Reg. No. | | | | | | | | | | |

MANIPAL INSTITUTE OF TECHNOLOGY

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A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATIONS, NOV. 2017

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2102]

REVISED CREDIT SYSTEM

(18/11/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.

1A.	Find the Fourier series expansion of $f(x)=2x-x^2, 0<x<3,\ f(x+3)=f(x)$ and hence show that $\sum_{n=1}^{\infty}\frac{1}{n^2}=\frac{\pi^2}{6}$.	**4**
1B.	Expand $f(x)=\begin{cases} x, & 0<x<\pi/2 \\ \pi-x, & \pi/2<x<\pi \end{cases}$ as a half range Fourier cosine series.	**3**
1C.	Find the Fourier transform of $e^{-a\lvert x\rvert}, a>0$ and hence evaluate $\int_0^{\infty}\frac{\cos xt}{a^2+t^2}dt$.	**3**
2A.	Find the Fourier cosine and sine transforms of $x^{a-1}, a>0$.	**4**
2B.	Find the analytic function f(z) = u+iv for which $u-v=e^x(\cos y-\sin y)$	**3**
2C.	If f(z) = u + iv is analytic function of z, show that $\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)\lvert f(z)\rvert^p = p^2\lvert f(z)\rvert^{p-2}\lvert f'(z)\rvert^2$	**3**
3A.	(i)Find all possible expansion of $f(z)=\frac{2z-3}{z(z^2-3z+2)}$ about z = 1. (ii) Expand f(z) = cos3z about z = π/2.	**4**
3B.	Evaluate $\oint_C \frac{z^2+1}{z^2(z^2+2z+2)}dz$ where $C:\lvert z-i\rvert=\frac{3}{2}$.	**3**
3C.	Verify Green's theorem for $\oint_C (x^2-2xy)dx+(x^2y+3)dy$ Where C is the boundary of the region defined by $y^2=8x$ and $x=2$.	**3**

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4A.	If f(r) is a differentiable function of $r = \lvert\bar{r}\rvert$, then show that $\nabla^2 f(r) = \frac{d^2 f}{dr^2} + \frac{2}{r}\frac{df}{dr}$ and hence find f(r) such that $\nabla^2 f(r) = 0$.	4
4B.	Show that $\vec{F} = (2xz\cos y + y + 2)i + (x - x^2 z\sin y + z)j + (x^2\cos y + y + 3)k$ is conservative. Find ϕ such that $\vec{F} = \nabla\phi$. Also, find the work done by $\vec{F}$ in moving a particle in this force field from (1, 0, 2) to $\left(2, \frac{\pi}{2}, 1\right)$.	3
4C.	Find the equations of the tangent plane and normal line to the surface $xz^2 y + x^3 y^2 - 2z = 1$ at the point (1,1,2).	3
5A.	Verify Stoke's theorem for $\vec{A} = (x^2 + y - 4)i + 3xyj + (2xz + z^2)k$ where S is the surface of $z = 4 - (x^2 + y^2)$ above the xy-plane.	4
5B.	Assuming the most general solution , find the deflection of the string of length l, fixed at end points, starts vibration with zero initial velocity and initial deflection is given by $u(x,0) = x(l-x)$, $0 < x < l$.	3
5C.	Derive the one dimensional heat equation using the divergence theorem.	3