44 (2) DGLF 2·3

# 2018

# DIGITAL LOGIC FUNDAMENTALS

Paper : 2·3

*Full Marks : 80*

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following questions :   1×10=10

   a) When will we get indeterminate state in RS flip-flop ?

   b) _____ and _____ are called universal gates.

   c) $(56)_{10} = (?)_2$

   d) De Morgan's theorem states that the complement of a product is equal to the _____ of the complements.

   e) Write the truth table of AND gate.

   f) What is flip-flop ?

   h) Implement the following Boolean function with only NAND gates.
   F=A+B

   i) What do you mean by sequential circuit ?

   j) What is race around condition ?

3. Answer the following questions :   3×5=15

   a) Implement a full adder circuit with two half adders and an OR gate.

   b) Implement the following function with a 4×1 MUX

   $F (A,B,C) = \Sigma (1,3,5,6)$

   c) Describe a full adder circuit with truth table and logic diagram.

   d) Simplify the Boolean function F in sum of products using the don't care conditions d :

   $F = B'C'D'+BCD'+ABCD'$

   $d = B'CD'+A'BC'D$

   e) Construct a 4×16 decoder with two 3×8 decoders.

   Answer **any five** questions from **Q.4** to **Q.11**

4. What is shift register ? What are its different types ? Explain.   1+1+5=7

   g) Find out the dual of the following Boolean expression :

   B'D+A'BC'+ACD+A'BC

   h) Write the truth table of NOR gate.

   i) Draw the symbol of NAND gate.

   j) Draw the symbol of OR gate.

2. Answer the following questions :
   2×10=20

   a) State the Duality principle.

   b) Write *two* application examples of multiplexer.

   c) Write *two* application examples of demultiplexer.

   d) Simplify the following Boolean expression to a minimum number of literals :

   (A+B)'(A'+B')'

   e) What is the difference between synchronous counter and asynchronous counter ?

   f) What do you mean by direct preset and direct clear input ?

   g) What is the difference between RS flip-flop and JK flip-flop ?

5. What is magnitude comparator ? Explain 2-bit magnitude comparator with logic diagram.   1+6=7

6. Determine the prime implicants of the function :   7

   $F (w, x, y, z) = \Sigma (1, 4, 6, 7, 8, 9, 10, 11, 15)$

7. Design a 3-bit binary counter with JK flip-flop.   7

8. Design a sequential circuit with JK flip-flops to satisfy the following state equations :   7

   A(t+1)=A'B'CD+A'B'C+ACD+AC'D'

   B(t+1)=A'C+CD'+A'BC'

   C(t+1)=B

   D(t+1)=D'

9. Explain 4-bit register with parallel load.   7

10. Design and explain a 4-bit synchronous binary counter.   7

11. Write short note on : **(any one)**   7

    (a) Multiplexer

    (b) Encoder.

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## 2018

## ENVIRONMENTAL STUDIES

Paper : 2·6

*Full Marks : 75*

Time : Three hours

**The figures in the margin indicate
full marks for the questions.**

*Answer **any five** questions.*

1. *(a)* What is Environment ? What are the scopes of its study ? **5**

   *(b)* What do you mean by renewable and non-renewable resources ? Give examples. **3**

   *(c)* What is mining ? Briefly discuss the environmental issues associated with mining. **7**

2. *(a)* Highlight the effect of deforestation on the hydrologic regime of a basin. **5**

   *(b)* What do you mean by man-induced landslides ? **4**

   *(c)* Explain the terms — producer, consumer and trophic levels with suitable examples. **6**

3. *(a)* What are the different kinds of ecological pyramids ? Discuss in brief highlighting their significance. **7**

   *(b)* What do you mean by extinct, endangered, vulnerable and rare species ? Give examples. **5**

   *(c)* What is habitat ? Explain with examples. **3**

4. *(a)* What do you mean by the term "values of biodiversity" ? Discuss the different kinds of biodiversity values. **7**

   *(b)* What do you mean by bio geographical classification ? Briefly discuss the bio geographical zones of India. **8**

5. *(a)* What are the causes of surface water pollution ? Briefly discuss the effects of surface water pollution on man and environment. **8**

   *(b)* What do you mean by soil pollution ? Discuss how soil is polluted due to anthropogenic activities. How does it affect soil productivity ? **7**

6. *(a)* Discuss the issues concerning resettlement and rehabilitation of people associated with developmental activities. **5**

   *(b)* Briefly discuss the salient features of Forest (Conservation) Act, 1980. **5**

   *(c)* What is rainwater harvesting ? Discuss its significance from environment point of view. **5**

7. *(a)* How do you determine population growth rate ? How does it link with the maintenance of environmental quality ? Illustrate. **5**

   *(b)* What do you mean by Human Rights ? Discuss its status in India. **5**

   *(c)* Write the meaning of the terms — doubling time of population, total fertility rate and zero population growth. **5**

8. Write short notes on **any two** of the following : **7½×2=15**

   *(a)* Thermal pollution

   *(b)* Biodiversity hot spots

   *(c)* Greenhouse gases.

## 2018

### MATHEMATICS- I

Paper : 1·4

*Full Marks : 80*

Time : Three hours

**The figures in the margin indicate full marks for the questions.**

1. Answer the following : 5×1=5

   (a) Define symmetric matrix.

   (b) Find the transpose of the matrix

   $$A = \begin{pmatrix} 1 & -2 & 3 \\ 4 & 5 & -3 \\ 7 & 8 & -1 \end{pmatrix}$$

   (c) Write the co-factor of "$a$" for the following matrix $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

   (d) Define unit matrix.

   (e) Write the condition that a matrix $A$ is a singular matrix.

2. Find the rank of the matrix
   $$A = \begin{pmatrix} 2 & 3 & 4 \\ 3 & 1 & 2 \\ 1 & 2 & 2 \end{pmatrix}$$
   5

3. Let $A = \begin{pmatrix} 1 & 2 \\ 3 & -4 \end{pmatrix}$ and $f(x) = 2x^2 - 3x + 5$. Find $f(A)$. 4

4. Solve the following system of equations by matrix inversion method : 6
   $$4x - 5y - 11z = 12$$
   $$x - 3y + z = 1$$
   $$2x + 3y - 7z = 2$$

5. Answer **any two** parts : 5×2=10

   (a) Prove that a square matrix can be expressed as a sum of symmetric and skew-symmetric matrices.

   (b) If $\lambda$ is an eigenvalue of a non-singular matrix $A$ then prove that $\lambda^{-1}$ is an eigenvalue of $A^{-1}$.

   (c) Find the characteristic roots of the matrix $A = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$ and verify Cayley-Hamilton theorem for this matrix.

6. (a) Express in $A + iB$ form and find the argument for the Complex number $\dfrac{(1+i)(2+i)}{3+i}$. 4

   (b) Express in polar form : $1 + i\sqrt{3}$ 2

   (c) For all $z \in c$ prove that

   (i) $\dfrac{1}{2}(z + \bar{z}) = Re(z)$ 2

   (ii) Show that $|z| = 0 \Leftrightarrow z = 0$ 2

   (d) For what value of "$a$" the roots of the equation
   $x^2 - 2(5 + 2a)x + 3(7 + 10a) = 0$ will be equal. 5

   (e) If one root of $x^2 - mx + n = 0$ is twice the other, show that $2m^2 = 9n$. 5

7. (a) Find $\dfrac{dy}{dx}$ : 3×2=6

   (i) $y = x^{2/3} + \sqrt[3]{x} - \log(x^2 + 2)$

   (ii) $y = \dfrac{1 + \cos x}{1 - \sin x}$

   (b) Evaluate : 3×2=6

   (i) $\lim\limits_{x \to 0} \dfrac{e^{ax} - e^{bx}}{x}$

   (ii) $\lim\limits_{x \to 0} \dfrac{(x+2)^{3/2} - (a+2)^{3/2}}{x - a}$

   (c) Find the derivative of $(x^2 + 2)$ with the first principle of derivative. 3

   (d) Find the derivative of—

   (i) $\log(ax^2 + bx + c)$ 2

   (ii) $\sin(3x^2 + 4x - 2)$ 3

8. (a) By the Lagrange's mean value theorem prove that 4
   $$\dfrac{b-a}{1+b^2} < \tan^{-1}b - \tan^{-1}a < \dfrac{b-a}{1+a^2}$$
   for $0 < a < b$

   (b) Evaluate :
   $$\lim\limits_{x \to 0} \dfrac{e^x - e^{-x} - 2x}{x - \sin x}$$
   3

   (c) Find the maximum value of $\left(\dfrac{1}{x}\right)^x$. 3

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