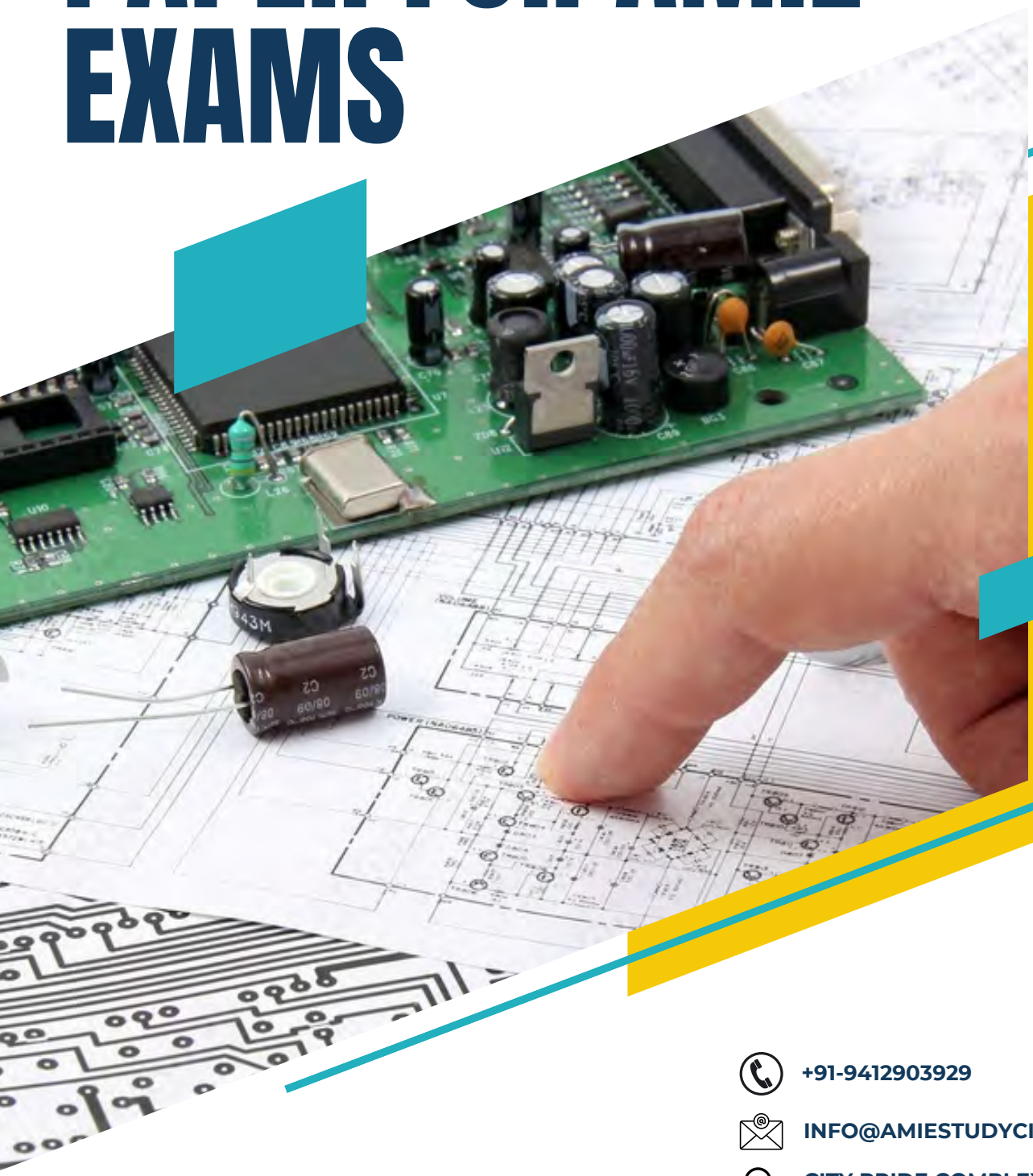
MODEL TEST PAPER FOR AMIE EXAMS



DESIGN OF ELECTRONIC DEVICES & CIRCUITS

TEST PAPER 1

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DESIGN OF ELECTRONIC DEVICES & CIRCUITS

***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) What is an integrated circuit? How does it differ from a discrete circuit? Discuss the relative merits and demerits of ICs over discrete circuits. 6

   (b) Draw the functional block diagram of an op-amp and explain the operation of each block. Also write down the characteristics of an ideal op-amp. 6

   (c) Explain the following terms in connection with operational amplifiers: 8

   (i) Common mode rejection ratio

   (ii) Virtual ground

   (iii) Inverting and non inverting modes of operation

   (iv) Input and output offset voltage

2. (a) Difference mode gain of a diff amplifier is 2000. Calculate the output voltages for (i) CMRR = 100 and (ii) CMRR = 10,000; if the inputs are V_1 = 1.0 mV and V_2 = 0.9 mV and show the effect of high CMRR. Assume V_i applied of 1 mV input. 8

   (b) Using a neat sketch, explain the working of a sample and hold circuit. What are the applications of sample and hold circuits. How can the hold time be controlled? 6

   (c) Explain some of the linear and non linear applications of OPAMP by giving suitable examples. 6

3. (a) Design a second order low pass Butterworth filter with a cut-off frequency of 1 kHz and a pass band gain of 3. Use a capacitor of value 0.01 μF. Also plot its gain frequency response. 8

(b) What does an unregulated power supply consist of? State three disadvantages of an unregulated power supply. 6

(c) Draw the circuit diagram of a simple Zener diode voltage regulator and explain how the circuit operates. 6

4. (a) Draw the circuit and explain the working of a series pass transistor voltage regulators. make a comparison between a series and shunt voltage regulator. 6

(b) Distinguish between positive and negative voltage regulators. Write down the advantages and disadvantages of positive and negative voltage regulators. 6

(c) Explain "fold back current limiting" technique. How does it eliminate the limitation of constant current limiting circuit. Describe its output characteristics. 8

Group B

5. (a) Write down the condition for oscillation in an oscillator circuit. How oscillation builds up in any oscillator circuit? 4

(b) With a neat schematic explain the operation of an RC phase shift oscillator. Also derive expressions for its frequency of operation and condition for sustaining oscillation. 8

(c) Sketch the circuit of a Wien bridge oscillator. Find an expression for frequency of oscillations in Wein bridge oscillator. Show that amplifier used in a Wein bridge oscillator must have a gain greater than 3 for sustained oscillations. 8

6. (a) Derive the expression for f_s and f_p of crystal oscillator. Also sketch its equivalent circuit. Write down some advantages and disadvantages of a crystal oscillator. 6

(b) Design an stable multivibrator which has a frequency of oscillation of 10 kHz and duty cycle of 75%. derive the necessary mathematical steps for the design. 8

Hint: Take astable multivibrator. You may assume R_B as 10 kΩ to start with.

(c) The 555 IC timer is connected as a free running multivibrator. Determine the frequency of oscillation. Given $R_A = R_B = 1$ kW and C = 1000 pF. The symbols used have the usual meaning. 6

7. (a) Explain DSB-SC (double sideband suppressed carrier) modulation. Obtain the expression or single tone DSB-SC modulated wave and find its spectrum. Plot it in time-domain and frequency domain. 7

(b) Draw and explain the block diagram of a superheterodyne receiver. 6

(c) What is a PLL? How does it work? Discuss its applications. With the help of a block diagram and necessary equations, explain the Phase Locked Loop demodulator for a FM wave. 7

8. (a) Draw the block diagram of a ramp type digital voltmeter and explain its working. How can it be modified for multiple range of measurements? 7

Hint: Describe ramp type A/D converter.

(b) Explain the working of dual slope ADC. Explain how noise rejection is obtained. 6

(c) Draw the block diagram of a frequency meter (frequency counter) and explain its working. Sketch system waveforms. 7

Group C

9. Answer the following in brief: 20

(i) The ideal Op Amp has the following characteristics

(a) $R_i = \infty$; $A_v = \infty$; $R_0 = 0$

(b) $R_i = 0$; $A_v = \infty$; $R_0 = 0$

(c) $R_i = 0$; $A_v = 0$; $R_0 = 0$

(d) $R_i = \infty$; $A_v = \infty$; $R_0 = \infty$

(ii) Which type of Analog to Digital Converter is the fastest

(a) Successive approximation register

(b) Dual slope ADC

(c) Flash ADC

(d) Pipelined ADC

(iii) An ideal Op-Amp is a

(a) Voltage-controlled current source

(b) Voltage-controlled voltage source

(c) Current controlled current source

(d) Current-controlled voltage source

(iv) From the power saving option which modulation technique is preferred

(a) AM

(b) DSBSC

(c) VSB

(d) FM

(v) A non-inverting amplifier with a gain of 100 is nulled at 25°C. Determine the output voltage if the temperature rises to 40°C for an offset voltage drift of 0.15 MV/°C.

(a) 600 MV

(b) 450 MV

(c) 225 MV

(d) 60 MV

(vi) A second-order low-pass filter has a roll-off rate of

(a) - 40 dB/octave

(b) - 40 dB/decade

(c) - 20 dB/octave

(d) - 20 dB/decade

(vii) A PLL that is very useful as an FSK. demodulator is

(a) 565 PLL

(b) 564 PLL

(c) 562 PLL

(d) 561 PLL

(viii) Consider a 1024-bit ROM. How many address bits does it require?

(a) 16

(b) 12

(c) 10

(d) 8

(ix) An astable multivibrator also known as

(a) One shot multivibrator

(b) Free-running multivibrator

(c) Bistable multivibrator

(d) Monostable multivibrator

(x) In a DVM, a signal conditioning circuit is used

(a) To bring current to a suitable limit

(b) To bring resistance to a suitable limit

(c) To bring resistance to s suitable limit

(d) To bring voltage to a suitable limit

(Refer our course material for answers)