Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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III SEMESTER B.TECH. (CHEMICAL/BIOTECH)

MAKE UP END SEMESTER EXAMINATIONS, DEC 2017

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2103]

REVISED CREDIT SYSTEM

(26/12/2017)

Time: 3 Hours MAX MARKS: 50

Instructions to Candidates:

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

1A.	Find the Fourier series expansion for the given function $f(x) = x \sin x$ in the interval $(0, 2\pi)$.	**4**
1B.	Solve the equation $u_{xx} + 2u_{xy} + u_{yy} = 0$ using the transformation $v = x, z = x - y$.	**3**
1C.	Find $\nabla \emptyset$, if a) $\emptyset = log\lvert\vec{r}\rvert$ and b) $\emptyset = \frac{1}{r}$.	**3**
2A.	Verify Stokes theorem for $\vec{A} = (2x - y)i - yz^2 j - y^2 zk$ where S is upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ and C is the boundary. Let R be the projection of S on xy-plane.	**4**
2B.	Obtain the half range cosine series for the function $f(x) = (x - 1)^2$ in $0<x<1$.	**3**
2C.	Show that $u = r^2 \cos 2\theta - r \sin \theta$ is harmonic. Find its harmonic conjugate and also find the corresponding analytic function.	**3**
3A.	Find the residue of the following functions at their singularities: (i) $\frac{z - sinz}{z^2}$ (ii) $\frac{1}{z - \sin z}$	**4**

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3B.	Find the Fourier transform of $f(x) = \begin{cases} 1\ ;\ \lvert x \rvert < a \\ 0;\ \lvert x \rvert > a \end{cases}$ and show that $\int_0^\infty \frac{\sin t}{t} dt = \frac{\pi}{2}$.	**3**
3C.	Solve by the method of separation of variables, $y^3 \frac{\partial z}{\partial x} + x^2 \frac{\partial z}{\partial y} = 0$	**3**
4A.	Derive the one dimensional heat equation by stating the appropriate physical assumptions.	**4**
4B.	Find the constants 'a' and 'b' such that the surface $ax^2 - byz = (a+2)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at (1,-1, 2).	**3**
4C.	Evaluate $\oint \frac{z^2+1}{z(2z+1)} dz$ where C is defined at $\lvert z \rvert = 1$, and also discuss about the types of singular points.	**3**
5A.	Find all possible expansion of the following: (i) $f(z) = \frac{1}{z^2-3z+2}$ about $z = 1$ (ii) $f(z) = \frac{1}{z^2}$ $at\ z = 1$	**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.	Verify the Green's theorem in the plane for $\oint (3x^2 - 8y^2)dx + (4y - 6xy)dy$ where C is a boundary of the region defined by $x = 0, y = 0, x + y = 1$.	**3**