BITS, PILANI – DUBAI CAMPUS, KNOWLEDGE VILLAGE, DUBAI
SECOND SEMESTER 2005 – 2006
TA UC 222 MEASUREMENT TECHNIQUES – II
TEST 1(CLOSED BOOK)

MAXIMUM MARKS: 20   **WEIGHTAGE: 10%**

DATE: 02.04.06   **DURATION: 50 MINUTES**

1a. Define Steady flow, Laminar flow and compressible flow.

[3M]

1b. List the comparative merits of venturimeter, orifice meter, and nozzle flow meter.

[3M]

2a. A reservoir manometer is built with a tube diameter of 5 mm and a reservoir diameter of 25 mm. The manometer liquid is having a specific gravity of 0.82.
   (i)   Show the construction of reservoir type manometer.
   (ii)   Derive the expression for manometer sensitivity.
   (iii)   Determine the manometer sensitivity.

[1M+3M+1M]

2b. A McLeod gauge has a bulb and capillary volume of 100 cm^3 and capillary diameter of 0.3 mm.
   (i)   Show the construction of McLeod gauge.
   (ii)   Derive the expression for pressure indicated by the gauge.
   (iii)   Calculate the pressure indicated by a reading of y=4 cm of the gauge.

[1M+2M+2M]

3a. Define the working principle of elastic elements for force measurement.

[1M]

3b. A small cantilever beam is constructed of spring steel having, E=195 GPa. The beam is 4.7 mm wide and 0.9 mm thick with a length of 25.4 mm. Calculate the indicated force when the displacement y=2.54 mm.

[3M]

BITS, Pilani-Dubai Campus
Knowledge Village

II Year - II Semester 2005 - 2006
MT-1

COURSE NO.: TAUC211;   COURSE TITLE: Measurement Techniques-I;
TIME: 2 hrs;   WEIGHTAGE: 40%   Date: 17th May'06

I.D. No._____

NAME:_____

RECHECK REQUEST:

PHYSICS

NOTE: (Answer all Questions, Data provided are complete. Some questions might have more than one correct answer. Mark all the right choices)

Please enclose the final answer of the numerical questions in a box ☐

Possibly for use

$\{c = 2.998 \times 10^8 \text{ m·s}^{-1}$; $\mu_0 = 4\pi \times 10^{-7} \text{ N A}^{-2}$; $\varepsilon_0 = 8.85 \times 10^{-12} \text{ F·m}^{-1}$;

$h = 6.63 \times 10^{-34} \text{ J·s}$; $e = 1.602 \times 10^{-19} \text{ C}$; $m_e = 9.1 \times 10^{-31} \text{ kg}$; $m_p = 1.67 \times 10^{-27} \text{ kg}\}$

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Specific Charge of the electron –e/m

1. The lorentz force acting on an electron with velocity v in a magnetic field of strength B is _____

2. An electron of mass m and charge e accelerated by a potential difference $\triangle V$ attains a kinetic energy of _____.

3. A horizontal circular coil has 50 turns and a mean radius of 3.14cm. It carries a current of 3.0A. The current is clockwise. What is the magnitude and direction of the magnetic field at the center of the coil.

Ans:

Photo Electric Effect

4. The maximum energy Kmax of photoelectron emitted in a photo electric cells is measured using lights of various frequencies v. The graph shows how Kmax varies with v. The slope of the graph is equal to
   a.   Charge if an electron
   b.   Charge to mass ratio of an electron
   c.   Work function of the emitter in the cell
   d.   Planck's constant

Kmax ↑ (graph with line starting at v_0 on horizontal axis $v \rightarrow$)
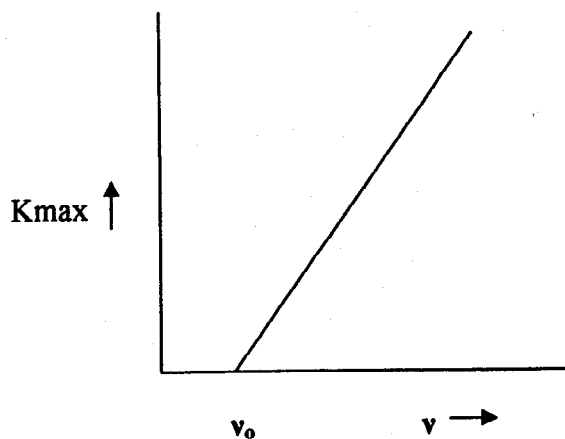
5. The work function for aluminum surface is 4.2eV and that for sodium surface is 2.0eV. The two metals were illuminated with appropriate radiations so as to cause photo emission. Then
a.   both aluminum and sodium will have the same threshold frequency
b.   the threshold frequency of aluminum will be more than that of sodium
c.   the threshold frequency of aluminum will be less than that of sodium
d.   the threshold wavelength of aluminum will be more than that of sodium

Diffraction at Single and Double Slit

6. In a single slit diffraction experiment, the width of the slit is made double its original width. Then the central maximum of the diffraction pattern will become
a.   narrower and fainter
b.   narrower and brighter
c.   broader and fainter
d.   broader and brighter

7. In Young's double slit experiment, the 10th maximum of wavelength λ_1 is at a distance y1 from its central maximum and the 5th maximum of wavelength λ_2 is at a distance y2 from its central maximum. The ratio of y_1/y_2 will be
a. $2\lambda_1/\lambda_2$
b. $2\lambda_2/\lambda_1$
c. $\lambda_1/2\lambda_2$
d. $2\lambda_2/2\lambda_1$

Inductance of Solenoid

8. An air cored solenoid has 300 turns, its length is 25cm and its cross-section is 3 cm². Calculate it self inductance in henry.

Ans:

9. A solenoid 95.6cm long has a radius of 1.90 cm, with a winding of 1230 turns and carries a current of 3.58A. Calculate the strength of the magnetic field inside the solenoid

Ans:

Electron Diffraction

10. The wavelength λ of de-broglie waves associated with an electron of mass m and charge e accelerated through a potential difference of V is given by (h is planck's constant)

a) $\lambda = h/mv$ b) $\lambda = h/2meV$ c) $\lambda = h/\sqrt{meV}$ d) $\lambda = h/\sqrt{2meV}$

11. What do you understand by diffraction of light. Distinguish between Interference and diffraction of light?

Ans:

Fine Structure and One Electron Spectrum

12. A grating has 315 rulings/mm. For what wavelengths is the visible spectrum can fifth order diffraction be observed.

Ans:

13. When white light is incident on a diffraction grating, the light that will be deviated from central image will be

a) yellow b) violet c) indigo   d)red

14. Maximum number of orders available with a grating is

a. independent of grating element
b. directly proportional to grating element
c. inversely proportional to grating element
d. directly proportional to wavelength

Vibration of strings
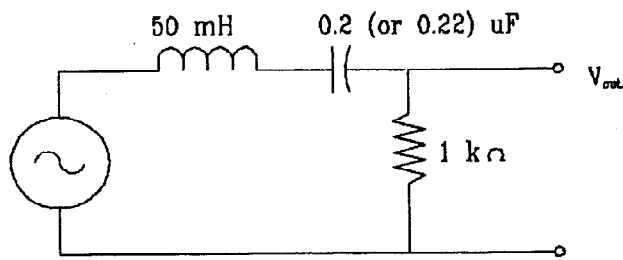
15. Wires of which all materials are used in the lab and which two materials used have same density?

Ans:

RLC

16. In a plot of current vs frequency for series tuned circuit, it is observed that the Q factor _____ with decrease in damping resistance.

17. In the following circuit where would you connect a voltmeter and where would you connect an ammeter?

5

Ferromagnetic Hysteresis

18. Which of the following hysteresis loops best describes a permanent magnet and which would be best suited for making an audio tape.
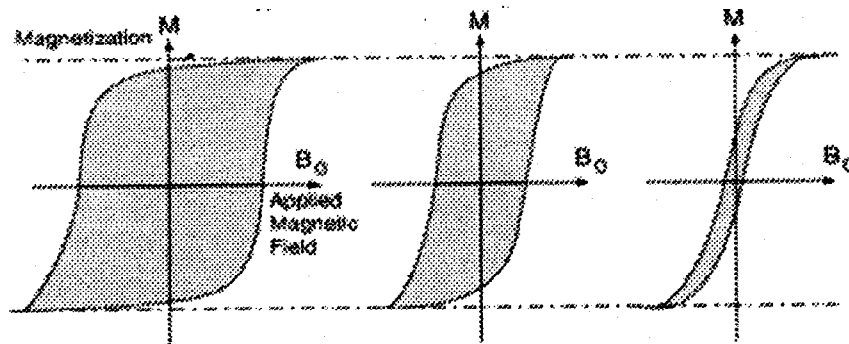

Ans:

19. Soft iron alloys are used as transformer cores because their

a) magnetic saturation limit is high and retentivity and coercivity are small.

b) retentivity is high

c) coercivity is high

d) area of hysteresis is large

Hall Effect

20. A strip of copper 150 μm wide is placed in a uniform magnetic field B of magnitude 0.65 T, with B perpendicular to the strip. A current I = 23 A is then sent through the strip such that a Hall potential V_H appears across the width of the strip. Calculate V_H [n = 8.47×10^{28} electron/m^3]

Ans:

21. In the following diagram of a copper block, depict which side is at higher Hall potential
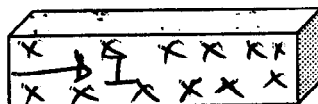
Solar Cell

22. For the following data calculate Intensity, J, and draw Intensity vs position graph. What is the relation between the two? (Graph sheet provided)

Position (cm)	Current in the thermopile (Amp)	
200	26.08	
300	21.70	
400	15.43	
500	11.51	
600	9.35	
700	7.48	
800	5.39	
900	3.01	

Ans:

Elastic collisions

23.. Conservation of linear momentum is equivalent to

    a) Newton's 1st law of motion

    b) Newton's 2nd law of motion

    c) Newton's 3rd law of motion

    d) None of the above

24. A ball of mass m moving with a velocity v strikes a wall, undergoes an elastic collision and rebounds with the velocity v. What is the change in momentum and change in kinetic energy of the ball?

Ans:

1.Lactose is a disaccharide which upon hydrolysis produces _____ and

_____ .

2.Fructose reduces Fehling's solution probably due to easily oxidisable

(a) $> C = O$ group
(b) — CHO group
(c) — OH group
(d) —CO CH_2OH group

3.Carbohydrates can be detected by _____ test.

4. The main reason for the high acidic nature of carboxylic acids is
    (a)greater resonance stabilization of carboxylic acid.
    (b) greater resonance stabilization of carboxylate ion.
    (c)greater basic nature of conjugate base $RCOO^-$.
    (d)equal stabilization of both carboxylic acid and carboxylate ion.

5.What happens when tartaric acid is warmed with Tollen's reagent?Give the chemical
    equation .

6. Write the units of rate constant for a second order reaction.

7. Following observations were made during hydrolysis of methyl acetate at $25°C$ using 0.05N HCl as catalyst.

t(sec)	0	75	119	183	∞
Volume of the alkali used (ml)	9.6	12.1	13.2	14.7	21.0

Show that the reaction is of the first order.

8. Mention any two applications of conductance measurements.

9. 0.1M acetic acid solution when placed between two electrodes each having an area of 2.5cm^2 and separated by 0.8cm has a resistance of 6956 ohms. Calculate the specific conductivity and molar conductivity of the solution.

10. Sketch the pH curve for the titration of HOCl versus NaOH. Show appropriate pH values and mark the stoichiometric point.

11. The pH at the half way of stoichiometric point between the titration of a weak acid and a strong base is 5.75. Calculate the ionization constant of the acid.

12. Balance the following redox equation in acidic medium.
Mn^{2+} (aq) + PbO_2 (aq) --------> MnO_4^- (aq) + Pb^{2+} (aq)

13. Mention any two properties that a primary standard should possess?

14. In the given reaction

Aniline + acetic anhydride --------->

What will be the product formed if heating is prolonged and excess of acetic anhydride is employed?
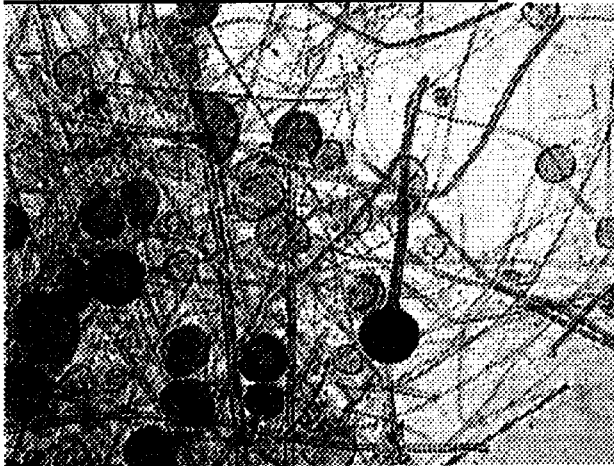
15. The acetylation of aniline is a _____ substitution at a carbonyl carbon atom.

16. The basic character of aniline is due to

_____

BIOLOGY

1. What is the formula for Calibration Constant?

2. What are the basic differences between Scanning Electron Microscopy and Transmission Electron Microscopy?

3. Identify the structure and label it.

4. Name five major components to the UV-Vis. spectrophotometer.

5. What is the principle involved in this spectrophotometer?

6. Why during Spectrophotometric analysis that you have done in the class, the colour of the solution turns blue.

7. What happens when 0.1N Hcl is added to a drop of blood?

8. Hayme's fluid contains _____

9. Writer down the materials required for WBC, RBC and Hemoglobin count estimation

10. If a male has blood group B, he will have _____ antigen on the RBC surface and _____ antibodies in his blood, he can only receive the blood from _____

11. Temporary increase in certain type of WBC during a particular disease state is Known as_____, Example: _____.

12. Which part of the cell generally takes up the dye used for staining?

13. Write the formula of Mitotic Index and length of each phase?

14. **Match the following:**

A. Haemolytic Anemia   (i)   bone marrow fails to produce RBC

B.Sickle cell Anemia   (ii) Sahli's Acid Hematin Method

C.Aplastic Anemia   (iii) RBC destroyed prematurely

D. Hb estimation   (iv) genetic disorder

Evaluation Component : **TEST - II** (closed book)
[Theory]

II Year II Semester of the Academic Year 2005-2006

TA UC 222 MEASUREMENT TECHNIQUES – II (EEE Part)

Date : 15th May 2006   Maximum Marks: 20
Duration: 50 mts   Weightage: 10%

Note:-   1. Answer ALL the Questions
         2. Focus your answers to points of the Question; else you may loose time.
         3. Make your assumptions, if any, explicit

- - -

1)
   a) A first order system is subjected to a harmonic input of 3Hz. The system has a time constant of 0.5 s. Calculate the decrease in amplitude response and the phase lag.   [2 M]

   b) A thermometer acting as a first order system is initially at a temperature of 35°C. It is then suddenly subjected to a temperature of 110°C. After 8sec the thermometer indicates a temperature of 75°C. What are the "time constant" and the "rise time" of the thermometer?   [2 M]

2) Consider the Two resistors R_1 and R_2 with values as: $R_1 = 100.0 \pm 0.1\ \Omega$ and $R_2 = 50.0 \pm 0.03\ \Omega$ respectively. Calculate the uncertainty in the measurement of their combined resistance if they are connected in (a)a series arrangement and (b) a parallel arrangement   [4 M]

3)
   a) Define the following terms with reference to measurement systems and indicate with a suitable example as how they are expressed   [2 M]
       i) Precision
       ii) Sensitivity

   b) What is calibration w.r.t. a measurement system and indicate steps to carry out the same for any given measurement system.   [2 M]

4)
   a) Explain the construction and the principle of transduction of LVDT. Also list its advantages w.r.t. displacement measurement.   [4 M]

   b) Explain the principle of working of a Moving iron instrument.   [2 M]

   c) What is Hall Effect? Explain the working principle and an application of Hall effect transducer.   [2 M]

......B E S T   O F   L U C K......

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