| **Name:**<br><br>**Enrolment No:** | UPES<br>UNIVERSITY WITH A PURPOSE |
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**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**

**Online End Semester Examination, June 2021**

Course: **Mathematical Economics II** Semester: **II**

Program: **BA (Hons.) Economics** Time: **03 Hours.**

Course Code: **ECON1018** Max. Marks: **100**

**SECTION A**

**Each question carries 5 marks.**

| S. No. | **Questions** | **CO** |
|---|---|---|
| Q1 | Identify the order and degree of the following differential equations.<br><br>**(a)** $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 = 4x$<br>**(b)** $\left(\frac{d^3y}{dx^3}\right)^2 + \left(\frac{d^2y}{dx^2}\right)^3 = 2$ | **CO1** |
| Q2 | Let $y_t = by_{t-1} + a$, $b \neq 1$ and $b < 0$.<br>Comment on the time path of $b^t$. | **CO2** |
| Q3 | State the order of the following difference equations.<br><br>**(a)** $y_t = \alpha + \beta y_{t-1}$<br><br>**(b)** $y_t = \alpha + \delta y_{t-1} + \gamma y_{t-2}$ | **CO1** |
| Q4 | Identify the complementary function and the particular solution for the following difference equation.<br><br>$y_t = Ab^t + c$ | **CO1** |
| Q5 | State the conditions where the following equation is dynamically stable.<br>$y_t = Ab^t + c$ | **CO1** |
| Q6 | Let $y_t = by_{t-1} + c$,<br>State the time path of $b^t$ if $-1 < b < 0$. | **CO2** |

**SECTION B**

**Each question carries 10 marks.**

| | | |
|---|---|---|
| Q7 | The marginal cost is given as | **CO2** |

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|---|---|---|
| | $MC = \frac{dTC}{dQ} = 25 + 30Q - 9Q^2$, where *TC* is total cost and $Q$ is output. Fixed cost is 65. Find total cost, average cost and variable cost functions. | |
| Q8 | Given the demand function $P_d = 113 - Q^2$ and the supply function $P_s = (Q+1)^2$, Find the consumers' surplus and producers' surplus if there is perfect competition in the market. | **CO3** |
| Q 9 | Solve the following differential equation. Check if it is an exact differential equation. $$(12y + 7t + 6)dy + (7y + 4t - 9)dt = 0$$ | **CO1** |
| Q 10 | Maximize the utility function $U = x^{0.25}y^{0.4}$ subject to the budget constraint $2x + 8y = 104$, where *x* and *y* represent two different goods. Price per unit of *x* and *y* are Rs. 2 and Rs. 8, respectively. Income of the consumer is Rs. 104. Find the value of *x* and *y* at which the utility function is maximum. | **CO3** |
| Q 11 | Find the demand function $Q = f(P)$ if price elasticity of demand $e = -c$, where c is a constant. | **CO3** |
| **Section C** **Each question carries 20 Marks. Answer any one question.** | | |
| Q12 | (1) Given the following equations: $C_t = 300 + 0.87Y_{t-1}$ $I_t = 150 + 0.13Y_{t-1}$ and $Y_0 = 6000$ (a) Find the time path of national income $Y_t$ (b) Find the value of $Y_t$ at $t = 1$ (c) Comment on the stability of the time path. **OR** (2) The rate at which the population (P) of a country is growing is given by the equation $\frac{dP}{dt} = 0.02(400 - P)$, given that $P = 100$ at $t = 0$ ($t$ is time in years). (a) Solve the differential equation to obtain an expression for $P$ in terms of $t$. (b) Calculate the time taken for the population to reach 1000. | **CO4** |