AFE BABALOLA UNIVERSITY, ADO-EKITI, EKITI STATE, NIGERIA
COLLEGE OF ENGINEERING

BACHELOR OF ENGINEERING ASSIGNMENT V

ENG 282: Engineering Mathematics II

Session: 2019/2020 **Semester:** Second **Unit:** 3 **Duration:** 7 days

Instructions: Solve all the problems and submit your solutions as a PDF file.

Question 1 [25 Marks]
A tank contains 1200 gal of water in which 150 lb of salt is dissolved initially. 50 gal of brine, each (gallon) containing $(1+\sin t)$ lb of dissolved salt, runs into the tank per minute. The mixture, which is kept uniform by stirring, runs out of the tank at the rate of 30 gal per minute. Denoting the amount of salt in the tank at any time *t* as *m*,

(a) formulate an ordinary differential equation for studying the dynamics of the amount of salt in the tank,
(b) solve the differential equation manually, and
(c) write a MATLAB *mfile* program to solve the differential equation using *dsolve* command and plot the dynamic response of the system for $0 \le t \le 7.5\,hr$ with $\Delta t = 0.5\,\text{min}$.

Question 2 [25 Marks]
The main dynamic model of a system is as given in Equation (1) while Equation (2) is its mean dynamic model. Write a MATLAB *mfile* program to:

(a) simulate the two models and insert the responses of the main dynamic model and those of the mean dynamic model in the odd-numbered and the even-numbered time values, respectively, for $0 \le t \le 500\,\text{min}$ and $\Delta t = 1\,\text{min}$,
(b) plot the graph of the combined responses as a single curve, and
(c) store the combined data generated in a Worksheet named "veriler" of an Excel Workbook named "odevbesdata" with headings of the first and the second columns being "t (min)" and "V (Litre)", respectively.

$$y = \frac{50}{0.05} + \frac{50}{1.0025}\sin t + \frac{50(0.05)}{1.0025}\cos t - 802.49e^{-0.05t} \quad (1)$$

$$y_m = 1000 - 800e^{-0.05t} \quad (2)$$