Faculty of Engineering and Technology			
Ramaiah University of Applied Sciences			
Department / Faculty	Mathematics / FMPS	Programme	B. Tech.
Semester/Batch	4th / 2017		
Course Code	BSC208A	Course Title	Engineering Mathematics – 4
Course Leader(s)	Mahesha Narayana, Somashekhara G., Hemanthkumar B., Sumanth Bharadwaj, Shivashankar C., T. N. Sakshath and Siddabasappa C.		

Assignment – 1			
Reg. No.		**Name of Student**	

Questions		**Marking Scheme**	**Max Marks**	**First Examiner Marks**	**Moderator**
Q1	**1.1**	Determination of integral surface	7		
	1.2	Plot of the integral surface	3		
		Max Marks	10		
Q2	**2.1**	Mathematical problem of logistic model	2		
	2.2	Exact solution of the model	2		
	2.3	MATLAB function to obtain population after 12 years in steps of (i) one year (ii) 6 months by Runge - Kutta method of fourth order	7		
	2.4	Plot of the exact and numerical solutions	3		
	2.5	Comment on the solution and graph	1		
		Max Marks	15		
		Total Assignment Marks	25		

Course Marks Tabulation				
Component-1 (B) Assignment	**First Examiner**	**Remarks**	**Moderator**	**Remarks**
Question No. 1				
Question No. 2				
Marks (out of 25)				

Signature of First Examiner **Signature of Moderator**

Please note:

1. Documental evidence for all the components/parts of the assessment such as the reports, photographs, laboratory exam / tool tests are required to be attached to the assignment report in a proper order.
2. The First Examiner is required to mark the comments in RED ink and the Second Examiner's comments should be in GREEN ink.
3. The marks for all the questions of the assignment have to be written only in the **Component – CET B: Assignment** table.
4. If the variation between the marks awarded by the first examiner and the second examiner lies within +/- 3 marks, then the marks allotted by the first examiner is considered to be final. If the variation is more than +/- 3 marks then both the examiners should resolve the issue in consultation with the Chairman BoE.

Assignment – 1
Term – 1

Instructions to students:

1. The assignment consists of **2** questions.
2. Maximum marks is **25**.
3. The assignment has to be neatly word processed as per the prescribed format.
4. The maximum number of pages should be restricted to **10**.
5. The printed assignment must be submitted to the course leader.
6. **Submission Date: 18/02/2019**
7. **Submission after the due date is not permitted.**
8. **IMPORTANT**: It is essential that all the sources used in preparation of the assignment must be suitably referenced in the text.
9. Marks will be awarded only to the sections and subsections clearly indicated as per the problem statement/exercise/question.

Preamble

The aim of the course is to introduce the basic concepts in real analysis, MATLAB programing and matrix algebra. Students are taught the concepts of limits, continuity, differentiation, series expansion for the functions of one and two variable, improper integrals of single real variable and double integral. The mathematical operations in Matrix theory, Eigen value and Eigen vector, Inversion and diagonalization of matrix and matrix solution for linear system of equations and implementation of the same using MATLAB are discussed in this course.

Question No. 1. **(10 Marks)**

An integral surface is a particular solution of a partial differential equation. Given the equation of a surface, differentiating it one can obtain a partial differential equation and integrating a partial differential equation one may get a surface and hence the surface is named as integral surface. With respect to the given partial differential equation

$$x(y^2+z)p - y(x^2+z)q = (x^2-y^2)z,$$

perform the following:

Q1.1 Determine the integral surface that passes through the straight lines $x + y = 1$ and $z = 1$.

Q1.2 Plot the integral surface obtained in **Q1.1** using MATLAB.

Question No. 2. **(15 Marks)**

The population of a city after reaching a certain stage starts decreasing due to non-availability of resources such as food and space. In such system the growth rate decreases linearly to zero as the population reaches its maximum. This is known as the "carrying capacity" of the environment. The population can be modelled by a nonlinear differential equation which is known as "Logistic model". Let the initial population of the city be 50 million, growth rate be 0.5 million per year and the carrying capacity of the city be 5000 then perform the following:

Q2.1 Write mathematical form of the Logistic model.

Q2.2 Obtain the exact solution of the mathematical problem defined in **Q2.1.**

Q2.3 Write a MATLAB function to obtain the population (in millions) after 12 years in steps of

(i) One year

(ii) 6 months

by Runge-Kutta method of fourth order.

Q2.4 Plot the exact solution and numerical solution obtained in **Q2.2** and **Q2.3** in the same graph.

Q2.5 Comment on the solution and graph.