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

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL

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

MAKEUP EXAMINATIONS, DEC. 2017

SUBJECT: ENGINEERING MATHEMATICS-III [MAT 2102]

REVISED CREDIT SYSTEM
(22/12/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions.

1A.	Expand $f(x) = x\sin x,\ -\pi < x < \pi,\ f(x+2\pi) = f(x)$ as a Fourier series and hence deduce that $\frac{1}{1.3} - \frac{1}{3.5} + \ldots\ldots\ldots\ldots = \frac{\pi - 2}{4}$.	4
1B.	Expand $f(x) = 2 - x,\ 0 < x < 2$ as a half range Fourier cosine series.	3
1C.	Find the Fourier transform of $f(x) = \begin{cases} a - \lvert x\rvert, & \lvert x\rvert \le a \\ 0, & \lvert x\rvert > a \end{cases}$ and hence evaluate $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt$	3
2A.	Find the Fourier cosine and sine transforms of $e^{-ax}, a > 0$.	4
2B.	Find the analytic function f(z) = u+iv for which $u = e^x(x\cos y - y\sin y)$	3
2C.	If f(z) = u + iv is analytic function of z , show that $\left(\frac{\partial}{\partial x}\lvert f(z)\rvert\right)^2 + \left(\frac{\partial}{\partial y}\lvert f(z)\rvert\right)^2 = \lvert f'(z)\rvert^2$	3
3A.	Find all possible expansion of $f(z) = \frac{1}{(z^2 - 5z + 6)}$ about z = 0.	4
3B.	Evaluate $\oint_C \frac{z^2+2}{(z^2-4)(z^2-1)}dz \ \ where\ C: \lvert z-1\rvert = \frac{3}{2}$.	3
3C.	If f(r) is a differentiable function of r = $\lvert\bar{r}\rvert$, then show that $f(r)\bar{r}$ is irrotational and also find the its divergence .	3
4A.	State and prove Green's theorem in the plane.	4

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4B.	Prove that $\vec{F} = (y^2\cos x + z^3)i + (2y\sin x - 4)j + (3xz^2 + 2)k$ is a conservative force field, find the scalar potential of $\vec{F}$ and find the work done by $\vec{F}$ in moving an object in this field from (0,1,-1) to ((π/2),-1, 2).	3
4C.	Find the acute angle between the surfaces $xy^2z = 3x+z^2$ and $3x^2-y^2+2z = 1$ at the point (1,-2, 1).	3
5A.	Evaluate $\iint_S \vec{F}.\hat{n}\, ds$ where $\vec{F} = 2xyi + yz^2j + xzk$ and S is the surface of the parallelopiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1 and z = 3.	4
5B.	Under suitable assumptions, derive the one dimensional wave equation.	3
5C.	Assuming the most general solution, find the temperature u(x, t) in a laterally insulated bar of length L, whose ends are kept at zero degree temperature and the initial temperature is given by $f(x) = \begin{cases} x, & 0 < x < L/2 \\ L-x, & L/2 < x < L \end{cases}$.	3