GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

R4A19001181

Registration No: | | | | | | | | | | |

Total Number of Pages : 2 **B.TECH**

4th Semester Regular Examination-April-May 2019

BELPC4030 Electrical and Electronics Instrumentation

(Regulations 2017) EE/EEE ENGG.

Time : 3 Hours Maximum : 100 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) 10 x 2=20 Mark

Q.1. Answer *All* Questions.

a *1.* Permanent Magnet Type ammeter *2.* Induction type ammeter *3.* Moving iron voltmeter *4.* Moving iron ammeter **[CO2] [PO1]**
Which of the following instruments can be used to measure AC current only? Answers:
(a) *4* only (b) *2* only (c) *1, 2, 4* (d) *2* and *4* only

b A *10 MHz* CRO has **[CO6] [PO1]**
(a) *5 MHz* sweep (b) *10 MHz* vertical oscillator (c) *10 MHz* horizontal oscillator
(b) *10 MHz* supply frequency

c The error of an instrument is normally given as a percentage of **[CO4] [PO1]**
(a) measured value (b) full-scale value (c)mean value (d) rms value

d A potentiometer may be used for_____. **[CO1] [PO1]**
(a) measurement of resistance (b) measurement of current (c) calibration of ammeter
(d) calibration of voltmeter (e) all of the above

e In the center of a zero analog ammeter having a range of *-10 A* to *+10 A*, there is a detectable change of the pointer from its zero position on either side of the scale only when the current reaches a value of *1 A* (on either side). **[CO5] [PO1]**
The ammeter has a
(a) dead zone of *1 A* *(b)* dead zone of *2 A (c)* resolution of *1 A (d)* sensitivity of *1 A*

f In *3*-phase power measurement by two wattmeter method, both the Wattmeters had identical readings. The power factor of the load was **[CO1] [PO2]**
(a) unity (b) *0.8* lagging (c) *0.8* leading (d) zero

g The electrical power to a Megger is provided by **[CO2] [PO1]**
(a) battery (b)Permanent Magnet D.C. generator (c) A.C. Generator (d)any of the above

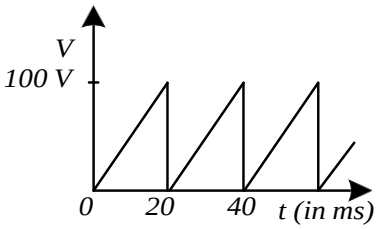
h In a *3*-phase power measurement by two wattmeter method the reading of one of the Wattmeter was zero. The power factor of the load must be **[CO1] [PO2]**
(a) unity (b) *0.5* (c) *0.3* (d) *0*

i In an Anderson bridge, the unknown inductance is measured in terms of **[CO3] [PO1]**
(a) known inductance and resistance (b) known capacitance and resistance
(c) known resistance (d) known inductance

j The power of an n-phase circuit can be measured (without disconnection) by using a minimum of **[CO5] [PO1]**
(a) *(n – 1)* wattmeter elements (b) *n* wattmeter elements (c) *(n + 1)* wattmeter elements
(d) 2n wattmeter elements

PART – B: (Short Answer Questions) 10x2=20 Marks

Q.2. Answer *ALL* questions

a	What is the need for *control torque* in analog instruments?	**[CO2] [PO1]**
b	Differentiate between *accuracy* and *precision* by giving proper example.	**[CO4] [PO1]**
c	If $R_1 = 100 \pm 0.1\ \Omega$ and $R_2 = 50 \pm 0.03\ \Omega$ then find R_1 *II* R_2.	**[CO5] [PO2]**
d	What are the different methods of damping used in measurement instruments?	**[CO2] [PO1]**
e	What do you mean by *transducers*. What are the different types of transducers?	**[CO1] [PO1]**
f	How can reactive power be measured using Electrodynamometer type instruments?	**[CO2] [PO1]**
g	A saw-tooth voltage waveform (as shown in the figure below) is fed to a Moving Iron type Voltmeter.  What will be the reading of the Voltmeter?	**[CO5] [PO2]**
h	What do you mean by *creeping* in Energy meters?	**[CO4] [PO1]**
i	What are the difficulties associated with the measurement of low and high resistances?	**[CO4] [PO1]**
j	What do you mean by *standardization of Potentiometers*?	**[CO1] [PO1]**

PART – C: (Long Answer Questions) 4x15=60 Marks

Answer *ALL* questions

Q.3

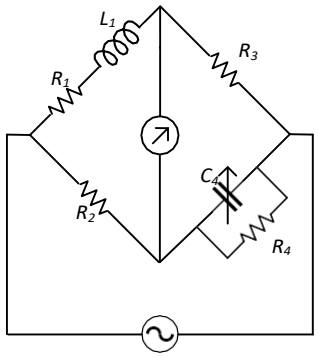
a.	Describe in detail the working of PMMC and MI type instruments with the help of well labeled diagrams.	8+7 Marks	**[CO2] [PO1]**
b.	An MI instrument gives full-scale deflection of *10 mA* when the potential difference across its terminal is *100 mV*. Find out (i) the shunt resistance for full scale deflection corresponding to *100 A*, and (ii) the series resistance for full scale reading of *1000 V*. Calculate the power dissipation in both the cases.		**[CO1] [PO2]**
	OR		
c.	Explain the working of Electrodynamometer type instrument with the help of a diagram. Write the expression for deflection torquewhen used as an ammeter.		**[CO2] [PO1]**
d.	The resistance of voltage coil of an Electrodynamometer type instrument is *8.2 kΩ* and the mutual inductance changes uniformly from *-173 μH* at zero deflection to *+175 μH* at full scale deflection, the angle of full scale being 95^o. What will be the deflection of the instrument if *100 V* is applied across the voltage coil, and a current of *3 A* at *0.75 p.f.* is passed through the current coil. Spring constant is given as 4.63×10^{-6} *N-m/rad*.	8+7 Marks	**[CO5] [PO2]**

Q.4

a. Derive the expressions for inductance and resistance of a coil when it is measured using Maxwell's Inductance-capacitance bridge and write the expression for quality factor. **[CO3] [PO2]**

10+5 Marks

For the figure given below, $R_2=400\ \Omega$, $R_3=600\ \Omega$, $R_4=1000\ \Omega$. The meter that is present at the middle of the bridge shows zero deflection when $C_4=0.5\ \mu F$.



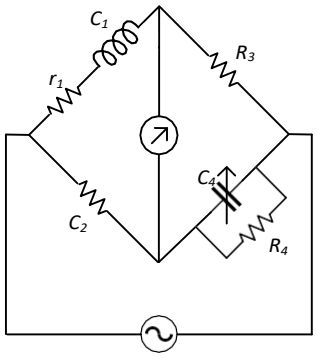
Calculate R_1 and L_1 and Quality factor of the coil at arm *1* when frequency is *1 kHz*.

b. What do you mean by *Piezo-Electric* transducer? Explain its operating principle. **[CO6] [PO1]**

OR

c. Find out the expressions for unknown lossy capacitance when it is measured using Schering Bridge. **[CO3] [PO2]**

A block of dielectric material *4.5 mm* thick is placed between electrodes of *0.12 m* diameter. The capacitor hence formed is denoted by C_1 in the figure given below, along with its internal resistance r_1. $C_2=106\ pF$, $R_4=(1000/\pi)\ \Omega$, $R_3=260\ \Omega$. The meter that is present at the middle of the bridge shows zero deflection for $C_4=0.5\ \mu F$.



10+5 Marks

	Calculate the capacitance, its power factor and relative permittivity of the dielectric material if *f=50 Hz*.		
d	Explain the working principle of Linear Variable Differential Transformer (LVDT) along with its applications.		**[CO6] [PO1]**

Q.5

a	Describe the working of a Ballistic Galvanometer and explain how it can be used as a Flux meter.	10+5 Marks	**[CO2] [PO1]**
b	How are Potentiometers used for measurement purpose? Describe the working principle of a DC potentiometer.		**[CO1] [PO1]**
	OR		
c	With the help of construction diagram explain the working principles of a D' Arsonval Galvanometer. Derive its torque equation.		**[CO2] [PO1]**
d	For a moving coil galvanometer, find the number of turns that must be wound on the coil to produce a reflection of 150^o with a current of *10 mA*. It is given that the coil is wound on a non- magnetic former whose height as well as width are *2 cm*. It moves in a constant magnetic field of $0.12\ Wb/m^2$. Moment of inertia of moving parts is $0.25 \times 10^{-6}\ kg\text{-}m^2$, and the spring constant is $30 \times 10^{-6}\ N\text{-}m/rad$.	10+5 Marks	**[CO5] [PO2]**

Q.6

a	Explain the working of CRO with the help of its block diagram.	10+5 Marks	**[CO2] [PO1]**
b	What are *Lissajous patterns*. How can they be used for frequency measurement of a signal?		**[CO6] [PO1]**
	OR		
c	Draw the phaser diagram of a Current Transformer (C.T) and find out the expressions for *phase angle* as well as *phase angle error*.	10+5 Marks	**[CO2] [PO1]**
d	Draw the block diagram of a Digital Voltmeter and explain its working principle.		**[CO6] [PO1]**