmann statistics.

PART-C

Answer All the Questions **5 x 12 = 60**

16. (a) State and prove Stoke's theorem

(Or)

16. (b) Show that $\vec{v}\ (x, y, z) = 2xyzi + (x^2 Z + 2y)i + x^2 yk$ is irrotational and find a scalar function U(x, y, z) such that $\vec{v}$ = grad (u)

17. (a) Derive an expression for cylindrical polar coordinates

17. (b) Transform the spherical polar coordinates into i,j,k and transform cylindrical polar co-ordinates into i, j,k

18. (a) Evaluation of Beta function

$\beta(l, m) = \dfrac{\lceil l \ \lceil m}{\lceil (l+m)}$

(Or)

18. (b) Derive the relation between beta and gamma functions

19. (a) State and explain D'Alembert's Principle and derive Lagrange's equations of motion from it.

(Or)

19. (b) Deduce the Langrange's equation of motion from Hamilton's principle.

20. (a) Compare the B-E., M-B and F-D statistics

(Or)

20. (b) Derive an expression for the most probable distribution of the particles among various energy levels for a system obeying B-E statistics.

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