

Ch761 Chemical Engineering Maths.

Total marks. $50+20+30=100$ Nov 22, 2008.

① consider the equation $\epsilon \frac{d^2 y}{dx^2} + \nu \frac{dy}{dx} = \exp(x)$

where $x \in (0,1)$.

the boundary conditions are $y = \alpha$ at $x=0$

where ① $\epsilon \ll 1$

② α is a known constant $y = 1$ at $x=1$.

③ ν is $+1$ in one case and -1 in the other.

the analytical solⁿ is given by.

$$y = C_1 + C_2 \exp(-\nu x/\epsilon) + \frac{\exp(x)}{\nu + \epsilon}.$$

For $\nu = +1$

(a) location of boundary layer

(b) inner and outer solutions] approximations only.

(c) composite solution.

Repeat (a), (b) and (c) for $\nu = -1$.

Marks: $2 \times [10 + (5+5) + 5] = 50$

② Solve $x \frac{dy}{dx} - y = x^2 \exp(x)$ by

Frobenius method, Use $x(y=0) = \alpha$
where α : known constant.

Marks: 20

③ consider $Lu = f(x)$ in $a < x < b$.

with BC^s. $u(a) = h$ and $u(b) = k$.

write the equation and BC^s for.

(a) Causal Green's function

(b) its adjoint

explaining each term.
→ Derive an expression for $u(x)$

(c) in terms of adjoint of Green's function

(d) in terms of Green's function

showing intermediate steps, deriving any extra relations and stating all approximations.

Marks. $5+5+10+10 = 30$

Best of Luck [Don't give up, We will