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Roll No .....

MEEM-101

M.E./M.Tech., I Semester

Examination, December 2020

Applied Mathematics

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Find the Laplace transform of

i) $e^{-3t}\sin^2 t$

ii) $t^2\cos 2t$

b) Find the inverse Laplace transform of

i) $\dfrac{1}{s(s+1)}$

ii) $\dfrac{s}{(s^2+1)(s^2+2)}$

2. a) Solve the following differential equation using Laplace transform :

$$\frac{d^2y}{dt^2}+4\frac{dy}{dt}+3y=e^{-t},\ y(0)=y'(0)=1$$

b) Find Fourier transform of

$$f(t)=\begin{cases}1-t^2, & -1<t<1\\ 0, & \text{otherwise}\end{cases}$$

3. a) Find the Z transform of

   i) $\frac{(n+1)(n+2)}{2}$

   ii) $n(n-1)$

   b) Find the Z transform of $f * g$, where $f(n) = u(n)$, $g(n) = 2^n u(n)$ using Convolution theorem.

4. a) Use Picard's method, obtain a solution upto third approximation of Differential equation

   $\frac{dy}{dx} = x + y^2$ where $y(0) = 0$

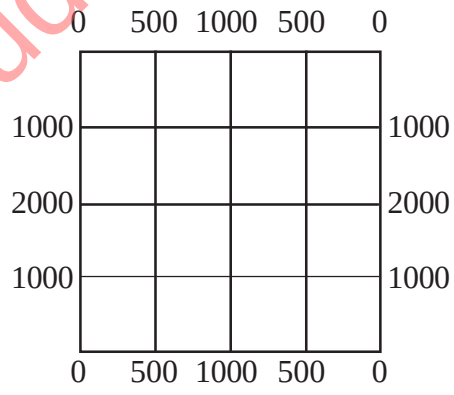
   b) Using Euler's method, solve for y at $x = 0.5$ from

   $\frac{dy}{dx} = x + y + xy,\ y(0) = 1$ taking $h = 0.1$.

5. a) Solve the Elliptic equations

   $u_{xx} + u_{yy} = 0$

   for the following squares mesh with boundary values as shown :



b) Using Simpson's rule, evaluate $\int_0^1 \frac{dx}{1+x^2}$, taking $h = 0.1$.

6. a) In a class of 10 students , 4 are boys and the rest are girls. Find the probability that a student selected will be a girl.

b) Fit a Poisson distribution to the following :

x :	0	1	2	3	4
y :	192	100	24	3	1

7. a) In a lot of 500 solenoids 25 are defective, find the probability of 0, 1, 2, 3 defective solenoids in a random sample of 20 solenoids.

b) Two independent samples of sizes 7 and 9 have the following values :

Sample A :	10	12	10	13	14	11	10	-	-
Sample B :	10	13	15	12	10	14	11	12	11

Test whether the difference between the mean is significant.

8. Consider the following system of differential equations representing a prey and predator population model :

$$\frac{dx}{dt} = x^2 - y \ , \ \frac{dy}{dt} = x + y$$

i) Identify all the critical points of the system of equations given above.

ii) Obtain the type and stability of these critical points.

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