Hall Ticket No | | | | | | | | | | |  Question Paper Code: AEEC24

# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

**B.Tech VI SEMESTER END EXAMINATIONS (REGULAR) - JULY 2023**
**Regulation: UG-20**
**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**
**Time: 3 Hours** (ELECTRICAL AND ELECTRONICS ENGINEERING) **Max Marks: 70**

**Answer ALL questions in Module I and II**
**Answer ONE out of two questions in Modules III, IV and V**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

## MODULE – I

1. (a) Illustrate the construction and working principle of permanent magnet moving coil instrument. Show that the controlling torque is proportional to angular deflection of pointer.
[BL: Understand| CO: 1|Marks: 7]

(b) A moving coil ammeter has a fixed shunt of 0.02 Ω with a coil circuit resistance of R = 1 kΩ and need potential difference of 0.5 V across it for full-scale deflection.
i) To what total current does this correspond?
ii) Calculate the value of shunt to give full scale deflection when the total current is 10A and 75A.
[BL: Apply| CO: 1|Marks: 7]

## MODULE – II

2. (a) Outline the working principle of polar type AC potentiometer with neat sketch and obtain the resultant induced emf in the rotor winding due to two stator winding.
[BL: Understand| CO: 2|Marks: 7]

(b) A current transformer of turns ratio 1 : 248 is rated as 1000 / 4 A, 20 VA. The core loss and magnetizing components of the primary current are 4 A and 8 A under rated conditions. The ratio error for the rated burden and the rated secondary current at 0.8 power factor lagging.
[BL: Apply| CO: 2|Marks: 7]

## MODULE – III

3. (a) Explain the single-phase dynamometer type wattmeterfor the measurement of power with neat sketch and show the relation of control torque is proportional to the angular deflection.
[BL: Understand| CO: 3|Marks: 7]

(b) The spring constant of a 10-A dynamometer wattmeter is $10.5 \times 10^{-6}$ N-m per radian. The variation of inductance with angular position of moving system is practically linear over the operating range, the rate of change being 0.078 mH per radian. If the full-scale deflection of the instrument is 83 degrees, calculate the current required in the voltage coil at full scale on DC circuit.
[BL: Apply| CO: 3|Marks: 7]

4. (a) Illustrate the suitable arrangement of wattmeter connection for measuring the three-phase power under balanced load condition with neat circuit and phasor diagram.
[BL: Understand| CO: 4|Marks: 7]

(b) A 3-phase, 400 V load has a power factor of 0.6 lagging. The two wattmeters read a total input power of 20 kW. Find reading of each wattmeter. [BL: Apply| CO: 4|Marks: 7]

## MODULE – IV

5. (a) Interpret the bridge required for the measurement of minimum resistance. Explain the construction and working principle with neat circuit diagram of the bridge and derive the expression for bridge balance condition. [BL: Understand| CO: 5|Marks: 7]

(b) Calculate the current flows through the galvanometer for given bridge shown in Figure 1. [BL: Apply| CO: 5|Marks: 7]

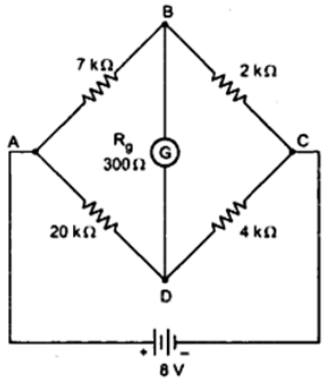


Figure 1

6. (a) List the method of bridges used for the measurement of inductance. Explain the Maxwell's inductance bridge with neat circuit and mention its advantages and disadvantages. [BL: Understand| CO: 5|Marks: 7]

(b) The arms of an AC Maxwell bridge are arranged as follows: AB is a non-inductive resistance of 1,000Ω in parallel with a capacitor of capacitance 0.5 F, BC is a non-inductive resistance of 600Ω CD is an inductive impedance (unknown) and DA is a non- inductive resistance of 400 Ω. If balance is obtained under these conditions, find the value of the resistance and the inductance of the branch CD. [BL: Apply| CO: 5|Marks: 7]

## MODULE – V

7. (a) Demonstrate how the measurement of position can be carried out with LVDT. Outline the characteristics, advantages and applications. [BL: Understand| CO: 6|Marks: 7]

(b) A resistance wire strain gauge with a gauge factor of 2 is bonded to a steel structural member subjected to a stress of 100 $MN/m^2$. The modulus of elasticity of steel is 200 $GN/m^2$. Calculate the percentage in value of the gauge resistance due to the applied stress. Comment upto the results. [BL: Apply| CO: 6|Marks: 7]

8. (a) Which sensor is used to measure the magnitude of magnetic field for the application of position and speed sensing. Explain its construction and working principle and mention the advantages and applications. [BL: Understand| CO: 6|Marks: 7]

(b) A capacitive transducer using five plates. The dimensions of each plate are 25 × 25 mm and the distance between plates is 0.25 mm. This arrangement is to be used for measurement of displacement by observing the change in capacitance with distance x. Calculate the sensitivity of the devise. Assume that the plates are separated by air. The permittivity of air is 8.85 × $10^{-12}$F/m. [BL: Apply| CO: 6|Marks: 7]