

Roll No.

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(Write Roll Number from left side exactly as in the Admit Card)

**2115**

*Signature of Invigilators*

1. \_\_\_\_\_

2. \_\_\_\_\_

Question Booklet Series

**A**

**PAPER–III**

Question Booklet No.

**Subject Code : 21**

OMR Sheet No. ....

(To be filled by the candidate)

**ELECTRONIC SCIENCE**

*Time : 1 Hour 15 Minutes*

*Maximum Marks: 100*

*Instructions for the Candidates*

- Write your Roll Number in the space provided on the top of this page as well as on the OMR Sheet provided.
- At the commencement of the examination, the question booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and verify it:
  - To have access to the Question Booklet, tear off the paper seal on the edge of this cover page.
  - Faulty booklet, if detected, should be got replaced immediately by a correct booklet from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
  - After this verification is over, the Question Booklet Series and Question Booklet Number should be entered on the OMR Sheet and the OMR Sheet Number should be entered on this Question Booklet.
- This paper consists of fifty (50) multiple-choice type questions. All the questions are compulsory. Each question carries *two* marks.
- Each Question has four alternative responses marked: **(A)** **(B)** **(C)** **(D)**. You have to darken the circle as indicated below on the correct response against each question.

*Example:* **(A)** **(B)** **(C)** **(D)**, where **(C)** is the correct response.
- Your responses to the questions are to be indicated correctly in the OMR Sheet. If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
- Rough work is to be done at the end of this booklet.
- If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
- Do not tamper or fold the OMR Sheet in any way. If you do so, your OMR Sheet will not be evaluated.
- You have to return the Original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry question booklet and duplicate copy of OMR Sheet after completion of examination.
- Use only Blue/Black Ball point pen.**
- Use of any calculator or log table or mobile phone etc. is strictly prohibited.**
- There are no negative marks for incorrect answers.**

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**ELECTRONIC SCIENCE**

**PAPER III**

1. Thin gate oxide in a CMOS process is preferably grown by

- (A) Wet Oxidation
- (B) Dry Oxidation
- (C) Epitaxial deposition
- (D) Ion implantation

2. Energy of the signal

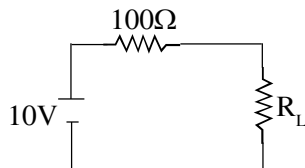
$X(t) = e^{-3t}$  for all 't' is

- (A)  $\frac{1}{2}$
- (B)  $\frac{1}{3}$
- (C)  $\frac{1}{6}$
- (D)  $\frac{1}{8}$

3. If  $L[f(t)] = F(s)$  then  $L[f(t-T)]$  is equal to

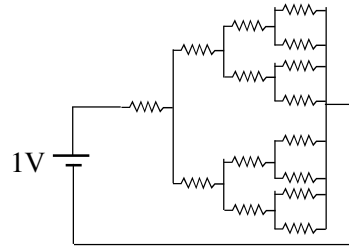
- (A)  $e^{sT} F(s)$
- (B)  $e^{-sT} F(s)$
- (C)  $\frac{F(s)}{1+e^{sT}}$
- (D)  $\frac{F(s)}{1-e^{-sT}}$

4. The maximum power that can be transferred to the load resistor  $R_L$  from the voltage source in following figure is



- (A) 1 Watt
- (B) 10 Watt
- (C) 0.25 Watt
- (D) 0.5 V

5. All the resistors in the following figure are  $1\Omega$ . The value of the current I is



- (A)  $\frac{1}{15}$  Amp
- (B)  $\frac{2}{15}$  Amp
- (C)  $\frac{4}{15}$  Amp
- (D)  $\frac{8}{15}$  Amp

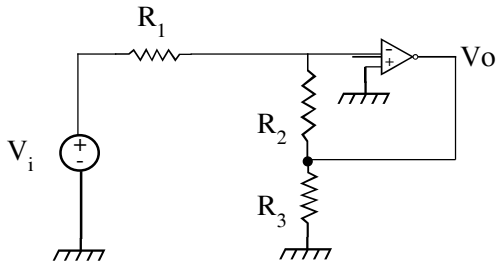
6. Match the following signals with their corresponding fourier transforms:

- |                    |  |
|--------------------|--|
| 1. $u(t)$          | (a) $\frac{2}{j\omega}$                      |
| 2. $\text{sgn}(t)$ | (b) $\pi \delta(\omega) + \frac{1}{j\omega}$ |
| 3. $u(-t)$         | (c) $2\pi \delta(\omega)$                    |
| 4. 1               | (d) $\pi \delta(\omega) - \frac{1}{j\omega}$ |

- (A) 1-(a), 2-(c), 3-(d), 4-(b)
- (B) 1-(b), 2-(a), 3-(d), 4-(c)
- (C) 1-(b), 2-(a), 3-(c), 4-(d)
- (D) None of the above

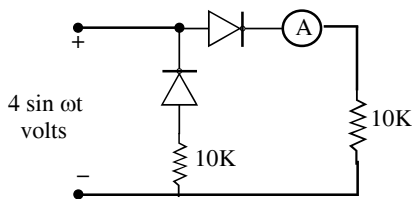
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7. Assuming the op-amp to be ideal, the voltage gain of the amplifier shown below is



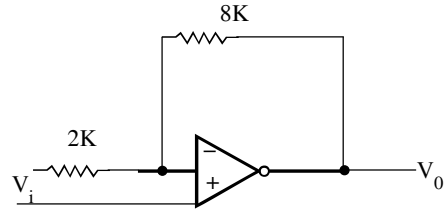
- (A)  $-\frac{R_2}{R_1}$
- (B)  $-\frac{R_3}{R_1}$
- (C)  $-\frac{R_2 \parallel R_3}{R_1}$
- (D)  $-\left(\frac{R_2+R_3}{R_1}\right)$

8. In the circuit of figure below, assume that the diodes are ideal and the meter is an average indicating ammeter. The ammeter will read



- (A)  $0.4\sqrt{2}A$
- (B)  $0.4A$
- (C)  $\frac{0.8}{\pi} A$
- (D)  $\frac{0.4}{\pi} A$

9. For the circuit below, the op-amp has very poor open-loop voltage gain of 45 but otherwise ideal. The gain of the amplifier equals



- (A) 5
- (B) 20
- (C) 4
- (D) 4.5

10. The contents of some memory location of a microprocessor based system are shown

Address (H)	Contents(H)
3000	02
3001	30
3002	00
3003	30

The program is as follows

LHLD	3000H
MOV	E,M
INX	H
MOV	D,M
LDAX	D
MOV	L,A
INX	D
LDAX	D
MOV	H,A

The contents of HL pair after the execution of program will be

- (A) 0030H
- (B) 3000H
- (C) 3002H
- (D) 0230H

11. The following instructions have been executed by an 8085 microprocessor

6010H	LXI 8A79H
6013H	MOV A, L
6015H	ADD H
6016H	DAA
6017H	MOV H, A
6018H	PCHL

From which address will the next instruction be fetched?

- (A) 6019H
- (B) 6379H
- (C) 6979H

12. How many addressing modes are available for JNZ instruction of 8051 microcontroller?

- (A) 1
- (B) 2
- (C) 3
- (D) 6

13. The minimum number of gates required to implement the Boolean expression.

$$AB + AB' + A'C$$

- (A) 1 AND gate and 1 OR gate
- (B) 2 NAND gates
- (C) 3 AND gates and 2 OR gates
- (D) None of the above

14. The binary equivalent of the decimal number 0.4375 is

- (A) 0.0111
- (B) 0.1011
- (C) 0.1100
- (D) 0.1010

15. Three identical amplifiers with each one having a voltage gain of 50, input resistance of  $1k\Omega$  and output resistance of  $250\Omega$  are cascaded. The open circuit voltage gain of the combined amplifier is

- (A) 49 db
- (B) 51 db
- (C) 98 db
- (D) 102 db

16. A distorted sinusoid has the amplitudes  $A_1, A_2, A_3, \dots$  of the fundamental, second harmonic third harmonic,..... respectively. The total harmonic distortion is

- (A)  $\frac{A_2 + A_3 + \dots}{A_1}$
- (B)  $\frac{\sqrt{A_2^2 + A_3^2 + \dots}}{A_1}$
- (C)  $\frac{\sqrt{A_2^2 + A_3^2 + \dots}}{\sqrt{A_1^2 + A_2^2 + A_3^2}}$
- (D)  $\frac{A_2^2 + A_3^2 + \dots}{A_1}$

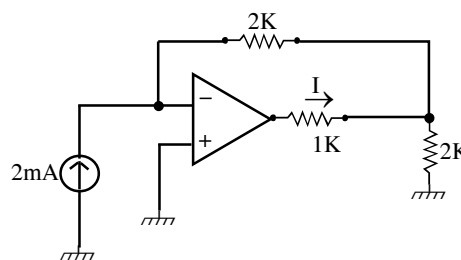
17. In a differential amplifier, CMRR can be improved by using an increased

- (A) emitter resistance
- (B) collector resistance
- (C) power supply voltage
- (D) source resistance

18. If  $\overline{CS} = \overline{A}_{15} A_{14} A_{13}$  is used at the chip select logic of a 4KB RAM is an 8085 system. Then its memory range will be

- (A) 3000 H – 3 FFFH
- (B) 7000 H – 7 FFFH
- (C) 5000 H – 5 FFFH and 6000 H – 6 FFFH
- (D) 6000 H – 6 FFFH and 7000 H – 7 FFFH

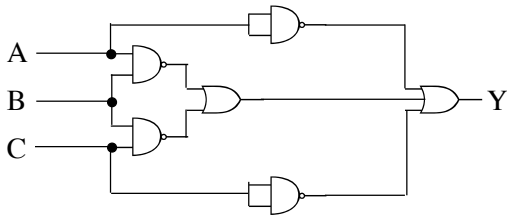
19. Assume that the operational amplifier in figure is ideal. The current  $I$  through the 1K resistor is



- (A) - 4mA
- (B) - 5mA
- (C) None of these
- (D) 4mA

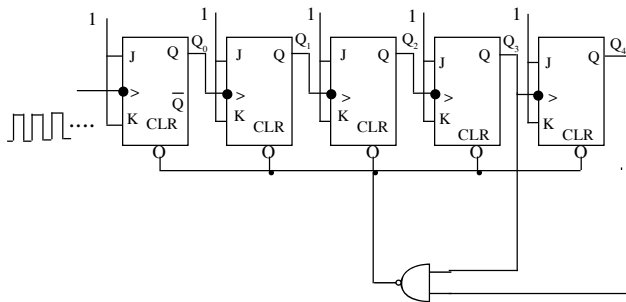
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20. For the logic circuit below, the output Y is equal to



- (A)  $\overline{AB} + C$
- (B)  $\overline{A} + \overline{B} + \overline{C}$
- (C)  $\overline{AB} + \overline{BC} + \overline{A} + \overline{C}$
- (D)  $\overline{AB} + BC$

21. The MOD number of the asynchronous counter shown in fig is



- (A) 24
- (B) 48
- (C) 25
- (D) 36

22. STA 8000H instruction of 8085 microprocessor is executed by

- (A) one machine cycle
- (B) two machine cycles
- (C) three machine cycles
- (D) four machine cycles

23. Consider the following instruction

```
MVI A, A9H
MVI B, 57H
ADD B
ORA A
```

The flag status (S, Z, CY) after the instruction ORA A is executed is

- (A) 0, 1, 1
- (B) 0, 1, 0
- (C) 1, 0, 0
- (D) 1, 0, 1

24. The Boolean expression  $X + X'Y$  equals

- (A)  $X + Y$
- (B)  $X + XY$
- (C)  $Y + YX$
- (D)  $X'Y + Y'X$

25. The Boolean expression  $AB + AB' + A'C + AC$  is unaffected by the value of Boolean variable

- (A) A
- (B) B
- (C) C
- (D) None of the above

26. Consider the following set of 8085 instruction:

```
MVI A, DATA1
ORA A
JP DSPLY
XRA A
ADI 05H
DSPLY: OUT PORT1
HLT
```

If DATA1 = 92H, the output at PORT1 is

- (A) 00H
- (B) FFH
- (C) 05H
- (D) 01H

27. C++ encourages structuring a software as a collection of components that are

- (A) highly cohesive and loosely coupled.
- (B) not highly cohesive but loosely coupled.
- (C) highly cohesive and tightly coupled.
- (D) not highly cohesive but tightly coupled.

28. Cout stands for

- (A) Class output
- (B) Character output
- (C) Common output
- (D) Call output

29. What is the magnitude of the voltage reflection coefficient of the load, for a lossless transmission line terminated by a pure resistance?

- (A)  $\frac{1}{2}$
- (B) 2
- (C)  $\frac{1}{3}$
- (D) 1

30. Any point 'P' in the smith chart is located at  $(\frac{1}{\sqrt{2}}) \angle 45^\circ$ , the normalised load reactance corresponding to the point P is

- (A) 1
- (B) 2
- (C) 3
- (D) 4

31. The electric field at the centre of a uniformly charged conductor is (where q is the total charge,  $\epsilon_0$  is the free space permittivity and r is the distance of the centre)

- (A)  $\frac{q}{4\pi\epsilon_0 r^2}$
- (B)  $\frac{q}{4\pi\epsilon_0 r}$
- (C)  $\frac{qr}{4\pi\epsilon_0}$
- (D) zero

32. The ratio of the electric field vector  $\vec{E}$  to the magnetic field vector  $\vec{H}$  to  $\vec{E}/\vec{H}$  has the dimension of

- (A) Resistance
- (B) Inductance
- (C) Capacitance
- (D) Product of Inductance and Capacitance

33. The bandwidth of phase modulated signal  $x_c(t) = A_c \cos [2000 \pi t + 0.4 \sin (40\pi t)]$  is

- (A) 56 Hz
- (B) 80 Hz
- (C) 120 Hz
- (D) 160 Hz

34. An angle modulated signal is described by the equation

$x_c = 10 \cos [2\pi f_c t + 10 \sin (4000 \pi t) + 5 \sin (2000 \pi t)]$   
The peak frequency deviation is

- (A) 20 kHz
- (B) 25 kHz
- (C) 30 kHz
- (D) 35 kHz

35. To convert FM modulator to Phase modulator one needs to add in the front end of FM modulator circuit a

- (A) Adder
- (B) Multiplier
- (C) Integrator
- (D) Differentiator

36. Which of the following parameter passing mechanism(s) is/are supported by C++, but not by C?

- (A) Pass by Value
- (B) Pass by Value-result
- (C) Pass by Reference, but can be simulated with pointers
- (D) All of the above

[ Please Turn Over ]

37. If the modulating frequency is increased, the bandwidth of PM signal changes in accordance with

- (A)  $2(k_a + f_m)$
- (B)  $2(k_a + 1)f_m$
- (C)  $2|k_a| + 3$
- (D)  $2\left|\frac{k_a}{f_m}\right| + 3$

38. Consider the following program fragment:

```
Char C = 'a';
while (C++ <= 'z')
    put char (xxx);
```

If the required output is abcdef ..... z (i.e. all the alphabets from 'a' to 'z') then xxx should be

- (A) C
- (B) C++
- (C) C - 1
- (D) - C

39. The mutual information between two discrete random variable X and Y is denoted by  $I(X : Y)$  when  $I(X : Y)$  is given by

- (A)  $I(X : Y) = H(X) + H(Y) + H(X/Y)$
- (B)  $I(X : Y) = H(X) - H(X/Y)$
- (C)  $I(X : Y) = H(Y) - H(X/Y)$
- (D)  $I(X : Y) = H(X) - H(X, Y)$

40. If y is of integer type then the expression  $3 * (y - 8) / 9$  and  $(y - 8) / 9 * 3$  yield the same value if

- (A) y is an even number.
- (B) y is an odd number.
- (C)  $y - 8$  is an integral multiple of 9.
- (D)  $y - 8$  is an integral multiple of 3.

41. Assuming perfect conductors of a transmission line, pure TEM propagation is not possible in

- (A) Coaxial cable.
- (B) Air filled cylindrical waveguide.
- (C) Parallel twin-wire line in air.
- (D) Semi-infinite parallel plate waveguide.

42. The following code fragment:

```
int x, y = 2, z, a;
x = (y * = 2) + (z = a = y);
printf("%d", x);
```

- (A) Prints 8
- (B) Prints 6
- (C) Prints 6 or 8 depending on the compiler
- (D) is syntactically wrong

43. The single-tone modulated signal

$$m(t) = A_m \cos(2\pi f_m t)$$

is used to generate the VSB signal

$$s(t) = \frac{1}{2} a A_m A_c \cos[2\pi(f_c + f_m)t] + \frac{1}{2} A_m A_c (1-a) \cos[2\pi(f_c - f_m)t]$$

where  $a$  is a constant, less than unity, representing the attenuation of the upper side frequency. Find quadrature component of the VSB signal  $s(t)$ .

- (A)  $-\frac{1}{2} a A_m A_c \sin 2\pi f_m t$
- (B)  $\frac{1}{2} A_m A_c (1-2a) \sin 2\pi f_m t$
- (C)  $\frac{1}{2} A_m A_c (1-2a) \cos 2\pi f_m t$
- (D)  $\frac{1}{2} a A_m A_c \cos 2\pi f_m t$

44. The short circuited input impedance and open circuited input impedance of a transmission line are  $j3\Omega$  and  $-j9\Omega$  respectively, then characteristic impedance of transmission line is

- (A)  $\sqrt{3}\Omega$
- (B)  $\frac{1}{\sqrt{3}}\Omega$
- (C)  $3\sqrt{3}\Omega$
- (D)  $3\Omega$

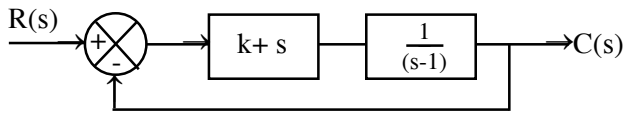
45. When an electron jumps from the valence shell to conduction band, it leaves a gap called

- (A) energy gap
- (B) hole
- (C) electron-hole pair
- (D) recombination



46. High capacity optical storage devices use blue lasers for read-out because
- (A) of larger bandwidth.
  - (B) easy polarizability.
  - (C) smaller focused spot.
  - (D) higher frequency results in faster read-out.
47. What can a semiconductor sense?
- (A) Magnetism
  - (B) Temperature
  - (C) Pressure
  - (D) All of the above
48. Electrons with 1, 2 or 3 valence electron usually make excellent
- (A) Conductors
  - (B) Semiconductors
  - (C) Insulator
  - (D) Neutral
49. If a laser beam of 1 watt is equivalent to 30 dBm, a 20dBm laser beam has a power of
- (A) 0.66 watt
  - (B) 0.5 watt
  - (C) 0.1 watt
  - (D) 1.5 watt
50. Which semiconductor material is made from coal ash?
- (A) Germanium
  - (B) Silicon
  - (C) Tin
  - (D) Carbon
51. A thermocouple arrangement is to be used to measure a high temperature of 1400°C. Point out the pair of thermocouple that would be most suitable for the application.
- (A) Type J
  - (B) Type E
  - (C) Type K
  - (D) Type R
52. Which of the following thermocouples has the lowest measuring range?
- (A) Copper — Constantan
  - (B) Chromel — Constantan
  - (C) Chromel — Alumium
  - (D) Iron — Constantan
53. Which property of quartz crystal changes with the change in temperature?
- (A) Resistance
  - (B) Capacitance
  - (C) Inductance
  - (D) Resonant frequency
54. Unijunction transistor act as a
- (A) Four-layer diode
  - (B) Diac
  - (C) Triac
  - (D) Latch
55. Thermocouple is a
- (A) passive transducer
  - (B) active transducer
  - (C) piezoelectric
  - (D) None of the above
56. A thermistor converts
- (A) light to resistance
  - (B) temperature to resistance
  - (C) voltage to resistance
  - (D) current to voltage
57. A digital voltmeter measures
- (A) peak value
  - (B) peak to peak value
  - (C) rms value
  - (D) average value

58. If the compensated system shown in the figure has a phase margin of  $90^\circ$  at the gain crossover frequency of 2 rad/sec, the value of the gain  $k$  is



- (A) 1
- (B) 2
- (C) 3
- (D) 4

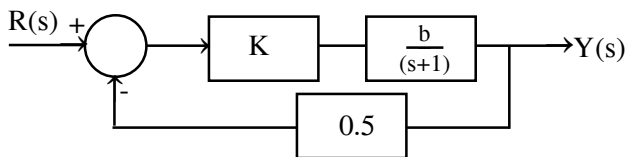
59. Consider the open loop transfer function

$$G(s). H(s) = \frac{ke^{-2s}}{s}$$

The phase crossover frequency is

- (A)  $\frac{\pi}{4}$  rad/ sec.
- (B)  $\frac{\pi}{2}$  rad/ sec.
- (C)  $\frac{3\pi}{4}$  rad/ sec.
- (D)  $\pi$  rad/ sec.

60. Block diagram of a system is shown in the figure. The nominal value of the parameter 'b' is 4.0,  $k= 2$ .



The sensitivity  $S_b^T$  where  $T$  is closed loop transfer function is

- (A)  $\frac{s+1}{s+2}$
- (B)  $\frac{s+1}{s+5}$
- (C)  $\frac{s+3}{s+2}$
- (D)  $\frac{s+3}{s+5}$

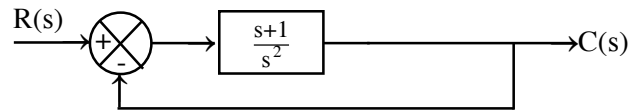
61. A unity negative feedback system has the open loop transfer function

$$G(s). H(s) = \frac{k}{(s+1)(s+2)(s-3)}$$

How many times Nyquist plot intersects the positive real axis of  $G(s) H(s)$  plane?

- (A) Once
- (B) Twice
- (C) Thrice
- (D) Never

62. Figure below depicts the block diagram of a control system:



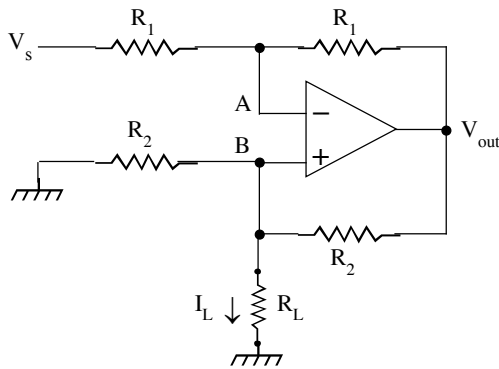
The gain margin of the control system is

- (A) 0
- (B) 2
- (C) 1/2
- (D)  $\infty$  (infinity)

63. Number of octaves between 200Hz and 800 Hz is

- (A) One Octave
- (B) 2- Octaves
- (C) 3- Octaves
- (D) 4- Octaves

64. In the op-amp circuit given in circuit in figure, the load current  $I_L$  is



- (A)  $-\frac{V_s}{R_2}$   
 (B)  $\frac{V_s}{R_2}$   
 (C)  $-\frac{V_s}{R_L}$   
 (D)  $\frac{V_s}{R_L}$

65. To operate properly, a transistor's base-emitter junction must be forward biased, with reverse bias applied to which junction?

- (A) Collector-emitter  
 (B) Collector-base  
 (C) Base-emitter  
 (D) None of the above

66. The mobility of an electron in a semiconductor is expressed in terms of

- (A)  $\text{cm}^2 / \text{V-S}$   
 (B)  $\text{cm} / \text{V-S}$   
 (C)  $\text{cm}^2 / \text{V}$   
 (D)  $\text{cm}^2 / \text{S}$

67. The bond that provides forces to bind the adjacent atoms of the Si crystal is

- (A) Ionic  
 (B) Metallic  
 (C) Covalent  
 (D) Molecular

68. The electrical conductivity of a semiconductor with the fall of temperature

- (A) decreases  
 (B) increases  
 (C) remains constant  
 (D) becomes negative

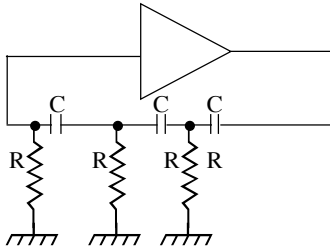
69. Which of the following registers can be used as two individual 8-bit registers?

- (A) DPJR  
 (B) PC  
 (C) SBUF  
 (D) PSW

70. Which port can be used as I/O port in case of 8051 microcontroller?

- (A) PORT 0  
 (B) PORT 1  
 (C) PORT 2  
 (D) PORT 3

71. The oscillator circuit shown in figure has an ideal inverting amplifier. Its frequency of oscillation (in Hz) is



- (A)  $\frac{1}{2\pi\sqrt{6}RC}$   
 (B)  $\frac{1}{2\pi RC}$   
 (C)  $\frac{1}{\sqrt{6}RC}$   
 (D)  $\frac{\sqrt{6}}{2\pi RC}$

72. The Routh's criterion tells us the number of roots of the characteristic equation lying

- (A) in the right half of s- plane.  
 (B) in the left half of s- plane.  
 (C) on the origin of s- plane.  
 (D) in the s- plane is unpredictable.

73. Tunnel diodes are useful in

- (A) low frequency circuits.  
 (B) high frequency circuits.  
 (C) both at high and low frequencies.  
 (D) intermediate frequency circuits.

74. The transfer function of a system (BPF) is given by

$$H(s) = \frac{s}{s^2 + 24s + 36}$$

Quality factor of the transfer function is

- (A) 4  
 (B) 1/4  
 (C) 3  
 (D) 1/3

75. If the unit step response of a network is  $(1 - e^{-\alpha t})$ , then unit impulse response is

- (A)  $\alpha e^{-\alpha t}$   
 (B)  $\alpha e^{+\alpha t}$   
 (C)  $-\alpha e^{-\alpha t}$   
 (D) None of the above