

Cutting, Overwriting, Erasing, Fluid painting and use of Lead Pencil will earn no marks.  
 Write answer of the Question No.1 and 2 on this sheet and handover it to the supervisory staff of examination within first 35 minutes.

Time Allowed: 35 Minutes

(OBJECTIVE PART)

Max Marks: 32

1- a) Encircle the correct answer:

1x4

Sign of Suptd.

i)  $\frac{d}{d\theta} \sin \theta =$

a)  $\sin \theta$

b)  $\cos \theta$

c)  $\sec \theta$

d)  $\operatorname{CoSec} \theta$

ii)  $\int f(x) dx =$  \_\_\_\_\_ if  $f(x) = 0$ .

a) Zero

b) Constant

c) Infinity

d) None

iii)  $\Pi$  radian =

a)  $760^\circ$

b)  $360^\circ$

c)  $180^\circ$

d)  $90^\circ$

iv) Time Factor is included in the

a) Static Analysis

b) Comparative Static Analysis

c) Dynamic Analysis

d) Both b & c

b) Encircle True or False:

1x8

i)  $\int \cos \theta d\theta = \sin \theta + C$

TRUE / FALSE

ii) Slow growth model is not a stable model.

TRUE / FALSE

iii) Marginal function is obtained from total function with integration.

TRUE / FALSE

iv)  $\sin (90 + \theta) = \sin \theta$ .

TRUE / FALSE

v)  $\cos (\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$ .

TRUE / FALSE

vi) Domar growth model do not explain the impact of investment on demand & supply of the economy.

TRUE / FALSE

vii) Integration is the reverse process of differentiation.

TRUE / FALSE

viii) Consumer Surplus can be calculated with the help of integration.

TRUE / FALSE

c) Fill in the blanks meaningfully:

1x4

i)  $e^{2\theta} =$  \_\_\_\_\_

ii) The Conjugate of  $C = 3 + 5i$  will be = \_\_\_\_\_.

iii)  $\cos (\theta + 2n\pi) =$  \_\_\_\_\_.

iv) The characteristic equation of the difference equation  $y_{t+2} - 2y_{t+1} + 3y_t = 4$  is \_\_\_\_\_.

(Continued Overleaf)

2- Give short answers of the following questions: 2x8

i) Exact Differential Equation.

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ii) Integrating Factor.

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iii) Phase Diagram.

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iv) Improper Integral.

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v) Qualitative Analysis.

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vi) Phase Line.

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vii) De Moivre Theorem.

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viii) Euler Relation.

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**SUBJECTIVE PART**

- 3- a) Find 9
- i)  $I = \int (x + 3)(x + 1)^{1/2} dx$
- ii)  $I = \int_e^6 \left( \frac{1}{x} + \frac{1}{1+x} \right) dx$
- iii)  $\int_{-1}^1 \frac{1}{x^3} dx$
- b) Find the amount of capital accumulation during the time intervals [0,1] and [1,3] respectively when the rate of investment is described by the function  $I(t) = 12t^{1/3}$  and that  $K(0) = 25$  8
- 4- a) Solve the first order differential equation. Also find definite solution with the given initial condition 9
- $\frac{dy}{dt} + t^2y = 5t^2; y(0) = 6$
- b) Analyze the importance of phase diagram for qualitative Graphic Approach. 8
- 5- a) Find the definite solution of the differential Equation. 9
- $zy''(t) - 12y'(t) + 20y = 40;$   
 $y(0) = 4, y'(0) = 5$
- Discuss the nature of the time path.
- b) Find the Cartesian form of the complex number 8
- $2 \left( \cos \frac{\pi}{6} + i \sin \frac{\pi}{6} \right)$
- 6- a) Given the equation of Inflation Unemployment Model 9
- $P = \frac{1}{6} - 3U + \Pi$   
 $\frac{d\Pi}{dt} = \frac{3}{4} (P - \Pi)$   
 $\frac{du}{dt} = \frac{-1}{2} (m - P)$
- Find the time path for  $P(t)$ ,  $\Pi(t)$  and  $u(t)$
- b) Find the particular integral of 8
- $y''(t) + 3y'(t) - 4y = 2e^{-4t}$
- 7- a) Given demand and supply for the Cobweb model. Find intertemporal equilibrium price and determine whether it is stable. 9
- $Q_{dt} = 19 - 6P_t \quad Q_{st} = 6P_t - 1 - 5$
- b) Solve the given difference equation and analyze the time path. 8
- $y_{t+2} + 3y_{t+1} - \frac{7}{4}y_t = 9 \quad (y_0 = 6; y_1 = 3)$
- 8- Write note on the following.
- i) Minimize  $c = (x_1 - 4)^2 + (x_2 - 4)^2$
- Subject to Constraints  $2x_1 + 3x_2 \geq 6$   
 $-3x_1 - 2x_2 \geq -12$   
 $x_1, x_2 \geq 0$
- Find graphical solution. Also apply Kuhn-Tucker Condition. 12
- ii) What is meant by Non-Linear Programming? Differentiate it with Linear Programming 5

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**1- a) Tick or Encircle the correct answer:**

1x4

i)  $e^{i\pi} =$

a) Zero

b) 1

c) -1

d)  $\sin \pi$

ii)  $\int \cos \theta d\theta$

a)  $\cos \theta$

b)  $\sin \theta$

c)  $-\cos \theta$

d)  $-\sin \theta$

iii) Given a total function, the process of differentiation can yield the:

a) Average function

b) Marginal function

c) Convex function

d) Concave function

iv) The present value of a perpetual income stream flowing at the uniform rate of \$ Dollars per year with continuous discount rate  $r$  will be:

a)  $\frac{D}{r}$

b)  $\frac{r}{D}$

c)  $rD$

d) None

**b) Indicate True or False:**

1x8

i)  $\int \sin \theta d\theta = -\cos \theta + C$ .

TRUE / FALSE

ii)  $\frac{d}{d\theta} \sin \theta = -\cos \theta$ .

TRUE / FALSE

iii)  $\sin(-\theta) = \sin \theta$ .

TRUE / FALSE

iv)  $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$ .

TRUE / FALSE

v) Differentiation is the reverse process of integration.

TRUE / FALSE

vi) The conjugate of complex number  $C = 10 - 5i$  is  $\overline{C} = -10 + 5i$ .

TRUE / FALSE

vii)  $\cos(\theta + 2n\pi) = \cos \theta$ .

TRUE / FALSE

viii) Integration is used for calculation of consumer surplus.

TRUE / FALSE

**c) Fill in the blanks meaningfully:**

1x4

i)  $e^{-2\pi} =$  \_\_\_\_\_.

ii)  $2\pi$  radian = \_\_\_\_\_ degree.

iii)  $\int 0.8x dx =$  \_\_\_\_\_.

iv) A differential equation  $Mdy + Ndx = 0$  will be \_\_\_\_\_ if  $\frac{\delta M}{\delta t} = \frac{\delta N}{\delta y}$ .

**2- Give short answers the following questions:**

2x8

i) Characteristics roots.

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ii) Dynamic analysis.

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iii) Circular functions.

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iv) Define Exact Differential Equation.

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v) Dynamic Stability.

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vi) Difference equation.

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vii) Interactive Method.

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viii) Schur Theorem.

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**SUBJECTIVE PART**

- 3- a) Find 8
- i)  $I = \int x \ln x \, dx.$
- ii)  $I = \int_{-2}^{e-2} \frac{dx}{x+2}$
- iii)  $I = \int_0^1 x^{-2/3} \, dx$
- b) Given the marginal propensity to consume  $C'(Y) = 0.8 + 0.1 Y^{-1/2}$  and the information that  $C = Y$  when  $Y = 100$ , Find the consumption function  $C(Y)$ . 9
- 4- a) Let the demand and supply be 9
- $Q_d = \alpha - \beta P + \sigma \frac{dP}{dt} \quad Q_s = -\gamma + \delta \quad (\alpha, \beta, \gamma, \delta > 0)$
- Find the time path  $P(t)$  assuming that rate of change of price over time is directly proportional to the excess demand.
- b) Find the solution of first order linear differential equation 8
- $\frac{dy}{dt} + Uy = w$  by four step procedure .
- 5- a) Find the time path of given differential equation. Also discuss the nature of the time path. 9
- $y''(t) - 2y'(t) + 10y = 5$   
 $y(0) = 6, \quad y'(0) = 8\frac{1}{2}$
- b) Find the Cartesian form of the complex number  $4e^{2\pi/3}$  8
- 6- Discuss the Domer Growth Model. Also discuss the concept of Razor Edge. 12
- b) Given  $ed = -1$  Find the Demand Function. 5
- 7- a) Explain the CobWeb Model mathematically and graphically. 9
- b) Solve the given difference equation and analyze the time path 8
- $yt+2 - 2yt + 1 + 2yt = 1 \quad (y_0 = 3 ; \quad y_1 = 4)$
- 8- Write note on the following
- i) Two – Variation phase diagram. 9
- ii) Arrow Enthoven sufficiency theorem. 8

**1- a) Tick or Encircle the correct answer:**

1x4

i) In Cobweb model, if S is steeper than D ( $\delta > \beta$ ), oscillation will be.

- a) Uniform.

b) Damped.
- c) Explosive.

d) None of above.

ii) In the difference equation if  $b < 0$  and  $|b| > 1$  then time path is

- a) Non oscillatory and divergent

b) Oscillatory and divergent
- c) Oscillatory and convergent

d) None of the above.

iii) In Samuelson Model if  $\gamma > \frac{4\alpha}{(1+\alpha)^2}$  then the roots are

- a) Repeated

b) Complex
- c) Distinct

d) None of Above

iv) Given  $Mdy + Ndt = 0$  the equation is exact if and only if

- a)  $\frac{\delta M}{\delta t} = \frac{\delta N}{\delta y}$

b)  $\frac{\delta M}{\delta t} = \frac{\delta N}{\delta t}$
- c)  $\frac{\delta M}{\delta t} + \frac{\delta N}{\delta y} = 0$

d) None of Above

**b) Indicate True or False:**

1x8

- i) Integration is a reverse process of differentiation.

TRUE / FALSE
- ii)  $\cos(\theta + \frac{\pi}{2}) = \sin \theta$ .

TRUE / FALSE
- iii) The solution of slow growth model is stable.

TRUE / FALSE
- iv)  $\int_0^a \frac{1}{x} dx = -\ln a$ .

TRUE / FALSE
- v)  $\int \sin x dx = -\cos x$ .

TRUE / FALSE
- vi) Phase diagram is used for the qualitative analysis of the differential equation.

TRUE / FALSE
- vii) Given  $Y_t = -3\left(\frac{1}{4}\right)^t + 2$ , then time path will be non-oscillatory.

TRUE / FALSE
- viii)  $\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$ .

TRUE / FALSE

c) Fill in the blanks meaningfully: 1x4

i) A definite integral has zero value when upper and lower limits  
are \_\_\_\_\_.

ii)  $\cos(-\theta) =$  \_\_\_\_\_.

iii) The solution of  $\frac{dy}{dt} + Uy = w$  is \_\_\_\_\_.

iv) If either limit of integration is infinity, then the integral is known as \_\_\_\_\_.

2- Give short answers the following questions: 2x8

i) Kuhn-Tucker conditions.

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ii) Homogeneous differential Equation

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iii) Argand diagram

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iv) Phase diagram

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v)      Pythagoras theorem.

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vi)      Characteristics Equation.

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vii)      Euler Relation?

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viii)      Schur Theorem.

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## SUBJECTIVE PART

3- a) Evaluate

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$$\begin{aligned} \text{i)} & \int_0^2 4x e^{x^2+2} dx \\ \text{ii)} & \int_1^3 \frac{4x}{(x^3+1)^3} dx \\ \text{iii)} & \int_0^2 \frac{3x^2}{(x^3+1)^2} dx \end{aligned}$$

b) Explain the concept of consumer and producer surplus mathematically and graphically

4- a) Given the differential equation

17

$$3y^2 dy + (y^3 - 2t) dt = 0$$

Verify that it is exact differential equation and solve by the four step procedure.

b) Solve the given differential equation as separable variable equation and also as Bernouli equation

$$\frac{dy}{dt} = 3y^2 t$$

5- a) Solve the differential equation

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$$y''(t) + 6y'(t) + 9y = 27$$

$$y(0) = 5 \quad y'(0) = -5$$

b) Solve the differential equation

$$y''(t) + 4y'(t) + 8y = 2$$

$$y(0) = 2 \frac{1}{4} \quad y'(0) = 4$$

6- a) Given the difference equation

17

$$Y_{t+1} + aY_t = C$$

Find the solution by iterative and general method.

b) Discuss the Cobweb model mathematically and graphically.

7- a) Given the difference equations

17

$$\text{i)} \quad Y_{t+2} - 4Y_{t+1} + 16Y_t = 0$$

$$\text{ii)} \quad Y_{t+2} + 3Y_{t+1} - \frac{7}{4}Y_t = 9$$

$$y(0) = 6 \quad y_1 = 3$$

$$\text{iii)} \quad \theta_t = 19 - 6P_t$$

$$\theta_{St} = 6P_{t-1} - 5$$

b) Given the difference equation

$$X_{t+1} + 6X_t + 9Y_t = 4$$

$$Y_{t+1} - X_t = 0$$

8- a) Explain the concept of Kuhn-Tucker conditions. Also discuss the maximization and minimization criterion

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$$\text{b) Min } C = (X_1 - 4)^2 + (X_2 - 4)^2$$

$$X_1 + X_2 \geq -6$$

$$-2x_2 \geq -11$$

Find graphical solution. Also apply Kuhn-Tucker conditions.