Prof. N. Haidar — FACULTY OF ARTS & SCIENCES , A. U. B.

Sec. 1 & 2 — Math 202 — Feb.1,1997

(1-st Semester , 1996-1997)

Time : 2 hours — FINAL EXAM — (closed book)

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(5) I. Solve the DE

$(x + \sin x + \sin y)\,dx + \cos y\,dy = 0$.

(ω) II. Solve the IVP

$y' - 2y e^x = 2(y e^x)^{1/2}$; $y(-\infty) = 0$.

(6) III. Determine the values of λ for which the BVP

$y'' + \lambda y = 0$; $y(0) = 0$, $y'(\pi) = 0$,

has nontrivial solutions .

(6) IV. Determine the maximal domain of uniqueness for the solution to the IVP

$y''' + \ln x\, y'' - (x-1)^{-3} y = \tan x$; $y''(2) = y'(2) = y(2) = 0$.

(5) V. Solve the DE

$(x-3)^2 y'' - 3(x-3) y' + 4y = x$.

(7) VI. Apply the method of Frobenius to find the general solution to the DE

$(1+x)\,x^2 y'' - (1+2x)\,x y' + (1+2x) y = 0$,

in the neighborhood of its $x = -1$ singularity .

(10) VII. Solve the nonhomogeneous Bessel's DE

$x^2 y'' + x y' + (x^2 - \tfrac{1}{4}) y = x^{7/2}$, $x > 0$.

(10) IIX. Solve the IVP

$$y'' + y = f(t) \quad ; \quad y(0) = 1,\ y'(0) = 0,\ f(t) = \begin{cases} b\ , 0 \le t < a \\ \\ 2b\ , a \le t \end{cases} \quad ; \ a > b > 0 .$$

(10) IX. Solve the system of integral equations

$$\begin{cases} y = 2t - \int_0^t (t-u)\, y(u)\, du + \int_0^t z(v)\, dv \\ \\ z = -2 - 4\int_0^t y(v)\, dv + 3\int_0^t (t-\tau)\, z(\tau)\, d\tau \end{cases}$$

for $y(t)$ only .
