

P877

[4036]-101

M.Sc. (Sem. - I)

ELECTRONIC SCIENCE

EL 1 UT0 1 : Foundation of Semiconductor Devices

(New) (2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Use of non - programmable calculator is allowed.*

Q1) Attempt any two of the following : **[2 × 8 = 16]**

- a) Discuss imperfections and impurities in solids. Explain in detail importance of pure crystal material in manufacturing of semiconductor devices.
- b) What is Hall effect? With the help of geometry for measuring Hall effect obtain relation for Hall voltage, hole mobility and electron mobility.
- c) Differentiate between JFET and MOSFET. Draw the small signal equivalent circuit for JFET and explain ac response of this device.

Q2) Attempt any two of the following : **[2 × 8 = 16]**

- a) Describe qualitatively, charge flow in a p-n junction with zero - bias, reverse - bias and forward bias conditions using energy band diagram.
- b) What is the importance of equivalent circuit models in electronic circuits? Explain Ebers - Moll model for BJT device. Draw and explain its equivalent circuit in detail.
- c) List frequency limitation factors in the MOSFET. Obtain the relation for cutoff frequency in an ideal case.

Q3) Attempt any four of the following : **[4 × 4 = 16]**

- a) What is the meaning of Fermi - Dirac probability function? State its use in semiconductor technology.
- b) Explain qualitatively how bands of allowed and forbidden energies are formed in a crystal.
- c) Explain variation of E_F with doping concentration and temperature.
- d) What is effective mass? State its importance in semiconductor devices.
- e) Write short note on C- V characteristics of a p-n junction diode.

P.T.O.

Q4) Attempt any four of the following : **[4 × 4 = 16]**

- a) Describe the charge flow in a forward biased schottky barrier diode.
- b) Explain the switching characteristics of a BJT with respect to turn off transient and turn on transient conditions. State the cause of storage delay time t_s .
- c) Explain working of DIAC, TRIAC. State their applications.
- d) Explain the construction of MOSFET. Discuss small dimension effects with respect to threshold voltage and narrow width.
- e) With neat diagram explain working of MESFET. State its types and their applications.

Q5) Attempt any four of the following : **[4 × 4 = 16]**

- a) Calculate the number of silicon atoms per cubic centimeter and the density of silicon at room temperature. (Assume at 300 K the lattice constant for silicon is 5.43 \AA).
- b) Minority carriers holes are injected into a homogeneous n-type semiconductor sample at one point. An electric field of 50 V/cm is applied across the sample and the field moves these minority carriers a distance of 1 cm in 100 \mu s . Calculate the drift velocity and diffusivity of the minority carriers.
- c) Discuss ideal I-V characteristics of a JFET. Explain the terms -
 - i) Internal pinch off voltage,
 - ii) Pinch off current,
 - iii) Drain to source saturation current.
- d) In a certain transistor 99.6 % of the carriers injected into the base cross collector base junction. If the leakage current is 5 \mu A and the collector current is 20 mA , calculate
 - i) The value of α_{dc} ,
 - ii) The emitter current.
- e) With neat cross sectional diagram explain working of npn polysilicon emitter BJT.



P878

[4036]-102

M.Sc. (Sem. - I)

ELECTRONIC SCIENCE

**EL 1 UT 02 : Analog Circuits : Design and Analysis
(2008 Pattern) (New Course)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of logtable / non - programmable calculator is allowed.*
- 4) *Draw neat diagrams wherever necessary.*

Q1) Solve any two :

- a) i) What is a two - port network? Explain its impedance and transmission parameters. **[4]**
- ii) Design a 3 - op - amp instrumentation amplifier whose gain can be varied over the range $1 \leq A \leq 10^3$ by means of a $100 \text{ K}\Omega$ pot. **[4]**
- b) i) Distinguish between
 - Time and frequency domains.
 - Transient and steady state response of networks. **[4]**
- ii) Explain the following for a network
 - Complex frequency and complex plane.
 - Transfer function – poles and zeroes. **[4]**
- c) i) What is an equaliser. Explain series equaliser **[4]**
- ii) Explain following for an op - amp
 - Slew rate and limitation caused by it.
 - Input and output impedance and their significance. **[4]**

Q2) Solve any two :

- a) i) What is an ideal current source? Explain the working of Wilson current source. **[4]**
- ii) Obtain the expressions for differential and common mode gains for an emitter coupled pair and hence CMRR using half circuit concept or otherwise. **[4]**
- b) Discuss device mismatch effects in emitter coupled pair and obtain expressions for V_{os} and I_{os} . **[8]**

P.T.O.

- c) i) Explain causes of instability in amplifiers. What is meant by internally and externally frequency compensated op-amps? [4]
- ii) A 741 inverting amplifier with gain $A = -2$ is driven by a ± 10 V peak to peak triangular wave. Sketch and label waveforms at input, output and inverting input. [4]

Q3) Solve any two :

- a) Sketch trans diode configuration for log amplifier. Explain the working of two op - amp temperature compensated log amplifier giving due consideration to all practical aspects. [8]
- b) i) Compare the performance of inverting and non - inverting amplifiers as regards.
- Input and output impedance.
 - Common mode errors and limitations.
 - Type of feedback used. [4]
- ii) Explain the working of output stage of op - amp. 741. [4]
- c) i) Explain how you would estimate the errors due to offset voltage and bias current in a differentiator circuit. Why is it called a noise amplifying circuit? [4]
- ii) Explain advantages of active filters over passive filters. How do Butterworth and Chebyshev responses differ for low pass filter. [4]

Q4) Solve any two :

- a) Explain design considerations for low voltage / current amplifiers. Discuss shielding and guarding techniques. [8]
- b) Explain the working of a circuit for boosting output voltage of an op - amp. What precautions should be taken while using the voltage booster? [8]
- c) Write short notes on the following : [8]
- High power op - amp.
 - Programmable op - amp.

Q5) Solve any four :

- a) Explain the working of successive approximation type ADC. [4]
- b) Write a short note on pipelined converters. [4]
- c) How many bits are required at the input of a converter if it is necessary to resolve voltages to 5mV and the ladder has +10 V full scale? To what minimum accuracy should such a system be designed? [4]
- d) Explain ADC specifications. [4]
- e) Using just one op-amp powered from ± 12 V regulated power supplies design circuits to yield $V_o = 10V_i + 5V$ and $V_o = 10(V_2 - V_1) - 5V$. [4]



P880

[4036]-201

MS.c. - I (Sem. - II)

ELECTRONIC SCIENCE

**EL 2 - UT 04 : Applied Electromagnetics, RF and Microwave
(2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagram wherever necessary.*
- 4) *Log - book / Non programmable calculator is allowed.*

Q1) Attempt any two of the following : **[2 × 8 = 16]**

- a) Find the plane wave solution of maxwells equations for a conducting medium, Discuss absorption coefficient from it.
- b) Considering attenuation in transmission line, discuss ideal transmission line, small losses transmission line and distortionless lines.
- c) Explain the different basic parameters of an antenna. Discuss their role in designing of an antenna.

Q2) Attempt any two of the following : **[2 × 8 = 16]**

- a) Sketch types of rectangular and circular horn antennas. Discuss directivity or gain assuming no loss of horn antenna. State the advantages for it.
- b) Explain MESFET and MOSFET with reference to physical structure, principle of operation and electronic applications
- c) Discuss electromagnetic effects in high speed digital systems with suitable examples.

Q3) Attempt any four of the following : **[4 × 4 = 16]**

- a) State Ampere's law. How maxwell modified this law? Mention advantage of this modification.
- b) Describe different types of losses in microstrips.
- c) Write short note on smith chart.
- d) What are gauge transformations? Explain Lorentz gauge condition and coulomb gauge.
- e) What is RF heating? Why it is called as clean heating system?

P.T.O.

Q4) Attempt any four of the following : **[4 × 4 = 16]**

- a) “Light is simply a form of electromagnetic radiation”, comment. How this statement is supported by em spectrum?
- b) What is stub tuning? Explain double stub matching.
- c) Explain mechanism of radiation of electric field from an antenna.
- d) A magnetic field strength of $5 \mu\text{A/m}$ is required at a point on $\theta = \frac{\pi}{2}$, 2km from an antenna in air. Neglecting ohmic loss, how much power must the antenna transmit if it is
 - i) A Hertzian dipole of length $\lambda/25$,
 - ii) A half wave dipole.
- e) A lossless transmission line has a characteristic impedance of 50Ω and self inductance of $0.0921 \mu\text{H/m}$. Calculate the capacitance of 5 meter length of line.

Q5) Attempt any four of the following **[4 × 4 = 16]**

- a) Write a short note on shielding of a transmission line.
- b) Discuss application of electromagnetics in global positioning of satellite.
- c) Show that the skin depth is given by

$$\delta = \sqrt{\frac{2}{\omega\mu\sigma}}$$

- d) A waveguide operating in TE_{10} mode has dimensions $a = 2.26 \text{ cm}$, $b = 1 \text{ cm}$. The measured guide wavelength is 4 cm . Find
 - i) Cutoff Frequency of the propagating mode.
 - ii) The frequency of operation.
- e) An air line has characteristic impedance of 70Ω and phase constant of 3 rad/m at frequency 100 MHz . Calculate the inductance per meter and capacitance per meter of the line.



P881

[4036]-202
M.Sc. - I (Sem. - II)
ELECTRONIC SCIENCE
EL2-UT 05 : Communication Electronics
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

Q1) Answer any four of the following :

[4 × 4 = 16]

- a) Explain the terms :
 - i) Signal to noise ratio.
 - ii) Noise figure.
- b) With the help of circuit diagram, explain the working of any one AM detector circuit.
- c) Explain the working of collector or base neutralization method.
- d) Draw the block diagram of pulse code modulation and write its working in short.
- e) Draw the SDLC basic format and explain the importance of each field.
- f) What is VSAT? Describe its applications.

Q2) Attempt any two of the following :

[2 × 8 = 16]

- a) With the help of block diagram, explain TDM in detail.
- b) What is QAM? With the help of diagram explain the working of 16 QAM.
- c) Write short note on :
 - i) Bluetooth.
 - ii) CDMA.

Q3) Write any four of the following :

[4 × 4 = 16]

- a) Describe different transmission media used in communication with its advantages and disadvantages.
- b) With the help of diagram, explain the working of balanced ring modulator for SSB generation.
- c) Write short note on wide band integrated circuit amplifier.
- d) Mention the drawbacks of delta modulation and explain the working of adaptive delta modulation in short.
- e) Explain the working of typical data communication link with reference to DTE and DCE.

P.T.O.

Q4) Attempt any two of the following : **[2 × 8 = 16]**

- a) i) Describe internal and external noise types in short.
- ii) Explain data compression techniques.
- b) Draw the block diagram of SSB transmitter and explain each block.
- c) i) With the help of diagram, explain multistage tuned amplifier.
- ii) Write the major benefits of using RF amplifier in superheterodyne receivers. Mention the advantages of FET RF amplifier over BJT.

Q5) Write any four of the following : **[4 × 4 = 16]**

- a) With the help of diagram, explain foster - seely discriminator.
- b) Draw the circuit diagram of tuned amplifier and explain its working.
- c) Explain the working of any one error detection technique.
- d) Describe the working of local loop landline telephone.
- e) Explain the working of XMODEM in short.



P882

[4036]-203

M.Sc. - I (Sem. - II)

ELECTRONIC SCIENCE

**EL 2 - UT06 : Digital System Design Using VHDL
(2008 Pattern) (New)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

Q1) Attempt any two of the following : **[2 × 8 = 16]**

- a) What is package declaration and package body in VHDL? Write a package to declare and define function bin2gray and procedure bcd - ssd.
- b) What is array in VHDL? Write type declaration for one dimensional array of bits. Write VHDL code for XNOR gate and octal tristate buffer using process statement.
- c) Explain different sequential statements used in VHDL.

Q2) a) Attempt any two of the following : **[2 × 8 = 16]**

- i) Explain how look a head carry speed up the addition in 4 - bit parallel adder.
- ii) Design 2 - bit magnitude comparator circuit.
- iii) Design keyboard encoder with latching facility.

b) Attempt any one of the following : **[1 × 4 = 4]**

- i) Write VHDL code for 3 to 8 decoder using conditional signal assignment statement (s).
- ii) Design bcd to excess - 3 code converter using logic gates.

Q3) Attempt any two of the following : **[2 × 8 = 16]**

- a) Design synchronous counter to produce 0, 2, 4, 3, 5, 6,1 and repeat. Sequence.
- b) Design 1 digit BCD ripple counter. Draw timing diagram for this circuit.
- c) Write VHDL code for traffic light controller.

P.T.O.

Q4) Attempt any two of the following : **[2 × 6 = 12]**

- a) Write VHDL code for 4 - bit ALU.
- b) What is GAL? Write features of GAL16V8 Implement $Y = AC + \overline{BC} + \overline{A}BC$ using GAL16V8 : in simple mode.
- c) Draw and explain general structure of PLA. What is difference between PLA and PAL.

Q5) Attempt any two of the following : **[2 × 8 = 16]**

- a) Draw basic memory cell of DRAM. Explain how data is stored in DRAM. compare SRAM and DRAM.
- b) Explain with neat diagram internal architecture of FPGA. Compare FPGA and CPLD. List applications of FPGA.
- c) Draw basic cell of PROM. Explain how data is stored in PROM. List types of ROM. List applications of ROM.



Total No. of Questions : 5]

[Total No. of Pages : 2

P883

[4036]-301
M. Sc. - II (Sem. - III)
ELECTRONIC SCIENCE
EL3UT05 : Embedded Systems
(New Course) (2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Assume suitable data, if necessary.*

Q1) Attempt any four of the following.

[4 × 4 = 16]

- a) Explain serial communication with 8051 with reference to SFRs used, connections between 8051 and RS232.
- b) Explain the interrupt structure of 8051. How is the priority of interrupts decided?
- c) Explain different ports and their functions of 8051.
- d) Describe in short Harvard and Van - Neuman architecture.
- e) Explain TMOD register of 8051.

Q2) Attempt any four of the following.

[4 × 4 = 16]

- a) Explain with neat diagram interfacing of 4 × 4 keyboard to 8051. Explain how a pressed key is detected?
- b) Draw the interfacing of DAC to 8051. Write assembly / C program to generate ramp waveform.
- c) Explain SPI communication standard.
- d) Explain the Watch Dog Timer (WDT) in microcontroller.
- e) Draw the block diagram to interface 16 k × 8 data RAM to 8051. Write memory map of system.

P.T.O.

Q3) Attempt any two of the following. [2 × 8 = 16]

- a) Describe hardware development tools in short (any four)
- b) Write short note on
 - i) Assembler.
 - ii) Simulator.
 - iii) Crosscompiler.
- c) Write C program for 8051 to transfer “YES” to serial terminal with band rate of 9600.

Q4) Attempt any two of the following. [2 × 8 = 16]

- a) Write C program for one digit BCD counter using common cathode seven segment display interface to port of 8051.
- b) Explain memory organization of PIC microcontroller in detail.
- c) Write C program for PWM generation with PIC microcontroller. Frequency of PWM output should be 10 KHz and duty cycle 40%

Q5) Attempt any two of the following. [2 × 8 = 16]

- a) Write C program to implement ON/ OFF controller using ADC and relay interface with 8051.
- b) Draw and explain architecture of AVR microcontroller.
- c) Write C program for AVR microcontroller to display “ELECTRONICS” on first line of 2 × 16 LCD.



P884

[4036]-401

M.Sc. - II (Sem. - IV)

ELECTRONIC SCIENCE

**EL 4 UT06 : Control Systems : Theory and Applications
(New Course) (2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

Q1) Solve any Two

[2 × 8 = 16]

- a)
 - i) Compare open - loop and closed - loop control systems.
 - ii) Explain feedforward control strategy.
- b)
 - i) Give the procedure for obtaining transfer function of a system.
 - ii) Take a suitable example and explain the concept of block diagram for a control system.
- c)
 - i) Define pole, zero, characteristic equation and order of a transfer function. What is meant by dominant pole?
 - ii) Explain the following terms.
- Process load - Process lag - control lag - Dead time.

Q2) Solve any two

[2 × 8 = 16]

- a)
 - i) Explain the concept of control system stability.
 - ii) Explain following applications of Routh's method.
- Checking relative stability of a control system.
- Finding the range of gain for which system is stable.
- b) Discuss the effect of proportional, integral and derivative modes on system bode plots. How can they be helpful in adjustment for adequate stability gain and phase margins.
- c)
 - i) Define root - locus for a control system. State and explain angle and magnitude conditions for a point to be on the root - locus.
 - ii) Comment on following statements.
- In the limit of very high gain proportional mode works like ON- OFF control mode.
- Derivative mode can not be used alone.

P.T.O.

Q3) Solve any Two

[2 × 8 = 16]

- a) Compare performance of proportional, integral and derivative control on following points.
 - Performance equation - offset error - possibility of oscillation - speed of response to an error.
- b)
 - i) Develop the PLC ladder diagram for controlling a heating oven. System uses a NO start button to seal it in auto mode. It can be stopped with NC stop button. When auto mode is activated TON timer sounds the horn for first 10 seconds to warn that oven will start. Subsequently horn stops and heating coils start heating. When stop is pressed oven is turned OFF but fan continues to blow for another 5 minutes before turning off.
 - ii) Around a single op - amp design an ON - OFF controller with neutral zone of 4 V and central voltage of 3.2 V, $V_{sat} = 10$ V. Give the circuit diagram and find voltages corresponding to V_{UTP} and V_{LTP} ?
- c) Give a block diagram and explain the working of a PLC. What are input and output status files?

Q4) Solve any Two

[2 × 8 = 16]

- a) Explain PLC counter instructions. How are they used?
- b)
 - i) Describe processor operating modes.
 - ii) What is watch dog timer? What is its function?
- c)
 - i) Explain PLC sequencer output instruction (SQO).
 - ii) Discuss serial communication between PC and PLC.

Q5) Solve any Four

[4 × 4 = 16]

- a) Describe SLC 500 default data files.
- b) Explain the difference between relay ladder logic and PLC ladder logic.
- c) Evaluate the stability of a control system having following characteristic equation by Routh's criterion.
$$S^8 + 5S^6 + 2S^4 + 3S^2 + 1 = 0$$
- d) Write a short note on 'open - architecture control'.
- e) Write a short note on control valves.
- f) Design a motor controller that has a forward and a reverse button. Motor forward and reverse outputs will only be ON when one of the buttons is pushed. When both buttons are pushed motor will not work.



P879**[4036]-103****M.Sc. (Sem. - I)****ELECTRONIC SCIENCE****Instrumentation and Measurement Techniques
(2008 Pattern)***Time : 3 Hours]**[Max. Marks : 80**Instructions to the candidates:*

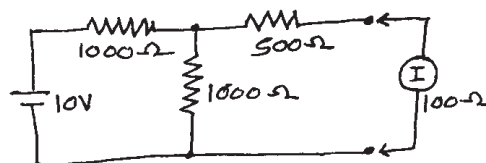
- 1) *All questions are compulsory.*
- 2) *All questions carries equal marks.*
- 3) *Draw neat labeled diagrams wherever necessary.*
- 4) *Use of logarithmic table and non-programmable calculator is allowed.*

Q1) a) Answer any Two : **[2 × 6 = 12]**

- i) What is noise? Explain the generated noise, conducted noise and radiated noise. Give the relations of noise factor and noise figure.
 - ii) State the different characteristics of measurement system. Explain loading effect on measurement due to shunt connected instrument, give suitable example.
 - iii) What is dynamic response of measurement system? Explain speed of response, measuring lag, fidelity and dynamic error. Give time domain analysis of measurement system for step input.
- b) A multimeter having sensitivity of $20000 \Omega/V$ is used for the measurement of voltage across a circuit having an output resistance of $20 K\Omega$, the open circuit voltage is $12V$. Find the reading of the multimeter when it is set to its $20V$ range. Find the percentage error and comment on the result. **[4]**

OR

- b) It is desired to measure the value of current in 500Ω resistor as shown in figure. A current meter with internal resistance of 100Ω . Find **[4]**
- i) The actual value of current.
 - ii) Measured value of current.
 - iii) The percentage error in measurement and the accuracy.

**P.T.O.**

Q2) a) Attempt any Two : **[2 × 6 = 12]**

- i) List the different types of transducers. State the factors influencing the choice of transducers for the measurement of physical parameter.
 - ii) Give the different types of transducers used for displacement measurement. With neat circuit diagram describe the working of LVDT. State advantages and limitation of LVDT.
 - iii) Four strain gauges of equal resistance of 120Ω and equal gauge factor of 2, are mounted on a tensile specimen. Two strain gauges are mounted along the axial direction and two in transverse direction. They are connected to a wheatstone bridge for maximum sensitivity and temperature compensation. The strain gauges are sensitive to bending, the output of the bridge is amplified ten times before it is connected to a mV meter. When the tensile member is not loaded. The bridge is balanced. A shunt resistance of $120K\Omega$ is connected across one of the strain gauge, the meter reads 30 mV. The shunt is moved. The bridge is balanced again. Now the tensile specimen is loaded, the voltmeter reads 500 mV. Determine the input excitation and strain experienced by each of the Strain gauges.
- b) A mild steel shaft is used to connect a motor drive to a constant load torque. To measure this torque, a resistance strain gauge having 120Ω resistance and gauge factor of 2 is mounted at 45° to the shaft axis. Shear modulus of steel is 80GPa, shaft diameter is 50 mm and change in strain gauge resistance due to load is 0.1Ω . Find the load torque. **[4]**

OR

- b) State the basic methods of force measurement. Describe variable-Reluctance/Fm oscillator Digital System for force measurement. **[4]**

Q3) a) Answer any Two : **[2 × 6 = 12]**

- i) List the different transducers/gauges used for pressure measurement. With neat diagram explain the working principle of thermal conductivity gauge used for very low pressure measurement.
- ii) State different methods of flow measurement. Describe turbine flow meter with diagram. Give applications and limitations of turbine flow meter.
- iii) List the temperature transducers. Describe the working principle of thermocouple temperature measurement. Explain the compensation technique used with the measurement.

- b) A resistance thermometer is to be constructed of nickel wire. At 20°C the thermometer resistance is 100Ω. What length of 0.4mm diameter wire should be used? What would be the length of 2mm diameter wire is used? Given resistivity = 0.8 mΩm.

If the resistance varies linearly with temperature then what would be the resistance at $t = -50^{\circ}\text{C}$ and 100°C ? The sensitivity is $0.2\Omega/^{\circ}\text{C}$. [4]

OR

- b) The output of a potentiometer is to be read by a recorder of 10 KΩ input resistance. The non-linearity must be hard to 1%. A family of potentiometers having thermal rating of 5W and resistance ranging from 100Ω to 10 KΩ in step of 100Ω are available.

Choose from the family of potentiometers, a potentiometer that has the greatest possible sensitivity and which meets the non-linearity requirements. Find the maximum excitation voltage permissible with this potentiometer. What is the sensitivity if the potentiometer is a single turn (360°). [4]

Q4) a) Answer any Two : [2 × 6 = 12]

- i) Draw the neat circuit block diagram of heterodyne wave analyzer. Describe the working of heterodyne wave analyzer. Explain the different types of distortion caused by an amplifier.
- ii) State the characteristics parameters of Operational Amplifier. Draw the circuit diagram and output equations for
 - 1) Inverting Amplifier,
 - 2) Non-Inverting Amplifier,
 - 3) Zero crossing detector,
 - 4) Schmitt Trigger, and
 - 5) Unity gain follower.
- iii) Draw the neat circuit diagram of wheatstone bridge circuit with sensitivity balance and calibration features. Explain how the bridge sensitivity adjusted for particular measurement. Give the bridge sensitivity relation.

- b) List the primary sensing elements for sensing of force, torque and pressure. [4]

OR

- b) The output of LVDT is 1.5V at maximum displacement. At a load of 0.5 MΩ, the deviation from linearity is maximum and it is $\pm 0.003\text{V}$ from a straight line through origin. Find the linearity at the given load. [4]

Q5) Answer any Four :

[4 × 4 = 16]

- a) State different methods of data transmission. What is telemetry? Explain why there is 4 to 20 mA current 100P used in telemetry.
- b) With neat circuit diagram describe voltage and current telemetry systems. Give applications of telemetry.
- c) List the different types of display and recorders used with measurement system.
With neat diagram explain the working of galvanometric type strip chart recorder.
- d) Draw the neat circuit block diagram of DFM. State the modes of operation of DFM.
- e) Describe the magnetic tape recording mechanism with neat diagram. How equalization carried out in magnetic tape recording?



P879

[4036]-103

M.Sc. (Sem. - I)

ELECTRONIC SCIENCE

Network Analysis and Synthesis

(2004 Pattern) (Old Course)

Time : 3 Hours]

[Max. Marks : 80

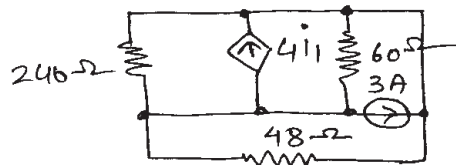
Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carries equal marks.*
- 3) *Draw neat labeled diagrams wherever necessary.*
- 4) *Use of logarithmic table and non-programmable calculator is allowed.*

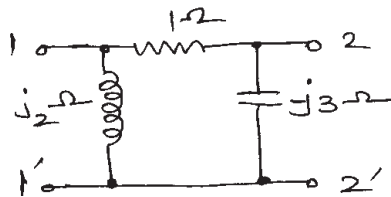
Q1) Solve any four :

[4 × 4 = 16]

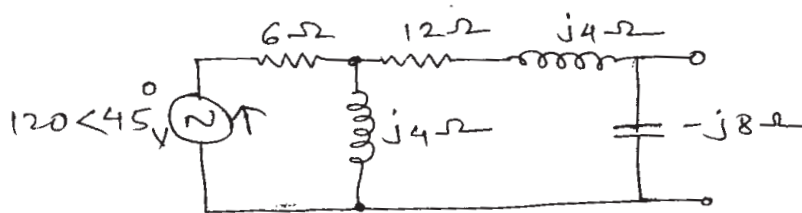
- a) Find Laplace transformation for positive sided growing and decaying exponential function.
- b) Find power absorbed and delivered by each element.



- c) Determine Y parameters of following network.



- d) What is meant by “Foster” and “Caner” realisation. Differentiate between two.
- e) Find Norton equivalent circuit.



Q2) Solve any Four :

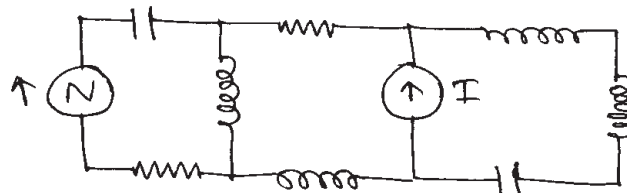
[4 × 4 = 16]

- Design band elimination filter having an impedance of 600Ω and $F_1 = 2\text{kHz}$ & $F = 6\text{Hz}$
- Explain star-delta conversion function by taking suitable example.
- What is "Hurwitz Polynomial" test it for $P(s) = s^4 + s^3 + s^2 + 3s + 4$.
- A system oscillates with frequency 2rad/sec . Find values of 'K-marginal' and 'p' no of poles in $G(s) = K(s + 1)/(s^3 + Ps^2 + 2s + 1)$
- Define Graph, Linear graph, and Tree.

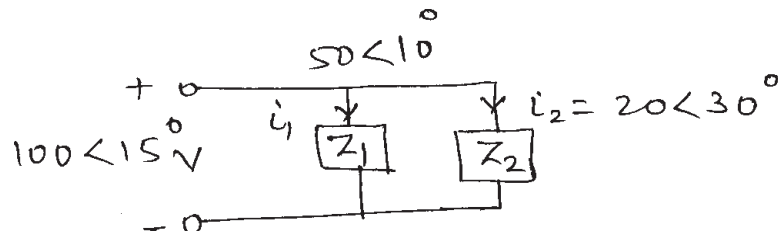
Q3) Solve any Four :

[4 × 4 = 16]

- Write synthesis of RC driving point impedance. List its properties.
- Define the terms self induced emf, self inductance, mutual inductance & coupled circuit.
- Obtain cutset matrix in the network given



- Determine power factor, reactive power and apparent power



- What is equalizer? State series equalizer Design full series equalizer with $R_0 = 500\Omega$ and attenuation is 10dB at 600 Hz .

Q4) Solve any Two :

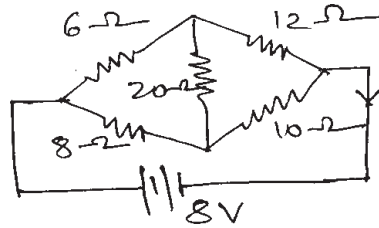
[2 × 8 = 16]

- Determine the conditions for $F(s) = \frac{s^2 + a_1s + a_0}{s^2 + b_1s + b_0}$ to be positive.
- Find time domain response for $Y(S) = \frac{10S}{[(s + 5 + j15)(s + 5 - j15)]}$
- Explain the linearity and determine whether following system is linear or not $Y(n) = n \times (n)$

Q5) Solve any Two :

[2 × 8 = 16]

- a) State and prove maximum power transfer theorem for A.C. circuit. Give qualitative analysis for purely inductive and capacitive network.
- b) State Reciprocity theorem. Find current I in the circuit shown below.



- c) State and prove convolution theorem by using it determine inverse Laplace of

i) $\frac{1}{(s^2 - a^2)s^2}$

ii) $\frac{1}{s^2(s+1)}$

P879

[4036]-103
M.Sc. (Sem. - I)
ELECTRONIC SCIENCE
Optoelectronics
(Old Course) (2004 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

Q1) Attempt any four : **[4 × 4 = 16]**

- a) Discuss the concepts of reflection and refraction at the interface of two homogeneous nonabsorbing dielectrics.
- b) Explain in brief the concepts of :
 - i) internal quantum efficiency of LED.
 - ii) external quantum efficiency of LED.State the expression for each.
- c) State the criteria that define the important performance and compatibility requirements for detectors.
- d) Discuss intrinsic and extrinsic losses in optical fiber communication. Compare losses due to splicing and connectors.
- e) Discuss the role of Dispersion Shifted (DS) fibers in communication.

Q2) Answer any two : **[2 × 8 = 16]**

- a) State and discuss the expression for waveguide action for step index optical fibers. Discuss modes in step index fibers.
- b) Explain working of Avalanche Photo Diode (APD). State merits and demerits of the same. State expression for the gain of APD.
- c) Briefly outline the general requirements for a source in optical fiber communication. Discuss the areas in which the injection laser fulfils these requirements and comment on any drawbacks of using this device as an optical fiber communication source.

Q3) Answer any four :

[4 × 4 = 16]

- a) State Snell's Law. Explain concept of total internal reflection.
- b) Draw structure and discuss in brief, the surface emitting LED (Burros type).
- c) Consider a multimode silica fiber with
 $n_1 = 1$ and $n_2 = 1.46$
(n_1 = refractive index of core and
 n_2 = refractive index of cladding).
Find :
 - i) Critical angle.
 - ii) Numerical Aperture.
 - iii) Acceptance angle in air.State two types of the rays that can propagate through the fiber.
- d) Explain the shadow method for the online measurement of the fiber outer diameter.
- e) Discuss the design considerations associated with the optical fiber communication systems.

Q4) Answer any four :

[4 × 4 = 16]

- a) Explain with neat diagram, the fiber NA measurement using scanning photodetector and rotating stage.
- b) A 2 km length of multimode fiber is attached to apparatus for spectral loss measurement. The measured output voltage from the photoreceiver using the full 2 km fiber length is 2.1 V at a wavelength of 0.85 μm . When the fiber is then cut back to leave a 2m length the output voltage increases to 10.7V. Determine the attenuation per kilometer for the fiber at a wavelength of 0.85 μm and estimate the accuracy of the result.
- c) Draw block diagram of principal components of an optical fiber communication system. Discuss different components in brief.
- d) Define following terms related to photodetectors :
 - i) Quantum efficiency.
 - ii) Spectral response.
 - iii) Frequency response.
 - iv) Dark current.

- e) The output of a single mode semiconductor laser with a RIN value of 10^{-15} dB/Hz is incident directly on an optical detector which has a bandwidth of 100 MHz. The device is emitting at a wavelength of 1.55 micrometers, at which the detector has a quantum efficiency of 60%. If the mean optical power incident on the detector is 2 milliwatt, determine :
- the rms value of the power fluctuation and
 - the rms noise current at the output of the detector.

Q5) Answer any two :

[2 × 8 = 16]

- Briefly describe the two processes by which light can be emitted from an atom. Discuss the requirement for population inversion in order that simulated emission may dominate over spontaneous emission.
- State different types of photodetectors. Explain PIN photodetector with neat diagram.
- Explain typical structure of a glass multimode step index fiber. State the bandwidth of the same. Discuss attenuation spectra for these fibers.

