CBCS SCHEME

USN | | | | | | | | | | | 15MAT31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Obtain the Fourier expansion of the function f(x) = x over the interval (-π, π). Deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + ...$ **(08 Marks)**

b. The following table gives the variations of a periodic current A over a certain period T:

t (sec)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75amp in the variable current and obtain the amplitude of the first harmonic. **(08 Marks)**

OR

2 a. Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \le x \le 2$. **(06 Marks)**

b. Represent the function

$$f(x) = \begin{cases} x, & \text{for } \ 0 < x < \pi/2 \\ \pi/2 & \text{for } \ \pi/2 < x < \pi \end{cases}$$

in a half range Fourier sine series. **(05 Marks)**

c. Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data:

x°	0	45	90	135	180	225	270	315
y	2	3/2	1	1/2	0	1/2	1	3/2

(05 Marks)

Module-2

3 a. Find the complex Fourier transform of the function

$$f(x) = \begin{cases} 1 & \text{for } \ |x| \le a \\ 0 & \text{for } \ |x| > a \end{cases}$$ Hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$. **(06 Marks)**

b. If $\bar{u}(z) = \frac{2z^2 + 3z + 12}{(z-1)^4}$ show that $u_0 = 0$ $u_1 = 0$ $u_2 = 2$ $u_3 = 11$. **(05 Marks)**

c. Obtain the Fourier cosine transform of the function

$$f(x) = \begin{cases} 4x, & 0 < x < 1 \\ 4 - x, & 1 < x < 4 \\ 0 & x > 4 \end{cases}$$ **(05 Marks)**

OR

4 a. Obtain the Z-transform of $\cos n\theta$ and $\sin n\theta$. **(06 Marks)**

b. Find the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx \quad m > 0$. **(05 Marks)**

c. Solve by using Z-transforms $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$. **(05 Marks)**

Module-3

5 a. Fit a second degree parabola $y = ax^2 + bx + c$ in the least square sense for the following data and hence estimate y at x = 6. **(06 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

b. Obtain the lines of regression and hence find the coefficient of correlation for the data:

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

(05 Marks)

c. Use Newton-Raphson method to find a real root of $x \sin x + \cos x = 0$ near $x = \pi$. Carryout the iterations upto four decimal places of accuracy. **(05 Marks)**

OR

6 a. Show that a real root of the equation $\tan x + \tanh x = 0$ lies between 2 and 3. Then apply the Regula Falsi method to find third approximation. **(06 Marks)**

b. Compute the coefficient of correlation and the equation of the lines of regression for the data:

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(05 Marks)

c. Fit a curve of the form $y = ae^{bx}$ for the data:

x	0	2	4
y	8.12	10	31.82

(05 Marks)

Module-4

7 a. From the following table find the number of students who have obtained:

i) Less than 45 marks

ii) Between 40 and 45 marks.

Marks	30-40	40-50	50-60	60-70	70-80
Number of students	31	42	51	35	31

(06 Marks)

b. Construct the interpolating polgnomial for the data given below using Newton's general interpolation formula for divided differences and hence find y at x = 3.

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

c. Evaluate $\int_0^1 \frac{x}{1+x^2} dx$ by Weddle's rule. Taking seven ordinates. Hence find $\log_e 2$. **(05 Marks)**

OR

8 a. Use Lagrange's interpolation formula to find f(4) given below. **(06 Marks)**

x	0	2	3	6
f(x)	-4	2	14	158

b. Use Simpson's 3/8th rule to evaluate $\int_1^4 e^{1/x} dx$. **(05 Marks)**

c. The area of a circle (A) corresponding to diameter (D) is given by

D	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the area corresponding to diameter 105 using an appropriate interpolation formula. **(05 Marks)**

Module-5

9 a. Evaluate Green's theorem for $\phi_c(xy + y^2)\,dx + x^2dy$ where c is the closed curve of the region bounded by $y = x$ and $y = x^2$. **(06 Marks)**

b. Find the extremal of the functional $\int_a^b \left(x^2 + y^2 + 2y^2 + 2xy\right)dx$. **(05 Marks)**

c. Varity Stoke's theorem for $\vec{F} = (2x - y)\hat{i} - yz^2\hat{j} - y^2z\hat{k}$ where S is the upper half surface of the sphere $x^2 + y^2 + z^2 = 1$ C is its boundary. **(05 Marks)**

OR

10 a. Derive Euler's equation in the standard form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y1}\right) = 0$. **(06 Marks)**

b. If $\vec{F} = 2xy\hat{i} + y^2z\hat{j} + xz\hat{k}$ and S is the rectangular parallelepiped bounded by $x = 0$, $y = 0$, $z = 0$, $x = 2$, $y = 1$, $z = 3$. Evaluate $\iint_S \vec{F}.\hat{n}\,ds$. **(05 Marks)**

c. Prove that the shortest distance between two points in a plane is along the straight line joining them or prove that the geodesics on a plane are straight lines. **(05 Marks)**

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CBCS SCHEME

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Find modulus and amplitude of $1-\cos\theta+i\sin\theta$. **(05 Marks)**

b. Express $\frac{3+4i}{3-4i}$ in $a+ib$ form. **(05 Marks)**

c. Find the value of 'λ' so that the points A(–1, 4, –3), B(3, 2, –5), C(–3, 8, –5) and D(–3, λ, 1), may lie on one plane. **(06 Marks)**

OR

2 a. Find the angle between the vectors $\vec{a}=5\hat{i}-\hat{j}+\hat{k}$ and $\vec{b}=2\hat{i}-3\hat{j}+6\hat{k}$. **(05 Marks)**

b. Prove that $\left[\vec{a}\times\vec{b},\ \vec{b}\times\vec{c},\ \vec{c}\times\vec{a}\right]=\left[\vec{a}\ \vec{b}\ \vec{c}\right]^2$. **(05 Marks)**

c. Find the real part of $\frac{1}{1+\cos\theta+i\sin\theta}$. **(06 Marks)**

Module-2

3 a. Obtain the n^{th} derivative of $\sin(ax+b)$. **(05 Marks)**

b. Find the pedal equation of $r^n=a^n\cos n\theta$. **(05 Marks)**

c. If $u=\frac{yz}{x}$, $v=\frac{zx}{y}$, $w=\frac{xy}{z}$, show that $\frac{\partial(u,v,w)}{\partial(x,y,z)}=4$. **(06 Marks)**

OR

4 a. If $u=\log\left(\frac{x^4+y^4}{x+y}\right)$ show that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=3$. **(05 Marks)**

b. If $u=f(x-y,\ y-z,\ z-x)$, show that $\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}+\frac{\partial u}{\partial z}=0$. **(05 Marks)**

c. If $y=a\cos(\log x)+b\sin(\log x)$, show that $x^2y_{n+2}+(2n+1)xy_{n+1}+(n^2+1)y_n=0$ **(06 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi}x\sin^8 x\,dx$. **(05 Marks)**

b. Evaluate $\int_0^1 x^2(1-x^2)^{3/2}dx$. **(05 Marks)**

c. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)dz\,dy\,dx$. **(06 Marks)**

OR

6 a. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xydydx$. **(05 Marks)**

b. Evaluate $\int_0^1 \int_0^1 \int_0^1 (x+y+z)dxdydz$. **(05 Marks)**

c. Evaluate $\int_0^\infty \frac{x^4}{(1+x^2)^4}dx$. **(06 Marks)**

Module-4

7 a. If $\vec{r} = (t^2+1)\hat{i} + (4t-3)\hat{j} + (2t^2-6t)\hat{k}$, find the angle between the tangents at t = 1 and t = 2. **(05 Marks)**

b. If $\vec{r} = e^{-t}\hat{i} + 2\cos 3t\,\hat{j} + 2\sin 3t\,\hat{k}$, find the velocity and acceleration at any time t, and also their magnitudes at t = 0. **(05 Marks)**

c. Show that $\vec{F} = (y+z)\hat{i} + (z+x)\hat{j} + (x+y)\hat{k}$ is irrotational. Also find a scalar function 'φ' such that $\vec{F} = \nabla\phi$. **(06 Marks)**

OR

8 a. Find the unit normal vector to the surface $x^2y + 2xz = 4$ at (2, –2, 3). **(05 Marks)**

b. If $\vec{F} = xz^3\hat{i} - 2x^2yz\hat{j} + 2yz^4\hat{k}$ find $\nabla \cdot \vec{F}$ and $\nabla \times \vec{F}$ at (1, –1, 1). **(05 Marks)**

c. If $\frac{d\vec{a}}{dt} = \vec{w} \times \vec{a}$ and $\frac{d\vec{b}}{dt} = \vec{w} \times \vec{b}$, then show that $\frac{d}{dt}(\vec{a} \times \vec{b}) = \vec{w} \times (\vec{a} \times \vec{b})$ **(06 Marks)**

Module-5

9 a. Solve $\sec^2 x \tan y dx + \sec^2 y \tan x dy = 0$. **(05 Marks)**

b. Solve $(y^3 - 3x^2y)dx + (3xy^2 - x^3)dy = 0$. **(05 Marks)**

c. Solve $\frac{dy}{dx} + \frac{y}{x} = xy^2$. **(06 Marks)**

OR

10 a. Solve $\frac{dy}{dx} + y\cot x = \cos x$. **(05 Marks)**

b. Solve $x^2ydx - (x^3 + y^3)dy = 0$ **(05 Marks)**

c. Solve $y(x+y)dx + (x+2y-1)dy = 0$ **(06 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **15CS32**

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Analog and Digital Electronics

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain the construction and principles of operation of JFET. **(08 Marks)**

b. Explain with neat sketches, the operation and parameter of n-channel depletion type MOSFET. **(08 Marks)**

OR

2 a. Discuss characteristics of an ideal op-amp and compare with practical op-amp. **(08 Marks)**

b. For the circuit shown in Fig.Q2(b) determine the valve of drain source voltage (V_{Ds}). Assume $V_{GS} = -0.8V$.

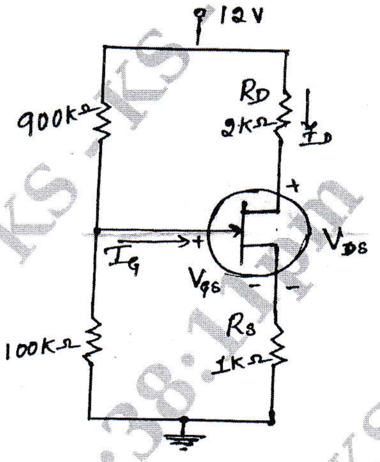

Fig.Q2(b) **(08 Marks)**

Module-2

3 a. What are universal gates? Draw the logic circuit for $y=(A+B+C)(A+B+C)$ using universal gates. **(05 Marks)**

b. Find the minimal SOP of the following Boolean function using K-Map.
F(a, b, c, d) = ∑m(7, 9, 10, 11, 12, 13, 14, 15) **(05 Marks)**

c. Define Hazards? How to design a static 1 hazard free circuit? Explain with an example. **(06 Marks)**

OR

4 a. Simplify the expression y = f(A, B, C, D) = ∑m (1, 2, 8, 9, 10, 12, 13, 14) using Quine – McClusky Method. **(10 Marks)**

b. What is the need of HDL? Write the verilog code for the circuit. Shown in Fig.Q4(b)

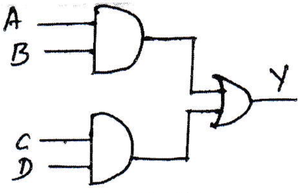

Fig.Q4(b) **(06 Marks)**

Module-3

5 a. What is multiplexer? Write the logic circuit and truth table of 4:1 multiplexer. **(05 Marks)**

b. Explain BCD to Decimal decoder along with circuit diagram. **(05 Marks)**

c. What is magnitude comparator? Design and explain 1 bit magnitude comparator. **(06 Marks)**

OR

6 a. Implement the following function using PLA
$A(x, y, z) = \sum m(1, 2, 4, 6)$
$B(x, y, z) = \sum m(0, 1, 6, 7)$
$C(x, y, z) = \sum m(2, 6)$ **(06 Marks)**

b. Implement the Boolean function expressed by
SOP $f(a, b, c, d) = \sum m(1, 3, 4, 5, 9, 11, 12)$ using 8:1 MUX. **(06 Marks)**

c. Write a note on parity Checker. **(04 Marks)**

Module-4

7 a. What is flip flop? Explain the working of JK master slave flip flop using NAND gates. **(08 Marks)**

b. Write the Execution table of SR, D, JK and T flip flop. **(04 Marks)**

c. Write the difference between synchronous and Asynchronous counter. **(04 Marks)**

OR

8 a. Using Positive edge triggered D flip flop, draw the logic diagram of 4bit SISO Register. Draw the timing diagram to shift binary number 1110 into Register. **(05 Marks)**

b. Explain with neat diagram 4 bit switched tail counter **(05 Marks)**

c. Explain how shift Register can be applied for sequence detector. **(06 Marks)**

Module-5

9 a. Explain a 3 bit binary Rippledown counter. Give block diagram, truth table and output waveforms. **(08 Marks)**

b. Design a sequences, a module – 4 Irregular counter with following counting sequence using D flip flop. **(08 Marks)**

$00 \to 10 \to 11 \to 01$

OR

10 a. Explain 4 bit D/A converter. **(10 Marks)**

b. What is binary ladder? Explain the binary ladder with digital input of 1000. **(06 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

15CS34

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020

Computer Organization

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. With a neat diagram, explain the connection between processor and memory. **(08 Marks)**

b. Explain: (i) Processor clock (ii) Clock rate (iii) Basic performance equation (iv) Performance measurement **(08 Marks)**

OR

2 a. List the addressing modes with assemble syntax and addressing functions. **(08 Marks)**

b. Explain basic input output operation. Write a program to read a line of character and display it. **(08 Marks)**

Module-2

3 a. Explain the interrupts with hardware. Write the steps in enabling and disabling interrupts. **(08 Marks)**

b. Explain the issues in handling the multiple devices in interrupts. **(08 Marks)**

OR

4 a. With a neat diagram, explain DMA and different types of bus arbitrations. **(08 Marks)**

b. Explain USB tree structure and protocols. **(08 Marks)**

Module-3

5 a. Draw the internal organization of a 2M × 8 dynamic memory chip. Explain fast page mode. **(08 Marks)**

b. Explain the mapping functions used in cache memory. **(08 Marks)**

OR

6 a. What is memory interleaving? Explain with example. **(08 Marks)**

b. What is virtual memory? Explain the address translation. **(08 Marks)**

Module-4

7 a. Design 4-bit carry look ahead adder and explain. **(08 Marks)**

b. Explain Booth recoding of a multiplier. Perform (+13) × (–6) using Booths algorithm. **(08 Marks)**

OR

8 a. Explain logic and circuit arrangement for implementing restoring division. **(08 Marks)**

b. Write the rules for arithmetic operations on floating point operations. **(08 Marks)**

Module-5

9 a. With a neat diagram, explain single bus organization of data path inside the processor. **(08 Marks)**

b. Write actions required and control sequence for execution of instruction ADD (R_3), R_1. **(08 Marks)**

OR

10 a. Briefly explain the block diagram of microwave oven. **(08 Marks)**

b. Explain the different possible ways of implementing a multiprocessor system. **(08 Marks)**

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USN ☐☐☐☐☐☐☐☐☐☐ **15CS35**

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Unix and Shell Programming

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Describe the salient features of UNIX Operating System. **(07 Marks)**
b. Write the general structure for command usage in UNIX. **(03 Marks)**
c. Explain in detail the commands needed for user management. **(06 Marks)**

OR

2 a. Compare and contrast External and Internal commands. **(04 Marks)**
b. Mention the use of following commands:
(i) script
(ii) cat
(iii) who
(iv) pwd
(v) ls
(iv) cal **(12 Marks)**

Module-2

3 a. Elaborate on absolute and relative pathnames with suitable example. **(04 Marks)**
b. With a neat diagram explain the UNIX file system organization that explains parent child relationship. **(09 Marks)**
c. Describe the /etc/shadow folder in UNIX file system. **(03 Marks)**

OR

4 a. Demonstrate the usage of any five commands related to files and directories. **(10 Marks)**
b. Illustrate the usage of ls command along with various options. **(06 Marks)**

Module-3

5 a. Define vi editor. Explain the different modes of vi editor. **(10 Marks)**
b. Write the wildcards for the following :
(i) name of a person containing only alphabets
(ii) marks of student 0 to 80
(iii) all names of the starting with lab
(iv) vowels of English alphabet
(v) names of students not starting with x, y and z
(vi) a single character after f. **(06 Marks)**

OR

6 a. Illustrate the usage of three standard files used in the shell. **(06 Marks)**
b. Briefly explain the application of local shell variables. **(07 Marks)**
c. Write a note on grep. **(03 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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Module-4

7 a. Define Environment Variable. Explain some environment variables. **(06 Marks)**
b. Explain Positional Parameters. **(05 Marks)**
c. Differentiate Hard and Softlink. **(05 Marks)**

OR

8 a. Write a shell program to find the factorial of a number. **(04 Marks)**
b. Explain the usage of sort command with options. **(05 Marks)**
c. Given a file

emp.lst

```
101  cse    pabubali     prof       1234567890
110  ise    vikram       prof       6789012345
121  civ    pratap       Asst prof  1234567899
156  auto   chennamma    prof       9900011111
101  cse    bahubali     prof       1234567890
252  mech   karuna       prof       2222333344
```

(i) display the top 5 employees of emp.lst.
(ii) display the last 4 employees of emp.lst.
(iii) cut the 3rd field of emp.lst. **(07 Marks)**

Module-5

9 a. Explain the following :
(i) PS (ii) PID (iii) Zombie (iv) nice **(08 Marks)**
b. Name the different phases of Process Creation. Explain. **(08 Marks)**

OR

10 a. Mention the operators used for string comparison in Perl. **(03 Marks)**
b. Write a Perl script to convert Decimal number to Binary number. **(06 Marks)**
c. Elaborate on array handling functions used in Perl with suitable example. **(07 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **15CS36**

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020

Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Define tautology and contradiction. Prove that the compound proposition $[(p \to q) \vee (p \to r) \leftrightarrow [p \to (q \vee r)]$ is tautology. **(05 Marks)**

b. Test the validity of the argument

$$\begin{array}{l} p \to q \\ q \to (r \wedge s) \\ \neg r \vee (\neg t \vee u) \\ \underline{p \wedge t} \\ \therefore u \end{array}$$

(05 Marks)

c. Give (i) direct proof, (ii) indirect proof and (iii) Proof by contradiction, for the statement "Square of an odd integer, is an odd integer". **(06 Marks)**

OR

2 a. Prove the following logical equivalence without using truth table.

$$(p \to q) \wedge [\neg q \wedge (r \vee \neg q)] \leftrightarrow \neg(p \vee q)$$

(05 Marks)

b. Establish the validity of the argument using the rules of inferences.

No engineering student of first or second semester studies Logic

<u>Anil is an engineering student who studies logic.</u>

∴ Anil is not in second semester. **(05 Marks)**

c. Let $p(x) : x^2 - 7x + 10 = 0;\ q(x) = x^2 - 2x - 3 = 0;\ r(x) = x < 0$

Determine the truth value of the following statements, if universe contains only the integers 2 and 5.

(i) $\forall x, p(x) \to \neg r(x)$ (ii) $\forall x, q(x) \to r(x)$

(iii) $\exists x, p(x) \to r(x)$ (iv) $\exists x, q(x) \to r(x)$ **(06 Marks)**

Module-2

3 a. Prove by mathematical induction for any integer $n \geq 1$.

$$\frac{1}{2.5} + \frac{1}{5.8} + \ldots\ldots\ldots\ldots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{6n+4}$$

(05 Marks)

b. How many positive integers n can be formed using the digits 3, 4, 4, 5, 5, 6, 7 if we want n to exceed 50,00,000? **(05 Marks)**

c. Find the coefficient of

(i) x^{12} in the expansion of $(1-2x)^{10}\ x^3$

(ii) $x^{11}y^4$ in the expansion of $(2x^3 - 3xy^2 + z^2)^6$

(iii) the constant term in the expansion of $\left(3x^2 - \frac{2}{x}\right)^{15}$ **(06 Marks)**

OR

4 a. Let $a_0 = 1$, $a_1 = 2$, $a_2 = 3$ and $a_n = a_{n-1} + a_{n-2} + a_{n-3}$ for $n \geq 3$. Prove that $a_n \leq 3^n$ for all positive integer n. **(05 Marks)**

b. If $L_0, L_1, L_2, \ldots\ldots$ are Lucas numbers, then prove that

$$L_n = \left(\frac{1+\sqrt{5}}{2}\right)^n + \left(\frac{1-\sqrt{5}}{2}\right)^n$$ **(05 Marks)**

c. In how many ways can one distribute eight identical bulls into four distinct containers so that (i) no container is left empty? (ii) the fourth container contains an odd number of balls? **(06 Marks)**

Module-3

5 a. Let f, g, h be functions from R to R defined by $f(x) = x^2$, $g(x) = x + 5$, $h(x) = \sqrt{x^2 + 2}$, verify that (h o g) o f = h o (g o f). **(05 Marks)**

b. Let $f : R \rightarrow R$ be defined by

$$f(x) = \begin{cases} 3x - 5 & \text{for } x > 0 \\ -3x + 1 & \text{for } x \leq 0 \end{cases} \quad \text{then find}$$

(i) $f(-1)$ (ii) $f(5/3)$ (iii) $f^{-1}(3)$ (iv) $f^{-1}(-6)$ (iv) $f^{-1}([-5, 5])$. **(05 Marks)**

c. Define partially ordered set. Draw the Hasse diagram representing the positive divisors of 36. **(06 Marks)**

OR

6 a. Determine the following relations are functions or not. If relation is function, find its range

(i) $\{(x, y)/x, y \in z, y = 3x+1\}$; (ii) $\{(x, y)/x, y \in z, y = x^2+3\}$;

(iii) $\{(x, y)/x, y \in R, y^2 = x\}$; (iv) $\{(x, y)/x, y \in Q, x^2+y^2=1\}$ **(05 Marks)**

b. State the Pigeonhole principle and generalization of the pigeonhole principle. Prove that if 30 dictionaries in a library contains a total of 61,327 pages, then at least one of the dictionaries must have at least 2045 pages. **(05 Marks)**

c. Let A = {1, 2, 3, 4, 6} and R be a relation on A defined by aRb if and only if a is a multiple of b. Represent the relation R as matrix and draw its digraph. **(06 Marks)**

Module-4

7 a. Determine the number of positive integers n, such that $1 \leq n \leq 300$, and n is

(i) not divisible by 5, 6, 8

(ii) divisible by at least one of 5, 6, 8 **(05 Marks)**

b. Four persons P_1, P_2, P_3, P_4 who arrive late for a dinner party, find that only one chair at each of five tables T_1, T_2, T_3, T_4, T_5 is vacant. P_1 will not sit T_1 or T_2, P_2 will not sit at T_2, P_3 will not sit at T_3 or T_4 and P_4 will not sit at T_4 or T_5. Find the number of way they can occupy the vacant chairs. **(05 Marks)**

c. Solve the recurrence relation:

$a_{n+1} = 3a_n + 5 \times 7^{n+1}$ for $n \geq 0$, give that $a_0 = 2$. **(06 Marks)**

OR

8 a. Find the number of permutations of the digits 1 through 9 in which the blocks 36, 78, 672 do not appear. **(06 Marks)**

b. Find the rook polynomial for the board in the Fig.Q8(b). Using expansion formula and product formula. **(06 Marks)**

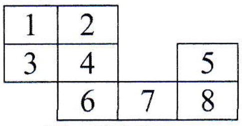

Fig.Q8(b)

c. If $a_0 = 0$, $a_1 = 1$, $a_2 = 4$ and $a_3 = 37$, satisfy the recurrence relation

$$a_{n+2} + ba_{n+1} + ca_n = 0 \quad \text{for } n \geq 0,$$

determine the constants b and c and then solve the relation for a_n. **(04 Marks)**

Module-5

9 a. Define complete graph and complete bipartite graph. Hence draw
  (i) Kuratowaski's first graph K_5,
  (ii) Kuratowaski's second graph K_{33}
  (iii) 3-regular graph with 8 vertices. **(05 Marks)**

b. Discuss the solution of Kongsberg bridge problem. **(05 Marks)**

c. Obtain an optimal prefix code for the message LETTER RECEIVED. Indicate the code. **(06 Marks)**

OR

10 a. State Handshaking property, how many vertices will a graphs have, if they contain
  (i) 16 edges and all vertices of degree 4?
  (ii) 21 edges, 3 vertices of degree 4 and other vertices of degree 3?
  (iii) 12 edges, 6 vertices of degree 3 and other vertices of degree less than 3. **(05 Marks)**

b. Define isomorphism of two graphs. Show that following pair of graphs are isomorphic. [Refer Fig.Q10(b)].

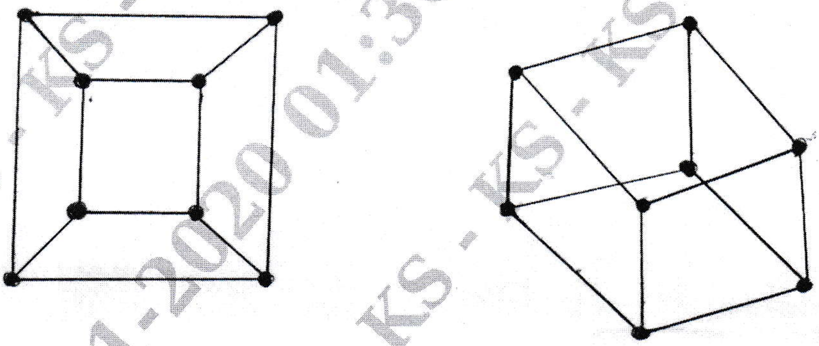

Fig.Q10(b) **(05 Marks)**

c. Define tree and prove that tree with n vertices has n – 1 edges. **(06 Marks)**

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