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SEAT No. :

PA-12

[Total No. of Pages : 2

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S.E. (Electrical)

ELECTRICAL MEASUREMENTS & INSTRUMENTATION

(2019 Pattern)(Semester-I)(203144)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q. 1 or Q. 2, Q. 3 or Q. 4.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

Q1) a) The inductance of MI instruments is given by, $L = 30 + 15\theta - 4\theta^2$ μH where θ is deflection in radians from zero. Spring constant is 25×10^{-6} N-m/rad. Estimate deflection in degrees for a current of 2.5 A. [4]

b) Define the following characteristics [5]

- i) Reproducibility
- ii) Drift
- iii) Accuracy
- iv) Linearity
- v) Speed of response

c) Why is damping mechanism provided in indicating instruments? Explain with neat diagram, fluid friction damping system. [6]

OR

Q2) a) Describe the effect of CT secondary open circuit under loading condition. [4]

b) In an experiment, range of ammeter, voltmeter and wattmeter is to be extended by means of instrument transformers in single phase purely resistive load circuit. Following are the readings obtained in the meters connected on secondary circuit of instrument transformers. [5]

Calculate

- i) load current,
- ii) voltage across load
- iii) power consumed by the load,
- iv) Nominal Ratio for PT,
- v) Transformation ratio for CT

P.T.O.

CT ratio 5:1, PT ratio – 440:110

I_2 (A)	V_2 (V)	W_2 (Watts)
0.6	57	35

- c) With neat diagram, explain construction and working of attraction type moving iron instrument. [6]

- Q3)** a) With neat diagram, deduce an expression for unknown inductance in Maxwell's inductance capacitance bridge. [6]
b) Draw neat diagram of Megger and label all the parts. [4]
c) The four arms of Maxwell's bridge network are as follows. [5]

AB & BC are non-inductive resistors of 80Ω each, DA is standard variable inductor L in series with resistance 40Ω & CD comprises a standard variable resistor R in series with unknown impedance. Balance is obtained when $L = 52.2 \text{ mH}$ & $R = 2.3\Omega$. Find the resistance & reactance of coil.

OR

- Q4)** a) With neat diagram, derive the expression for unknown resistance in Kelvin's double bridge. [6]
b) Derive the general bridge balance equation of an AC bridge in polar form. [4]
c) In measurement of resistance R by ammeter – voltmeter method, the resistance of ammeter is 0.5Ω and that of voltmeter is 2200Ω . When ammeter is connected on supply side and voltmeter across the resistance R, current measured is 1.5 A and voltage 188 V. Find the reading of voltmeter, if voltmeter is connected on supply side and across ammeter is connected in series with resistance R, if the current indicated by ammeter is 1.5 A. [5]



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SEAT No. :

P-5383

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S.E. (Electrical) (Insem)

**ELECTRICAL MEASUREMENTS &
INSTRUMENTATION**

(2019 Pattern) (203144) (Semester-III)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

- 1) Answer Q1 or Q2 and Q3 or Q4.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Assume suitable data, if necessary.

Q1) a) Explain necessity of controlling torque in indicating type instruments. Also explain spring and gravity control system used in indicating instruments. **[8]**

b) Explain how range can be extended for ammeter, voltmeter and wattmeter using instrument transformers? Draw necessary diagram for the same. **[7]**

OR

Q2) a) Draw neat diagram of CT and PT hence state use of instrument transformers and define the following terms with reference to instrument transformers. **[8]**

- i) Nominal ratio for CT
 - ii) Turns ratio for PT
 - iii) Burden for CT
 - iv) Transformation ratio for PT
- b) Derive the torque equation for PMMC type of instrument hence comment on scale of PMMC type of instruments. **[7]**

P.T.O.

Q3) a) Classify resistance with one example in each case hence deduce an expression for Wheatstone's bridge. [7]

b) State various detectors used for AC bridges hence solve the following. [8]

The impedances of the basic AC bridge are as follows

$$Z_1 = 100 \Omega \angle 80^\circ$$

$$Z_2 = 250 \Omega \text{ (Pure resistance)}$$

$$Z_3 = 400 \Omega \angle 30^\circ$$

$$Z_4 = \text{Unknown}$$

Determine constants (Resistance and Inductance/Capacitance) of unknown impedance at bridge balance if supply frequency is 1 kHz

OR

Q4) a) In an Anderson bridge for measurement of inductance L_x and resistance R_x in the arm AB, the arms CD and DA have resistances of 600Ω each and arm CE has capacitor of $1 \mu F$ capacitance. With ac supply at 100 Hz supplied across A and C balance is obtained with resistance of 400Ω in arm DE and 800Ω in arm BC. Detector is connected between arm B and E. Draw necessary diagram, write formula used hence calculate value of L_x and R_x . [7]

b) State the following statements are true or false hence justify your answer. [8]

i) Maxwell's Inductance - capacitance bridge can be used for measurement of inductance at power and audio frequencies.

ii) Thermoelectric effect can be neglected in Kelvin's Double bridge.

iii) In ammeter - voltmeter method, ammeter does not measure true current flowing through unknown resistance when it is connected on supply side and voltmeter across unknown resistance.

iv) Scale of Megger is from infinity to zero.

