Supervisor's Signature:.....

Date:.....

UNIVERSITY OF KELANIYA - SRI LANKA

Center for Distance & Continuing Education

Bachelor of Science (General) External

First year second semester examination (Repeat)-2019 (May 2025)

(New Syllabus)

FACULTY OF SCIENCE

Applied Mathematics - AMAT 26552

Scientific Computing Using Appropriate Software I

Index Number:.....

Course Code:.....

Course Title:.....

Date:.....

QUESTION	MARKS	
	First Examiner	Second Examiner
1		
2		
3		
4		
5		
TOTAL		

First Examiner's Marks	
Second Examiner's Marks	
Total	
Average	

APPLIED MATHEMATICS

AMAT 26552 – Scientific Computing using Appropriate Software I

No. of Questions: Five (05) **No. of Pages: Five (05)** **Time Allowed: Two (2) hrs**

Instructions to candidates

Programmable Calculators Are Not Allowed

Answer only **Four (04)** Questions. **Question 01** is **compulsory** and **THREE** other questions should be attempted from rest of the four questions.
You are **not allowed** to remove any page from this booklet.

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1. Answer **ALL** the following multiple-choice questions by writing the letter corresponding to the correct answer in the table provided below.
   Note: Only one letter can be written in each box for each question.
   [10 marks for each correct answer – Total for Question 1 is 100 marks]

Question No.	Answer
(i)	
(ii)	
(iii)	
(iv)	
(v)	

Question No.	Answer
(vi)	
(vii)	
(viii)	
(ix)	
(x)	

(i) Which of the following commands will correctly assign the value 25 to a variable x in MATLAB?

A. `let x = 25`
B. `x := 25`
C. `x == 25`
D. `x = 25;`
E. `assign x 25`

(ii) How can you create a row vector containing the numbers 1 through 5 in MATLAB?

A. `x = (1,2,3,4,5)`
B. `x = [1 2 3 4 5]`
C. `x = [1;2;3;4;5]`
D. `x = {1 2 3 4 5}`
E. `x = <1 2 3 4 5>`

(iii) Which command is used to generate a grid of coordinates for mesh or surface plots?

A. `grid(X,Y)`
B. `linspace(X,Y)`
C. `surf(X,Y)`
D. `meshgrid(X,Y)`
E. `coord(X,Y)`

Continued...

(iv) Which MATLAB function is used to prompt the user to enter a value during program execution?

A.`disp()`
B.`input()`
C.`fprintf()`
D.`fopen()`
E.`fzero()`

(v) What is the use of `fprintf()` in MATLAB?

A. Display formatted text
B. Open a file
C. Save a figure
D. Display variables without format
E. Generate a mesh plot

(vi) What is the purpose of the MATLAB command subplot(2,1,2)?

A. Divides the figure into 2 rows and 2 columns and selects position 1
B. Creates two figures in one window
C. Divides the figure into 2 columns and 1 row and selects position 2
D. Divides the figure into 2 rows and 1 column and selects position 2
E. Adds a subplot on top of a surface plot

(vii) What will be the output of the following MATLAB code?

```
x = 0;
while x < 3
    x = x + 1;
end
disp(x)
```

A. 0 B. 2 C. 3 D. 4 E. `Infinite loop`

(viii) What is the purpose of the end statement in MATLAB loops?

A. To exit the loop early
B. To indicate the end of a loop or control structure
C. To skip the next iteration
D. To define a function
E. To display output

(ix) In MATLAB, which function can be used for root finding?

A. `disp()`
B. `solve()`
C. `fzero()`
D. `diff()`
F. `Solutions()`

(x) Newton's method can be used to find critical points by applying it to:

A. The original function
B. The second derivative
C. The first derivative
D. The inverse function
F. The exponential

Continued...

2. The velocity $v(t)$ of a free-falling bungee jumper (with air resistance) is modeled by:

$$v(t) = \sqrt{\frac{mg}{c_d}} \tanh \sqrt{\frac{gc_d}{m}}\, t\,,$$

where m = mass (68.1 kg), g = gravity (9.81 m/s^2), c_d = drag coefficients ($0.25kg/m$), t = time 12 s.

(i) Write a function file to compute the velocity of the free-falling bungee jumper.
(ii) Write the corresponding script file to compute the velocity.
(iii) Modify your file using `input` and `disp` functions by defining input/output.
(iv) Extend your script file to obtain the acceleration of jumper.

3. The following structure allows you to execute a set of statements if a logical condition is true. Its general syntax is

```
if condition
    statements
end
```

The course module MATH 12345 is assessed using Six Quizzes, Three Class Tests and a Final Examination, and the final grade for the module is computed in the following manner:

- Quizzes: The grade of the lowest quiz is dropped and the average of the five quizzes with the higher grades constitutes 30% of the course grade.

- Class Tests and Final Exam: There will be three class tests and one final examination.

If the class tests average is higher than the final examination grade, the class tests average constitutes 50% of the course grade and final examination grade constitutes 20% of the course grade.
If the final exam grade is higher than the class tests average, the class tests average constitutes 20% of the course grade and final examination grade constitutes 50% of the course grade.

Write a MATLAB script file to complete the following task with the intension of determines the course grade for a student.

Task 01: Ask the user to enter the six quiz grades (in a vector), the three midterm grades (in a vector), and the grade of the final examination.
Task 02: Drop the lowest quiz grade and obtain the average of the five quizzes with highest grades.
Task 03: Obtain average of class tests and final examination.
Task 04: Assign letter grade according to the following key:

Grade	Numerical Score
A	90-100
B	80-89
C	70-79
D	60-69
E	00-59

Task 05: Display the course grade.

Continued...

4. (i) Starting on her 25th birthday, Mary deposits $2000 at the beginning of every year into a retirement annuity that pays 8% annual interest. She wants to retire when her annuity first reaches or exceeds $500,000. Write a script file to calculate the year that she would be able to retire under this plan.

   (ii) Write a script file that inputs following two matrices $[A]_{3\times3}$ and $[B]_{3\times3}$ and performs the following operations.

$$A = \begin{bmatrix} 12 & 4 & 7 \\ 8 & -2 & 5 \\ 10 & 14 & 7 \end{bmatrix} \qquad B = \begin{bmatrix} 4 & 6 & -8 \\ 8 & 3 & 9 \\ 11 & 2 & 6 \end{bmatrix}$$

   (a) Subtract A, B and store in P.
   (b) Take the element-wise multiplication of A, B and store in Q.
   (c) Take the element-wise left division of A, B and store in R.
   (d) Add a row vector $[5 \ -1 \ 7]$ to A and store in S.

5. Write a MATLAB function called `bisc_meth` to find a root of a continuous function $f(x)$ using the **bisection method**. Your function should have the following syntax:

```
[root, iterations] = bisc_meth(f, a, b, tol)
```

   Where:
   `f` is a function handle representing a continuous function.
   `a` and `b` are the initial interval endpoints such that `f(a)` and `f(b)` have opposite signs.
   `tol` is the desired absolute tolerance for the root (e.g., 0.001).
   `root` is the approximated root of the function.
   `iterations` is the number of iterations performed.

   Your code should construct under the following requirements:
   (i) Check that the function changes sign on `[a, b]`. If not, display an error.
   (ii) Use a **while loop** to continue halving the interval until the interval size is less than `tol`.
   (iii) Count and return the number of iterations.
   (iv) Display an appropriate error if the maximum number of iterations is exceeded.

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END