அரசினர் ஆடவர் கலைக்கல்லூரி (தன்னாட்சி), நந்தனம், சென்னை – 35.

CODE: **196201** TIME: 3Hrs

NOVEMBER 2020 MAX. MARKS : 50

PART A *(10 x 2=20)*

*Answer any **TEN** questions*

1. State the Gauss's divergence theorem,
2. State the Green's theorem,
3. What do you mean by diagonalisation of a matrix?
4. State Cayley-Hamilton's theorem.
5. If A_{ij} is an anti-symmetric tensor of second order and u^i is a tensor of rank one, then show that $A_{ij}\, u^i\, u^j = 0$.
6. Define invariant tensor.
7. State Cauchy's integral theorem.
8. Differentiate between the analytic and singular point of a function.
9. What is meant by a cyclic group?
10. Define subgroup. Give an example.
11. Write down the Levi-Civita symbol.
12. Define rank of a matrix.

PART B *(2 x5=10)*

*Answer any **TWO** questions*

13. Explain the concept of divergence and curl.
14. (i) If A is a real skew-symmetric matrix and $A^2+I=0$, then show that A is orthogonal. (ii) If H is a Hermitian matrix, what kind of matrix is e^{iH}?
15. Define and explain the addition and subtraction of tensors with example.
16. Find the residues of $\frac{ze^{iz}}{z^4+a^4}$ at its poles.
17. Give the necessary condition for f(z) to be analytic and deduce the Cauchy Riemann equation.
18. Give the properties of matrices in brief.
19. Discuss in brief on character tables and its construction.
20. Evaluate $\int \frac{e^z\, dz}{z(z-1)^2}$, where c is the circle |z|=2.

PART C *(2x10=20)*

*Answer any **TWO** questions*

21. Obtain the orthonormal set of vectors from the given set of vectors using Gram – Schmidt's orthogonalisation process $\overline{u_1}$ = (1,1,1) , $\overline{u_2}$= (1,0,1) , $\overline{u_3}$= (0,0,1).
22. (a) Diagonalise the following matrices: (i) $\begin{bmatrix} 4/3 & \sqrt{2}/3 \\ \sqrt{2}/3 & 5/3 \end{bmatrix}$, (ii) $\begin{bmatrix} cos\theta & -sin\theta & 0 \\ sin\theta & cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

    (b) Show that in Cartesian coordinate system the contravariant and covariant components of a vector are identical.

P.T.O

23. (i) Write note on contravariant and covariant tensor.

(ii) If A^{μ} and B_{v} are the components of a contravariant and covariant tensors of rank one show that

$C_{v}^{\mu} = A^{\mu} B_{v}$ are the components of a mixed tensors of rank two.

24. (a) State and prove the Cauchy residue theorem,

b) Find poles and residues at the poles for the following functions (i) $\frac{z}{\cos z}$, (ii) $\frac{z+1}{z^2+2z}$

25. (a) Show that any tensor of rank can be expressed as sum of symmetric and anti-symmetric tensor both of rank 2.

(b) Construct the character table for C_{3V} point group.
