(b) An object is standing on a plane whose slope varies with constant velocity ω. After t seconds its position is **[4]**

$$s(\omega,t)=\frac{g}{2\omega^2}[\sinh(\omega t)-\sin(\omega t)]$$

where g = 9.8 m/s^2 denotes the gravity acceleration. Write a function script which takes in the values s and t and returns the value of ω using the *bisection method* with a tolerance of 10^{-5}. [given that $\omega_1 \le \omega \le \omega_2$]

6. (a) The motion of a damped spring-mass system is described by the following ordinary differential equation: **[4]**

$$m\frac{d^2x}{dt^2}+c\frac{dx}{dt}+kx=0$$

where x = displacement from the equilibrium position (m), t = time (s), m = 20 kg mass, and c = the damping coefficient (N.s/m). The damping coefficient c takes on three values of 5 (underdamped), 40 (critically damped), and 200 (over damped). The spring constant k = 20 N/m. The initial velocity is zero and initial displacement x = 1m. Solve this equation over the time period $0 \le t \le 15$ s. Plot the displacement versus time for each of the three values of the damping coefficient on the same plot with proper labeling.

(b) Write a Matlab program which executes the motion of small circle of radius (r) on the circumference of the circle of radius (R). **[4]**

P.T.O.

Total No. of Pages: 4 *Roll No. ....*

THIRD SEMESTER **B.Tech.[EP]**

SUPPLYMENTRY EXAMINATION ***(FEB.-2019)***

EP-201 INTRODUCTION TO COMPUTING (NEW SCHEME)

Time: 3 Hours ***Max. Marks: 40***

Note: Question No. 1. is compulsory. Attempt any four from rest. Use comment line in each program to write the script/function file name.

1. Following commands are written and saved in a Matlab script file. What will the output of this file in the command window? **[8]**

```
A =[2 4 7 8; 10 12 18 21; 3 5 7 9; 1 2 3 4];
B=reshape(A,8,2)
C=A.^2
floor([5.6 -3.5])
x=[ 11 15 17 20 ]; y=[ 10 12 40 55 ];
z= x >=y
```

2. (a) Explain the following commands with suitable examples **[4]**

i. save
ii. holdon
iii. figure
iv. mesh

(b) The capacitance of two parallel conductors of length L and radius r, separated by a distance d in air, is given by **[4]**

$$C=\frac{\pi\varepsilon L}{\ln\left(\frac{d-r}{r}\right)}$$

where ε is the permittivity of air ($\varepsilon = 8.854\times10^{-12}$ F/m).

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Write a script file that accepts user input for d, L, and r and computes and display the value of capacitance C with proper message including unit.

3. (a) The following table shows the time versus pressure variation reading from vacuum pump. Fit a curve, $P(t) = P_0 e^{-t/\tau}$, through the data and determine the unknown constants P_0 and τ. **[4]**

T	0	0.5	1.0	5.0	10.0	20.0
P	760	625	528	85	14	0.16

(b) Write a function file to print the first N terms of the famous Fibonacci series of thirteenth century in reverse order **[4]**

Fibonacci series: 1, 1, 2, 3, 5, 8, 13, 21, ………………

4. (a) The period of a pendulum confined in the vertical plane is **[4]**

$$T = 4\sqrt{\frac{l}{2g}}\int_0^{\theta_0}\frac{d\theta}{\sqrt{\cos\theta - \cos\theta_0}}$$

Where $\theta_0 < \pi$ is the maximum angle between the pendulum and the downward vertical, l is the length of the pendulum, and g is the gravitational acceleration. Evaluate the integral numerically using *trapezoidal method* for $\theta_0 = \frac{\pi}{16}$ and compare your result with small angle approximation $T \approx 2\pi\sqrt{\frac{l}{g}}$. (Do not use inbuilt function)

(b) Write a Matlab code to print the following in the command window **[4]**

```
1+1 =1
1+2=3
1+4=5
1+5=6
End of inner loop
2+1 =3
2+2=4
2+4 =6
2+5=7
End of inner loop
3+1 =4
3+2=5
3+4 =7
3+5=8
End of inner loop
End of outer loop
```

5. (a) In nuclear physics, the semi-empirical mass formula used to approximate the binding energy of an atomic nucleus is given by **[4]**

$$\frac{BE}{A} = a_\upsilon - a_s\frac{1}{A^{1/3}} - a_c\frac{z^2}{A^{4/3}} - a_a\frac{(N-Z)^2}{A^2} + a_p\frac{\delta}{A^{4/3}}$$

where $N = A - Z, a_\upsilon = 14.1, a_s = 13.0, a_c = 0.595, a_a = 19.0, a_p = 33.5$

$$\delta = \begin{cases} 1 \text{ if N is even and Z is even} \\ 0 \text{ if N is even and Z is odd} \\ 0 \text{ if N is odd and Z is even} \\ -1 \text{ if N is odd and Z is odd} \end{cases},$$

and for fixed mass number (A), the most stable nuclei are those having

$$Z = \frac{1}{2}A\frac{1}{1 + A^{2/3}\frac{a_c}{4a_a}}$$

The five terms in the right hand side of the first equation stands for volume, surface, Coulomb, asymmetry and pairing terms respectively. A, N and Z are mass, proton and neutron numbers respectively and hence they are integers. For $2 \le A \le 300$, plot BE/A versus A along with the five terms given in the first equations. Also find for which combination of N and Z, the BE/A is maximum.