Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IIISEMESTER B.TECH (MECH/AUTO/AERO/IP/MT ENGINEERING)

MAKEUP EXAMINATION

SUBJECT: ENGINEERING MATHEMATICS -III [MAT 2101]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A.	Find half range Fourier cosine series for the given function $f(x)=\begin{cases}\frac{1}{4}-x, 0\le x\le\frac{1}{2}\\ x-\frac{3}{4}, \frac{1}{2}\le x\le 1\end{cases}$	**(4)**
1B.	Solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$, $0<x<1, t>0$, $h=\frac{1}{3}$, $k=\frac{1}{36}$ with the initial condition $u(x,0)=\sin\pi x$ and boundary conditions $u(0,t)=u(1,t)=0$. Compute for 2 time steps.	**(3)**
1C.	Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at the points (2, –1 , 2).	**(3)**
2A.	Find Fourier cosine and sine transform of the function x^{a-1}, a>0 and deduce $\left\{\frac{1}{\sqrt{x}}\right\}$	**(4)**
2B.	Solve $u_{xx}+u_{xy}-2u_{yy}=0$ using the transformation , $v=x+y,\ z=2x-y$.	**(3)**
2C.	Solve $x^2y''+xy'+(x^2-3)y=0$, with the conditions $y(1)=0, y(2)=2$ and $h=0.25$.	**(3)**

Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

3A.	Derive one dimensional heat equation with the physical assumptions made.	**(4)**
3B.	With $h=\frac{1}{3}$, solve $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=-81xy$, $0<x,y<1$ with the boundary conditions $u(0,y)=u(x,0)=0$ and $u(1,y)=u(x,1)=100$	**(3)**
3C.	Find the constants a and b such that $\vec{F}=(axy+z^3)i+(3x^2-z)j+(bxz^2-y)k$ is irrotational and find its scalar potential ϕ.	**(3)**
4A.	Solve $\frac{\partial^2 u}{\partial x^2}=\frac{\partial^2 u}{\partial t^2}$ where $h=0.5,\ 0<x<2,\ t>0$ and the conditions $u(x,0)=0, u_t(x,0)=100(2x-x^2)$ and $u(0,t)=u(2,t)=0$ are by choosing for 4-time steps	**(4)**
4B.	Prove that $\nabla^2 f(r)=f''(r)+\frac{2}{r}f'(r)$	**(3)**
4C.	Solve $x^2u_x+y^2u_y=0$, by the method of separation of variables	**(3)**
5A.	Verify Stokes theorem for the vector field $\vec{A}=(x^2-y^2)i+2xyj$ over a rectangular box bounded by the planes $x=0, x=a, y=0, y=b$ and $z=0, z=c$ with face $z=0$ is removed.	**(4)**
5B.	Show that $\int_0^\infty \frac{\cos(\frac{s\pi}{2})}{1-s^2}\cos sx.ds=\begin{cases}\frac{\pi}{2}\cos x, & \lvert x\rvert<\frac{\pi}{2}\\ 0, & \lvert x\rvert>\frac{\pi}{2}\end{cases}$	**(3)**
5C.	Obtain the constant term and the first 2 harmonics of Fourier series for y using the following table.	**(3)**

x	0	2	4	6	8	10
y	9	18.2	24.4	27.8	27.5	22