

Question 12

The set of equations

$$0.5000x + 0.3333y + 0.2500z = 1.000,$$

$$0.3333x + 0.2500y + 0.2000z = 1.000,$$

$$0.2500x + 0.2000y + 0.1667z = 1.000$$

is solved by using the Gaussian elimination method with only essential row interchanges and four significant figure arithmetic. The solution is

$$x = 10.60, y = -54.60, z = 55.58.$$

Using Gaussian elimination method with partial pivoting the solution is

$$x = 10.60, y = -54.65, z = 55.63.$$

The numbers on the right-hand sides of the three equations are changed to 1.001, 0.999 and 1.001 respectively and the equations are re-solved. Using Gaussian elimination with only essential row interchanges the solution is

$$x = 11.04, y = -56.29, z = 56.96,$$

whereas using Gaussian elimination with partial pivoting the solution is

$$x = 11.08, y = -56.40, z = 57.02.$$

Choose the option which best describes the problem.

Options

- A The problem is ill-conditioned.
- ☒ B The problem is well-conditioned but the method of Gaussian elimination with essential row interchanges results in induced instability for this problem.
- ☐ C The problem is well-conditioned and the method of Gaussian elimination with essential row interchanges is stable for this problem.

Unit 12

Question 13

The water in an insulated hot-water tank of capacity 50 litres is heated by a 3kW electric immersion heater. The water in the tank is initially at a temperature of 10 °C. Choose the option which is nearest to the temperature of the water in the tank 1 hour after the heater has been switched on. (You should assume that all the electrical energy supplied goes to heating the water. The density of water is 1 kg litre⁻¹, and the specific heat of water is 4200 J kg⁻¹ °C⁻¹.)

$$3000 \times 3600 = 50 \times 4200$$

Options

- | | | | |
|---------|---------|--|---------|
| A 22 °C | B 29 °C | <input checked="" type="radio"/> C 32 °C | D 39 °C |
| E 41 °C | F 51 °C | <input type="radio"/> G 61 °C | H 71 °C |