F 3111 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch—Electrical and Electronics Engineering

ELECTRICAL AND ELECTRONIC MEASUREMENTS (E)

(Prior to 2010 Admissions—Old Scheme)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Write the dimensions and SI units of :
   (i) resistance ; (ii) magnetic flux ;
   (iii) luminous flux ; (iv) permeability.
2. How magnetic materials are classified ?
3. Explain the general principle of basic slide wire d.c. potentiometer.
4. Explain the working of an earth megger.
5. Describe the term null as it applies to bridge measurements.
6. Find the equivalent parallel resistance and capacitance that causes a Wien bridge to null with the following component values : $R_1 = 3.1\ k\Omega$, $C_2 = 5.2\ \mu F$, $R_2 = 25\ k\Omega$, $R_4 = 100\ k\Omega$, $f = 2.5$ kHz.
7. Explain limiting errors. How it can be minimised ?
8. Discuss the reasons, why the errors of a current transformer are usually greater with relatively small loads than at rated full-load.
9. List the desirable properties of thermocouples.
10. State the advantages and disadvantages of bimetallic thermometers.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. (a) Explain theory and construction of Ballistic galvanometer. (6 marks)

Turn over

(b) A voltmeter having a sensitivity of 1000 Ω/V reads 100 V on its 150 V scale when connected across an unknown resistor in series with a milliammeter. When the milliammeter reads 5A, calculate :

(i) the apparent resistance of the unknown resistor ;

(ii) actual resistance of the unknown resistor ; and

(iii) error due to the loading effect of voltmeter.

(6 marks)

Or

12. (a) With neat diagrams, explain the theory and construction of flux meter. (6 marks)

(b) Explain the Lloyd-Fischer square used for the measurement of the iron losses in a specimen of laminations.

(6 marks)

13. With neat diagrams, explain the principle of operation and applications of any two types of a.c. potentiometer.

Or

14. The ratio arms of a Kelvin Bridge are 1000 Ω each. The Galvanometer has an internal resistance of 100 Ω and a current sensitivity of 500 mm/μA. A d.c. current of 10A is passed through the standard arm and the unknown, from a 2.2 V battery in series with a rheostat. The standard resistance is set at 0.1000 Ω and the galvanometer deflection is 30 mm. Neglecting the resistance of the yoke, determine the values of the unknown.

15. Describe the working of Maxwell's inductance capacitance bridge. Derive equations for balance and draw the phasor diagram under balance conditions.

Or

16. Describe the measurement of inductance using Hay's bridge. Derive the condition and explain its phasor diagram.

17. With a neat phasor diagram and equivalent circuit, derive an expression for transformation ratio and phase angle of a potential transformer.

Or

18. (a) A voltage has a true value of 1.50 V. An analog indicating instrument with a scale range of 0 – 2.5 V shows a voltage of 1.46 V. What are the values of absolute error and correction ? Express the error as a fraction of the true value and the full scale deflection.

(8 marks)

(b) Explain any four sources of possible errors in instruments. (4 marks)

19. Define luminous flux and luminous intensity. A lamp giving out 1060 lumen in all directions is suspended 6 m above the working plane. Calculate the illumination at a point on the working plain 3 m away from the foot of the lamp.

Or

20. (a) Explain the laws of thermocouple and their applications. (4 marks)

(b) An experiment is conducted to calibrate a copper-constants thermocouple. With cold junction at 0°, e.m.f. obtained at boiling point of water (100° C), and boiling point of sulphur (445°C) are 5 mV and 25 mV respectively. If the relation is assumed to be

$e_{t_1 - t_2} = a(t_1 - t_2) + b\left(t_1^2 - t_2^2\right)$:

(i) determine the constants a and b ;

(ii) if the above thermocouple indicates 2 mV with the cold junction of 40° C. Calculate the unknown hot junction temperature.

(iii) If the cold junction is maintained at 35° C, what would be the e.m.f. if the hot junction temperature is at 300° C ?

(8 marks)

[5 × 12 = 60 marks]