COEP Technological University

A Unitary Public University of Government of Maharashtra

(MA-20001) Ordinary Differential Equations and Multivariate Calculus

Program : S.Y.B.Tech. Sem. I | Academic Year : 2023-24

Examination : Re-Test 2 | Maximum Marks : 20

Date : 4/11/2023 | Time : 8 am - 9 am

Branch: | **Student MIS Number :**

Name and Signature of the Invigilator:

Q.1	Q.2	Q.3	Total	Signature

Attempt All the Questions.

Question [I](10 marks)

(1) If the auxilary equation of $(x^3D^3 + 4x^2D^2)y = 0$ is $m^3 + m^2 - 2m = 0$ then:

   (a) It's three linearly independent solutions are ...

   (b) General solution is ... [CO2][**1.5**]

(2) For the differential equation $x^2y'' - xy' + y = x \ln x, \quad x > 0$, find $y_p(x)$ using the method of variation of parameters. Given that the linearly independent solutions of corresponding homogeneous equation are $y_1(x) = x$ and $y_2(x) = x \ln x$. [CO3][3]

Detailed Answer:

(3) In an RLC circuit, the charge Q on the plate is given by $L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{Q}{C} = E \sin pt$. The circuit is tuned to resonance so that $p^2 = \frac{1}{LC}$. If initially the current $I(t)$ and the charge $Q(t)$ be zero, then show that, for small values of $\frac{R}{L}$, the current in time t is given by $\frac{Et}{2L} \sin pt$. [CO5][3.5]

Detailed Answer:

(4) Solve $y'' - 3y' + 2y = 4x^2$ by the method of undetermined coefficients. [CO3][2]

Detailed Answer:

Question [II](5 marks)

(1) Using appropriate theorems/properties, find the Laplace transform of $\int_0^t \frac{1-e^{-u}}{u}\, du$. [CO3][3]

Detailed Answer:

(2) Fill in the blanks : If $\mathcal{L}\{f(t)\} = F(s)$ then

(a) $\mathcal{L}\{t\ f(t)\} = \ldots$ (b) $\mathcal{L}\{\sin(3t)\ U(t-\pi)\ \} = \ldots$ [CO1, CO2][2]

Question [III](5 marks)

(1) If $\mathcal{L}\{f(t)\} = F(s)$ (where $s > k$ for some k), then prove that $\mathcal{L}\{e^{at} f(t)\} = F(s-a)$ (where $s - a > k$). [CO4][2]

Detailed Answer:

[CO3][3]

(2) Find $\mathcal{L}^{-1}\left\{\dfrac{s^2+3}{s(s^2+9)}\right\}$.

Detailed Answer:

ROUGH WORK (Will Not Be Assessed)