| Reg. No. | | | | | | | | | | |
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# MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
*(A constituent unit of MAHE, Manipal)*

**III SEMESTER MECH/IP/AERO/AUTO/MT**

**END SEMESTER EXAMINATIONS, JAN. 2022**

SUBJECT: ENGG. MATHEMATICS III [MAT 2151]

**REVISED CREDIT SYSTEM**

**(20-01-2022)**

**PART B**

Time: 1 hour 15 minutes MAX. MARKS: 20

**Instructions to Candidates:**

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

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| **1A.** | Solve $32\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ ; $0 < x < 1;\ t > 0$ for 4 steps by explicit method with $h = \frac{1}{4};\ \lambda = \frac{1}{3}$ and $u(x,0) = 0 = u(0,t); u(1,t) = t$. | **4** |
| **1B.** | Solve $x^2y'' + xy' + (x^2 - 3)y = 0$, with h=0.25, $y$ (1) =0, $y$ (2) =2. | **3** |
| **1C.** | Find the constants a, b if the directional derivative of $\phi = ay^2 + 2bxy + xz$; at P(1,2,-1) is maximum in the direction of the tangent to the curve $\vec{A} = (t^2 - 1)\hat{i} + (3t - 1)\hat{j} + (t^2 - 1)\hat{k}$ at the point (0,2,0). | **3** |

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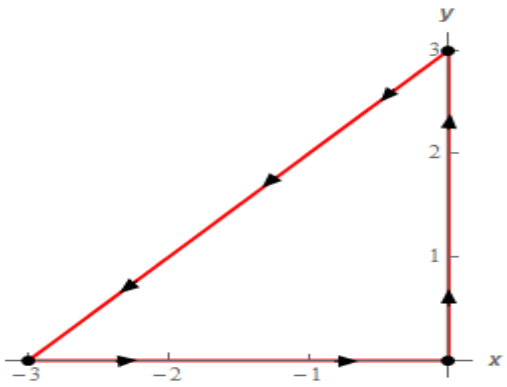
| **2A.** | Solve $u_{xx} - 4u_{xy} + 3u_{yy} = 0$ given $v = x + y, z = 3x + y$ using method of indicated transformation. | **4** |
| **2B.** | Obtain the Fourier series for f(x) of period $2l$ and defined as follows $f(x) = \begin{cases} l - x, & 0 < x \le l \\ 0, & l \le x \le 2l \end{cases}$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ..... = \frac{\pi}{4}$. | **3** |
| **2C.** | Verify Greens theorem for $\int_c (xy^2 + x^2)dx + (4x - 1)dy$ where $C$ is shown below   | **3** |
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