



Marks : 50

Time : 8.30 am to 11.00 am

- 1) All sections are compulsory.
- 2) Draw the diagrams wherever necessary.
- 3) Use of log table is allowed. Calculator is not allowed.
- 4) For each MCQ correct answer must be written along with its alphabet, only the first attempt will be considered for evaluation.

Q1. Select and write the correct answer for the following multiple choice type of questions. (8)

- i) The magnitude of a vector cannot be _____.
A) zero B) negative
C) positive D) unity
- ii) Law of polygon of vectors is a repeated use of _____.
A) triangle law of vectors. B) parallelogram law of vectors.
C) addition of vectors in one dimension. D) multiplication law of vectors.
- iii) The magnitude of self cross product is _____.
A) magnitude of a vector. B) square of the magnitude of vectors.
C) half the magnitude of vectors. D) zero.
- iv) A geostationary satellite has an orbital period of _____.
A) 2 hr B) 6 hr
C) 12 hr D) 24 hr
- v) If the horizontal velocity is less than critical velocity, then the satellite will travel in _____.
A) parabolic path B) straight path
C) elliptical path D) circular path

- $P = \frac{a^3 b^2}{c}$, Then percentage error in P is _____.

B) 10%

D) 4%

- B) $2 \times 11.2 \text{ kms}^{-1}$

D) $\sqrt{15} \times 11.2 \text{ kms}^{-1}$

(8)

- vi) Write one use of dimensional analysis.

vii) What is order of magnitude of 9.1×10^{-31} .

viii) What is number of significant figures in 0.1250.

Section B

(12)

Q3. What are derived quantities?

Name two quantities.

Q4. Write SI unit of

- i) Electric current

ii) Amount of substance

Q5. Write dimensions of

i) velocity gradient.

ii) charge

Q6. A force $\vec{F} = 3\hat{i} + C\hat{j} + 2\hat{k}$ acting on a particle displaces it.

The displacement is given by $\vec{s} = 4\hat{i} + 2\hat{j} + 3\hat{k}$ in its own direction. If the work done is 6J what is the value of C?

Q7. Find a unit vector in the direction of the vector $3\hat{i} + 4\hat{j}$.

Q8. State, Kepler's Law of orbit and Law of areas.

Q9. If a vector $A = 2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to vector $\vec{B} = 4\hat{i} - 4\hat{j} + m\hat{k}$.

Then what is the value of m?

Section C

Attempt the following questions. (Any Six)

(18)

Q10. State Law of parallelogram of vectors and write the formula for magnitude of resultant vector (R).

Q11. Derive an expression for total energy of an orbiting satellite.

Q12. Derive an expression for acceleration due to gravity (g_h) at height h from the surface of the Earth.

Q13. Obtain the expression for time period of a satellite revolving in circular orbit at height 'h' from the surface of the Earth.

Q14. The pressure on a square plate is measured by measuring the force on the plate and the length of sides of the plate. If the maximum error in the measurement of force and length are 4 % and 2% respectively. Calculate percentage error in the measurement of pressure.

Q15. The angular momentum $\vec{L} = \vec{r} \times \vec{p}$ where $\vec{r}$ is a position vector and $\vec{p}$ is linear momentum of a body. If $\vec{r} = 4\hat{i} + 6\hat{j} - 3\hat{k}$ and $\vec{p} = 2\hat{i} + 4\hat{j} - 5\hat{k}$. Find $\vec{L}$.

Q16. Calculate the value of acceleration due to gravity on the surface of Mars. If the radius of Mars is 3.4×10^3 km and its mass is 6.4×10^{23} kg.
(Given : $G = 6.67 \times 10^{-11}$ SI unit)

Section D

Attempt the following questions. (Any One)

(4)

Q17. Write characteristics of Dot product. (Any Four)

Q18. a) Find the angle between the two vectors, $\vec{A} = 3\hat{i} + 4\hat{j} + 5\hat{k}$
and $\vec{B} = 3\hat{i} + 4\hat{j} - 5\hat{k}$

b) Find magnitude of $\vec{V}$ where $\vec{V} = 3\hat{i} + 4\hat{j} + 2\hat{k}$.

