

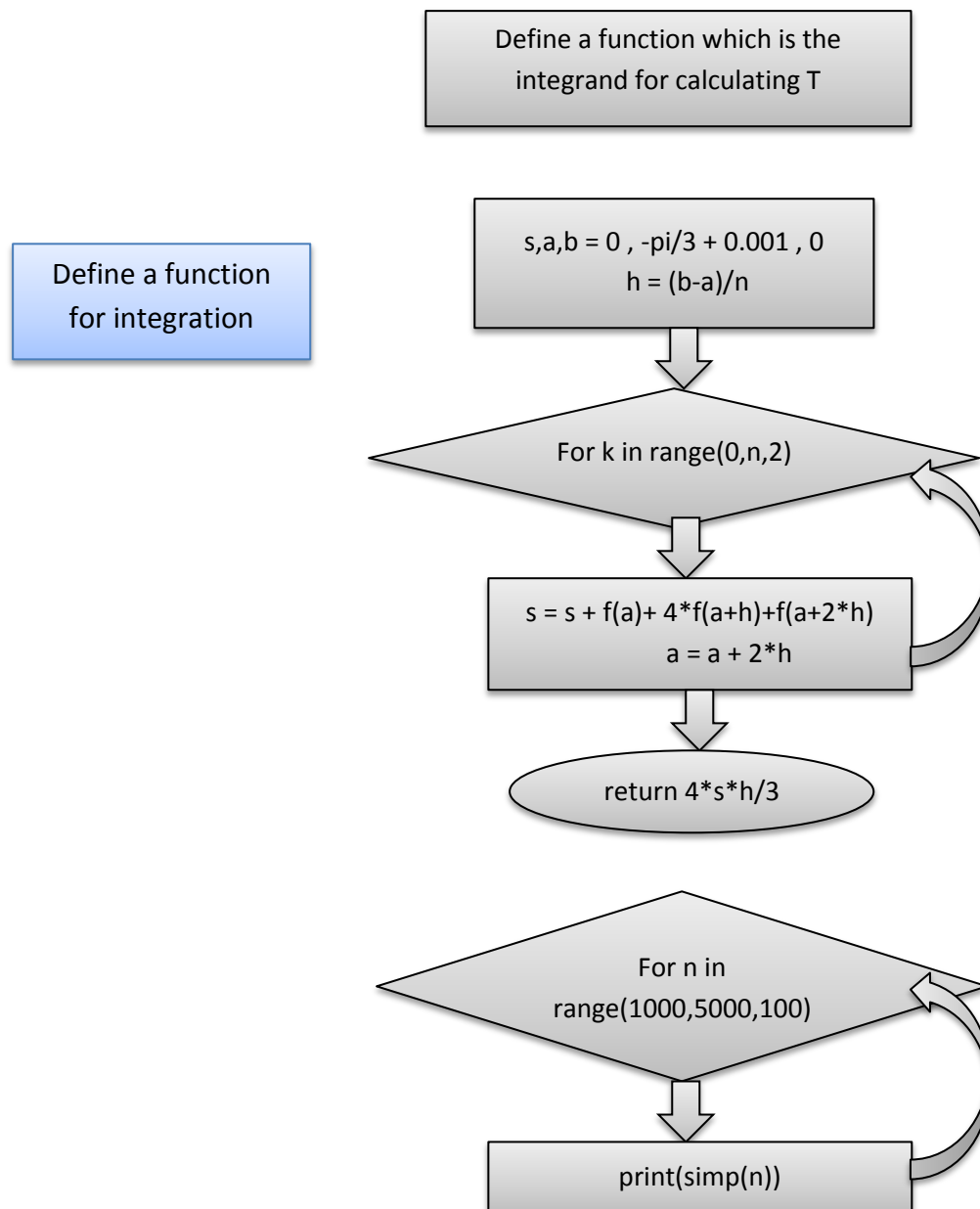
Assignment – 5 Integration(II)

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Problem – 1

Method :



Results :

we run a program for $\epsilon = 0.001$ and the value of n varying from 1000 to 5000 with an increment of 100 and got following output.

1000	2.0916637890245986
1100	2.091622042906285
1200	2.0915926971552663
1300	2.091571576932543
1400	2.091556063761286
1500	2.091544463938478
1600	2.0915356523389845
1700	2.091528863903967
1800	2.0915235675743546
1900	2.091519387882728
2000	2.0915160549504512
2100	2.0915133718791603
2200	2.0915111930548074
2300	2.091509409448526
2400	2.0915079384912594
2500	2.091506716994663
2600	2.091505696130898
2700	2.0915048378289405
2800	2.091504112154993
2900	2.0915034953893628
3000	2.091502968598252
3100	2.091502516564439
3200	2.09150212697863
3300	2.0915017898229746
3400	2.091501496898187
3500	2.0915012414564202
3600	2.0915010179160594
3700	2.0915008216379074
3800	2.0915006487477017
3900	2.091500495996119
4000	2.0915003606465254
4100	2.0915002403843808
4200	2.0915001332455785
4300	2.0915000375565707
4400	2.0914999518863935
4500	2.091499875008146
4600	2.0914998058655674

4700	2.091499743547271
4800	2.091499687264258
4900	2.091499636331248

Discussion and Conclusion :

From the result we can conclude that the time period of oscillation is almost constant(= 2.091) with varying n.

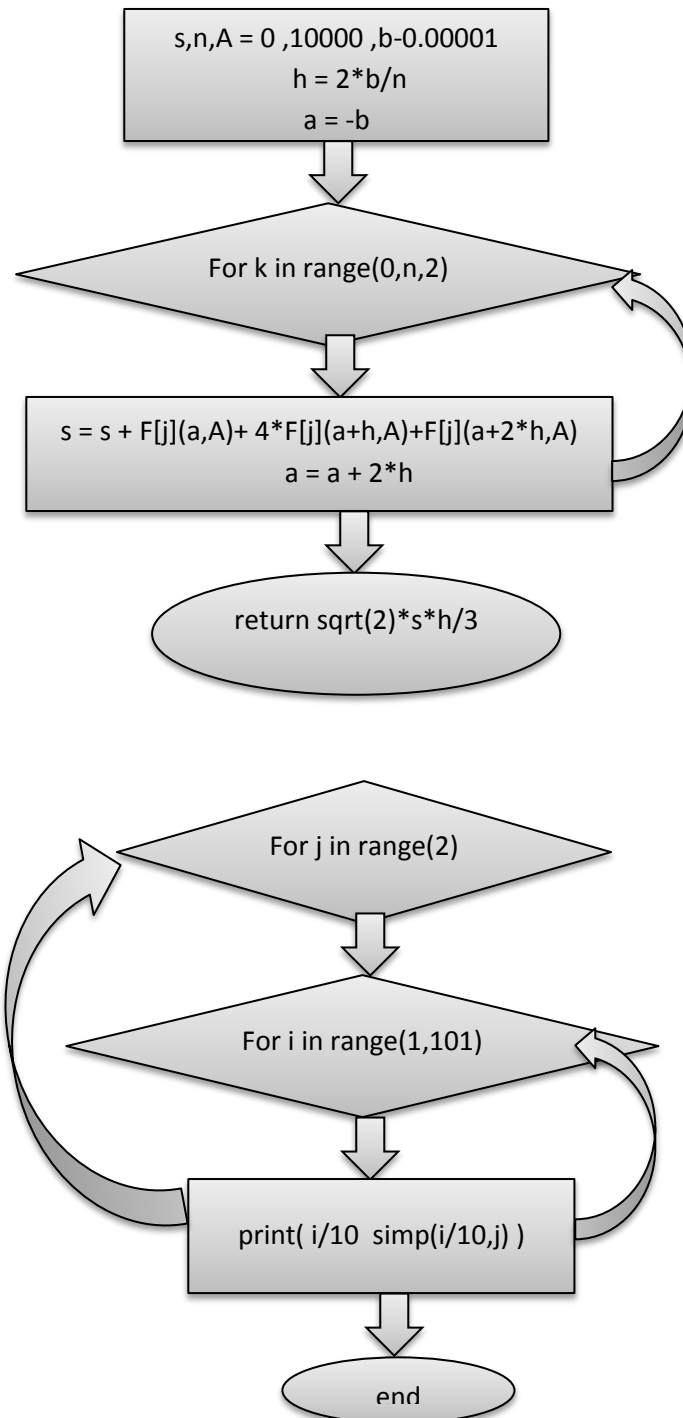
If the assumption of small angle is considered, the period of oscillation is given by 2.007.

Problem – 2

Method :

Define two separate functions
for integrand of given formula
for given potential function.
And make an array of functions

Define a function
for integration



Result :

We used simpson method to evaluate the integration for $n = 10000$ and $\epsilon = 0.00001$ and b varying 1 to 10 with an increment of 0.1.

We got following results :

0.1	3.1452178978676115
0.2	3.137862255736081
0.3	3.137915068491683
0.4	3.139069198696976
0.5	3.1404994494989094
0.6	3.1419921377705022
0.7	3.1434765234075943
0.8	3.1449270048437996
0.9	3.1463347646780346
1.0	3.147697822219316
1.1	3.149017086641681
1.2	3.1502946608855935
1.3	3.151533073411366
1.4	3.1527349229239654
1.5	3.153902715836296
1.6	3.1550387979221086
1.7	3.156145329339632
1.8	3.1572242845233216
1.9	3.1582774607079007
2.0	3.1593064918003932
2.1	3.16031286220409
2.2	3.161297923882298
2.3	3.1622629088152556
2.4	3.1632089415272984
2.5	3.164137052254685
2.6	3.1650481828714274
2.7	3.1659432023218144
2.8	3.166822908519856
2.9	3.1676880377567884
3.0	3.1685392733736233
3.1	3.1693772454174245
3.2	3.170202541631341
3.3	3.1710157056622283
3.4	3.171817248246779
3.5	3.1726076429715895
3.6	3.1733873320872035
3.7	3.1741567344231623
3.8	3.174916236299326
3.9	3.1756662072137853

4.0	3.176406990405996
4.1	3.1771389088905
4.2	3.1778622722406276
4.3	3.178577366264164
4.4	3.179284467322894
4.5	3.179983832835188
4.6	3.180675707825832
4.7	3.1813603263036416
4.8	3.182037907606897
4.9	3.182708664320112
5.0	3.1833727967121983
5.1	3.1840304911963906
5.2	3.184681933788356
5.3	3.1853272970607205
5.4	3.18596674523994
5.5	3.186600435908584
5.6	3.187228525303116
5.7	3.187851152808833
5.8	3.188468457794043
5.9	3.1890805764910977
6.0	3.1896876359101056
6.1	3.1902897562491597
6.2	3.1908870564956584
6.3	3.1914796515465134
6.4	3.1920676471042024
6.5	3.1926511475885255
6.6	3.1932302567868285
6.7	3.1938050737778734
6.8	3.1943756843300073
6.9	3.1949421844087174
7.0	3.195504662708277
7.1	3.1960631979235123
7.2	3.1966178725783876
7.3	3.1971687716905692
7.4	3.1977159620082602
7.5	3.198259519799983
7.6	3.1987995179343494
7.7	3.1993360274772265
7.8	3.1998691085462556
7.9	3.2003988287797074
8.0	3.200925254208953
8.1	3.2014484386448263
8.2	3.201968442685027
8.3	3.202485325779787

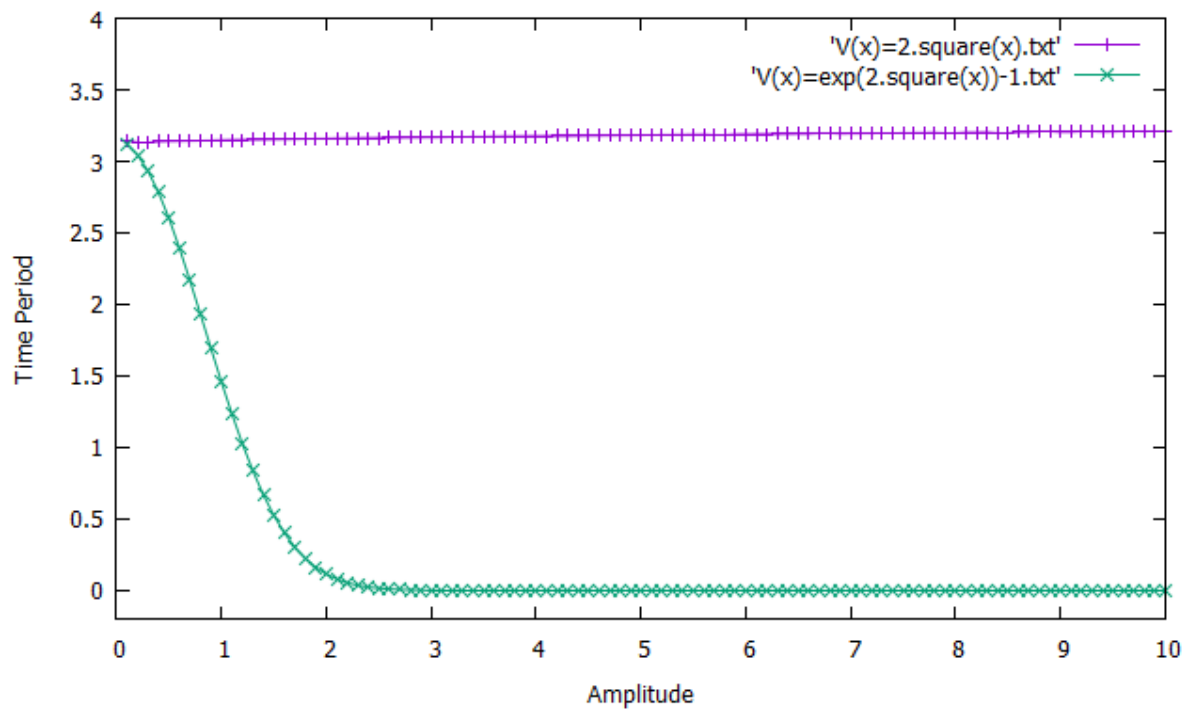
8.4 3.202999146689294
8.5 3.20350995007477
8.6 3.204017792784502
8.7 3.2045227289822873
8.8 3.2050248006959943
8.9 3.2055240593525713
9.0 3.2060205548809892
9.1 3.206514326042798
9.2 3.207005421902568
9.3 3.2074938821444294
9.4 3.207979753200679
9.5 3.208463069380443
9.6 3.2089438736335936
9.7 3.2094222076421417
9.8 3.2098981030092664
9.9 3.2103716020959983
10.0 3.210842739368207

0.1 3.121707811454686
0.2 3.0450923359940814
0.3 2.9328033157688473
0.4 2.7830374236497746
0.5 2.6008975738831825
0.6 2.3931409991916497
0.7 2.1672870773030084
0.8 1.9310941394075793
0.9 1.6921330488244288
1.0 1.4574256718766543
1.1 1.233146090609677
1.2 1.0243863774298092
1.3 0.8349917265672476
1.4 0.6674738948872059
1.5 0.5230134186120762
1.6 0.40155588572871315
1.7 0.3019952711039721
1.8 0.22242226967580872
1.9 0.16040410420200374
2.0 0.11325906521698896
2.1 0.07829461061254062
2.2 0.05298923188317464
2.3 0.03511118844261195
2.4 0.02277808838453364
2.5 0.014468332263875028
2.6 0.008998434630702453

2.7	0.005480013881995951
2.8	0.0032679979611269683
2.9	0.001908474580803764
3.0	0.0010914756635483317
3.1	0.0006113399014420303
3.2	0.0003353587285669106
3.3	0.00018018184883472738
3.4	9.482056855919775e-05
3.5	4.887636280345155e-05
3.6	2.4678225460236065e-05
3.7	1.2205647962299841e-05
3.8	5.913601002400084e-06
3.9	2.80672049633177e-06
4.0	1.3050084392098548e-06
4.1	5.944357152537323e-07
4.2	2.65267300923324e-07
4.3	1.159735810018196e-07
4.4	4.9675209036541766e-08
4.5	2.0846536228860933e-08
4.6	8.571355312868626e-09
4.7	3.452978613246562e-09
4.8	1.3629316693040445e-09
4.9	5.271044958121698e-10
5.0	1.9974140144255267e-10
5.1	7.416417450439213e-11
5.2	2.698240194839936e-11
5.3	9.61906352782271e-12
5.4	3.3601281067265793e-12
5.5	1.1501502983897626e-12
5.6	3.8577466487088704e-13
5.7	1.267936662142363e-13
5.8	4.083667419853644e-14
5.9	1.2888314423883671e-14
6.0	3.986012448638169e-15
6.1	1.2080407811532975e-15
6.2	3.5878017710113004e-16
6.3	1.0441971730789794e-16
6.4	2.9781529556887063e-17
6.5	8.323863399388219e-18
6.6	2.279918208356419e-18
6.7	6.119737044642972e-19
6.8	1.6097858553686176e-19
6.9	4.1498067519135424e-20
7.0	1.048369855224753e-20

7.1	2.5955561550929303e-21
7.2	6.297640424441137e-22
7.3	1.4974730055823406e-22
7.4	3.489602473541301e-23
7.5	7.969493895238333e-24
7.6	1.783714346918395e-24
7.7	3.9125645700801047e-25
7.8	8.41087507798917e-26
7.9	1.7720094665378827e-26
8.0	3.658792314268297e-27
8.1	7.403855934283898e-28
8.2	1.4683453116166456e-28
8.3	2.85397383142901e-29
8.4	5.436567315928292e-30
8.5	1.0149717478159453e-30
8.6	1.8571154121024564e-31
8.7	3.330281175474664e-32
8.8	5.853036685125531e-33
8.9	1.0081871354252254e-33
9.0	1.7020088160313779e-34
9.1	2.816075902207854e-35
9.2	4.566567871528015e-36
9.3	7.257709225436511e-37
9.4	1.1305098316615325e-37
9.5	1.7258985584453243e-38
9.6	2.5823988108001552e-39
9.7	3.787036025551486e-40
9.8	5.443078022628368e-41
9.9	7.667602293158555e-42
10.0	1.0586328423110154e-42

Graphs :



Discussion and Conclusion :

we used simpson method for evaluation as we know it is more reliable.

Here we used a function for huge range of amplitude so that we can conclude the trend precisely. As we can see from graph for $v(x) = 2 \cdot X^2$ the time period of oscillation is almost constant but for $v(x) = \exp(2 \cdot X^2) - 1$. The time period decreases with an increase in voltage.