UG/5th Sem/ELEC(H)/Pr/19

2019

B.Sc. (Honours)

5th Semester Examination

ELECTRONICS

Paper - DSE-1P

(Practical)

Full Marks : 20   Time : 3 Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.

Semi-conductor Fabrication
and Characterization

Answer any *one* question selecting by lucky draw.

1. Measure the resistivity of a given semiconductor material with temperature (30°C - 90°C) by four-probe method. Draw a graph : resistance versus temperature.

   Experiment : (Theory : 3, Execution : 9, Graph : 3)

[Turn Over]

2. Study the Hall effect of a semiconductor and determine the type of carrier and mobility.

   Experiment : (Theory - 3, Execution - 9, Results : Type I - 1, Mobility - 2)

3. Suppose we want to perform a dry-wet-dryoxidation sequence on a <100> silicon wafer at 1100°C for 5 minutes in dry O_2, 2 hours in wet O_2 and finally for 5 minutes in dry O_2. Use oxidation simulation process to determine the final oxidation thickness.

   Experiment : (Execution : 12, Results : 3)

4. Suppose we want to simulate the predeposition of boron into an n-type <100> silicon wafer at 850°C for 15 minutes. If the silicon substrate is doped with phosphorus at a level of 10^{16} cm^{-3}, use the diffusion process simulation to determine the boron doping profile. Plot the boron concentration as a function of depth into the silicon substrate.

   Experiment : (Execution : 12, Plot : 3)

5. Design a pattern using photolithographic process simulation.

   Experiment : 15

6. Draw a transmission spectrum of a given material and determine optical band gap.

Experiment : (Theory - 3, Execution - 9, Results - 3)

Distribution of Marks

Experiment	:	15 marks
Laboratory Note Book	:	02 marks
Viva-voce	:	03 makrs
Total	:	20 marks

[Turn Over]

Power Electronics

Full Marks : 20   Time : 3 Hours

Answer any *one* question selecting by lucky draw.

1. Plot the V-I characteristic of DIAC.

    (Experiment : Theory-3, Execution-9, Graph-3)

2. Plot the V-I characteristic of TIAC.

    (Experiment : Theory-3, Execution-9, Graph-3)

3. Plot the V-I characteristic of SCR. Measure latching and Holding current.

    (Experiment : Theory-3, Execution-7, Graph-3, Results-2)

4. Study and plot the V-I characteristic of MOSFET.

    (Experiment : Theory-3, Execution-9, Plot-3)

5. Plot the V-I characteristic of IGBT.

    (Experiment : Theory-3, Execution-9, Plot-3)

6. Design a half wave rectifier circuit using SCR with R_L load and study its output wave form.

    (Experiment : Theory-3, Execution-7, Graph-5)

Distribution of Marks

Experiment	:	15 marks
Laboratory Note Book	:	02 marks
Viva-voce	:	03 makrs
Total	:	20 marks

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Numerical Techniques

Full Marks : 20   Time : 3 Hours

Answer any *one* question selecting by lucky draw.

1. Write a program to find the root of $x^3 - x - 4 = 0$, using Bisection method upto accuracy of 0.001.

2. Write a program to solve a nonlinear equation using Newton-Raphson method.

3. Write a program to solve the following system :

$$2x_1 + 4x_2 - 6x_3 = -8$$

$$x_1 + 3x_2 + x_3 = 10$$

$$2x_1 - 4x_2 - 2x_3 = -12$$

Use Gauss-Jordan Elimination method.

4. Write a program to solve the following system of equations by Gauss-Seidel Iteration :

$$2x_1 + 3x_2 + 4x_3 = 5$$

$$3x_1 + 4.5x_2 + 5x_3 = 6$$

$$4x_1 + 5x_2 + 6x_3 = 7$$

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5. Write a program to evaluate the following using Simpson's 1/3 rule :

$$\int_0^2 \left(3x^3 + 2x^2 - 1\right) dx$$

6. Write a program to estimate $\int_0^1 \frac{dx}{1+x^2}$ using the Trapezoidal rule with n=4, and correct up to five decimal places.

7. Write a program to solve the differential equation $\frac{dy}{dx} = x + y$, $y(0) = 1$ by Euler Cauchy method to estimate y(1) using h = 0.5.

8. Write a program to estimate y(0.4) when $y'(x) = x^2 + y^2$ with y(0) = 0, h = 0.2 using the 4th-order Runge-Kutta method.

9. Write a program to compute a root of the following equation.

$$x^2 - 5x + 6 = 0$$

Using the Secant Method.

[Turn Over]

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10. Write a program to find the root of $\sin x - x + 2 = 0$, using Regula-falsi method.

Distribution of Marks

Experiment —

Writing of the program	:	5 marks
Execution	:	5 marks
Result	:	5 marks
Laboratory Note Book	:	02 marks
Viva-voce	:	03 makrs
Total	:	20 marks

Electrical Machines

Full Marks : 20   Time : 3 Hours

Answer any *one* question selecting by lucky draw.

1. Perform of open circuit and short circuit test on single phase transformer. Calculate the equivalent circuit parameters and loss calculation for the transformer. Also draw the equivalent circuit.

   (Experiment : Theory-3, Execution-9, Result-3)

2. Study of characteristics of DC series motor and draw characteristics of the series motor from the experimental results.

   (Experiment : Theory-3, Execution-9, Graph-3)

3. Perform a laboratory experiment and plot the graphs of the motor characteristics from the experimental data.

   (Experiment : Theory-3, Execution-9, Result-3)

4. Study of Load characteristics of single phase induction motor. Draw the characteristics and phasor diagram of the given machine from experimental data.

   (Experiment : Execution-8, Data-3, Graphs-4)

[Turn Over]

5. Study of Load characteristics of three phase squirrel cage induction motor. Draw the characteristics and phasor diagram of the given machine from experimental data.

(Experiment : Execution-8, Data-3, Graphs-4)

6. Perform an experiment on the speed control of shunt DC motor by using SCR. Draw the necessary diagrams and characteristics of the given experiment.

(Experiment : Execution-8, Data-3, Graphs-4)

7. Determine the equivalent circuit parameters of a single phase transformer from open circuit and short circuit tests. Compute the percentage regulations at 25% and full load for power factor of 1, 0.6 lag and 0.8 lead. Also find out the transformer efficiency at 75% and full load for power factor of 1, 0.8 lag and 0.6 lead. Plot the variation of efficiency with load VA for each power factor. Comment on the result.

(Experiment : Theory and circuit - 2+2, Data Recording - 3+3, Graph - 3, Comment - 1, Discussion - 1)

8. Study the torque-angular velocity characteristics of a seperately excited dc motor for at least two different

armature and field winding voltages including the rated value. Plot the graph (torque vs angular velocity). Comments on the derived result.

(Experiment : Theory and circuit - 2+2, Recording of Data - 3+3, Graph - 3, Comment - 1, Discussion - 1)

9. Obtain the torque-speed characteristics of a three phase squirrel cage induction motor for at least two different stator voltage and with V/F control for K = 0.5, 1.0 and any other values of K. Plot T-N_r characteristics graph for each case.

(Experiment : Theory and circuit - 2+2, Data Recording - 2+3, Graph - 5, Discussion - 1)

10. Determine the open circuit characteristics of a dc shunt generator and find out its critical resistance. Hence obtain the residual magnetism in field. Plot the external characteristics of a loaded dc shunt generator. Take two different values of I_a.

(Experiment : Theory and circuit - 2+2, Va vs I_F data and graph - 2+2, Va vs VSI$_L$ data and graph - 2+2, Critical resistance - 1, Residual magnetism - 1, Discussion - 1)

[Turn Over]

Distribution of Marks

Experiment	:	15 marks
Laboratory Note Book	:	02 marks
Viva-voce	:	03 makrs
Total	:	20 marks