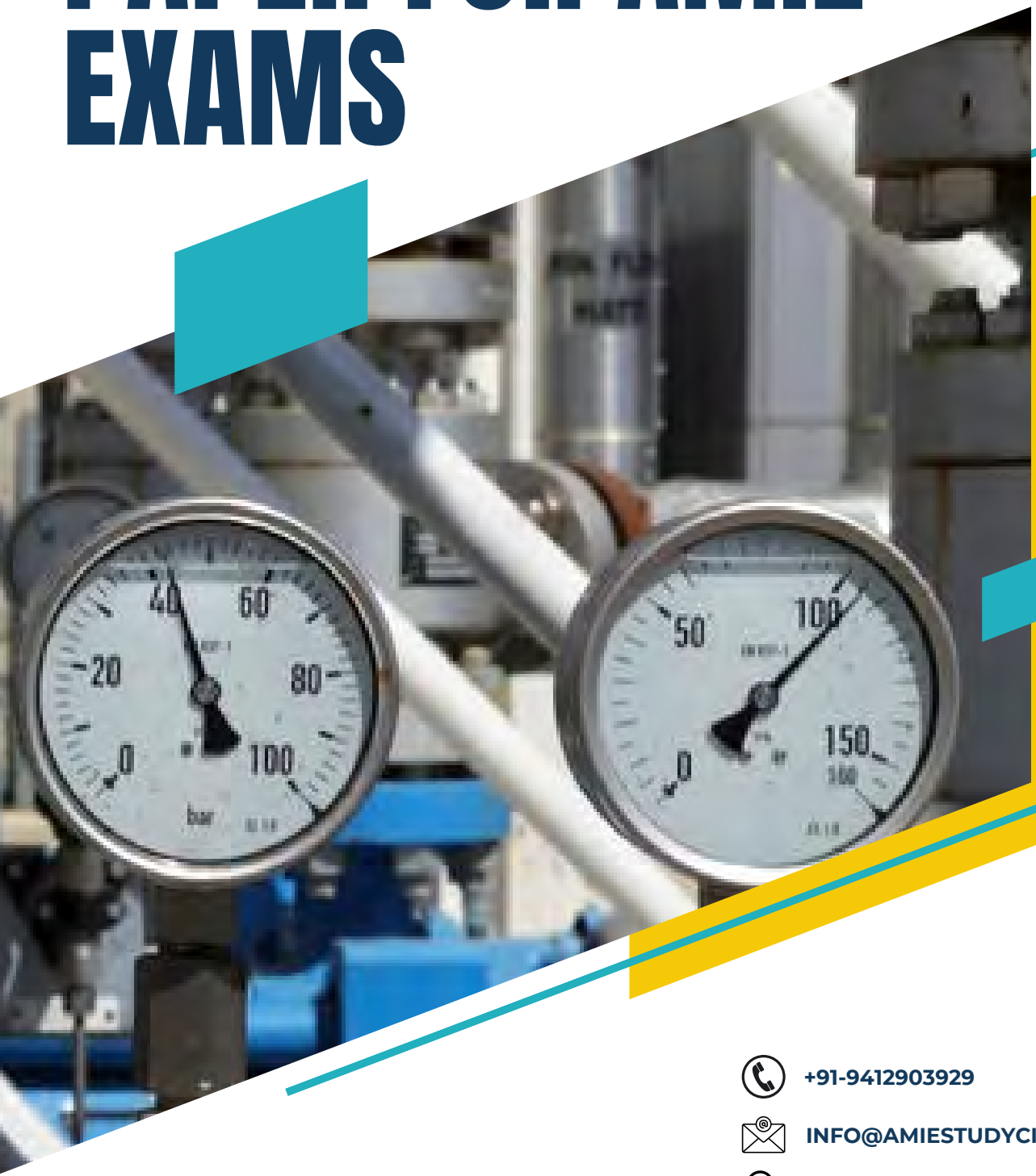
MODEL TEST PAPER FOR AMIE EXAMS



MEASUREMENT & CONTROL

+91-9412903929

INFO@AMIESTUDYCIRCLE.COM

CITY PRIDE COMPLEX, NR IIT CAMPUS, ROORKEE

AMIESTUDYCIRCLE.COM

TEST PAPER 1

MEASUREMENT & CONTROL

***Time**: Three Hours*

***Maximum Marks**: 100*

Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches.

Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Derive the dimensions of (i) e.m.f. (ii) permeability (iii) resistivity (iv) electric flux density in L, M, T and I system of dimensions. 10

   (b) Describe the constructional details and working of a single phase electrodynamometer type of power factor meter. Also, prove that the displacement of moving system is equal to the phase angle of the system. Mention its advantages and disadvantages. 10

2. (a) Explain two wattmeters method to measure the total power in a three-phase circuit. 10

   (b) Describe the construction details and operational principle of a Drysdale polar type potentiometer. How is it standardized? What is the function of phase shifting transformer in the potentiometer? 10

3. (a) Draw a neat schematic diagram and phasor diagram of the Anderson bridge. Also, derive the equation of balance. 10

   (b) The four arms of an ac bridge network are as follows: 10

   Arm AB: an unknown impedance

   Arm BC: a standard capacitor C_3 of 1000 pF

   Arm CD: a non inductive resistor R_4 of 100Ω in parallel with a capacitor C_4

of 0.01 μF

Arm DA: a non inductive resistor R_2 of 1000Ω.

The ac supply is connected across terminals B, D and the supply frequency is 50 Hz. If the bridge is balanced with the above values, determine the components of the unknown impedance, while deriving the balance conditions along with its phasor diagram at balance.

4. (a) Describe with the help of a neat diagram, a method for determination of BH curve of a magnetic sample. How can you separate the eddy current loss and hysteresis loss component from the total core loss? 10

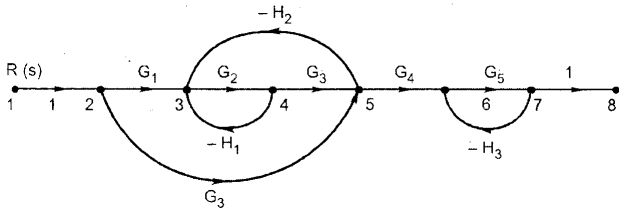
(b) What is meant by impulse testing of transformer ? Give the procedure for impulse testing of transformer. 10

Group B

5. (a) Draw the signal flow graphs for the following set of algebraic equations. These equations should be arranged in the form of cause and effect relations before signal flow graphs can be drawn. Show that there are many possible signal flow graphs for each set of equations. 8

$$x_1 = -x_2 - 3x_3 + 3$$
$$x_2 = 5x_1 - 2x_2 + x_3$$
$$x_3 = 4x_1 + x_2 - 5x_3 + 5$$

(b) Find the overall transfer function of the system whose signal flow graph is shown below. 6



(c) Compare the constructional and functional differences between d.c. and a.c. tachogenerators. 6

6. (a) Obtain the state model for a system whose transfer function is given as 8

$$G(s) = \frac{1}{s^3 + 9s^2 + 26s + 24}$$

(b) What are the time domain specifications? Explain with diagrams. 6

(c) Obtain the response of unity feedback system whose OLTF is G(s) = 4/s(s + 5) and when the input is unit step. 6

7. (a) Define gain margin and phase margin and explain the quantities with reference to Bode plots and Nyquist plots. 6

(b) Sketch the polar plot of 8

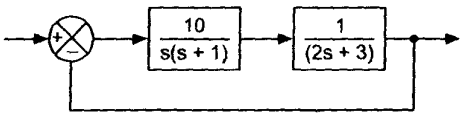
(i) $G(s) = \dfrac{10}{(s+2)(s+4)}$ (ii) $G(s) = \dfrac{(1+sT_1)}{(1+sT_2)}$

(c) Given the system characteristic equation as 6

$$s^4 + 6s^3 + 21s^2 + 36s + 20 = 0$$

Determine whether the system is stable or not by applying Routh-Hurwitz criterion.

8. (a) Is the system shown in given figure is stable? 6



(b) What is root locus? Explain the salient features of root locus plot. How to plot it? 6

(c) Show that the root loci for a control system with 8

$$G(s) = \frac{K(s+1)}{s(s-1)}, H(s) = 1$$

is a circle with centre at (-1, 0) and radius √2.

Group C

9. Answer the following in brief: 20

(i) For Nyquist plot, we use

(a) open loop function

(b) closed loop function.

(c) characteristic function.

(d) any one of the above.

(ii) A synchro is used to

(a) Accelerate a rotating shaft

(b) Convert an angular position of a shaft into an electrical signal

(c) convert linear motion into an angular motion.

(d) Amplify low frequency signal

(iii) Which one of the following method can be used to determine the absolute stability of a control system?

(a) Routh stability criterion

(b) Root locus technique

(c) Bode plots

(d) Nyquist criterion

(iv) The transfer function of a system is given as $100/s^2 + 20s + 100$. The system is

(a) an overdamped system

(b) an underdamped system

(c) a critically damped system

(d) an unstable system

(v) A human being is

(a) a feedback controlled system

(b) an open loop control system

(c) an uncontrolled system

(d) none of these

(vi) The difference between the measured value and true value is called the

(a) relative error.

(b) absolute error

(c) gross error.

(d) probable error.

(vii) A null-type of instrument as compared to a deflection type instrument has

(a) a higher accuracy

(b) a lower sensitivity.

(c) a faster response.

(d) All of the three above.

(viii) A potentiometer is basically a

(a) deflection-type instrument.

(b) null type instrument

(c) Both (a) and (b) above.

(d) digital instrument

(ix) Standardization of potentiometer is done in order that they become

(a) accurate.

(b) precise.

(c) accurate and direct reading

(d) accurate and precise.

(x) The equations under balance conditions for a bridge are $R_1 = R_2 R_3 /R4$, $L_1 = R_2R_3C_4$ where R_1 and L_1 are respectively unknown resistance and inductance in order to achieve converging balance:

(a) R_2 and R_3 should be chosen as variables.

(b) R_2 and C_4 should be chosen as variables.

(c) R_4 and C_4 should be chosen as variables

(d) R_3 and C_4 should be chosen as variables

(Refer our course material for answers)