AF-121

August-2021

B.Sc., Sem.-VI

CC-315-A : Physics

(Experimental & Measurement Technology)

Time : 2 Hours]   **[Max. Marks : 50**

Instructions :   (1)   **All** questions in **Section – I** carry equal marks.

                (2)   Attempt any **three** questions in **Section – I**.

                (3)   The questions in **Section – II** is **COMPULSORY**.

SECTION – I

1. (a) Explain the cycle of activities in experimental science with the necessary diagram.   **7**

     (b) Discuss the systematic errors arising in the experimental design of Ohm's law. What are the good design suggestions for this experiment ?   **7**

2. (a) What do you mean by sample and parent distribution ? Discuss the different type of statistical distribution functions.   **7**

     (b) (i)   The following measurements are made using a voltmeter :   **4**

              15.0, 15.4, 14.9, 15.2, 15.3, 14.8, 15.8, 14.9, 15.5 and 15.6. Calculate mean value, mean deviation, sample variance and the variance of sample mean,

         (ii)   A perfect cube dice is thrown 4 times. Find the probability that '2' will show exactly twice.   **3**

3. What are photomultipliers ? Explain the two effects used to produce photoelectrons from the photo emissive surfaces. With a neat sketch, explain the construction and working of a photomultiplier. What is the main disadvantage of photomultipliers ?

     What charge would be delivered to anode for a single photon detected by a 14 stage photomultiplier having a stage gain of 3.7 ? If the anode of a tube is connected to a parallel circuit consisting 1 nF capacitor and 1 MΩ resistor with their one end each connected to ground, what will be amplitude of pulse ?   **14**

4. (a) Write Planck's radiation formula for the spectral distribution of radiation. Show the spectral distribution as a function of wavelength for different temperatures and characterize it based on temperature. Discuss the infra-red pyrometer used to measure the temperature of radiation.   7

    (b) What is a low temperature thermometry ? Explain the low temperature measurement using a semiconductor thermometer.   7

5. (a) Define the time for mono layer coverage (t_m) used to characterize the vacuum. Obtain the equation for the same. Calculate the monolayer coverage time for a surface in argon at a pressure of 10^{-9} mbar and the temperature 20 $^\circ$ C. The surface has a site density of 3×10^{-5} cm^{-2} and the sticking probability of 0.1 for argon.   7

    (b) With the necessary diagram, describe different components of a typical vacuum system. Discuss the pump down sequence.   7

6. (a) Describe the following transducer characteristics in brief :   7

    (i) Hysteresis

    (ii) Reproducibility

    (iii) Linearity

    (iv) Sensitivity and

    (v) Response time

    (b) Explain the use of different thermal detectors as a light sensor in detail.   7

7. (a) Explain how the capacitance gauge and Pirani gauge are useful for the precise pressure measurement in a vacuum.   7

    (b) Define the pumping speed of a vacuum pump. Explain the variation of pumping speed as a function of intake pressure for mechanical and high vacuum pumps. Show that the pressure at time t for a pump speed S and the ultimate pressure Pu is $P = P_u \exp\left(-\dfrac{S}{V}t\right)$ 7

8. (a) Describe the working of mechanical rotary and multistage diffusion pump used in a vacuum system.   7

    (b) Write the equation for an effective pumping speed (Se). Give an analogy between the terms appearing in the equation with an electrical quantity. Describe the procedures to be carried out in event of leak in a vacuum system   7

SECTION – II

9.   Attempt any **eight** questions :   8

(1)   What is the probability to get exactly 5 "heads" in tossing five identical coins together ?

(2)   What is the resolution of 3½ digit digital voltmeter adjusted in 200 V range ?

(3)   Which of the distribution function is used to represent the results of gamma ray emission from a sample of nuclear material ?

(4)   Which are the direct gap semiconductors used in different colour LEDs ?

(5)   What are optical couplers ?

(6)   What is an optical pyrometry ?

(7)   Give the equation for diffusion length in a semiconductor.

(8)   What is an adiabatic demagnetization ?

(9)   What is the condition that results true molecular flow for the molecule of a gas ?

(10) Which pump uses gaseous plasma induced with a titanium ?

(11) What is the conventional unit of throughput (Q) in a vacuum pump ?

(12) What is the range of the pressure level used for industrial and laboratory purpose ?

(13) What is the range of the pressure level used for capacitance gauge ?

(14) What is the threshold value of vacuum used for its use in thin film fabrication ?

(15) In which region of an electromagnetic spectrum, is the spectral response of cadmium sulphide (CdS) as photoconductive bulk material maximum ?

(16) What will be the band gap of a photo detector to detect an electromagnetic radiation of 550 nm wavelength ?

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AF-121

August-2021

B.Sc., Sem.-VI

CC-315-B : Physics

(Instrumentation)

Time : 2 Hours]   **[Max. Marks : 50**

Instructions : (1) **All** questions in **Section – I** carry equal marks.

(2) Attempt any **three** questions in **Section – I**.

(3) The questions in **Section – II** is **COMPULSORY**.

SECTION – I

1. (a) What is a transducer ? Describe the classification of transducers based on physical principals involved. Give the suitable illustrations of voltage generating type transducers.   **7**

   (b) What are photoelectric transducers ? State different types of such transducers. Explain the construction and working of a solar cell.

   An Earth satellite has 12 Ni-Cd batteries which supply a continuous current of 0.5 A throughout a day. Solar cells having maximum power point of (0.45 V, 56 mA) are employed to keep batteries fully charged. If the illumination from sun for 12h in every 24 h is 125 mW/cm^2, determine the approximate number of cells required by assuming a 1.5 V voltage drop in a series connected resistor. Show the schematic representation of such an array.   **7**

2. (a) With the help of a neat schematic diagram, explain the working of capacitive pressure transducer. Write its advantages and disadvantages.   **7**

   (b) Give the basic principle of different temperature transducers. Describe the function of Resistance Temperature Detectors (RTD) and thermistor as temperature transducers.   **7**

3. (a) With a suitable diagram, explain how can a basic moving galvanometer be used to measure the different electrical quantities. Derive the necessary equation to convert a moving coil meter into an ammeter. What is an Ayrton shunt arrangement for the multi range ammeter using a basic moving coil meter ?   **7**

   (b) State the advantages of digital instruments over analog instruments. Using necessary diagram, explain how can the voltage to frequency conversion be obtained using the dual slope integration technique.   **7**

4. (a) Describe the rectifier type voltmeters used to measure AC voltages. **7**

(b) Describe how can a basic moving coil meter be used as an ohmmeter. **7**

5. (a) Describe the working of an electromagnetic flow meter with the neat diagram. **7**

(b) What is the piezoelectric effect ? Describe the working of piezoelectric transducer using a neat schematic diagram. **7**

6. (a) What do you mean by an electronic voltmeter ? Explain the working of FETVM using a neat circuit diagram. **7**

(b) Give the comparison between VOM and VTVM. Explain the working of two tubes VTVM using a neat circuit diagram. **7**

7. (a) What are signal generators ? Give their detailed classification. Explain how will you generate 4 kHz pulse waves of 30 % duty cycle using different type of multivibrators. **7**

(b) Draw the schematic diagram of a laboratory square and pulse wave generator. Explain its working to generate different type of waves using it. **7**

8. (a) Draw the schematic block diagram of AF sine and square wave generator. Name the front panel controls of a typical AF generator and describe the function of each control. **7**

(b) What is the difference between a signal generator and a function generator ? Explain how can the different shaped wave forms be generated using a function generator. **7**

Section – II

9. Attempt any **eight** questions : **8**

(1) A metallic strain gauge with a gauge factor of 2 is bonded to a steel member which is subjected to a stress of 10.5×10^9 N/m^2. If modulus of elasticity for steel is 21×10^{12} N/m^2, what is the % fractional change in the resistance of gauge due to the applied stress ?

(2) The hot junction of a thermocouple is increased from an environment of 200° C to 800° C. If the time constant of thermocouple is 1 second, what will be the temperature of hot junction after elapse of 5 seconds ?

(3) The light dependent resistor (LDR) made from cadmium selenide (CdSe) has the spectral response in the _____ region of an electromagnetic spectrum.

(4) Which metal combinations in thermocouple produce maximum e.m.f. per 100° C ?

(5) A wire strain gauge bonded to a steel member produces the change in the resistance equal to 360 $\mu\Omega$ when subjected to a strain of 10^{-6}. If the original resistance of the gauge is 120 Ω under no strain situation, what is the gauge factor of a strain gauge ?

(6) Which photodetectors are ultrafast and has an excellent signal-to-noise ratio ?

(7) The full scale deflection current of d'Arsonval type meters A, B, C and D are 50 $\mu\Omega$, 100 $\mu\Omega$, 500 $\mu\Omega$ and 1 mA respectively. Which of these meters has lowest sensitivity ?

(8) In a dual-slope integration technique employed for a digital voltmeter, the reference voltage applied is equal to 6 V. If number of clock pulses required by unknown and reference voltages to reach required level are 500 and 200 respectively, what should be the magnitude of unknown input voltage ?

(9) A 50 μA d'Arsonval meter movement with internal resistance of 1 KΩ is to be used as series type multirange voltmeter of ranges 5V, 25 V and 50 V. What are the value of respective multiplier resistances ?

(10) Which noise spectrum in a random noise generator has larger amplitude in a lower frequency range ?

(11) Which noise spectrum in a random noise generator has a flat response in the 25 Hz to 25 kHz frequency range ?

(12) What will be the shunt resistance required to convert 1mA d'Arsonval meter having 50 Ω internal resistance into 100 mA ammeter ?

(13) What do you mean by force summing device in a strain gauge ?

(14) Which is the type of modulation employed in a conventional standard signal generator ?

(15) What is the taut-band mechanism in a d'Arsonval meter movement ?

(16) What is the use of buffer amplifiers in modern signal generators ?

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AF-121

August-2021

B.Sc., Sem.-VI

CC-315-C : Physics

(Visual Basic)

Time : 2 Hours] [Max. Marks : 50]

Instructions : (1) **All** questions In **Section – I** carry equal marks.

(2) Attempt any **three** question in **Section – I**.

(3) **Section – II** is **COMPULSORY**.

Section – I

1. (A) Explain List box & Frame box in VB. 7

   (B) Describe the project explorer in detail. 7

2. (A) Write a VB script to print first 20 natural numbers. 7

   (B) Write short note on if-then-else statement in VB. 7

3. (A) Explain File Menu in VB. 7

   (B) Explain the uses of following. 7

      (1) Window menu

      (2) Edit menu

4. (A) Write a VB script to prepare a simple calculator. 7

   (B) Write a VB script to print any two digit odd numbers. 7

5. (A) Write a note on Explicit Type Declaration Statement. 7

   (B) Explain Text Box Controls in VB. 7

6. (A) Explain Object Data type in VB. 7

(B) Explain code window and how we execute that window. 7

7. (A) Write note on Error handling in VB. 7

(B) Write a VB script to calculate factorial of first 7 numbers. 7

8. (A) Write note on use of VB in Education 7

(B) Write a VB script to calculate factorial of first N numbers. 7

Section – II

9. Answer in Short : Attempt any **eight** marks : 8

(1) Dim statement is used for _____.

(2) Command Button is used to execute _____.

(3) InputBox Command is used for _____.

(4) Ctrl C command is used to _____ text.

(5) Ctrl V command is used to _____ text.

(6) Ctrl N command is used to _____ file.

(7) Ctrl F command is used to _____ text.

(8) Ctrl X command is used to _____ text.

(9) Int Function is used to get _____.

(10) Round Function is used to get _____.

(11) MOD Function is used to get _____.

(12) SQRT Function is used to get _____.

(13) _____ Short Cut key to print file.

(14) _____ Short Cut key to Save file.

(15) _____ short cut key to select entire form.

(16) _____ short cut key to specify in Bold Face.

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