Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

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

END SEMESTER MAKEUP EXAMINATIONS, DEC 2015

SUBJECT: ENGG. 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.	Solve $(x^3+1)y'' + x^2y' - 4xy = 2$, $y(0)=0$, $y(2)=4$ with $h = 0.5$.	**04**
1B.	Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, $0<x<1$, $0<y<1$ subjected to the conditions $u(x,1) = u(0,y) = 0$, $u(1,y) = 9(y - y^2)$, $u(x,0) = 9(x - x^2)$ by taking $h = \frac{1}{3}$	**03**
1C.	Show that $\vec{F} = (2xy + z^3)\,\boldsymbol{i} + x^2\,\boldsymbol{j} + 3xz^2\,\boldsymbol{k}$ is conservative. Find the work done in moving an object from (1, −2, 1) to (3, 1, 4) in this field.	**03**
2A.	Solve $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$ $0<x<1$, $t>0$ with $u(x,0) = 0$, $\frac{\partial u}{\partial t}(x,0) = 0$, $u(0,t) = 0, u(1,t) = 100\,sin\pi t$. Compute u for four time steps with h = 0.5.	**04**
2B.	Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -81xy$, $0<x<1$, $0<y<1$, $u(0,y) = 0$, $u(x,0) = 0$, $u(1,y) = u(x,1) = 100$ with $h = \frac{1}{3}$.	**03**
2C.	Obtain the Fourier series for $f(x) = \begin{cases} 1 + \frac{2x}{\pi}; & -\pi \le x \le 0 \\ 1 - \frac{2x}{\pi}; & 0 \le x \le \pi \end{cases}$	**03**
3A.	Verify Green's theorem in the plane for $\oint (xy + y^2)dx + x^2\,dy$, where the closed curve of the region is bounded by $y = x$ and $y = x^2$.	**04**

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3B.	Find a unit normal to the surface $-x^2yz^2 + 2xy^3z = 1$ at the point P(1, 1, 1).	**03**
3C.	Find the half range sine series for f(x) = x in (0 , 2)	**03**
4A.	Find the directional derivative for the scalar function $\emptyset(x,y,z) = x^2yz + 4xz^2$ at $p(1,-2,-1)$ In the direction of $2\boldsymbol{i} - \boldsymbol{j} - 2\boldsymbol{k}$.	**04**
4B.	From the Fourier integral representation show that $\int_0^\infty \frac{s \sin sx}{1+s^2}\, dx = \frac{\pi}{2} e^{-x}\ (x > 0)$	**03**
4C.	Find the Fourier transform of $f(x) = \begin{cases} 1-\lvert x\rvert & \lvert x\rvert < 1 \\ 0 & \lvert x\rvert > 1 \end{cases}$ and hence show that $\int_0^\infty (\frac{sint}{t})^4 dt = \frac{\pi}{3}$.	**03**
5A.	Derive one dimensional heat equation with necessary assumptions.	**04**
5B.	Solve the partial differential equation $U_{xx} - 4U_{xy} + 3U_{yy} = 0$ using the transformation v = x + y, z = 3x + y.	**03**
5C.	Obtain the constant term and the coefficient of the first order sine and cosine term in the Fourier series expansion of	**03**

x (in degree)	0	60	120	180	240	300
y	9	18	24	28	26	20