

1<sup>st</sup> sem 1<sup>st</sup> Sessional Exam. - 2016

Paper : 1.1(M)

Sub : Physics

Full marks : 15

Time : 45 min.

1. Find a vector that is perpendicular to  $\vec{u} = 2\vec{i} + \vec{j} - \vec{k}$  and  $\vec{v} = \vec{i} - \vec{j} + \vec{k}$  2

OR

- Define gradient of a scalar  $\Phi$ . Is it a vector or scalar ?
2. Obtain the cosine of the angle between the vectors  $\vec{A} = 3\vec{i} + 4\vec{j} + \vec{k}$  and  $\vec{B} = \vec{i} - \vec{j} + \vec{k}$  3

OR

3. Answer any two questions -
- (a) Define vector fields and scalar fields with one example of each. 2+2+1
- (b) Define divergence and curl of a vector  $\vec{A}$  and obtain the expression for  $\nabla \cdot \vec{A}$ . 2+3
- (c) Given  $\vec{A} = \vec{i} + 2\vec{j} - \vec{k}$ ,  $\vec{B} = \vec{j} + \vec{k}$  &  $\vec{C} = \vec{i} - \vec{j}$  Evaluate  $\vec{A} \times (\vec{B} \times \vec{C})$  5
- (d) Using the definition of the differential operator  $\nabla$ , establish that  $\nabla(uv) = v(\nabla u) + u(\nabla v)$  where u and v are scalar functions of x, y and z. 5

3<sup>rd</sup> sem 2<sup>nd</sup> Sessional Exam. - 2016

Paper : 3.1

Full marks : 15

Time : 1 Hour

ANSWER ANY THREE QUESTIONS

- 1 State and prove Gauss' law. 5
2. Find the expression for potential due to an electric dipole. 5
- 3 State Poisson's and Laplace's equation. Find the electric field due a circular ring. 4+1
- 4.
- (a) What are polar and nonpolar dielectrics ? 1+4
- (b) Find the expression of energy for dipole-dipole interaction.
- 5, Find out the expression of potential for multipole. 5

**6<sup>th</sup> sem 2<sup>nd</sup> Sessional Exam. - 2016**  
**Paper : 6.4**

**Full marks : 15**

**Time : 1 Hour**

1. *Answer any two question*

- |  |   |
|--|---|
| a) (i) What do you mean by Phase space and distribution function?          | 3 |
| (ii) Deduce Boltzmann's theorem relating entropy with probability.         | 4 |
| b) Using BE distribution law, derive Planck's radiation law for blackbody. | 7 |
| c) State and prove Liouville's theorem. What is its physical significance? | 7 |
| d) (i) What are microscopic and macroscopic states?                        | 4 |
| (ii) State Ergodic hypothesis. What does it physically mean?               | 3 |
| e) (i) Distinguish between Bose - Einstein and Fermi - Dirac statistics.   | 3 |
| (ii) Define bosons and fermions. Give two examples of each.                | 4 |
| f) Obtain Maxwell - Boltzmann or Bose - Einstein distribution law.         | 7 |
| 2. What is Fermi energy?   | 1 |

Total Marks : 15

1. (a) What is a skew-symmetric matrix ? 1  
 (b) Define Hermitian conjugate matrix. 1  
 (c) What is unitary matrix ? 1  
 2. Show that  $(AB)^T = B^T A^T$  2

Or

Verify that  $\begin{bmatrix} \cos \phi & 0 & \sin \phi \\ 0 & 1 & 0 \\ -\sin \phi & 0 & \cos \phi \end{bmatrix}$  is orthogonal matrix. 2

3. Answer any two questions:

(a) State Cayley-Hamilton theorem. Obtain the characteristic equation of a matrix

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 1 & 1 \\ 2 & 3 & 1 \end{bmatrix} \quad 5$$

and verify Cayley-Hamilton theorem.

(b) Define scalar and diagonal matrix with examples.

Show that multiplication of diagonal matrix is commutative. 3+2

(c) Define adjoint of a matrix and symmetric matrix.

Find inverse of

$$A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix} \quad 2+3$$

(d) Find the eigen values and eigen vectors of

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 3 & 1 & 1 \\ 2 & 3 & 1 \end{bmatrix} \quad 5$$

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Full marks : 15

Paper : 2.1

Time : 1 Hour

1. Answer any three Question. 4 x 3 = 12

(a) State and prove Stoke's theorem.

(b) State and prove Gauss's theorem.

(c) Evaluate the line integral  $\int \vec{F} \cdot d\vec{r}$ , where  $\vec{F} = xy\hat{i} + yz\hat{j} + zx\hat{k}$  and c is the curve and  $\vec{r} = t\hat{i} + t^2\hat{j} + t^3\hat{k}$  t varying from -1 to +1. What is line integral ?

(d) Obtain the expression  $\nabla \cdot \vec{r}$  in spherical polar co-ordinates.

(e) Prove that  $\partial [e^{(x-a)}] = \frac{1}{|c|} \partial(x-a)$

(f) Show that  $\Gamma \frac{1}{2} = \sqrt{\pi}$

2. Answer any one question

1 x 3 = 3

(a) Find  $\Gamma_1$  and  $\Gamma_4$

(b) Evaluate  $\int_0^{\infty} x^{5/4} e^{-x^2} dx$