

**Code No: 135AN****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****B. Tech III Year I Semester Examinations, November/December - 2018****ELECTRICAL MEASUREMENTS AND INSTRUMENTATION****(Electrical and Electronics Engineering)****Time: 3 hours****Max. Marks: 75****Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A****(25 Marks)**

- 1.a) For moving iron type instruments, give the expression for the deflecting torque. [2]
- b) Describe errors in measuring instruments. [3]
- c) Describe the basic principle of operation of a d.c. potentiometer. [2]
- d) Explain why a potentiometer does not load the voltage source whose voltage is being determined. [3]
- e) Mention errors in dynamometer wattmeters. [2]
- f) Explain driving and braking torques. [3]
- g) Describe loss of charge method. [2]
- h) Explain measurement of loss angle. [3]
- i) What are advantages of electrical transducers? [2]
- j) Explain gauge sensitivity. [3]

**PART – B****(50 Marks)**

- 2.a) Explain deflecting, control and damping torques.
- b) Describe the principle of PMMC meters. [5+5]

**OR**

- 3.a) Explain the operation of electrometer type electrostatic voltmeters.
- b) Describe the principle of attracted disc type E.S. voltmeters. [5+5]

- 4.a) Draw the circuit diagram of Crompton's potentiometer and explain its working. Describe the steps used when measuring an unknown resistance.
- b) Power is measured with an a.c. potentiometer. The voltage across a  $0.1\Omega$  standard resistance connected in series with the load is  $0.35 - j0.10V$ . The voltage across 300:1 potential divider connected to the supply is  $0.8 + j0.15V$ . Determine the power consumed by the load and the power factor. [5+5]

**OR**

- 5.a) Describe how high currents and voltages are measured with the help of instrument transformers. Draw diagrams to illustrate your answer. Describe the advantages of instrument transformers as regards extension of range of current and voltage on high voltage a.c. systems.
- b) A current transformer with 5 primary turns has a secondary burden consisting of a resistance of  $0.16\Omega$  and an inductive reactance of  $0.12\Omega$ , when the primary current is 200A, the magnetizing current is 1.5A and the iron loss current is 0.4A. Determine any expressions used, the number of secondary turns needed to make the current ratio 100:1 and also the phase angle under those conditions. [5+5]

- 6.a) Describe the construction of single phase dynamometer.  
b) The total resistance of pressure circuit of a watt-meter is  $4000\Omega$  and the inductance of the pressure coil circuit is  $6.5\text{mH}$ . Give the shunted capacitor method of compensating the inductance error and determine across what portion of the series resistance a  $0.1\mu\text{F}$  capacitor should be shunted to effective compensation. [5+5]

**OR**

- 7.a) Explain the operation of single phase induction type energy meter.  
b) A  $50\text{A}$ ,  $230\text{V}$  meter on full load test makes 61 revolutions in 37s. If the normal disc speed is 520 revolutions per kWh, find the percentage error. [5+5]

- 8.a) Describe Carey Foster's bridge.  
b) A bridge is balanced at  $1,000\text{Hz}$  and has the following constants: AB,  $0.2\mu\text{F}$  pure capacitance; BC,  $500\Omega$  pure resistance; CD, unknown; DA,  $R=300\Omega$  in parallel with  $C=0.1\mu\text{F}$ . Find the R and C or L constants of arm CD, considered as a series circuit. [5+5]

**OR**

- 9.a) Explain the principle of Owen's bridge.  
b) An ac bridge has in arm AB a pure capacitance of  $0.2\mu\text{F}$ ; in arm BC, a pure resistance of  $500\Omega$ ; in arm CD, a series combination of  $R=50\Omega$  and  $L=0.1\text{H}$ . Arm DA consists of capacitor  $C=0.4\mu\text{F}$  in series with a variable resistor  $R_x$ ,  $\omega=5,000\text{ rad/s}$ . Find the value of  $R_x$  to obtain bridge balance. [5+5]

- 10.a) Describe the principle of operation of LVDT.  
b) An LVDT with a secondary voltage of  $5\text{V}$  has a range of  $\pm 25\text{mm}$ .  
i) Find the output voltage when the core is  $-18.75\text{mm}$  from centre,  
ii) Plot the output voltage versus core position for a core movement going from  $+18.75\text{mm}$  to  $-10\text{mm}$ . [5+5]

**OR**

- 11.a) Explain the force transducer with neat block diagram.  
b) A transducer that measures force has a normal resistance of  $300\Omega$ , forms a four arm strain gauge bridge and is excited by  $7.5\text{V DC}$ . When the force of  $0.1\text{N}$  is applied, all the four strain gauge resistances are changed by  $5.2\Omega$ . Find the output voltage and determine its sensitivity. [5+5]

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