**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**End Semester Examination, December 2020**

**Programme Name: B. Tech (ASE, ASE&AVI, FSE)** **Semester : III**

**Course Name : Transforms and Numerical Methods** **Time : 3 Hours**

**Course Code : MATH-2038** **Max. Marks : 100**

**Nos. of page(s) : 2**

**Instruction: Use of scientific calculator is allowed in this paper.**

## Section-A

1. **Each question will carry 5 Marks. 2. Select correct answer in each question. 3. All Questions of this section are compulsory.**

| S. No. | | CO |
|---|---|---|
| Q1 | Laplace Transform of $\frac{1}{\sqrt{\pi t}}$ is<br>(a) $\frac{1}{\sqrt{s}}$ (b) $\frac{\pi}{\sqrt{s}}$ (c) $\frac{1}{\sqrt{\pi s}}$ (d) $\frac{2}{\sqrt{\pi s}}$ | CO1 |
| Q2 | Inverse Laplace transform of $\frac{e^{-s}-3e^{-3s}}{s^2}$ is<br>(a) $(t+1)-3(t+3)$<br>(b) $(t+1)u(t+1)-3(t+3)u(t+3)$<br>(c) $(t+1)^2-3(t+3)^2$<br>(d) $(t-1)u(t-1)-3(t-3)u(t-3)$ | CO1 |
| Q3 | A positive root of the equation $xlog_{10}x = 4.772393$ lies between<br>(a) 10 and 11<br>(b) 2 and 3<br>(c) 4 and 5<br>(d) 6 and 7 | CO2 |
| Q4 | Value of the integral $\int_0^1 \frac{x^2}{1+x^3}dx$ using Simpson's 1/3rd formula taking $h = 0.25$ correct to 5 decimal places is<br>(a) 0.23000<br>(b) 0.23108<br>(c) 0.23333<br>(d) 0.24444 | CO3 |
| Q5 | The following table gives the viscosity of an oil as a function of temperature. What is the approximate viscosity of oil at a temperature of $140^0$ using Lagrange' s formula?<br>Temp$^0$ \| 110 \| 130 \| 160 \| 190<br>Viscosity \| 10.8 \| 8.1 \| 5.5 \| 4.8<br>(a) 7 (b) 8 (c) 6 (d)5 | CO3 |
| Q6 | Solution of $\frac{dy}{dx} = x^2y - 1$, y(0)=1 by Taylor's series method at $y = 0.1$ is<br>(a) 1.1<br>(b) 2.5<br>(c) 0.55<br>(d) 0.9 | CO4 |

## Section-B

1. **Each question will carry 10 Marks. 2. All Questions of this section are compulsory.**

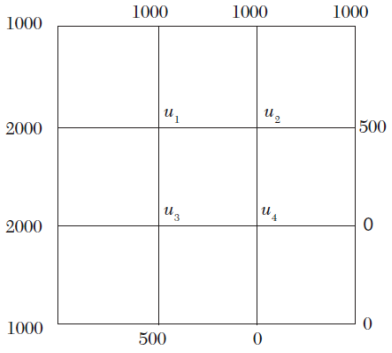
| S. No. | | CO |
|---|---|---|
| **Q7** | Evaluate $\int_0^\infty \int_0^t e^{-t} \frac{\sin u}{u}\, du\, dt$ using Laplace transform. | **CO1** |
| **Q8** | Solve $100x - 21\sin(0.5 + x)$=0 using iteration method correct to 4 decimal places starting from $x = 1.2$. | **CO2** |
| **Q9** | From the following table of half-yearly premium for policies maturing at different ages, estimate the premium for policy maturing at the age of 63: | **CO3** |

| Age: | 45 | 50 | 55 | 60 | 65 |
|---|---|---|---|---|---|
| Premium (In Rs.) | 114.84 | 96.16 | 83.32 | 74.48 | 68.48 |

| | | | |
|---|---|---|---|
| **Q10** | Calculate the value of the integral $\int_4^{5.2} \log_e x\ dx$ from Trapezoidal rule by taking $h = 0.2$. | **CO3** |
| **Q11** | Using Runge-Kutta method of fourth order, solve for $y(0.1)$ taking $h = 0.1$ given that $\frac{dy}{dx} = xy + y^2, y(0) = 1.$ | **CO4** |

## Section-C

1. **The question will carry 20 Marks. 2. Choose one question from two options.**

| S. No. | | CO |
|---|---|---|
| **Q12** | Solve the Laplace equation $u_{xx} + u_{yy} = 0$ at the interior points of the figure below by Gauss Seidal method upto 3 iterations:   **OR** Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial u^2}{\partial x^2}$ with the conditions $u(0,t) = 0, u(x,0) = x(1-x) and\ u(1,t) = 0$ using Schmidt method. Assuming $h = 0.25$, tabulate $u$ for two time levels by choosing appropriate value of $k$. | **CO4** |