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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, RESEARCH AND STUDENTS' AFFAIRS

UNIVERSITY EXAMINATIONS

2018 /2019 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION

COURSE CODE: MAT 205

COURSE TITLE: ORDINARY DIFFERENNTIAL EQUATION I

DATE: 15TH APRIL, 2019 **TIME: 9.00 AM – 12.00 PM**

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF 3 PRINTED PAGES **PLEASE TURN OVER**

REGULAR: MAIN EXAM

MAT 205: ORDINARY DIFFERENTIAL EQUATIONS I

STREAM: BedSc/Arts/Bus **DURATION: 3 Hours**

INSTRUCTION TO CANDIDATES

i. *Answer **ALL** questions from **section A** and any **THREE** from **section B***

ii. *Do not write on the question paper.*

SECTION A [31 Marks] ANSWER ALL QUESTIONS

QUESTION ONE [16 marks]

a) Define the following terms as used in ordinary differential equations giving examples;

i. differential equation,

ii. order,

iii. degree,

iv. linearity and homogeneous (4mks)

b) Find the particular solution satisfying the given boundary conditions

$2\frac{dr}{d\theta} + \sin 2\theta = 0$; $r = 2, \theta = \frac{\pi}{2}$ (3mks)

c) Find the curve which satisfies the equation $2xy\frac{dy}{dx} = x^2 + 1$, which passes through the point (1,2) (3mks)

d) Solve the equation $(x^2 - xy + y^2)dx - xydy = 0$ (3mks)

a) Apply the reduction of order formula to solve the following differential equation $y'' + 2y' - 3y = 0, y_1 = e^x$ (3mks)

QUESTION TWO [15 marks]

a) Solve using integrating factor method $(x^2 + 1)\frac{dy}{dx} + 4xy = x$ (3mks)

b) Determine if the differential equation $dz = (3x^2 + 4y^2)dx + 8xydy$ is exact hence solve

(3mks)

c) Solve the differential equation $5\frac{dy}{dx} = \cot 2y$ (3mks)

d) Find the general solution to the differential equation $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 8y = 0$ (3mks)

e) The sum of Kshs 50,000 is invested in a bank which pays an interest at a rate of 8% p.a compounded continuously. Find the amount of money after 25yrs (3mks)

SECTION B (39 MARKS):

QUESTION THREE [13 marks]

a) Solve the Bernoulli equation $\frac{dy}{dx} + y = xy^3$ (6mks)

b) Show that $y = A\sin x + B\cos x$ is the general solution of the differential equation $y'' + y = 0$ and find the particular solution that satisfies $y(0) = 2, y'(0) = 3$ (7mks)

QUESTION FOUR [13 marks]

a) Solve the differential equation $y'' - y' - 2y = 4x^2$ using the method of variation of parameters (7mks)

b) When a cake is removed from the oven, its temperature is $300^0 F$. Three minutes later, its temperature is $200^0 F$. How long will it take to cool to $100^0 F$ if the room temperature is $70^0 F$ (6mks)

QUESTION FIVE [13 marks]

a) Consider the initial value problem $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 0, y(0) = 1, y'(0) = -1 + 2\sqrt{3}$

i. Find its solution (5mks)

ii. Write the solution in the form $Ce^{ax}\cos(\beta x - \alpha)$ (3mks)

b) Solve the equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{1}{1+e^{2x}}$ (5mks)

QUESTION SIX [13 marks]

a) Find the general solution of $(D^2 + 9)y = cos3x$ (5mks)

b) Solve the homogeneous linear differential equation $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{d^{x2}} + x\frac{dy}{dx} = 24x^2$ (8mks)

QUESTION SEVEN [13 marks]

a) Show that the differential equation $x^3y''' - 6xy' + 12y = 0$ has three linearly independent solutions each of the form $y = x^r$ (7mks)

b) A body moves with simple harmonic motion so that$s = \ddot{-}16s$. If s=3 and $s \dot{=} 16$ when t=0, find the motion. (6mks)