U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E **Semester: II**
Branch: Common to all Branches **Duration: 3 hrs.**
Course Code: 18MA2BSEM2 **Max Marks: 100**
Course: Engineering Mathematics-2 **Date: 13.09.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

SUPPLEMENTARY EXAMS 2023

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) Evaluate: i) $\int_0^{\infty} \frac{e^{-t} - e^{-3t}}{t}\, dt$ ii) $L\left\{\int_0^t \frac{\sin t}{t}\, dt\right\}$. **6**

b) Find the Laplace transform of periodic function $f(t) = \begin{cases} \sin(\omega t) & 0 < t < \frac{\pi}{\omega} \\ 0 & \frac{\pi}{\omega} < t < \frac{2\pi}{\omega} \end{cases}$ **7**

$f\left(t + \frac{2\pi}{\omega}\right) = f(t)$.

c) Express $f(t) = \begin{cases} \cos t & 0 < t < \pi \\ 1 & \pi < t < 2\pi \\ \sin t & t > 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. **7**

UNIT - II

2 a) Find $L^{-1}\left[\frac{s^2 + 6s + 9}{(s-1)(s-2)(s+4)}\right]$. **6**

b) Find $L^{-1}\left[\frac{s}{s^4 + 4a^4}\right]$. **7**

c) In an electrical circuit with e.m.f E(t), resistance R and inductance L_1, the current i builds up at the rate given by $L_1 \frac{di}{dt} + Ri = E(t)$. If the switch is connected at $t = 0$ and disconnected at $t = a$, find the current i at any instant. **7**

OR

3 a) Find $L^{-1}\left[\frac{s\, e^{-s/2} + \pi e^{-s}}{s^2 + \pi^2}\right]$. **6**

b) Employing Laplace transform method, solve the differential equation $\frac{d^2x}{dt^2} + 9x = \cos(2t)$ if $x\left(\pi/2\right) = -1$ and $x(0) = 1$. **7**

c) Apply the method of Laplace transform to solve the simultaneous equation $\frac{dx}{dt}+y=\sin t$ $\frac{dy}{dt}+x=\cos t$ being given $x=2,\ \ y=0$ when $t=0$. **7**

UNIT - III

4 a) Form a partial differential equation by eliminating arbitrary function f from the relation $f(x^2+y^2+z^2, z^2-2xy)=0$. **6**

b) Solve $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$. **7**

c) Apply the method of separation of variables to obtain the solution of one dimensional heat equation. **7**

UNIT - IV

5 a) Find the angle between the surfaces $x^2+y^2+z^2=9$ and $z=x^2+y^2-3$ at $(2,-1,2)$. **6**

b) Show that $div(\vec{A}\times\vec{B})=\vec{B}.curl(\vec{A})-\vec{A}.curl(\vec{B})$ where $\vec{A}$ and $\vec{B}$ are vector point functions of x, y and z. **7**

c) Verify Green's theorem for the integral $\int_C (3x^2-8y^2)dx+(4y-6xy)dy$ taken around the closed curve bounded by the curves $x=0,\ y=0$ and $x+y=1$. **7**

OR

6 a) Find the directional derivative of $\phi=xy^2+yz^3$ at the point (2, -1, 1) along the normal to the surface $x\log z-y^2=-4$ at the point (-1,2,1). **6**

b) A vector field is given by $F=\left(6xy+z^3\right)\hat{i}+\left(3x^2-z\right)j+\left(3xz^2-y\right)k$. Show that the field is irrotational and find its scalar potential. **7**

c) Apply Stokes' theorem to evaluate $\oint_C \left(2x-y\right)dx-yz^2dy-y^2zdz$ where C is the projection over the upper half of the sphere $x^2+y^2+z^2=a^2$ in the *xy*-plane. **7**

UNIT - V

7 a) Show that the spherical polar coordinate system forms an orthogonal curvilinear coordinate system. **6**

b) Express $\vec{F}=2xi-3y^2\,j+zxk$ in cylindrical polar coordinate system. **7**

c) Derive an expression for finding $\nabla^2\psi$ in orthogonal curvilinear coordinate system. Write the expression for $\nabla^2\psi$ in cylindrical polar coordinate system and spherical polar coordinate system. **7**

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SUPPLEMENTARY EXAMS 2023