SH-I/ELC/101/C-1/19

B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

Course ID : 11711 **Course Code : SH/ELC/101/C-1**

Course Title : Basic Circuit Theory and Network Analysis

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* of the following questions: 1×3=3

(a) What are linear circuit elements?

(b) What do you mean by 'Branch' of an electrical network?

(c) Define 'cycle' of an alternating voltage.

(d) Draw the frequency response curve of an RLC Series Circuit.

(e) What are the three types of power used in ac circuit?

(f) What is meant by steady state value of a response?

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

(a) What do you mean by ideal current source? Draw its I-V characteristics.

(b) Define 'peak value' and 'effective value' of an alternating quantity.

(c) Draw the phasor diagram of series R-L circuit.

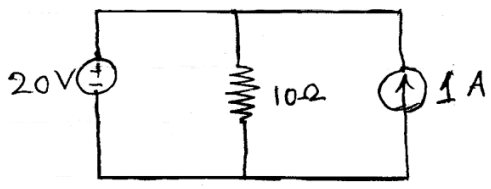
(d) What is an Impedance Triangle?

(e) For purely resistive circuit excited by a sinusoidal varying voltage, what are the phase angle and power factor?

(f) The resistance of two wires is 25Ω when connected in series and 6Ω when connected in parallel. Calculate the resistance of each wire.

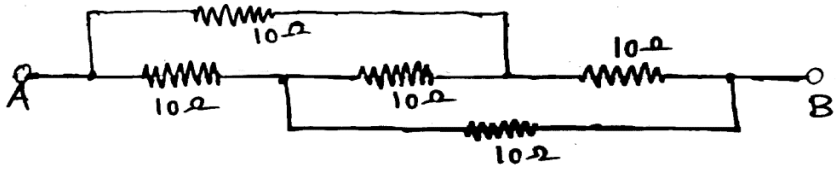
3. Answer *any two* of the following questions: 5×2=10

(a) State Superposition theorem. Determine the current through 10Ω resistor using this theorem. 2+3=5

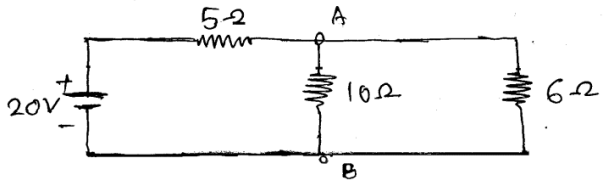


(b) Derive the transient response of series RL circuit with DC input. Sketch the variation of current and voltage across the inductor. 3+1+1=5

(c) Calculate the resistance between the terminals A–B.



(d) Using Norton's Theorem, find the current through 10Ω resistor for the given network. 5

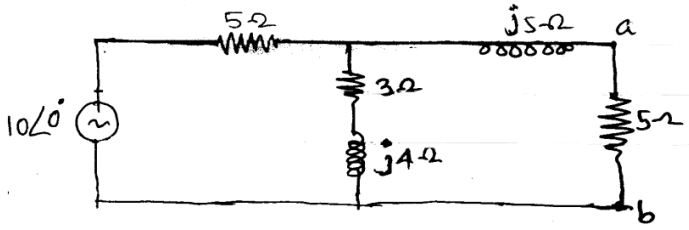


4. Answer *any one* of the following questions: 6×1=6

(a) What are Z-parameters and Y-parameters? Derive the expression for Z-parameters in terms of Y-parameters. 2+4=6

(b) An RLC Series Circuit consists of R = 16Ω, L = 0·5mH and C = 2μF. Calculate the Quality factor (Q) at resonance, bandwidth and half power frequencies. 2+2+2=6

(c) Find the current through the branch a–b of the given network using Thevenin's theorem.



SH-I/ELC/102/C-2/19

B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

Course ID : 11712 **Course Code : SH/ELC/102/C-2**

Course Title : Mathematics Foundation for Electronics

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* of the following questions: 1×3=3

(a) What is Cauchy's integral theorem?

(b) Give the definition of beta function $[\beta(m,n)]$.

(c) Give an example of row matrix.

(d) What is a simple pole? Give one example of it.

(e) When a differential equation is called a linear equation?

(f) Give one application of Laplace Theorem.

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

(a) Obtain the polar representation of any complex function $f(z)$, where $f(z) = z = x + iy$.

(b) What is removable singularity? Give one example of it.

(c) What is a partial differential equation? Give one example of it.

(d) Show that a square matrix *A* and its transpose have the same eigenvalues.

(e) Prove that $\frac{m+n}{m}\beta(m+1,n) = \beta(m,n)$.

(f) Show that $v(x,y) = 3x^2y - y^3$ is a harmonic function.

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

(a) Using the method of separation of variables find general solution of the equation

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}.$$

(b) Find the eigenvectors and the eigenvalues of the given matrix

$$A = \begin{pmatrix} 5 & -3 \\ -6 & 2 \end{pmatrix}.$$

(c) (i) Locate and name all the singularities of

$$f(z) = \frac{z^8 + z^4 + 2}{(z-1)^3(3z+2)^2},$$

in the finite z plane, where 'z' is complex.

(ii) Find the points where *C–R* equations are satisfied for the function

$$f(z) = w(x,y) = u(x,y) + iv(x,y) = xy^2 + ix^2y.$$ 2½+2½=5

(d) Considering the value of $\Gamma\left(\frac{1}{2}\right) = \frac{\sqrt{\pi}}{2}$, plot the graph of the gamma function for $n = -\infty$ to $+\infty$.

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

(a) Show that

$$\Gamma\left(n + \frac{1}{2}\right) = \frac{\Gamma(2n+1)\Gamma\left(\frac{1}{2}\right)}{2^{2n}\left(\Gamma(n+1)\right)}$$

(b) Constract the recurrence relation by solving the given differential equation using "*Frobenius*" power series method.

$$(1-x^2)\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 0.$$

(c) State Cauchy's integral formulae and apply it to find the integral

$$I = \int_C \frac{z^2 - z + 1}{(z-1)}\,dz,$$

where C is the circle for $|z| = 1$.

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SH-I/Electronics-103/GE-1(T)/19

B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

Course ID : 11714 **Course Code : SH/ELC-103/GE-1(T)**

Course Title: Electronic Circuits and PCB Designing

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

The figures in the right hand side margin indicate 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 depletion region in pn-junction?

(b) What are PCBs?

(c) Why is BJT is called current controlled device?

(d) What is an operating point?

(e) What is an amplifier?

(f) What is a filter?

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

(a) Why an ordinary transistor is called bipolar?

(b) How are amplifiers classified according to the transistor configuration? Name them.

(c) State Superposition theorem.

(d) What is the need for transistor biasing?

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

(f) What do you mean by Copper Clad Laminates?

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

(a) What is a layout of a PCB? Enlist general rules for preparing a PCB layout.

(b) What are the various methods of biasing of a transistor? Describe the potential divider biasing circuit in detail.

(c) Show with a diagram the different current components in an n-p-n transistor with emitter-base junction forward biased and collector-base junction reverse biased.

(d) Give the relationship between α, β and γ of a transistor.

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

(a) Draw the circuit diagram of an npn-transistor in CE configuration and explain its output characteristics.

(b) What do you understand by ac and dc load time? How will you construct them on output characteristics?

(c) What is ripple factor? Prove that ripple factor of half wave rectifier is 1·21.

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B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

Course ID : 11714 **Course Code : SH/ELC-103/GE-1(T)**

Course Title: Digital System Design

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

The figures in the right hand side margin indicate 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) Define Radix.

(b) What is Logic gate?

(c) Why is a hexadecimal number system called as an alpha numeric number system?

(d) What are the two forms of Boolean expression?

(e) What is meant by Karnaugh map?

(f) Write the characteristic equation of a JKflip-flop.

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

(a) Give two major differences between combinational and sequential logic.

(b) Which gates are called as the universal gates? What are their advantages?

(c) Define Fan-in and Fan-out.

(d) State De Morgan's theorem

(e) Write an expression for barrow and difference in a full subtractor circuit.

(f) How do you eliminate the race around condition in a JK flip-flop?

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

(a) Express the function $Y = A + \bar{B}C$ in canonical POS.

(b) Realize the Boolean function using appropriate multiplexer $F(A, B, C) = \sum(0, 1, 3, 7)$.

(c) Perform the following:

(i) $(9F.5C)_{16} = (?)_8$

(ii) $(1011011)_2 = (?)_{10}$

(iii) $(689.04)_{10} = (?)_8$

(iv) $(567)_8 = (?)_2$

(v) $(76.45)_{10} = (?)_{16}$

(d) What is a multiplexer? Draw the logic diagram of a 4 line to 1 line multiplexer.

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

(a) What is a half subtractor? Draw its truth table. Design a half subtractor using NAND gates only.

(b) Perform the following:

(i) $(-5)_{10} + (4)_{10}$ using 1's complement method.

(ii) $(13)_{10} - (20)_{10}$ using 2's complement method.

(c) Draw RS flip-flop circuit and explain its operation with truth table. Suggest how to eliminate the undetermined state.

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B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

Course ID : 11714 **Course Code : SH/ELC-103/GE-1(T)**

Course Title: Communication Systems

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

The figures in the right hand side margin indicate 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) Plot the frequency spectrum of single tone AM system.

(b) Define Pulse Amplitude Modulation (PAM).

(c) Mention two advantages of digital communication system.

(d) What is demodulation?

(e) How many side bands are there in FM?

(f) Write the full form of ASK and FSK.

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

(a) What is the need of modulation in communication system?

(b) Define modulation index for AM and write its formula's in terms of V_{max} and V_{min}.

(c) State two advantages of FM over AM.

(d) What is Carson's rule?

(e) Differentiate between Narrowband and wideband FM.

(f) What is Signal to Noise Ratio?

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

(a) The equation of an angle modulated voltage is $V = 20\sin[5 \times 10^8 t + 4\sin 500t]$. Find

(i) the carrier frequency

(ii) modulating frequency

(iii) modulation index

(iv) maximum deviation

(v) power dissipated in 10Ω resistor.

(b) Explain the working of TDM system with necessary block diagram.

(c) State and prove Sampling theorem for band limited signals.

(d) Explain direct method of generation of FM signal using a varactor diode.

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

(a) With a neat block diagram, explain the concept of PCM.

(b) Explain the following: Short noise, Thermal noise, White noise, Noise figure.

(c) Explain the operation of envelop detector with neat diagram and waveform.

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B.Sc. 1st Semester (Honours) Examination, 2019-20

ELECTRONICS

Course ID : 11714 **Course Code : SH/ELC-103/GE-1(T)**

Course Title: Instrumentation

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

The figures in the right hand side margin indicate 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) Define transducer.

(b) What is a multimeter?

(c) What is Aquadag?

(d) What are the precautions taken while using a DC voltmeter?

(e) Why an ammeter should have a low resistance value?

(f) What is piezoelectric effect?

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

(a) Define "indicating instruments" and "recording instruments". Give examples of each case.

(b) How do you extend the range of an Ammeter?

(c) Define the sensitivity of a strain gauge.

(d) What do you mean by loading effect?

(e) What are active and passive transduces? Give examples.

(f) What are the shunts and multiplier?

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

(a) Describe the operation of Shunt type ohmmeter with the help of a schematic diagram.

(b) Explain how PMMC instrument can be used as a voltmeter.

(c) Explain the working principle of strain gauge. Derive its gauge factor.

(d) Define a data acquisition system. Draw the functional block diagram of a typical DAQ.

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

(a) Describe briefly how the following measurements can be made with the use of CRO:

(i) Frequency

(ii) Voltage

(b) Design a single range d.c. milliammeter using basic movement with an internal resistance $R_m = 30$ Ohm and a full deflection current $I_m = 1mA$. Range is 0-10mA.

(c) Explain the operation of LVDT with a diagram. List its applications.

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SH-I/ELC/101/C-1(PR)/19

B.Sc. 1st Semester (Honours) Practical Examination, 2019-20

ELECTRONICS

Course ID : 11721 **Course Code : SH/ELC/101/C-1(P)**

Course Title : Basic Circuit Theory and Network Analysis (Practical)

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

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

1. Design a circuit and experimentally verify Kirchoff's Current Law (KCL).

2. Design a circuit and experimentally verify Kirchoff's Voltage Law (KVL).

3. Experimentally verify Thevenin's theorem using a given resistive network and a dc voltage source.

4. Experimentally verify Superposition theorem using a given resistive network and two dc voltage sources.

5. Experimentally verify Maximum Power Transfer theorem using a dc voltage source.

6. Perform an experiment to study the frequency response of a series LCR circuit and determine its

(i) Resonant Frequency

(ii) Quality factor

7. Calibrate the horizontal axis of a CRO with different time base (at least two). Hence find out the frequency of a given unknown signal from these calibration curves.

8. Calibrate the vertical axis of a CRO with different volts/div. (at least two). Hence find out the amplitude of a given unknown signal from these calibration curves.

9. Using the given experimental set up measure the variation of phase difference of the given R-C phase shift network with the variation of signal frequency and report your observations graphically. Compare the experimental result with the theoretical prediction.

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SH-I/Electronics-102/C-2(PR)/19

B.Sc. 1st Semester (Honours) Practical Examination, 2019-20

ELECTRONICS

Course ID : 11722 **Course Code : SH/ELC/102/C-2(P)**

Course Title : Mathematics Foundation for Electronics (Practical)

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

1. Solve the following system of equations using Cramer's rule and verify your answer with MATLAB.

(a) $-x_1 + 2x_2 - 3x_3 + 5x_4 = 14$

$x_1 + 3x_2 + 2x_3 - x_4 = 9$

$3x_1 - 3x_2 + 2x_3 + 4x_4 = 19$

$4x_1 + 2x_2 + 5x_3 + x_4 = 27$

(b) $x_1 - 2x_2 + x_3 = -4,\ -2x_1 + 3x_2 + x_3 = 9,\ 3x_1 + 4x_2 - 5x_3 = 0.$

2. For the system of equations compute the unknown x_1, x_2 and x_3 using matrix inverse method and verify your answers using MATLAB.

$2x_1 + 3x_2 + x_3 = 9,\ x_1 + 2x_2 + 3x_3 = 6, 3x_1 + x_2 + 2x_3 = 8.$

3. Solve the following system of equations using Gaussian-Elimination method and verify your answers with MATLAB.

$-x_1 + 2x_2 - 3x_3 + 5x_4 = 14$

$x_1 + 3x_2 + 2x_3 - x_4 = 9$

$3x_1 - 3x_2 + 2x_3 + 4x_4 = 19$

$4x_1 + 2x_2 + 5x_3 + x_4 = 27$

4. Solve the following first order ordinary differential equations and verify your result with MATLAB (*any one*).

(i) $4\frac{dx}{dt} + 3x = 1$, with initial condition $x\,(0) = 3$

(ii) $4\frac{dx}{dt} + 3x = 1$, with initial condition $x\,(1) = 2$

(iii) $4\frac{dx}{dt} + 3x = t^2 + \cos t$

(iv) $4\frac{dx}{dt} + 3x = t^2 + \cos t$, with initial condition $x(0)=3$.

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SH-I/Electronics-103/GE-1/(P)/19

B.Sc. 1st Semester (Honours) Practical Examination, 2019-20

ELECTRONICS

Course ID : 11724 **Course Code : SH/ELC-103/GE-1(P)**

Course Title: Electronic Circuits and PCB Designing

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

The figures in the right hand side margin indicate marks.

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

The questions are of equal value.

Perform *any one* experiment from the following:

1. Experimentally verify Thevenin's theorem using the given resistive network and one dc voltage source.

2. Experimentally verify Superposition theorem using the given resistive network and two dc voltage sources.

3. Experimentally verify Maximum Power Transfer theorem for a dc voltage source.

4. Using the given experimental set up, measure the variation of the output d.c. voltage across a suitable resistor with the variation of the input a.c. (r.m.s.) voltage of a half-wave rectifier. Repeat the experiment with a capacitor filter. Represent your observation graphically.

5. Using the given experimental set up, measure the variation of the output d.c. voltage across a suitable resistor with the variation of the input a.c. (r.m.s.) voltage of a full-wave rectifier. Repeat the experiment with a capacitor filter. Represent your observation graphically.

6. Using the given experimental set up of a half-wave rectifier with capacitor filter, measure the variation of the output d.c. voltage and a.c. ripple voltage with the variation of the load resistor. Hence, graphically plot the ripple factor of the given rectifier as a function of the load resistor.

7. Using the given experimental set up of a full-wave rectifier with capacitor filter, measure the variation of the output d.c. voltage and a.c. ripple voltage with the variation of the load resistor. Hence, graphically plot the ripple factor of the given rectifier as a function of the load resistor.

8. Perform an experiment to study the voltage regulation characteristics of a Zener diode based power supply circuit.

9. Draw the family of output characteristics curves of a BJT operating in CE mode. Hence, find out transistor β.

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B.Sc. 1st Semester (Honours) Practical Examination, 2019-20

ELECTRONICS

Course ID : 11724 **Course Code : SH/ELC-103/GE-1 (P)**

Course Title: Digital System Design

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

The figures in the right hand side margin indicate marks.

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

The questions are of equal value.

Perform *any one* experiment from the following:

1. Design AND, OR, NOT and XOR gates using NAND gates only and verify their truth tables.

2. Design AND, OR, NOT and XOR gates using NOR gates only and verify their truth tables.

3. Build a Flip-Flop Circuit (RS/Clocked RS/D-type) using gates and verify their truth tables.

4. Design a Half Adder using NAND/NOR gates and verify its truth tables.

5. Design a Full adder using NAND/NOR gates and verify its truth tables.

6. Design a Half Subtractor using NAND/NOR gates and verify its truth tables.

7. Design a Full Subtractor using NAND/NOR gates and verify its truth tables.

8. Design a 4×1 Multiplexer using gates and verify its truth tables.

9. Design a MOD-10 counter using D/T/JK Flip-Flop and obtain its timing diagram.

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B.Sc. 1st Semester (Honours) Practical Examination, 2019-20

ELECTRONICS

Course ID : 11724 **Course Code : SH/ELC-103/GE-1 (P)**

Course Title: Communication Systems

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

The figures in the right hand side margin indicate marks.

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

The questions are of equal value.

Perform *any one* experiment from the following:

1. Study of Amplitude modulation.

2. Study of Amplitude demodulation.

3. Study of Frequency modulation.

4. Study of Frequency demodulation.

5. Study of Time Division Multiplexing.

6. Study of Frequency Shift Keying.

7. Study of Amplitude Shift Keying.

8. Study of PWM and PPM.

9. Study of PAM modulator and demodulator.

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B.Sc. 1st Semester (Honours) Practical Examination, 2019-20

ELECTRONICS

Course ID : 11724 **Course Code : SH/ELC-103/GE-1 (P)**

Course Title: Instrumentation

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

The figures in the right hand side margin indicate marks.

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

The questions are of equal value.

Perform *any one* experiment from the following:

1. Design of multi range ammeter using galvanometer.

2. Design of multi range voltmeter using galvanometer.

3. Determine the characteristics of resistance transducer — Strain Gauge.

4. Determine the characteristics of LVDT.

5. Determine the characteristics of Thermistors/RTD.

6. Perform an experiment to measure the temperature by Thermocouples.

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