DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute affiliated to VTU, Approved by AICTE & ISO 9001:2008 Certified)
(Accredited by National Assessment & Accreditation Council (NAAC) with 'A' grade

QUESTION BANK

Characterization Techniques for Engineering Materials

VI semester - 17CM6IECTQ

	UNIT 1	Marks
1.	What must be the "Residual error", according to the principle of least squares, for a "best fit line" (i)Maximum (ii) Minimum (iii) Negligible (iv) none	1
2.	Identify the major source of interference with the desired signal in electronic systems (i)Error signal (ii) Interference signal (iii) Noise signal (iv)Faulty signal	1
3.	Which of the following error is caused by poor calibration of the instrument? (i) Random error (ii) Gross error (iii) Systematic error (iv) Precision error	1
4.	Which of these, a software noise reduction incorporates (i) Computation of median (ii) corrective algorithms (iii) filters (iv) none	1
5.	Identify the term used to specify the closeness of two or more measurements (i) Threshold (ii) Accuracy (iii) Fidelity (iv) Precision	1
6.	Select, by which property, the orientation of molecules in an alpha numeric display made of liquid crystals can be changed (i)gravitational field (ii)Electric field (iii)radiant field (iv) Gallois field	1
7.	Identify the disadvantage of the instrumental methods of characterization (i)Quickness (ii) calibration required (iii) accuracy (iv) None of these	1
8.	Checking the accuracy of the instrument with a standard is called as (i)Precision (ii) calibration (c) accuracy (iv) error	1
9.	Spectroscopy involves the interaction of electromagnetic radiation with (i) Molecules (ii) atoms (iii) matter (iv) all of these	1
10.	The measurement close to the true value is called (i)Precision (ii) calibration (iii) accuracy (iv) error	1
11.	Deflection system of a cathode ray tube consists of (i)1 set of plates (ii) 2 set of plates (iii) 3 set of plates (iv) 4 set of plates	1
12.	Which of the following error is caused by poor calibration of the instrument? (i) Random error (ii) Gross error (iii) Systematic error (iv) Precision error	1
13.	What determines light intensity in a CRT? (i) voltage (ii) current (iii) momentum of electrons (iv) fluorescent screen	1
15.	Identify the advantage of the instrumental methods of characterization (i) fast (ii) accurate (iii) non-destructive (iv) all of these	1
16.	Inner walls of cathode ray tube is coated with (i)Copper (ii) Iron (iii) Aluminium (iv) Fluorescent material	1
17.	Characterization" of material refers to (i) Description of features (ii) detection of composition (iii) detection of structure (iv) all	1

18.	Least square analysis is referred to as (i) Descriptive analysis (ii) Regression analysis (iii) predictive analysis (iv) none	1
	UNIT 2	
19.	Identify the terms used to broadly classify spectra into two categories (i)Atomic and molecular spectra (ii) Atomic and electronic spectra(iii) Molecular and electronic spectra (iv) None of the mentioned	1
20.	Which of these different types of energies are associated with a molecule (i) Electronic energy (ii) Vibrational energy (iii) Rotational energy (iv) All	1
21.	Identify the correct order of different types of energies is (i)E_{el} >>E_{vib} >>E_{rot} >>E_{tra} (ii)E_{el} >>E_{rot} >>E_{vib} >>E_{tra} (iii)E_{el} >>E_{vib} >>E_{tra} >>E_{rot} (iv) E_{tra} >> E_{vib} >> E_{rot} >> E_{el}	1
22.	Identify the unit for voltage gain given by output voltage/input voltage or log (Vo/Vi) (i)It has no units, it is a ratio (ii) Decibels (iii) Hertz (iv) None of the mentioned	1
23.	Which of these different types of energies are associated with a molecule (i) Electronic energy (ii) Vibrational energy (iii) Rotational energy (iv) All	1
24.	The characterization involving transition among vibration energy levels of a molecule. (i) IR spectroscopy (ii) UV spectroscopy (iii) NMR spectroscopy (iv) visible spectroscopy	1
25.	AAS is used in estimation of (i) Halogens (ii) Carbon compounds (iii) Alkaline earth metals (iv) Inert gases	1
26.	AAS is mostly concerned with (i) excited state atoms (ii) ground state atoms (iii) both (a) and (b) (iv) None of these	1
27.	Molecular spectra exhibits bands instead of lines, because it is associated with (i)Vibrational transitions (ii) rotational transitions (iii) electronic transitions (iv) all	1
28.	A wave with shorter wavelength has (i) High frequency (ii) high energy (iii) both (i)&(ii) (iv) low energy	1
29.	Identify the factors that affect the intensity of spectral lines (i)Population of energy levels (ii) concentration of sample (iii) selection rules (iv) all of these	1
30.	Which region of the electromagnetic spectrum the highest energy photons (i)Ultraviolet (ii) infrared (iii) microwave (iv) x-ray	1
31.	Which of the following is not a parameter of electromagnetic radiation? (i) Wavelength (ii) Voltage (iii) Wave number (iv) Amplitude	1
32.	Identify the radiations used to recognize a functional group in an organic molecule (i)Ultraviolet (ii) infrared (iii) microwave (iv) x-ray	1
33.	Which of these is correct? (i) Wavelength is directly proportional to energy (ii) Wavenumber is directly proportional to wavelength (iii) Wavelength is directly proportional to frequency (iv) Wavenumber is directly proportional to energy	1
34.	Which of the following is the principle of Atomic Absorption Spectroscopy? (i) Radiation is absorbed in vapour state and are excited to higher states (ii) Medium absorbs radiation and transmitted radiation is measured (iii) Colour is measured (iv) Colour is simply observed	1
35.	Which of the following is not a fuel used in flame photometry? (i) Acetylene (ii)Propane (iii)Hydrogen (iv) Camphor oil	1
36.	Which of these has longest wavelength? (i) Gamma rays (ii) Radiowaves (iii) IR radiations (iv) UV radiations	1

37.	A cathode cup in the hollow cathode lamp is made up of (i) Same element in test sample (ii) Different element than test sample (iii) Glass (iv) polymer	1
38.	What does the Selection rule illustrate about atoms or molecules to display the spectrum (i) characteristic requirements (ii) possible transitions (iii) energy of quantum levels available for transition (d) all of these	1
39.	Which are the components oscillating in a Electromagnetic radiation (i)Electric field (ii) magnetic field (iii) electric and magnetic field (iv) none of these	1
	UNIT 3	
40.	Identify the mathematical form of Beer lambert's law (i) A= εcrl = log I0/I (ii) A = εcl/v (iii) A = εcl = log I0/I (iv) none	1
41.	Which of these is not a chromophore? (i) NO_2 (ii) **OH** (iii) C = C (iv) C ≡ C	1
42.	Which of these is not an auxochrome (i) NH_2 (ii) C=O (iii) C=N (iv) **C=C**	1
43.	Which of these do not give absorption band in IR region. (i)CO_2 (ii)H_2O (iii)H_2 (iv) HCl	1
44.	Identify the increasing order of energies involved in the UV transitions. (i) $n\rightarrow \pi^*$, $\pi\rightarrow\pi^*$, $n\rightarrow\sigma^*$, $\pi\rightarrow\sigma^*$,$\sigma\rightarrow\sigma^*$ (ii) $\pi\rightarrow\sigma^*$, $\pi\rightarrow\pi^*$, $n\rightarrow\sigma^*$, $\sigma\rightarrow\sigma^*$, $n\rightarrow \pi^*$ (iii) $n\rightarrow\sigma^*$, $\sigma\rightarrow\sigma^*$, $n\rightarrow \pi^*$,$n\rightarrow \pi^*$, $\pi\rightarrow\pi^*$ (iv) $n\rightarrow \pi^*$, $\pi\rightarrow\pi^*$, $n\rightarrow\sigma^*$,$\pi\rightarrow\sigma^*$,$\sigma\rightarrow\sigma^*$	1
45.	On which factors the vibrational stretching frequencies of molecule depend? **(i)Force constant** (ii)Atomic population (iii)Temperature (iv) Magnetic field	1
46.	Identify the increasing order of stretching frequencies for C≡C, C=C & C—C (i) C—C > C=C > C≡C **(ii)C≡C > C=C > C—C** (iii) C—C > C=C < C≡C (iv) C ≡ C < C—C > C = C	1
47.	What will be the effect of converting $H_2C=CH_2$ to $H_2C=CH-CH=CH_2$ on λ_{max} (i) no effect (ii) shorter wavelength (iii) longer wavelength (iv) both (ii)&(iii)	1
48.	The factors that affect the λ_{max} are (i)conjugation (ii) polarity of the solvent (**c) both (i) and (ii)** (d) none of these	1
49.	shift of λ_{max} towards longer wavelength region is called (i)blue shift **(ii)red shift** (iii) hyperchromic effect (iv) hypochromic effect	1
50.	Normal modes of vibrations for a nonlinear triatomic molecule is given by (i)3n-5 (ii)3n-6 (iii) 3n-4 (iv) 3n-3	1
51.	Identify the requirements for absorption of IR radiation (i)Dipole moment (ii)radiation of matching frequency **(iii)both (i)and(ii)** (iv) None	1
52.	Most commonly used solid sample handling technique in IR spectroscopy is **(i)KBr pellet** (ii) KCl Pellet (iii) NaCl pellet (iv) NaBr pellet	1
53.	The source used in the instrumentation of IR spectroscopy is **(i)Globar** (ii) Hallow cathode lamp (iii) X-ray tube (iv) None of these	1
54.	The transitions among the electronic energy levels leads to (i) IR spectroscopy **(ii) UV spectroscopy** (iii) NMR spectroscopy (iv) Microwave spectroscopy	1
55.	Identify the units of an IR spectrometer on the X-axis (i) meter (ii) centimeter (iii) **per centimeter** (iv) nanometer	1
56.	Which of the following does not depend on absorbance, according to Beer-Lambert Law (i)**Extinction coefficient of the sample**. (ii) Colour of the solution. (iii) Distance the light has travelled through the sample. (iv) Solution concentration.	1

57.	Which of these contributes to the vibrational stretching frequency of the molecule? (i) **Force constant** (ii) Atomic population (iii) Temperature (iv) Magnetic field	1
58.	Which of these electronic transitions lead to absorption spectra? (i)Higher energy level to lower energy level **(ii) Lower energy level to higher energy level** (iii) Intermediate levels (iv) All	1
59.	As conjugation increases, λ_{max} (i) Decreases **(ii) Increases** (iii) no effect (iv) none of these	1
60.	Number of fundamental vibrations in CO2 is **(i) 4** (ii) 3 (iii) 5 (iv) 6	1
61.	Identify the type of transitions in butadiene (i) n $\rightarrow \pi^*$ **(ii) $\pi \rightarrow \pi^*$** iii) n $\rightarrow \sigma^*$ (iv) all of these	1
62.	Identify the type of transition in acetylene molecule (i) n $\rightarrow \pi^*$ **(ii) $\pi \rightarrow \pi^*$** iii) n $\rightarrow \sigma^*$ (iv) all of these	1
63.	What is the correct increasing order of stretching frequencies for C ≡ C, C = C and C — C? (i)C — C > C = C > C ≡ C **(ii) C ≡ C > C = C > C — C** (iii) C — C > C = C < C ≡ C (iv) C ≡ C < C — C > C = C	1
64.	Which of these criteria is most important for a solvent to be used in UV spectroscopy (a) Low polarity (ii) low solubility (iii) low viscocity **(iv) all of these**	1
	UNIT 4	
65.	Name the effect experienced by ^1H nuclei located near electronegative atom (i) Resonance (ii) shielded (iii) deshielded (iv) split	1
66.	Select the transition caused to nuclei due to radio waves in presence of magnetic field (i) Vibrational transition **(**ii) spin transition (iii) electronic transition (iv) none	1
67.	Identify the kind of signal in NMR exhibited by CH_4 and C_6H_6 (i) Triplet (ii) Singlet (iii) Doublet (iv) Quintet	1
68.	Find the number of NMR signals obtained for CH_3COCH_3 (i) 6 (ii) 3 (iii) 2 (iv) 1	1
69.	NMR involves the interaction of molecules with (i)IR rays (ii) UV rays (iii) X-rays (iv) Radiowaves	1
70.	Identify the NMR active nuclei (i)^1H (ii) ^{12}C (iii) ^2H (iv) All of these	1
71.	Identify the reference compound used in NMR spectroscopy (a) THF (b) TMS (c) TSM (d) None of these	1
72.	How is the energy difference between the allowed spin states for a ^1H nucleus related to strength of the external magnetic field (i) Exponential (ii) inversely proportional (iii) directly proportional (iv) logarithmic	1
73.	The ^1H NMR spectrum of chloroethane shows (i) 1 triplet and 1quartret (ii) 2 triplets (iii) 2 quartets (iv) 1doublet and 1 triplet	1
74.	For a nucleus with nuclear spin quantum number I = ½, what are the values of mI? (i) $^{+1/2,}$ 0 (ii) $^{-1/2}$, 0 (iii) $^{+1/2, -1/2}$ (iv) $^{-1/2\ ,\ 1}$	1
75.	NMR spectroscopy indicates the chemical nature of and spatial positions of (i) Electrons and Protons (ii) Neutrons and electrons (iii) Nuclei and electrons (iv) Nuclei and neighbouring nuclei	1

76.	Transitions among spin energy levels result in which type of spectroscopy (i) ESR (ii) NMR (iii) both (a) and (b) (iv) UV	1
77.	^{1}H nuclei located near electronegative atoms tend to be (i) Resonating (ii) shielded (iii) deshielded (iv) split	1
78.	Which Electromagnetic radiation is used in ^{1}H NMR spectroscopy (i) x-ray (ii) radiowaves (iii)Infrared (iv) microwaves	1
79.	Identify the kind of signal in NMR exhibited by CH_4 and C_6H_6 (i) Triplet (ii) Singlet (iii) Doublet (iv) Quintet	1
80.	Find the number of NMR signals obtained for CH_3COCH_3 (i) 6 (ii) 3 (iii) 2 (iv) 1	1
81.	Which type of magnet is commonly used in NMR spectrometer (i)Temporary magnet (ii) permanent magnet (iii) electromagnet (iv) none of these	1
82.	Which of these can minimise interference due to unwanted protons in an NMR spectrum (i)Applying high temperature (ii)By using Deuterated Solvents (ii) using aqueous samples (iv) none	1
	UNIT 5	
83.	Name the electrode on which copper is deposited during electrogravimetric determination of Copper in brass (i) anode (ii) cathode (iii) both cathode and anode (iv) none	1
84.	Which of these measurements are involved in voltammetry (i) variation of potential as the temperature is varied (ii) variation of colour as potential is varie d (iii) variation of current as the potential is varied (iv) none	1
85.	Identify the working electrode used in poloarographic technique (i) Dropping mercury electrode (ii) Mercury pool (iii) both (i) & (ii) (iv) None	1
86.	Choose the technique in which electrode potential varies with the concentration (i) Voltammetry (ii) Potentiometry (iii) Electrogravimetry (iv) Polarography	1
87.	.Which of these corresponds to concentration of the substance in a Polarogram (i) Diffusion current (ii) Residual current (iii) Limiting current (iv) Average current	1
88.	Identify the most versatile voltammetric technique used for corrosion study. (i) linear sweep (ii) cyclic (iii) square wave (iv) chronoamperometry	1
89.	Which equation relates electrode potential with the concentration (i) Henderson's equation (ii) Ostwald's equation (iii) Nernst equation (iv) None	1
90.	Identify the electrodes used in voltammetry. (i) working electrode (ii) reference electrode (iii) counter electrode (iv) All of these	1
91.	The reaction responsible for the deposition of metal on the cathode in electrogravimetry is (i) oxidation (ii) neutralization (iii) reduction (iv) complexaion	1
92.	Recognize the working electrode used in polarography (i) DME (ii) pool of Hg (iii) both (i) and (ii) (iv) None of these	1
93.	What does 'F' in the Nernst equation refer to? (i)charge on a mole of electrons (ii) moles of electrons (iii) Cell potential (iv) none	1
94.	Which is the auxillary electrode in polarography (i) Dropping mercury (ii) mercury pool (iii) Graphite electrode (iv)None	1
95.	Which of the following electrochemical methods requires the formation of an insoluble form of the analyte (i) Electrogravimetry (ii) potentiometry (iii) voltammetry (iv) conductometry	1
96.	Which is the Electrochemical method obtained by measuring current as a function of applied potential (i) potentiometry (ii) electrogravimetry (iii) voltammetry (iv) None of these	1
97.	Supporting electrolyte is used in polarography to suppress (i)Migration current (ii) diffusion current (iii) convection current (iv) residual current	1

98.	The technique that deposits the material by application of potential is (i) Potentiometry (ii) Electrogravimetry (iii) Voltammetry (iv) Polarography	1
99.	Identify the electrode which functions as a cathode whenever the working electrode is operating as an anode and vice versa. (i) Inert electrode (ii) modified electrode (iii) thermal electrode (iv) auxillary electrode	1
100.	Which feature of auxillary electrode ensures no current limitations arise. (i) large surface area (ii) inertness (iii) optimum electrode distance (iv) all of these	1

UNIT 1

1. Define (i) precision (ii) signal (iii) noise (iv) amplifier (v) readout device (vi) calibration (vii) characterization (viii) instrumental analysis (ix) Precision (x) accuracy (xi) Errors (xii) noise (xiii)
2. Classify the methods of characterization based on data generation, quantification andprinciple of measurements.
3. List the advantages and disadvantages in instrumental methods of characterization
4. Explain the components involved in the instrumental methods of characterization with a neat block diagram.
5. Distinguish between determinate and indeterminate errors with suitable examples.
6. List the methods to minimize errors.
7. Identify the sources of noise with suitable examples.
8. Represent signal to noise ratio mathematically and suggest two methods for noise reduction
9. Classify amplifiers based on the type of signal amplified and on properties of output.
10. Explain the role of method of standard addition and method of least square in handling the data.
11. Differentiate the construction of LED and LCD used as alphanumeric displays.
12. Explain the construction and working of CRT with a neat diagram.

UNIT 2

13. Define (i) Frequency (ii) wavenumber (iii) Absorption maximum (iv) spectroscopy
14. Identify the different regions of electromagnetic spectrum and the corresponding spectroscopic techniques.
15. Explain the factors influencing the position and intensity of spectral lines.
16. List the advantages and disadvantages of cathode ray tube & amplifiers.
17. Differentiate atomic and molecular spectra
18. State the principle of AAS and FES.
19. Outline the instrumentation of AAS spectrophotometer with a neat labeled diagram.
20. Differentiate the advantages, disadvantages, construction Total consumption burner and Premix burner using suitable diagram.

21. List the applications, advantages and disadvantages of AAS and FES
22. List the different fuels used in flame photometry.
23. Why FES is temperature dependent but AAS is not.
24. Low temperature flame is used for analysis of alkali and alkaline earth metals. Justify.
25. List any 2 differences between AAS and FES.

UNIT 3

26. Define (i) Beer-Lambert's law (ii) Chromophores (iii) Auxochromes (iv) Bathochromic shift (v) Hypsochromic shift (vi) Hyperchromic effect (vii) Hypochromic effect (viii) Red shift (ix) Blue shift (x) molar extinction coefficient (xi) Finger print region (xii) coupled interaction (xiii)zero point energy
27. Elaborate on the Types of transitions in Organic molecules.
27. $n \rightarrow \pi^*$ occurs at a higher wavelength than $\pi \rightarrow \pi^*$. Justify
28. Outline the effect of conjugation on UV absorption with a suitable example.
29. Identify the mathematical form of Beer-Lambert's law and mention the terms involved.
30. Outline the electronic transitions in organic molecules and arrange them in increasing order of energies.
31. Explain the instrumentation and working of double beam UV spectrometer with a neat labeled diagram.
32. List the requirements for a suitable solvent in ultraviolet spectroscopy.
33. Water cannot be used as solvent in IR spectroscopy. Justify.
34. List the differences between Dispersive IR and Fourier transform IR spectroscopy.
35. Explain the Theory of IR spectroscopy.
36. Elaborate on the detectors used in UV and IR spectrophotometers.
37. State the two conditions for a molecule to absorb IR radiations.
38. Interpret the fundamental modes of vibrations for stretching and bending vibrations in CO_2 and H_2O molecule with relevant structures.
39. Illustrate with examples the effect of the following on group frequencies
    (a) coupled interactions (b) electronic effects and (c) hydrogen bonding
40. Explain the instrumentation and working of FTIR spectrometer with a neat labeled diagram
41. List any 4 applications of electronic spectroscopy and IR spectroscopy.
42. Compare Nujol mull and KBr pellet sample technique used in IR spectroscopy.
43. Illustrate with a suitable example, the effect of the following on IR frequency absorbed (i)Multiple bond (ii) Increase in polarity (iii) conjugation (iv)Hydrogen bonding

UNIT 4

44. Explain the different types of nuclei in NMR spectroscopy
45. Explain the theory of NMR spectroscopy.
46. Define (i) spin active nuclei (ii) resonance (iii) spin transitions (iv) spin- spin relaxation (v) spin lattice relaxation (vi) shielding (vii) deshielding (viii) chemical shift (ix) equivalent protons (x) spin-spin splitting (xi) spin spin coupling (xii) coupling constant (xiii) n+1 rule

43. Define Chemical shift. What is the effect of the following on chemical shift?

44. Justify the usage of TMS being used as referece in NMR spectroscopy
    (i) Electronegativity of adjacent atom (ii)hybridisation (iii) hydrogen bonding (iv)Anisotropic effect /pi magnetic induction
45. Outline the principle, instrumentation and working of NMR spectrometer with a neat labeled diagram.
46. List the advantages of TMS as a reference.
47. List the applications of NMR.

UNIT 5

48. Outline the theory & instrumentation of Potentiometry with a neat labeled diagram
49. Outline the different types of electrodes with an example.
50. Explain the significance of Nernst equation in a potentiometric titration.

50 . List the applications of Potentiometry.

51. Outline the theory of electrogravimetry and its application to quantify copper in brass.
52. List the applications of electrogravimetry.
53. Outline the classification of voltammetric methods.
54. Identify and explain the voltammetric technique used in corrosion studies.
55. Define polarography. Explain the construction and working of dropping mercury electrode with a neat labeled diagram
56. Define (i) Residual current (ii) Limiting current (iii) Diffusion current (iv) half wave potential
57. List the applications of voltammetry, electrogravimetry and polarography.