

**SECTION A      ANSWER ANY TWO (2) QUESTIONS**

**QUESTION 1**

(a) A moving-coil millivoltmeter has a resistance of  $20\Omega$  and reaches full-scale when the potential difference of  $100\text{mV}$  is applied across its terminals. The moving coil has the effective dimensions of  $3.1\text{cm} \times 2.6\text{cm}$  and is wound with 120 turns. The flux density in the gap is  $0.15\text{Wb/m}^2$ . Determine the control constant of the spring and the cross section area of copper wire for coil winding if 55% of total instrument resistance is due to coil winding. If copper  $\rho = 1.73 \cdot 10^{-6} \Omega\text{cm}$ .

**[10 Marks]**

(i) Explain types instrument drifts and show graphically,

**[6 Marks]**

(ii) Explain what is meant by instruments range.

**[4 Marks]**

**QUESTION 2**

(a) Design a multirange ammeter to give the following ranges  $10\text{mA}$ ,  $100\text{mA}$ ,  $1\text{A}$ ,  $10\text{A}$  and  $100\text{A}$ . If the meter have internal resistance of  $10\Omega$  and full scale current of  $1\text{mA}$ .

**[5Marks]**

(i) Describe what is meant by absolute and secondary instruments,

**[3 Marks]**

(ii) Define and state the difference between instrument accuracy and precision.

**[6 Marks]**

(iii) State in detail the types of instruments errors and show equations.

**[6 Marks]**

**QUESTION 3**

(a) Describe in details the principle of operation of both types of Moving Iron Instruments. **[8 Marks]**

(b) Describe with the aid of diagrams the types and process of instrument damping. **[8 Marks]**

(i) If the repeatability of ohmmeter were found to be 2.3 after measuring the same resistor, find the value of X if the measured resistance were;  $2.3\Omega$ ,  $2\Omega$ ,  $2.1\Omega$ ,  $1.8\Omega$ ,  $3\Omega$ ,  $X\Omega$  and  $3.88\Omega$ .

**[4 Marks]**

**SECTION B**

**ANSWER ANY THREE (3) QUESTIONS**

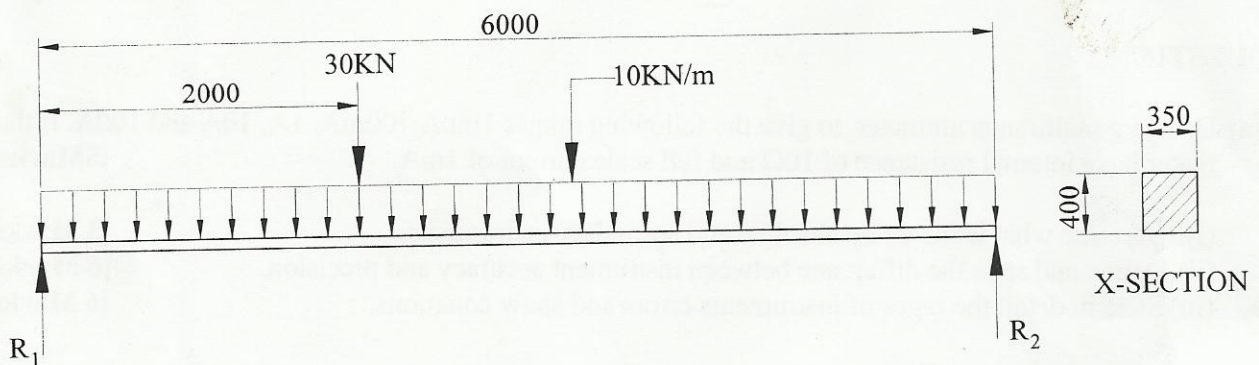
**QUESTION 4**

A beam 6 meters long with a solid rectangular cross section of 350mm wide x 400mm deep is loaded as shown below. Determine;

- (i) The slope at the end,
- (ii) The deflection at the middle.

[8 Marks]  
[12Marks]

Take  $E=210\text{GPa}$ .



Figure

**QUESTION 5**

A shaft carries four masses in parallel planes A, B, C and D in order along a shaft. The masses at B and C weigh 18 kg and 12.5 kg respectively and each has an eccentricity of 60mm. The masses at A and D have an eccentricity of 80mm. The angle between the masses at B and C is  $100^\circ$  and that between the masses at B and A is  $190^\circ$  both the angles measured in the same sense. The axial distance between the planes A and B is 100mm and between B and C is 200mm. If the shaft is in complete dynamic balance determine;

- (i) The weight of the masses at A and D,
- (ii) The distance between plane C and D,
- (iii) The angular position of mass at D.

[8 Marks]  
[6 Marks]  
[6 Marks]