Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (E&C/EE/ICE/BM ENGINEERING)

END SEMESTER EXAMINATIONS, NOV. 2016

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2102]

REVISED CREDIT SYSTEM
(25/11/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.

1A.	Find the half range Fourier cosine series expansion of $f(x)=1-\frac{x}{l}, 0<x<l.$ Also draw the graph of corresponding periodic extension of f(x).	**3**
1B.	Find the Fourier transform of $f(x)=\begin{cases}1-x^2, & \lvert x\rvert\le 1\\ 0, & \lvert x\rvert>1\end{cases}$ *and hence evaluate* $\int_0^\infty \frac{\sin t - t\cos t}{t^3}\,dt.$	**3**
1C.	Expand f(x) = xsinx , $0 \le x \le 2\pi$, $f(x+2\pi) = f(x)$ as a Fourier series and hence evaluate $\sum_{n=2}^{\infty}\frac{1}{n^2-1}$.	**4**
2A.	Find the Fourier cosine transform of $e^{-ax}, a>0$, and hence find $F_S\left\{\frac{x}{a^2+x^2}\right\}$	**3**
2B.	Find the analytic function f(z) = u+iv for which $u=\frac{\sin 2x}{\cosh 2y+\cos 2x}$	**3**
2C.	(i) Find all possible expansion of $f(z)=\frac{z+4}{(z+3)(z-1)^2}$ about z = -1. (ii) Expand f(z) = sin2x about $z = \pi/4$.	**4**
3A.	If f(z) = u + iv is analytic function of z , show that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)u^p = p(p-1)u^{p-2}\lvert f'(z)\rvert^2$	**3**

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3B.	Evaluate $\oint_C \frac{z^2}{(z+1)^2(z^2+4)}dz \;\; where\ C:\lvert z-2i\rvert = 3.$	**3**
3C.	Verify Green's theorem for $\oint_C \left(3x^2 - 8y^2\right)dx + \left(4y - 6xy\right)dy$ Where C is the boundary of the region defined by x = 0, y = 0 and x + y = 1.	**4**
4A.	Find the constants a and b so that the surface $ax^2 - byz = (a+2)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at the point (1, –1,2).	**3**
4B.	Show that $\vec{F} = \left(y^2 \cos xy + z^3\right)\hat{i} + \left(\sin xy + xy\cos xy - 4z\right)\hat{j} + \left(3xz^2 - 4y\right)\hat{k}$ is conservative , find its scalar potential and work done in moving an object in this field from (0, 1, – 1) to $\left(\frac{\pi}{2}, -1, 2\right)$.	**3**
4C.	If f(r) is a differentiable function of r = $\lvert\vec{r}\rvert$ then show that $f(r)\vec{r}$ is irrotational. Find f(r) so that $f(r)\vec{r}$ is also solenoidal.	**4**
5A.	Evaluate $\iint_S \vec{A}\bullet\hat{n}\,dS$ where $\vec{A} = 2x^2y\hat{i} - y^2\hat{j} + 4xz^2\hat{k}$ and $\hat{n}$, positive unit normal to Surface S of the region in the first octant bounded by $y^2 + z^2 = 9\ and\ x = 2.$	**3**
5B.	Assuming the most general solution, solve the one dimensional heat equation $u_t = c^2u_{xx}$ in a laterally insulated bar of length L whose ends are kept at zero and the initial temperature is $f(x) = \begin{cases} x, & 0 < x < L/2 \\ L-x, & L/2 < x < L \end{cases}$.	**3**
5C.	Solve the partial differential equation $u_{tt} = c^2u_{xx}$ using the transformations v = x + ct , w = x – ct subject to the conditions u(x,0) = f(x) and $u_t(x,0) = g(x)$.	**4**