X

Unit 5 - Week 4

Week 4 Assignment

The due date for submitting this assignment has passed. Due on 2018-09-05, 23:59 IST.
As per our records you have not submitted this assignment.

1) Consider the following steps: ***0 points***

(i) Division of the domain into a number of sub-domain. Each sub-domain is represented by a finite number of grid points.
(ii) Integration of the governing differential equation over such sub-domain
(iii) Conversion of the governing differential equation into algebraic quantities using Taylor's series of expansion
(iv) Profile assumption for the dependent variable for evaluating the integral in order to express the results in terms of algebraic quantities at the grid points.

Finite volume method involves

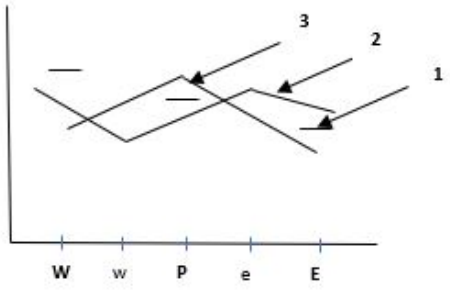
- (a) Step (i) only
- (b) Steps (i) and (iii) only
- (c) Steps (i) and (ii) only
- (d) Steps (i), (ii) and (iii)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(d) Steps (i), (ii) and (iii)

2) ***1 point***

Three different profile for a transport variable is shown in the figure. Which of the following is a valid profile assumption in case of finite volume method?



- (a) 1 (piecewise constant)
- (b) 2 (piecewise linear between the control volume faces)
- (c) 3(piecewise linear between the grid points)
- (d) Profile assumption is not required in case of finite volume method

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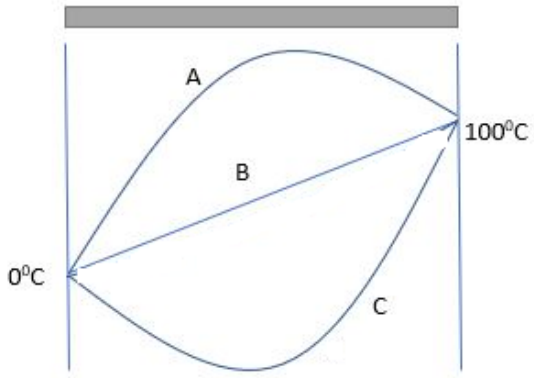
No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) 3(piecewise linear between the grid points)

3) ***1 point***

Which of the following temperature distribution profiles represents a physically consistent solution in case of conducting rod without any heat generation with $0°C$ at one end and $100°C$ at the other end?



- (a) A and B
- (b) B only
- (c) C only
- (d) B and C

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b) B only

4) Which of the following is not correct in case of finite volume method discretization? ***0 points***

- (a) If the source term is linearized as S=Sc+SpTp then Sp may be of any sign.
- (b)If the source term is linearized as S=Sc+SpTp then Sp should be negative.
- (c)If the source term is linearized as S=Sc+SpTp then Sc should be negative.
- (d)If the source term is linearized as S=Sc+SpTp then Sc should be positive.

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b)If the source term is linearized as S=Sc+SpTp then Sp should be negative.

5) Consider the following statements regarding the finite volume method discretization. ***1 point***

(i) All co-efficient of the discretized equation should be of same sign
(ii) The co-efficient of the discretized equation can be of any sign depending on the problem statement
(iii) Profile should satisfy continuity of fluxes at the control volume faces
(iv) When a linear governing differential equation is discretized, its discretized version should satisfy the following requirement: If T is a solution, then T+c is also a solution,
where c is a constant.

Which of the above statements are correct?

- (a) (i), (ii), (iii), (iv)
- (b) (i), (ii), (iii) only
- (c) (i), (ii), (iv) only
- (d) (i), (iii), (iv) only

No, the answer is incorrect.
Score: 0

Accepted Answers:

(d) (i), (iii), (iv) only

6) **1 point**

Consider the following finite volume based discretized equation.

(a) $-5\phi_P = -3\phi_E - 2\phi_W + 5$

(b) $-5\phi_P = -3\phi_E - 2\phi_W - 5$

(c) $-5\phi_P = 3\phi_E + 2\phi_W + 5$

(d) $-5\phi_P = 3\phi_E - 2\phi_W + 5$

Which of the following is a correct form of finite volume based discretized equation?

- (a) (i) only
- (b) both (i) and (ii)
- (c) (iii) only
- (d) both (iii) and (iv)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b) both (i) and (ii)

7) **1 point**

Consider the source term in the form $S = 3 + 4T$. The source term can be linearized in the form $S = S_c + S_p T_p$ as given below:

(i) $S_c = 3$ and $S_p = 4$

(ii) $S_c = 3 + 4T_p^*$ and $S_p = 0$

(iii) $S_c = 3 + 8T_p^*$ and $S_p = -4$

Which of the following source term linearization is/are correct?

- (a) (i) only
- (b) (ii) only
- (c) (ii) and (iii)
- (d) (i), (ii) and (iii)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) (ii) and (iii)

8) **1 point**

For flow through a porous medium, the distributed resistance to flow is expressed by the source term $S = -C|u|u$, for the x – direction momentum equation. Here 'C' is a positive constant and 'u' is the velocity component in the x- direction. The source term can be linearized as

(i) $S = Cu^{*2} - 2Cu^*u$ for $u > 0$

(ii) $S = -Cu^{*2} + 2Cu^*u$ for $u < 0$

(iii) $S = Cu^{*2} - 2Cu^*u$ for $u < 0$

(iv) $S = -Cu^{*2} + 2Cu^*u$ for $u > 0$

Which of the following statements is/are correct?

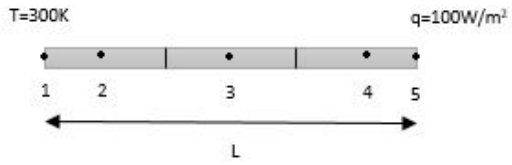
- (a) (i) only
- (b) (ii) only
- (c) (i) and (ii)
- (d) (iii) and (iv)

No, the answer is incorrect.
Score: 0

Accepted Answers:
(c) (i) and (ii)

9) ***0 points***

Consider a 1-dimensional slab of length 3 cm and thermal conductivity 10 W/mK with uniform heat generation of 1000W/m^3. The boundary conditions are: at x=0,T=300K, at x=L, q=100W/m^2. If the domain is discretized into 3 equal control volumes with 5 points as shown in the figure, then the percentage difference in the value of temperature at node 5 when the boundary condition at node 5 is implemented using finite volume formulation and finite difference formulation is



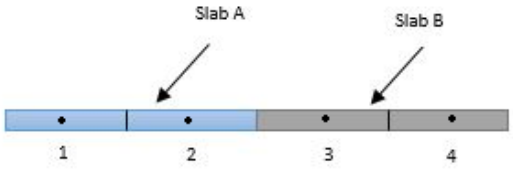
- (a) 0%
- (b) 0.25%
- (c) 0.50%
- (d) 0.75%

No, the answer is incorrect.
Score: 0

Accepted Answers:
(b) 0.25%

10) ***1 point***

Consider a composite slab made of two different materials with thermal conductivity k_A = 10W/mK and k_B=20 W/mK for the material A and B respectively. Let the length of each slab be 1 cm and the entire slab is discretized into four equal control volumes as shown in the figure. If the resulting finite volume disretized equation is of the form $A_P T_P = A_W T_W + A_E T_E$, then the equation for the temperature at grid point 2 will be



- $a) T_2 = 0.2857T_3 + 0.2143T_1$
- $(b) T_2 = 0.5714T_3 + 0.2143T_1$
- $(c) T_2 = 0.5714T_3 + 0.4286T_1$
- $(d) T_2 = 0.2857T_3 + 0.4286T_1$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$(c) T_2 = 0.5714T_3 + 0.4286T_1$

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