

Roll No: -----



UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May, 2018

Program Name: B.Tech Electrical

Semester – IV

Course Name : Electrical measurement & Instrumentation

Max. Marks : 100

Course Code : ELEG223

Duration : 3 Hrs

No. of page/s: 2

SECTION A (20 MARKS)

Attempt all questions. Each question carries 5 marks.

- Q1- [CO1] An ammeter reads 6.7 A and the true value of current is 6.54 A. Determine the relative error and static correction for this instrument.
- Q2- [CO4] Differentiate between the following citing suitable examples:
(a) Transducers and inverse transducers
(b) Active and passive transducers
- Q3- [CO4] A resistance wire strain gauge uses a soft iron wire of small diameter. The Gauge factor is + 4.2. Neglecting the piezoresistive effects, determine the Poisson's ratio.
- Q4- [CO1] Define transformation ratio, turns ratio and nominal ratio in case of current transformer.

SECTION B (40 MARKS)

Attempt all questions. Each question carries 10 marks.

- Q5- [CO4] An LVDT has an output of 6 V (rms) when the displacement is 0.4×10^{-3} mm. Determine the sensitivity of this instrument in V/mm. A 10 V Voltmeter with 100 scale divisions is used to read the output. Two tenth of the division can be estimated with ease. Determine the resolution of the voltmeter.
- Q6- [CO2] The Coil of a moving coil voltmeter is 40 mm long and 30 mm wide and has 0 turns on it. The control spring exerts a torque of 240×10^{-6} N-m when the deflection is 100 divisions on full scale. If the flux density of the magnetic field in the air gap is 1 Wb/m², estimate the resistance that must be put in series with the coil to give one volt per division. The resistance of voltmeter coil may be neglected.
- Q7- [CO1] A 1000/100 volts potential transformer has primary and secondary resistances of 94.5 Ω and 0.86 Ω respectively. The primary reactance of this transformer is 66.2 Ω . Total equivalent reactance refer to primary is 110 Ω . And no load current is 0.02 A at 0.4

power factor. Determine phase angle error at no load. And also determine the burden in VA at unity power factor at which the phase angle will be zero.

- Q8- [CO3] Derive the equation for balance in Maxwell's inductance capacitance bridge. Draw the phasor diagram for balance condition.

SECTION C (40 MARKS)

Attempt all questions. Each question carries 20 marks.

- Q9- [CO4] Draw and explain the circuit of a digital frequency meter. What are the different methods used for high frequency determination?

OR

Explain the working of ramp type digital voltmeter with neat block diagram. Also draw the associated waveforms.

- Q10- [CO3] An AC bridge has in arm ab, a pure capacitance of $0.2 \mu\text{F}$; in arm bc, a pure resistance of 500Ω ; in arm cd a series combination of a 50Ω resistance and a 0.1 H inductance. Arm da consists of a capacitor of $0.4 \mu\text{F}$ in series with a resistance R_2 . Draw the phasor diagram of the bridge under balance condition. Also determine the value of R_2 to give bridge balance. Can complete balance be obtained by adjustment of R_2 . If not, specify the position and value of an adjustable resistance to complete the balance.

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SECTION A (20 MARKS)

Attempt all questions. Each question carries 5 marks.

- Q1- [CO1] A 0 – 150 Pa manometer has a guaranteed error of 1 % of full scale reading. The pressure measured by the instrument is 75 Pa. Determine the limiting error in percent.
- Q2- [CO1] Define transformation ratio, turns ratio and nominal ratio in case of potential transformer.
- Q3- [CO2] Determine the multiplying factor of a shunt of 200 Ω resistance used with a galvanometer of 1000 Ω resistance. Determine the value of shunt resistance to give a multiplying power of 50.
- Q4- [CO4] Give comparison between analog and digital instruments.

SECTION B (40 MARKS)

Attempt all questions. Each question carries 10 marks.

- Q5- [CO4] Explain the construction and working of linear variable differential transformers (LVDT). Also give the advantages and disadvantages of LVDT.
- Q6- [CO4] Explain the principle of resistive wire strain gauge and derive the expression for the gauge factor. A resistive wire strain gauge having a nominal resistance of 350 Ω is subjected to a strain of 500 micro strain. Determine the change in the value of resistance neglecting the piezoresistive effect.
- Q7- [CO1] A 1000/ 5 A, 50 Hz current transformer has a secondary burden comprising a non-inductive impedance of 1.6 Ω . The primary winding has one turn. Calculate the flux in the core and ratio error at full load. Neglect leakage reactance and assume the iron loss in the core to be 1.5 W at full load.
- Q8- [CO3] Derive the equation for balance in Anderson's bridge. Draw the phasor diagram for balance condition.

SECTION C (40 MARKS)

Attempt all questions. Each question carries 20 marks.

Q9- [CO4] Explain the working of potentiometric type digital voltmeter with neat block diagram. Also draw the associated waveforms.

OR

Explain the working of integrating type digital voltmeter with neat block diagram. Also draw the associated waveforms.

Q10- [CO3] An AC bridge has in arm ab, a series combination of a resistance R_1 and a 0.2 H inductance; in arm bc, a pure resistance of 500 Ω ; in arm cd a pure capacitance of 0.2 μF . Arm da consist of a inductance of 0.1 H in series with a resistance of 100 Ω . Draw the phasor diagram of the bridge under balance condition. Also determine the value of R_1 to give bridge balance.