Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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III SEMESTER B. TECH END SEMESTER EXAMINATIONS NOVEMBER 2018

SUBJECT: **ENGINEERING MATHEMATICS III - [MAT 2103]**

(COMMON TO BT\CHE)

Date of Exam: Time of Exam: Max. Marks: **50**

Instructions to Candidates: Answer ALL the questions

1A.	Obtain the Fourier series for the function $(x) = \begin{cases} -\pi \; in \; -\pi < x < 0 \\ x \; in \; 0 < x < \pi \end{cases}$.	**4**
1B.	Find the cosine series for $f(x) = (x-1)^2, 0 < x < 1$.	**3**
1C.	Find $F_C\{e^{-ax}\}$, $F_S\{e^{-ax}\}$, $0 < a < 1$, hence evaluate $F_C\{xe^{-ax}\}$, $F_S\{xe^{-ax}\}$.	**3**
2A.	Find the Fourier transform of $f(x) = e^{-a\|x\|}$, $a > 0$, hence evaluate $\int_0^\infty \frac{\cos xt}{a^2+t^2}\, dt$ and $F\{xe^{-a\|x\|}\}$.	**4**
2B.	If $f(z) = u + iv$ is an analytic function of z=x+iy, show that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right) u^p = p(p-1)u^{p-2}\|f'(z)\|^2$.	**3**
2C.	Find a conjugate harmonic function of $u = e^{-x}(xcosy + ysiny)$.	**3**
3A.	Find all possible series expansions of $f(z) = \frac{1}{(z+2)(z-1)}$ with center at z = -1.	**4**
3B.	Evaluate $\int_{\|z\|=4} \frac{z+1}{z(z^2+5z+6)}\, dz$	**3**
3C.	Find the bilinear transformation which maps $z = 1, i, -1$ to $w = i, 0, -i$. What are invariant points in this transformation? Hence find image of |Z|<1.	**3**
4A.	Show that $\vec{F} = (2xy^2 + yz)\hat{\imath} + (2xy + xz + 2yz^2)\hat{\jmath} + (2y^2z + xy)\hat{k}$ is conservative force field. Find the scalar potential.	**4**
4B.	Find the angle between the surfaces $xy^2z = 3x + z^2$ and $3x^2 - y^2 + 2z = 1$ at the point $P(1, -2, 1)$.	**3**
4C.	Evaluate $\iint_S (\nabla \times \vec{A}) \cdot \hat{n}\, dS$ where $\vec{A} = (2x - y)\hat{\imath} - yz^2\hat{\jmath} - y^2z\hat{k}$ and S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ above the xy-plane.	**3**
5A.	Verify Green's theorem in plane for $\oint (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y=x^2$.	**4**

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5B.	Solve the equation $u_{xy} - u_{yy} = 0$ using the transformation $v = x$ and $z = x + y$.	**3**
5C.	Derive one dimensional heat equation using Gauss divergence Theorem.	**3**