Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (MECH/AUTO/AERO/MT/IP)

END SEMESTER MAKEUP EXAMINATIONS, DEC 2019

SUBJECT: ENGINEERING MATHEMATICS III - MAT 2151

REVISED CREDIT SYSTEM

Time: 3 Hours | MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A. Solve $(x^3+1)y''+x^2y'-4xy-2=0,\ y(0)=0,\ y(2)=4$ with $h=0.5$.

1B. Solve $u_{xx}+u_{yy}=-81x^2y^2$ with $u(0,y)=u(x,0)=0$ and

$u(1,y)=u(x,1)=\ 100$ with $h=\frac{1}{3}$

1C. Solve $\frac{\partial u}{\partial t}=\frac{1}{16}\frac{\partial^2 u}{\partial x^2}, 0<x<1,\ t>0, u(x,0)=0, u(0,t)=0, u(1,t)=100t$

Compute u for one time step using Crank-Nicolson method with $h=0.25$

(3+3+4)

2A. For the differential equation $\frac{\partial^2 u}{\partial t^2}=\frac{\partial^2 u}{\partial x^2}, 0<x<1, u(x,0)=1-x^3, u(1,t)=0\,, u(0,t)=1-t^3,\ \frac{\partial u}{\partial t}(x,0)=0$ h=0.25. Calculate the solution for 4 time levels.

2B. Find the Fourier series expansion of $f(x)=2x-x^2, 0<x<3,$ where $f(x+3)=f(x)$

2C. Compute up to second harmonics of the Fourier series of $f(x)$ given in the following table where $f(x+2\pi)=f(x)$.

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$
$f(x)$	1.5	1.8	2.1	1.7	1.3	1.1

Reg. No.										

(3+3+4)

3A. Find the Fourier transform of $f(x) = e^{-a^2x^2}, a > 0$

3B. Find the Fourier cosine transform of $x^{a-1},\ a > 0$

3C. Find the constants k and l so that the surface $kx^2 - lyz = (k+2)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at the point (1, -1, 2).

(3+3+4)

4A. Check whether $\vec{F}$ is conservative? If so find its scalar potential

$$\vec{F} = 2xy^3z^4i + 3x^2y^2z^4j + 4x^2y^3z^3k$$

4B. Verify Green's theorem for $\oint_C (x^2 - 2xy)dx + (x^2y + 3)dy$ where C is the boundary of the region defined by $y^2 = 8x$ and the line $x = 2$.

4C. Verify Stoke's theorem for the vector field $\vec{A} = (2x - y)i - yz^2\,j - y^2zk$, where S is the surface of the cube bounded by $x = 0, y = 0, z = 0, x = 2, y = 2, z = 2$ above XY plane

(3+3+4)

5A. Solve $u_{xx} - 2u_{xy} + u_{yy} = 0$, using the transformation $v = x$ and $z = x + y$.

5B. Solve $x^2u_x + y^2u_y = 0$ by the method of separation of variables.

5C. Derive one dimensional wave equation with suitable assumptions.

(3+3+4)

****