Open Book, Open Notes, Open Web, Time Limited Test3 for Mech417/517

JEA09417

Available beginning April 16, 2009 with hardcopy due 5pm April 29, 2009 at the ME “In-Box”.

Cover Page

Instructions

You must work alone on this test. If you are not familiar with the Rice Honor system then review it before proceeding. Once you go beyond this cover page you have a maximum of two hours to work on this test, excluding an optional 30 minute break that prohibits consulting reference materials. No ‘number crunching’ problems are included.

Selection List of Possible Answers

Answer the questions on the following page by selecting a number from this list. If the desired answer is not seen here, then given a specific answer or equation. Some questions have two selections. Here, ⊡ denotes any parametric space, or parametric coordinates**,** $\boldsymbol{x}$ are physical coordinates, $\boldsymbol{N^e}$ are solution interpolations, $\boldsymbol{u}$ is the primary unknown at the element or system level.

1. 1 2. 2 3. 3 4. 4 5. 5 6. 6 7. 7 8. 8 9. 9

10. $\int_\Omega \boldsymbol{B^{eT}}\,\boldsymbol{E^e}\boldsymbol{B^e}d\Omega$ 11. $\int_\Gamma \boldsymbol{B^{bT}}\,\boldsymbol{E^b}\boldsymbol{B^b}d\Gamma$ 12. $\int_\Omega \boldsymbol{N^{eT}}\,\rho\,\boldsymbol{N^e}d\Omega$ 13. $\int_\Gamma \boldsymbol{N^{bT}}\,\varrho^b\boldsymbol{N^b}d\Gamma$

14. $\int_\Gamma \boldsymbol{N^{bT}}\,h^b\boldsymbol{N^b}d\Gamma$ 15. $\int_\Omega \boldsymbol{N^{eT}}\,h^e\boldsymbol{N^e}d\Omega$ 16. $\int_\Omega \boldsymbol{B^{eT}}\,\boldsymbol{E^e}\boldsymbol{\varepsilon_0}\,d\Omega$ 17. $\int_\Omega \boldsymbol{N^{eT}}\,\rho c_p\,\boldsymbol{N^e}d\Omega$

18. $\int_\Gamma \boldsymbol{N^{bT}}\,\varrho^b c_p\boldsymbol{N^b}d\Gamma$ 19. $\int_\Omega \boldsymbol{N^{eT}}\,\boldsymbol{f^e}d\Omega$ 20. $\int_\Gamma \boldsymbol{N^{bT}}\,\boldsymbol{f^b}d\Gamma$ 21. $\int_\Omega \boldsymbol{N^{eT}}\,\boldsymbol{t^e}d\Omega$

22. $\int_\Gamma \boldsymbol{N^{bT}}\,\boldsymbol{t^b}d\Gamma$ 23. $\int_\Gamma \boldsymbol{N^{bT}}\,h^bT^bd\Gamma$ 24. $\int_\Omega \boldsymbol{N^{eT}}\,h^eT^ed\Omega$ 25. $\int_\Gamma \boldsymbol{B^{bT}}\,\boldsymbol{E^b}\boldsymbol{\varepsilon_0}d\Gamma$

26. $2n_q$- 1 27. $n_q - 2$ 28. $\boldsymbol{u_k}\boldsymbol{P_k}$ 29. $\boldsymbol{P_k}\boldsymbol{\theta_k}$

30. $\boldsymbol{u_k}\boldsymbol{M_k}$ 31. $\boldsymbol{\theta_k}\boldsymbol{M_k}$ 32. $\boldsymbol{\sigma^T\varepsilon}/2$ 33. $\boldsymbol{u^T K\,u}/2$

34. $\dot{\boldsymbol{u}}^{\boldsymbol{T}}\boldsymbol{M}\dot{\boldsymbol{u}}/2$ 35. $\boldsymbol{\beta^e u}$ 36. $\boldsymbol{\beta^{eT}f^e}$ 37. $n_g(I-1)+J$

38. $n_g(I-1)+n_q$ 39. $\int_\Gamma \boldsymbol{N^{bT}}\,k^b\boldsymbol{N^b}d\Gamma$ 40. $\int_\Gamma \boldsymbol{N^{bT}}\,q^bd\Gamma$ 41. $\int_\Omega \boldsymbol{N^{eT}}\,Q^ed\Omega$

42. $\boldsymbol{N^e}(x,y)\dot{\boldsymbol{u}}^{\boldsymbol{e}}$ 43. $|\boldsymbol{J}|d\,\boxdot$ 44. $\boldsymbol{J^{-1}}\frac{\boldsymbol{\partial}}{\boldsymbol{\partial}\boxdot}$ 45. $\boldsymbol{J}\,\frac{\boldsymbol{\partial}}{\boldsymbol{\partial}\boxdot}$

46. $|\boldsymbol{J}|\,\frac{\boldsymbol{\partial}}{\boldsymbol{\partial}\boxdot}$ 47. $\frac{\boldsymbol{\partial N}}{\boldsymbol{\partial}\boxdot}$ 48. $\frac{\boldsymbol{\partial x}}{\boldsymbol{\partial}\boxdot}$ 49. $AE\boldsymbol{u}_{,xx}+\ q=0$

50. $EI\boldsymbol{u}_{,xxxx}-\ q=0$ 51. $\boldsymbol{B^eu^e}$ 52. $\boldsymbol{E^eB^eu^e}$ 53. $k\nabla^2T+Q=\varrho c_p\dot{T}$

54. $\begin{bmatrix}\boldsymbol{K}_{uu} & \boldsymbol{K}_{ug}\\ \boldsymbol{K}_{gu} & \boldsymbol{K}_{gg}\end{bmatrix}\begin{Bmatrix}\boldsymbol{u}_u\\ \boldsymbol{u}_g\end{Bmatrix}=\begin{Bmatrix}\boldsymbol{F}_u\\ \boldsymbol{F}_g\end{Bmatrix}$

55. $[\boldsymbol{K}_{uu}]\{\boldsymbol{u}_u\}=\{\boldsymbol{F}_u\}-\left[\boldsymbol{K}_{ug}\right]\{\boldsymbol{u}_g\}$

56. $\left[\boldsymbol{K}_{gu}\right]\{\boldsymbol{u}_u\}+\left[\boldsymbol{K}_{gg}\right]\{\boldsymbol{u}_g\}=\{\boldsymbol{F}_g\}$

57. $\left[\boldsymbol{K}_{uu}+\boldsymbol{K}_{ug}\right]\{\boldsymbol{u}_u\}=\{\boldsymbol{F}_u\}$

Name _____ **Begin Time** _____ **End Time** _____

1. The degree of a 1-D polynomial integrated by a number of Gaussian quadrature points ____
2. The equation for degree of freedom numbers _____
3. The element stiffness matrix _____
4. The element classic mass matrix _____
5. The elastic foundation stiffness matrix _____
6. The normal heat flux vector _____
7. The element heat capacity matrix _____
8. The element internal heat source vector _____
9. The mechanical work of a body force vector _____
10. The work from a surface traction vector _____
11. The heat convection square matrix _____
12. The heat convection source vector _____
13. The work of a set of point forces _____
14. The work of a set of point couples _____
15. The strain energy density _____
16. The thermal strain load vector _____
17. The system reaction recovery _____
18. The strain energy_____
19. The element velocity _____
20. The kinetic energy _____
21. The degree of polynomial exactly integrated by three 1-D Gauss points _____
22. The number of nodes on a 2-D complete quadratic polynomial triangle _____
23. The number of element degrees of freedom on a 1D two node C^1 element _____
24. The number of element degrees of freedom on a 1D two node C^2 element _____
25. The physical differential measure (volume) _____
26. System equations before applying the EBC _____
27. The 2D geometric Jacobian _____
28. The parametric interpolation gradient _____
29. Number of unit triangle quadrature points needed for a fourth-degree polynomial ____
30. Sum of the row entries in a C^0 stiffness matrix (before EBC) ____
31. Sum of the entries in a C^0 mass matrix (before EBC) ____
32. Sum of the column entries in a C^0 heat source vector (before EBC) ____
33. The physical gradient _____
34. Equilibrium equation of an elastic beam _____
35. Equilibrium equation of a heat conduction problem _____
36. The element strains at a point _____
37. The element stresses at a point _____
38. An element gather _____
39. An element scatter _____
40. The system after applying essential boundary conditions _____