SH-II/Electronics-201/C3/(PR)/19

B.Sc. 2nd Semester (Honours) Practical Examination, 2019

ELECTRONICS

(Semiconductor Devices Lab)

Paper : SH/ELC/201/C-3(P-3)

Course ID : 21721

Time: 2 Hours 30 Minutes **Full Marks: 15**

Perform *one* experiment

1. Draw the V-I characteristics of p-n junction diode. Hence find out the AC and DC resistances of the given diode.

2. Draw the V-I characteristics of the given Zener diode. Hence, find out the breakdown voltage of the diode.

3. Draw the output characteristics curves of the given BJT operating in CE mode (at least three). Hence, find out the values of β and r_o.

4. Draw the output characteristics curves of the given BJT operating in CB mode (at least three). Hence, find out the values of α and r_o.

5. Measure the variation of drain current (I_D) of the given JFET with the variation of drain-source voltage (V_{DS}) for at least three different values of gate-source voltage (V_{GS}). Take one $V_{GS} = 0V$. Represent your result graphically. Find out the approximate value of Pinch-off Voltage (V_P).

6. Perform an experiment to obtain the drain (or output) characteristics of the given n-channel enhancement type MOSFET. Hence, determine the output resistance and transconductance.

7. Perform an experiment to draw the V-I characteristics of the given UJT and calculate the Intrinsic-stand-off ratio.

8. Perform an experiment to obtain the V-I characteristics of the given SCR and hence find the ON state resistance of the given SCR. (Keep $I_g = 0$)

9. Perform an experiment to calculate the carrier concentration and mobility from the magnitude of Hall Voltage and the given experimental variables (i.e., magnetic field and sample resistance).

10. Perform and experiment to plot the I-V characteristics curve of a solar cell and identify the maximum power input, the short circuit current and the open circuit voltage.

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SH-II/Electronics-202/C4/19

B.Sc. 2nd Semester (Honours) Examination, 2019

ELECTRONICS

(Applied Physics)

Paper : SH/ELC/202/C-4(T-4)

Course ID : 21712

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the right hand side margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any three* of the following: 1×3=3

(a) Give the statement of Heisenberg's Uncertainty Principle.

(b) What is Compton's effect?

(c) What do you mean by matter waves?

(d) What is Fermi-level of energy?

(e) What is an ideal crystal?

(f) Draw T-S indicator diagram for a Thermodynamic process.

2. Answer *any three* of the following: 2×3=6

(a) Express Plank radiation formula in terms of frequency (γ) of the radiation.

(b) Write down the expression for probability distribution function for B-E and F-D statistics.

(c) What is packing fraction (f)? Write down the value of packing fraction in fcc (Face Centred Cubic) crystal lattice.

(d) What is 'Miller indices'? What is its importance?

(e) To study crystal structure why are ordinary light sources not used? What type of radiation is commonly used for this purpose?

(f) Give Clausious statement towards the second law of thermodynamics.

3. Answer *any two* of the following: 5×2=10

(a) On the basis of quantum theory define (i) Eigenfunction (ii) Eigenoperator and (iii) Eigenvalues, with proper examples. Give the probabilistic interpretation of the wave function $\Psi(x,t)$. 3+2=5

(b) Give the p-v indicator diagram for an (i) isothermal process and for an (ii) indicator adiabatic process. Hence derive the expression for efficiency of a Carnot's engine (η) from p-v indicator diagram. (1+1)+3=5

(c) Discuss energy band theory of solids based on Kronig-Penny model. 5

(d) Derive an expression for the perpendicular separation d_{kkl} between an identical set of parallel planes. How many types of Bravis lattices are there in an orthorhombic crystal? 4+1=5

4. Answer *any one* of the following: 6×1=6

(a) Briefly discuss Debye's theory of specific heat of solids at low temperature. What is electronic specific heat? 5+1=6

(b) Derive an expression for the energy of an electron in its *n*th orbit in "particle in a one-dimensional box" problem. Hence, find the expression of wave function Ψ at the same orbit. 4+2=6

(c) Write short notes on the following: 2+2+2=6

(i) Co-valent bond

(ii) Thermal conductivity

(iii) Resistivity of Metals

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SH-II/Electronics-202/C4/(PR)/19

B.Sc. 2nd Semester (Honours) Practical Examination, 2019

ELECTRONICS

(Applied Physics Lab)

Paper : SH/ELC/202/C-4(P-4)

Course ID : 21722

Time: 2 Hours 30 Minutes **Full Marks: 15**

Perform *any one* experiment from the following:

1. Perform an experiment to study the temperature variation of resistivity of the given Ge crystal by four-probe method. Vary the temperature from room temperature to 200°C (take at least five readings).

2. Experimentally study the forward (I-V) characteristics of the given semiconductor diode. Plot the graph with at least seven readings. Hence determine the value of Boltzman constant (k_B).

3. Determine the value of Planck's constant by using the given LED. Perform the experiment for at least 4 different wavelengths.

4. Measure the temperature variation of resistance of the given thermistor. Estimate the value of Energy Bandgap of the thermistor.

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SH-IV/ELC/401/C-8/T-8/19

B.Sc. 4th Semester (Honours) Examination, 2019

ELECTRONICS

(Operational Amplifiers and its Applications)

Paper : SH/ELC/401/C-8(T-8)

Course ID : 41711

Time: 1 Hour 15 Minutes **Full Marks: 25**

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

1. Answer *any three* from the following: 1×3=3

(a) Draw the pin configuration of IC741.

(b) List out the ideal characteristics of an OP-AMP.

(c) What do you mean by electronic filter?

(d) What is a Schmitt trigger?

(e) Define supply Voltage Rejection Ratio (SVRR).

(f) Why IC741 is not used for high frequency applications?

2. Answer *any three* from the following: 2×3=6

(a) What are difference mode and common mode gains? 1+1=2

(b) What is the output of each of the following IC regulators?

(i) 7806

(ii) 7905

(iii) 7818

(iv) 7924

(c) What is a current mirror and why is it called so?

(d) What is Multivibrator? Mention different types of Multivibrator. 1+1=2

(e) Draw pin diagram of IC555 and state the function of 'reset' pin. 1+1=2

(f) Explain ‘Virtual ground’ and ‘Virtual short’concept with reference to OP-AMP. 1+1=2

3. Answer *any two* from the following: 5×2=10

(a) Draw the circuit diagram of a first order Butter worth active high pass filter and derive its transfer function. 1+4=5

(b) What is an OP-AMP integrator? Draw the I/O waveforms of integrator for
  (i) step input signal
  (ii) square wave input signal
  (iii) sine wave input signal. List the applications of practical integrator. 1+3+1=5

(c) Explain the operation of a square wave generator using OP-AMP. Sketch the waveform across the capacitor and at the output. 3+(1+1)=5

(d) Design a first order active low pass filter for a high cut-off frequency of 2kHz and pass band gain of 2. 5

4. Answer *any one* from the following: 6×1=6

(a) Draw the block diagram of an Astable multivibrator using IC555 and derive an expression for its frequency of oscillation. 2+4=6

(b) Explain with neat circuit diagram of a sine wave oscillator using OP-AMP and derive the expression for frequency of Oscillation. 2+4=6

(c) Explain the working of logarithmic and antilogarithmic amplifiers using OP-AMP. 3+3=6

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SH-IV/ELC/401/C-8/P-8/(PR)/19

B.Sc. 4th Semester (Honours) Practical Examination, 2019

ELECTRONICS

(Operational Amplifiers and its Applications)

Paper : SH/ELC/401/C-8(P-8)

Course ID : 41721

Time: 2 Hours 30 Minutes **Full Marks: 15**

Perform *any one* from the following experiments:

1. (a) Study the following OP-AMP characteristics:

CMRR and slew rate

(b) Design an amplifier of given gain for an Inverting/Non-inverting configuration using an OP-AMP and show your result graphically.

(c) Design a three input OP-AMP Adder circuit and report your observations graphically.

(d) Design an Integrator circuit using OP-AMP and study its frequency response.

(e) Design a Differentiator using OP-AMP and study its frequency response.

(f) Design a first order low pass filter of give specification using OP-AMP and report your observations graphically.

(g) Design an Rc phase shift oscillator using OP-AMP and find its frequency of oscillation.

(h) Using IC555 Timer, experimentally verify the frequency of oscillation of an Astable Multivibrator.

(i) Design a Monostable Multivibrator using IC555 time and determine the time period of output waveform. Compare it with theoretical value.

(j) Design a Fixed Voltage power supply using IC regulators (using 78 series and 79 series).

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SH-IV/ELC/401/C-10/T-10/19

B.Sc. 4th Semester (Honours) Examination, 2019

ELECTRONICS

(Electronic Instrumentation)

Paper : SH/ELC/401/C-10(T-10)

Course ID : 41713

Time: 1 Hour 15 Minutes **Full Marks: 25**

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

1. Answer *any three* from the following questions: 1×3=3

(a) In an experiment, how many types of errors can arise? Name them.

(b) What do you mean by connectors and probes?

(c) How a galvanometer is converted into an ammeter and voltmeter?

(d) Why a very low resistance or a very high resistance cannot be measured accurately by wheatstone bridge with DC power supply?

(e) What are the balance conditions in a generalized AC wheatstone bridge?

(f) What is the function of time base circuit in a CRO?

2. Answer *any three* from the following questions: 2×3=6

(a) Draw the circuit diagram of a DC ammeter constructed from a PMMC-type galvanometer.

(b) How a CRO is used for measuring unknown frequences?

(c) Why Maxwell's impedance bridge is not suitable for the measurement of high Q-value self inductance(L) coil?

(d) Name one Audio Frequency oscillator. How Bark-housen criterion for oscillation is satisfied here?

(e) What is a thermocouple? What type of energy conversion does occur here?

(f) What is a strain gauge? Define gauge factor.

3. Answer *any two* from the following questions: 5×2=10

(a) Draw the circuit diagram of an AC voltmeter by using PMMC-type galvanometer and explain its operation. How a multirange voltmeter is constructed? 4+1=5

(b) Draw the circuit diagram of Anderson's AC bridge. Find the expression for the unknown self inductance(L) of a coil at the balance condition of the impedance bridge. 2+3=5

(c) Draw the block diagram of a CRO. Discuss the function of each block. 2+3=5

(d) How capacitors are used for making a transducer? What quantity can be used for the purpose of measurement by such type of transducer? 3+2=5

4. Answer *any one* from the following questions: 6×1=6

(a) Draw a neat sketch and explain the working principle of an LVDT. 2+4=6

(b) How magnetic field be used for producing deflection of electron beam in a CR Tube? Hence derive an expression for "megnatic deflection sensitivity". 2+4=6

(c) Draw a neat circuit diagram of schering bridge. Derive an expession for the unknown capacitance at the balance condition of the above mentioned bridge. 2+4=6

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SH-IV/ELC/401/C-10/P-10/(PR)/19

B.Sc. 4th Semester (Honours) Practical Examination, 2019

ELECTRONICS

(Electronics Instrumentation)

Paper : SH/ELC/401/C-10(P-10)

Course ID : 41723

Time: 2 Hours 30 Minutes **Full Marks: 15**

Perform *any one* experiment from the following:

(a) Design a voltmeter of three ranges (0V–10V, 0–20V and 0–50V) by selecting three different values of resistances and connecting them in series with the given galvanometer. Lable the designed voltmeter accordingly.

(b) Design an ammeter of three ranges (0–10mA, 0–50mA and 0–100mA) by selecting different values of resistances and connecting them in parallel(shunt) with the given galvanometer and label the designed ammeter accordingly.

(c) With the given 'Kelvin double bridge' set up, connect the unknown small resistance (R×) at the marked pointer. Hence obtain the balance condition of the bridge to determine the unknown small resistance.

(d) Plot the variation of voltage drop across the given thermistor with the variation of temperature for different fixed value of circuit current. Report your observations graphically. Take at least three different circuit currents.

(e) Perform an experiment to study and verify the characteristics of RTD.

(f) Perform an experiment to study and verify the characteristics of Thermocouple.

(g) Perform an experiment to measure an unknown resistance by wheatstone bridge.

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SH-IV/ELC/405/SEC-2/19

B.Sc. 4th Semester (Honours) Examination, 2019

ELECTRONICS

(Design and Fabrication of Printed Circuit Board)

Paper : SH/ELC/405/SEC-2

Course ID : 41715

Time: 2 Hours **Full Marks: 40**

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

1. Answer *any five* from the following: 2×5=10

(a) What are the essential components of a printed circuit board?

(b) Enlist few etchant solutions.

(c) What is photoprocessing?

(d) What is screen printing?

(e) What are SMT components? How are they different from ordinary components?

(f) What do you mean by drilling?

(g) What are the sources of pollutions in a PCB plant?

(h) What do you mean by soldering? How many types of soldering are there?

2. Answer *any five* from the following: 4×5=20

(a) What do you mean by copper clad Laminates? What are its important ingredients? 2+3=5

(b) State and explain Faraday's laws of electrolysis. 2+3=5

(c) What do you mean by inorganic and organic fluxes? Mention the desirable properties of fluxes. 2+3=5

(d) What do you mean by electrolytic process? Explain the process in brief. 2+3=5

(e) What is electroless plating? Explain in brief electroless gold plating. 2+3=5

(f) What are photo resists? Mention their types. What are their uses in PCB manufacturing process? 1+2+2=5

3. Answer *any one* from the following: 10×1=10

(a) Give an account of the pollution in PCB industries in detail. How can they be checked? 8+2=10

(b) Explain the following properties of copper clad Laminates: Insulation resistance, Dissipation factor, Dielectric loss, Flexural strength, Water absorption capacity. 2+2+2+2+2=10

(c) Explain the steps normally followed in the design and fabrication process of a single sided printed circuit board. 10

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SH-IV/ELC/401/C-9/T-9/19

B.Sc. 4th Semester (Honours) Examination, 2019

ELECTRONICS

(Signals of Systems)

Paper : SH/ELC/401/C-9(T-9)

Course ID : 41712

Time: 1 Hour 15 Minutes **Full Marks: 25**

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

1. Answer *any three* from the following questions: 1×3=3

(a) Give one example each of 'continuous time signal' and 'discrete time signal'.

(b) What is a periodic and an aperiodic signal?

(c) "A signal cannot behave both as an energy signal and a power signal"—explain it.

(d) Give the definition of Deterministic and Random signals.

(e) What is a 'Unit step function? What is its utility in signal analysis?

(f) What are Continuous time or Discrete time Linear Time Invariant (LTI) systems?

2. Answer *any three* from the following questions: 2×3=6

(a) What is complex exponential Fourier series? Hence define complex Fourier co-efficients.

(b) Draw the block diagram of a Linear Time Invariant (LTI) system through which any input signal can be transmitted either by F.T or by IFT.

(c) Given that $g(t) \rightleftharpoons G(f)$.

Find the area under the function *G(f)*, when $g(t) = e^{-t \cdot u(t)}$, *u(t),* is a unit step function.

(d) Define convolution theorem between two signals which are Fourier Transformable and simultaneously Inverse Fourier Transformable.

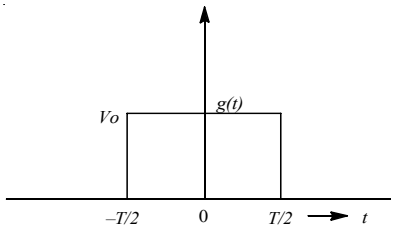
(e) When a function is not expansionable in terms of Fourier series but Fourier Transformable?

(f) What is the difference between Laplace Transform and Fourier Transform?

3. Answer *any two* from the following questions: 5×2=10

(a) Find the Fourier Transform of a decaying exponential pulse by using unit step function. Draw the amplitude spectrum and phase spectrum in frequency domain. 3+1+1=5

(b) Using 'Fourier Transformation' method, obtain the spectrum of the given single pulse of duration '*T*'. 5



(c) Using 'Fourier Series' method, obtain the expression of the different harmonics of a half wave rectifier output waveform. 5

(d) Prove the duality and conjugate property of signals. i.e. if

$g(t) \rightleftharpoons G(f)$ then $G(t) \rightleftharpoons g(-f)$ and $g^*(t) \rightleftharpoons G^*(-f)$ respectively, by Fourier Transformation method, where the symbols have their usual meanings. 2½+2½=5

4. Answer *any one* from the following questions: 6×1=6

(a) Find the Fourier Series for the given function defined by

$$f(t) = \frac{1}{2}a \text{ for } 0 \le t \le \frac{T}{2}$$

$$= -\frac{1}{2}a \text{ for } \frac{T}{2} \le t \le T$$

(b) Write short notes on: 2+2+2=6

(i) Causality

(ii) Stability

(iii) Invariability

(c) (i) Find the Laplace Transformation of the function $f(t) = \sin(at)$.

(ii) Derive Inverse Laplace Transformation of the function $f(s) = \frac{1}{S-a}$.

(iii) What is the main advantage of Laplace Transformation technique?

2+2+2=6

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SH-IV/ELC/401/C-9/P-9/(PR)/19

B.Sc. 4th Semester (Honours) Practical Examination, 2019

ELECTRONICS

(Signals and Systems)

Paper : SH/ELC/401/C-9(P-9)

Course ID : 41722

Time: 2 Hours 30 Minutes **Full Marks: 15**

Use MATLAB/SCILAB to perform *any one* of the following experiments:

1. Generation of continuous time signals: Unit Impulse, Unit Step, Unit Ramp, Exponential Signal, Sinusoidal Signal, Random Signal.

2. Generation of discrete time signals: Unit Impulse, Unit Step, Unit Ramp, Exponential Signal, Sinusoidal Signal, Random Signal.

3. Generation of Time shifted and Time scaled signal of Sine wave and Exponential waves in continuous and discrete domain.

4. Convolution of two sequences.

5. Find the Laplace Transform of the following:

(i) $f(t) = 5\cos(\omega t) + 4\sin(\omega t)$

(ii) $f(t) = e^{3t}u(-t) - e^{t}u(t)$

6. Find the Inverse Laplace Transform of the following:

(i) $I = (3S+4)/(S^2+4S)$

(ii) $I = (S+3)/(S(S+1)(S+2))$

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SH-II/Electronics-201/C3/19

B.Sc. 2nd Semester (Honours) Examination, 2019

ELECTRONICS

(Semiconductor Devices)

Paper : SH/ELC/201/C-3(T-3)

Course ID : 21711

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the right hand side margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any three* of the following: 1×3=3

(a) What is reverse Saturation Current?

(b) What is doping?

(c) Size of the collector region of transistor is larger than emitter. —Why?

(d) Why is BJT called a Current Controlled Device?

(e) Write the full form of MESFET and IGBT.

(f) Give the symbol of Tunnel diode and Varactor diode.

2. Answer *any three* of the following: 2×3=6

(a) Differentiate between drift and diffusion currents.

(b) Among CB, CE and CC configuration, which one is most popular and why?

(c) Write down the Einstein relationship in Semiconductor Physics and mention its significance.

(d) Differentiate between *n* and *p*-channel JFETs.

(e) What is Tunneling phenomenon? Mention two applications of Tunnel diode.

(f) What is Zener breakdown?

3. Answer *any two* of the following: 5×2=10

(a) A transistor has $I_E = 10mA$ and $\alpha = 0{\cdot}98$. Find the value of base and collector currents. The symbols have their usual meanings. 2½+2½=5

(b) Show with a diagram, the different current components in a p-n-p transistor with emitter-base junction forward biased and collector-base junction reverse biased. 2+3=5

(c) Explain the construction and V—I characteristics of a DIAC. 2+3=5

(d) Define mobility, current density and conductivity of a semiconductor. Establish the relation between mobility and conductivity. 3+2=5

4. Answer *any one* of the following: 6×1=6

(a) Draw the circuit diagram of an n-p-n transistor in CE configuration and explain its input and output characteristics. 2+(2+2)=6

(b) Derive ideal diode current equation. 6

(c) What is Hall effect? Show that Hall coefficient, $R_H = \frac{1}{Pe}$, where P signifies concentration of charge carrier and e is the charge. 1+5=6

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