

SANT GADGE BABA AMRVATI UNIVERSITY, AMRAVATI
Summer Examination 2020
HVPM's College of Engineering and Technology, Amravati
Department of Information and Technology Engineering
Bachelor of Engineering Sem. :- III

Subject :- Engineering Mathematics MIII

Code :-3 IT01

Instructions:-

- 1) Solve any two questions**
- 2) All question carry equal marks**

Q1.

a) Solve $(D^3 - D^2 - D + 1)y = \cosh x \cdot \sin x$. **02 Credit Point**

b) i] Obtain Laplace transform of $\int_0^t e^{-2t} t \sin^3 t \, dt$

ii] Obtain Inverse Laplace transform of $\frac{s+29}{(s+4)(s^2+9)}$ **02 Credit Point**

c) i] Solve the following difference equations $U_{x+2} - 2U_{x+1} + 4U_x = 6$

ii] Find inverse z-transform of the following. $\frac{z-4}{(z-1)(z-2)^2}$ **02 Credit Point**

d] Find the Fourier sine and cosine transform of

$$f(x) = \begin{cases} x & \text{for } 0 < x < 1 \\ 2-x & \text{for } 1 < x < 2 \\ 0 & \text{for } x > 2 \end{cases}$$
 02 Credit Point

e) Determine the analytic function $f(z) = u + iv$ whose real part is $\cos x \cosh y$

01 Credit Point

f) Prove that the vector function $\vec{A} = (x^2 + xy^2)i + (y^2 + x^2y)j$ is irrotational and find corresponding scalar potential Φ such that $\vec{A} = \vec{\nabla} \Phi$

01 Credit Point

Q2.

a) Solve $(D^2 + 5D + 6)y = e^{-2x} \cdot \sin 2x$ **02 Credit Point**

b) Solve by Laplace transform,

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 5y = e^{-x} \sin x \quad \text{where } y(0) = 0 \text{ and } y'(0) = 1$$
 02 Credit Point

c) i) Solve

$$Y_{n+2} - 2Y_{n+1} + Y_n = 3n + 4.$$

ii) Find inverse z-transform of the following. $\frac{z-4}{(z-1)(z-2)^2}$ **02 Credit Point**

d) Solve the following partial differential equations:

i] $((mz - ny)p + (nx - lz)q = ly - mx)$

ii] $z^2(p^2 + q^2 + 1) = 1$ **02 Credit Point**

- e) Find the Bilinear transformation which sends the points $1, i, -1$ from z -plane into the points $i, 0, -i$ of w -plane. **01 Credit Point**
- f) Find the work done in moving a particle once round the circle $x^2 + y^2 = 9, z = 0$ under the field of force given by $F = (2x - y + z)i + (x + y - z^2)j + (3x - 2y + 4z)k$ **01 Credit Point**

Q3

a) Solve $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} - 3y = x^2$ **02 Credit Point**

b) i] Evaluate $\int_0^\infty \frac{\cos at - \cos bt}{t} dt$

ii] Using convolution theorem find Laplace transform of $\frac{1}{(s^2+1)^3}$ **02 Credit Point**

c) Solve the following difference equation by Z-transform

$$U_{x+2} - 5U_{x+1} + 6U_x = 6x \quad \text{If } u(0)=u(1)=0$$
 02 Credit Point

d) Solve the following partial differential equations

i] $\left(\frac{\partial z}{\partial y}\right)^2 + \left(\frac{\partial z}{\partial x}\right)^2 = \frac{3a^2}{z^2}$

ii] $yzp + xzq + 2xy = 0$ **02 Credit Point**

e) $f(z)$ is analytic then show that

$$\left(\frac{\delta^2}{\delta x^2} + \frac{\delta^2}{\delta y^2}\right) |f(z)|^n = n^2 |f(z)|^{n-2} |f'(z)|^2$$
 01 Credit Point

f) Evaluate the surface integral $\iint \vec{F} \cdot n \, ds$ where $\vec{F} = (x + y^2)i - 2xj + 2yzk$ and S is the surface of the plane $2x + y + 2z = 6$ in the first octant. **01 Credit Point**

Q4.

a] Solve $(D^2 + 3D + 2)y = x \sin 3x$ **02 Credit Point**

b) Find Laplace transform of the triangular wave function of period $2c$,

$$\text{Defined by } f(t) = t \text{ for } 0 < t < c \\ = (2c - t) \text{ for } 0 < t < 2c$$
 02 Credit Point

c) i] Solve the difference equation

$$Y_{n+2} - 2\cos \alpha Y_{n+1} + Y_n = \cos n\alpha$$

ii] Find the Z-transform of $\frac{1}{n(n+1)}$ **02 Credit Point**

d) Find the Fourier sine and cosine transform of

$$f(x) = \begin{cases} \cos x & \text{for } 0 < x < a \\ 0 & \text{for } x > a \end{cases}$$
 02 Credit Point

e) If $f(z) = u + iv$ is analytic then find $f(z)$ if its imaginary part is

$$e^x (x \cos y - y \sin y) \text{ and show that it is harmonic.} \quad \text{01 Credit Point}$$

f) Find the directional derivative of the function $\theta = xy^2 + yz^2 + zx^2$ along the tangent to the

curve $x = t, y = t^2, z = t^3$ at the point $(1, 1, 1)$ **01 Credit Point**

