MUDRA PHYSICAL SCIENCES
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PART B & C
MODEL QUESTION BANK FOR THE TOPICS:

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7. Experimental Techniques & Data Analysis

UNIT-I

1. Single ended pre-recording systems is
   a) Dolby HX  
   b) Dolby SR  
   c) DNR  
   d) CEDAR

2. What is the significant number of the value 0.000102?
   a) 2  
   b) 3  
   c) 6  
   d) 7

3. Accuracy cannot be determined by the method?
   a) Absolute  
   b) Comparative  
   c) Minimal  
   d) None of these

4. For a set of experimental data the standard deviation is determined to be 1.5. Thus the
   mean deviation would be approximately
   a) 2.2  
   b) 3.2  
   c) 4.2  
   d) 1.2

5. The principle of Pirani gauge is based on
   a) Humidity of the medium  
   b) Thermal conductivity of the medium  
   c) Combustibility of the medium  
   d) None of these

6. Which amongst the following divides the frequencies in four equal parts and they are
   denoted by \( Q_1, Q_2, Q_3 \). Where \( Q_2 \) is same as the median?
   a) Average  
   b) Mode  
   c) Quartiles  
   d) None of these

7. Two sets of experiments have equivalent absolute errors but the number of measurements
   taken are different. Thus they would have
   a) Equivalent standard  
   b) Equivalent mean deviations  
   c) Equivalent variance  
   d) None of these

8. A differentiator is rarely used in analog computers because
   a) It reduces the gain  
   b) It decreases the output of the amplifier  
   c) It amplifies noise, drift and other unwanted disturbances  
   d) None of these

9. \( \sigma_e \) can be evaluated with adequate precision from practical purpose from the equation
   a) \( \sigma_e \approx \pm 2.25 \times d_{av} \)  
   b) \( \sigma_e \approx \pm 1.25 \times d_{av} \)  
   c) \( \sigma_e \approx +1.45 \times \sigma \)  
   d) \( \sigma_e \approx -1.45 \times \sigma \)
10. The errors involved in photometric measurements are of the order of
   a) 1%  
   b) 1-5%  
   c) 10-20%  
   d) 40-50%

11. A Hall effect transducer can be used for measurement of–
   a) Power  
   b) Electric current  
   c) Displacement  
   d) All of these

12. A cadmium sulphide cell has the highest response for a light of wavelength of nearly–
   a) 300 nm  
   b) 800 nm  
   c) 500 nm  
   d) 600 nm

13. The effective resistance of a coil at high frequencies is more than its d.c. resistance on account of–
   a) Skin effects  
   b) Proximity effect  
   c) Eddy current losses  
   d) All of the above

14. If ‘O’ represent observed value and T represent the measure value then the absolute error is represented by
   a) |O – T|  
   b) |T – O|  
   c) |O + T|  
   d) |O| / |T|

15. The gauge factor is defined as
   a) $\frac{\Delta R}{R} / \frac{\Delta L}{L}$  
   b) $\frac{\Delta R}{L} / \frac{\Delta L}{R}$  
   c) $\frac{\Delta R}{R} / \frac{\Delta D}{D}$  
   d) $\frac{\Delta R}{R} / \frac{\Delta \rho}{\rho}$

16. A light source may be considered as a point source if its diameter is
   a) Less than 10% of the distance between it and the detector
   b) Less than 1% of the distance between it and the detector
   c) More than 10% of the distance between it and the detector
   d) More than 1% of the distance between it and the detector

17. A voltage signal $v(t)$ has the following Fourier transform:
   $$V(j\omega) = \begin{cases} 
   e^{-j\omega} & \text{for } |\omega| < 1 \\
   0 & \text{for } |\omega| > 1 
   \end{cases}$$

   The energy that would be dissipated in a 1Ω resistor fed from $v(t)$ is
   a) $\frac{2}{\pi}$ Joules  
   b) $\frac{2e^{-2d}}{2\pi}$ Joules  
   c) $\frac{1}{\pi}$  
   d) $\frac{1}{2\pi}$ Joules
18. If \( P < 0.05 \), the level of significance is
   a) 5%  
   b) 50% 
   c) 0.05%  
   d) 0.50%

19. The most common type of scintillation materials
   a) Gases  
   b) Inorganic crystals 
   c) Liquids  
   d) Plastics

20. Radiation pyrometers are used in temperature range of–
   a) 0 – 500°C 
   b) 500 – 1000°C 
   b) –250 – 500°C 
   d) 1200 – 2500°C

21. The rate of deposition of positive charges in an ionization chamber is measured by
   a) Quadrant electrometer  
   b) Voltmeter 
   c) Ammeter  
   d) None of these

22. Keeping all the parameter same if the standard deviation is doubled, variance would be
   a) No effect  
   b) Doubled 
   c) Quadrupled  
   d) Halved

23. Which of the following instrument can be used for measuring the expansion of bodies by heat?
   a) Thermometer  
   b) Thermocouple 
   c) Differential air thermoscope 
   d) Pyrometer

24. The temperature transducers exhibit non-linear behaviour. The order in which they exhibit non-linearity (highest to lowest) is –
   a) Thermocouples, RTD, thermistors 
   b) Thermistors, thermocouples, RTDs, 
   c) RTDs, thermocouples, thermistors 
   d) Thermistors, RTDs, thermocouples

25. Three types of temperature transducers are compared as regards their sensitivity. The order in which they exhibit their sensitivities (highest to lowest) is –
   a) Thermistors, RTDs, thermocouples 
   b) Thermocouples, RTDs, thermistors 
   c) RTDs, Thermistors, thermocouples 
   d) RTDs, thermocouples, thermistors

26. The true value of flux density in a ring specimen is
   a) \[ B = B' + \mu_0 H \left( \frac{A_s}{A_c} - 1 \right) \]
   b) \[ B = B' - \mu_0 H \left( \frac{A_s}{A_c} - 1 \right) \]
   c) \[ B = B' + \mu_0 H \left( \frac{A_s}{A_c} - 1 \right) \]
   d) \[ B = B' - \mu_0 H \left( \frac{A_s}{A_c} - 1 \right) \]

   where
   \( B' \) = Measured value of flux density  
   \( H \) = Magnetizing force, \( A_s \) = Area of cross section of specimen, 
   \( A_c \) = Area of cross section of coil producing magnetizing force
27. The spectral density of white noise is –
   a) Exponential  b) Uniform  
   c) Poisson  d) Gaussian

28. In the generation of modulated signal, a varactor diode can be used for –
   a) FM generation only  b) AM generation only  
   c) PM generation only  d) Both AM and PM generation

29. For a moderately skew distribution, the mode is calculated by the empirical formula.
   a) Mode = 3 (Mean – Median)  b) Mode = Mean – Median  
   c) Mode = 3 Mean – 2 Median  d) Mode = 3 Median – 2 Mean

30. In case a signal band limited to $f_m$ is sampled at a rate less than $2f_m$, the constructed signal will be –
   a) Distortion less  b) Small in amplitude  
   c) Having higher frequencies suppressed  d) Distorted

31. Which of the following demodulator(s) can be used for demodulating the signal $x(t) = 5(1 + 2 \cos 2000 \pi t) \cos 2000 \pi t$?
   a) Envelope demodulator  b) Square-law demodulator  
   c) Synchronous demodulator  d) All of these

32. Mathematically standard deviation is represented by
   a) $\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N}}$  
   b) $\sigma = \sqrt{\frac{\sum (x_i - \bar{x})}{N}}$  
   c) $\sigma = \frac{\sum (x_i - \bar{x})^2}{N^2}$  
   d) $\sigma = \sqrt{\frac{\sum (x_i - \bar{x})^2}{N^2}}$

33. If the number of observation in two group be $n_1$ and $n_2$ with mean $m_1$ and $m_2$ respectively and if the two groups are combined then mean $m$ of the combined group is given by
   a) $m = \frac{n_1 m_1 + n_2 m_2}{n_1 + n_2}$  
   b) $m = \frac{n_1 m_1 + n_2 m_2}{m_1 + m_2}$  
   c) $m = \frac{n_1 m_1 + n_2 m_2}{n_1 + n_2}$  
   d) $m = \frac{n_1 m_1 + n_2 m_2}{m_1 + m_2}$

34. Input auto-correlation function is $R_{xx}(\tau) = \frac{1}{2} \int_{-\infty}^{\infty} R(\omega) e^{-j\omega \tau} d\omega$, then output power spectral density will be
   a) $\frac{N_0}{2(1 - \omega^2 \beta^2)}$  
   b) $\frac{N_0}{2(1 + \omega^2 \beta^2)}$  
   c) $\frac{N_0^2}{2(1 - \omega^2 \beta^2)}$  
   d) $\frac{N_0^2}{2(1 + \omega^2 \beta^2)}$
35. Inductance is measured by
   a) Wien bridge  
   b) Schering bridge  
   c) Maxwell’s bridge  
   d) Hay bridge

36. The impulse response of a filter, matched to a rectangular pulse is –
   a) An attenuator  
   b) A low pass filter  
   c) A high pass filter  
   d) An equalizer

37. Which of the following instrument can be used for detecting heat rays?
   a) Radiometer  
   b) Thermometer  
   c) Thermopile  
   d) Pyrometer

38. Which of the following photoelectric devices is used for production of electrical energy by converting solar energy?
   a) Photo emissive cell  
   b) Photo-diode  
   c) Photo transistor  
   d) Both (b) and (c)

39. The probability of density function of the envelope of a sinusoidal signal along with narrow band noise follows the following distribution –
   a) Gaussian  
   b) Rayleigh  
   c) Rician  
   d) Poisson

40. \( p\left(\chi^2 > \chi_1^2\right) = \alpha / 2 \) can also be given as
   a) \( \chi_1^2 = \chi_{n-1}^2(\alpha / 2) \)  
   b) \( \chi_1^2 < \chi_{n-1}^2(\alpha / 2) \)  
   c) \( \chi_1^2 > \chi_{n-1}^2(\alpha / 2) \)  
   d) None of these

41. If \( g(t) \leftrightarrow G(F) \) represents a Fourier transform pair, then according to the dually property of Fourier transform –
   a) \( G(t)g(f) \)  
   b) \( G(t)g^*(f) \)  
   c) \( G(t)g(-f) \)  
   d) \( G(t)g^*(-f) \)

42. The minimum value of \( m_f \) for an FM system required to produce a noticeable improvement in \( 5/N \) ratio over a comparable AM system with \( m = 1 \) is –
   a) \( \sqrt{3} \)  
   b) \( \sqrt{2} \)  
   c) \( \frac{1}{\sqrt{2}} \)  
   d) \( \frac{1}{\sqrt{3}} \)

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