[Total No. of Questions - 9] [Total No. of Printed Pages - 3]
(2123)

1354

B. Tech 3rd Semester Examination

Advanced Mathematics and Computer Programming (O.S.)

AS-3004

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt all questions. Select one question from each section. Section E is compulsory.

SECTION - A

1. (a) Show that every tensor can be expressed as the sum of two tensors, symmetric and skew-symmetric, in a pair of covariant or contravariant indices.

   (b) Let A^{pq}_{rst} be a tensor: choose p = t and q = s and show that A^{pq}_{rqp} is also a tensor. What is its rank? **(10+10=20)**

2. (a) A covariant tensor has components xy, $2y-z^2$, xz in rectangular co-ordinates. Find its covariant components in spherical co-ordinates.

   (b) (i) Prove that δ^{ik} is a symmetric contravariant tensor of rank 2.

   (ii) Prove that $\frac{\partial x^s}{\partial x^{-1}} = \frac{\partial x^{-t}}{\partial x^r} = \delta^s_r$. **(10+10=20)**

SECTION - B

3. (a) Define strain tensor and show that it is a tensor of order 2.

   (b) (i) Define Inertia tensor and give its applications to kinetic energy.

   (ii) Use tensor's to show that $\nabla.(\nabla \times A^r) = 0$ **(10+10)**

4. (a) Determine the metric tensor and conjugate metric tensor in spherical coordinates.

   (b) (i) State generalized Hooke's law and prove that the elasticity tensor C_{ijkl} involved in the law is a fourth order tensor.

   (ii) Define stress tensor and show that stress tensor can be expressed in quadratic form. **(10+10)**

SECTION - C

5. (a) Differentiate between the method overloading and operator overloading. Also tell how it is useful in programming?

   (b) Explain with suitable examples, the advantages of using object oriented programming over procedure oriented programming language. **(10+10)**

6. (a) Explain operator overloading in C++ with examples.

   (b) Discuss in detail the multiple and multilevel inheritance. **(10+10)**

SECTION - D

7. (a) What is object oriented programming? Explain classes and objects with example.

   (b) Write a program in C++ to compute the roots of quadratic equation $ax^2+bx+c=0$. **(10+10)**

8. (a) Differentiate between constructor and destructor.

   (b) Explain friend function and inline function with examples. **(10+10)**

SECTION - E

9. (a) Distinguish between C and C++.

   (b) List out any four containers supported by Standard Template Library.

   (c) What is Kronecker's delta? Prove that δ_i^j is a mixed tensor of rank two.

   (d) If the components of two tensors are equal in one coordinate system, show that they are equal in all the coordinates.

   (e) What are metric tensor and conjugate tensors? Evaluate $\delta_q^p \ \delta_r^q \ \delta_p^r$.

   (f) Write the prototype for a typical pure virtual function.

   (g) Explain Polymorphism with examples.

   (h) What are the visibility modes in inheritance?

   (i) Explain mixed tensors.

   (j) What are anisotropic and isotopic materials? Explain. **(10×2=20)**