Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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A Constituent Institution of Manipal University

III SEMESTER B.TECH. (CHEMICAL/BIOTECH)

END SEMESTER EXAMINATIONS, NOV 2017

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2103]

REVISED CREDIT SYSTEM

(21/11/2017)

Time: 3 Hours MAX MARKS: 50

Instructions to Candidates:

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

1A.	Expand $f(x)=2x-x^2$ in (0, 3) as Fourier series. Hence deduce that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\dots\dots\dots\dots=\frac{\pi^2}{12}$.	**4**
1B.	Solve the equation $u_{xy}-u_{yy}=0$ using the transformation $v=x, z=x+y$.	**3**
1C	Find the angle between the surfaces $z=\left(x-\frac{\sqrt{6}}{6}\right)^2+\left(y-\frac{\sqrt{6}}{6}\right)^2$ and $z=x^2+y^2$ at P$\left(\frac{\sqrt{6}}{12},\frac{\sqrt{6}}{12},\frac{1}{12}\right)$.	**3**
2A.	State Gauss divergence theorem. Hence evaluate $\iint_S \boldsymbol{F}.\boldsymbol{n}ds$ where $\boldsymbol{F}=4x\boldsymbol{i}-2y^2\boldsymbol{j}+z^2\boldsymbol{k}$ taken over the region bounded by $x^2+y^2=4$, $z=0\ and\ z=3$.	**4**
2B.	Obtain the half range cosine series of $f(x)=\begin{cases} kx & 0<x<\frac{l}{2} \\ k(l-x) & \frac{l}{2}<x<l \end{cases}$	**3**

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2C.	If u(x,y) and v(x,y) are harmonic functions in a domain D, then prove that $\left(\frac{\partial u}{\partial y}-\frac{\partial v}{\partial x}\right)+i\left(\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}\right)$ is analytic in D.	**3**
3A.	Find the residue of the following functions at their singularities: (i) $\frac{e^z}{(z-1)^3}$ (ii) $\frac{1}{1-\cos z}$	**4**
3B.	Prove the property $F_s\{xf(x)\}=-\frac{d}{ds}F_c(s)$. Also find $F_c\left\{\frac{1}{1+x^2}\right\}$ and use the given property to find $F_s\left\{\frac{x}{1+x^2}\right\}$.	**3**
3C.	Solve by the method of separation of variables $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=2(x+y)u.$	**3**
4A.	Derive the one dimensional wave equation by stating the appropriate physical assumptions.	**4**
4B.	Prove that $\boldsymbol{F} = (y^2\cos x + z^3)\,\boldsymbol{i} + (2y\sin x - 4)\,\boldsymbol{j} + (3xz^2 + 2)\boldsymbol{k}$ is a conservative force field. Find the scalar potential for **F.**	**3**
4C.	Verify Cauchy's theorem for $\int_C Z^3 dz$, where C is the boundary of the triangle with vertices 0, 2 and 2i.	**3**
5A.	Find all possible expansion of the following: (i) $\frac{1}{z^3-z}$ about $z=1$ (ii) $z\sin z$ about $z=\frac{\pi}{2}$	**4**
5B.	Find the Fourier transform of $f(x)=e^{-a^2x^2}, a>0$. Hence prove that $e^{\frac{-x^2}{2}}$ is a self-reciprocal function.	**3**
5C.	Using Green's theorem, evaluate $\int_C[(y-\sin x)dx+\cos x dy]$, where C is the triangle enclosed by the lines $y=0, x=\pi/2, y=\frac{2}{\pi}x.$	**3**