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Paper Code : GTE-104B

FINITE ELEMENT METHODS IN GEOTECHNICAL ENGINEERING

Time Allotted: 3 Hours | *Full Marks*: 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group – A

(Multiple Choice Type Questions)

1. Choose the correct alternative for *any ten* of the following: 1×10=10

(i) LLIB indicates

(a) two dimensional array (b) three dimensional array

(c) LNC array (d) None of these

(ii) Dummy index is a

(a) repeated index (b) non-repeated index

(c) Both (a) and (b) (d) None of these

(iii) Mathematical models of a process are developed using the following assumption(s):

(a) working process (b) appropriate axioms

(c) governing law of the process (d) All of these

(iv) Approximate solution of structural problems implies

(a) Functional approximation (b) Finite difference method

(c) Finite Element method (d) All of these

(v) Semi discrete Finite Element Models involve

(a) approximation of spatial variation of the dependent variable.

(b) construction of the weak form of the equation over a typical element.

(c) development of finite element model by seeking approximation.

(d) All of these

(vi) The well-known functional approximation methods are

(a) Galerkin

(b) Rayleigh-Ritz

(c) Collocation

(d) All of these

(vii) Surface force

(a) acts on the boundary surface.

(b) expressed as force per unit area.

(c) express as force per unit volume.

(d) Both (a) and (b)

(viii) FEM1D is useful for finite element program associated with

(a) heat transfer

(b) solid mechanics

(c) Both (a) and (b)

(d) None of these

(ix) "In this interpolation function slope of the function takes the similar value of given function." Then the function is

(a) Hermitian type of function

(b) Lagrange interpolation function

(c) Both (a) and (b)

(d) None of these

(x) Basic approach to substructure technique corresponding to internal and boundary degrees of freedom depends on

(a) stiffness matrix

(b) displacement vector

(c) load vector

(d) All of these

(xi) In super element approach each substructure is treated as

(a) complex element

(b) single element

(c) Both (a) and (b)

(d) None of these

Group – B

(Short Answer Type Questions)

Answer *any three* of the following. 5×3=15

2. Correlate finite element method and geotechnical engineering.
3. What is Shape Function?
4. Depicts on plane stress, plain strain and principal of virtual work. 1+1+3=5
5. Discuss on the basic steps involved in the Finite Element Method of analysis.
6. What is potential energy of a system?

Group – C

(Long Answer Type Questions)

Answer *any three* of the following. 15×3=45

7. Derive the shape function for the first order rectangular element as shown in Figure 1.

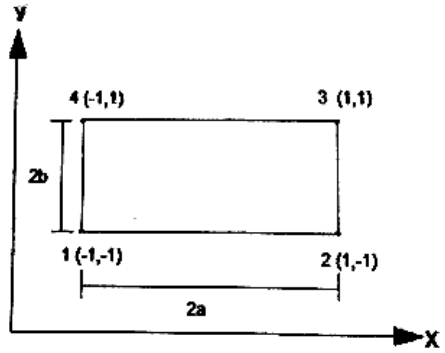

Figure - 1

8. (a) Discuss about isoparametric formulation.

   (b) Evaluate the Jacobian Matrix for four noded two-dimentional element. 5+10=15

9. (a) Prove that the total potential energy is the summation of external potential energy and strain energy.

   (b) Also define the minimization concept of total potential energy in connection with this. 10+5=15

10. Briefly classify and elaborate the static boundary condition for a deformable body under equilibrium.
