PAPER ID-421335

Subject Code: KAS403

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2021-22
MATHS-III

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If you require any missing data, then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2*10 = 20

Qno	Questions	CO
(a)	Evaluate $L(e^{-t}\,cost)$.	1
(b)	State convolution theorem for Laplace transform.	1
(c)	Find the Z-transform of $f(k) = cos\left(\frac{k\pi}{2}\right), k \geq 0$.	2
(d)	State change of scale property in Fourier transform.	2
(e)	Illustrate a relation which is equivalence on a set A, where $A = \{1,2,3,4,5\}$.	3
(f)	Show that every cyclic group is an abelian group.	3
(g)	Show by contradiction that $\sqrt{7}$ is irrational number.	4
(h)	If $f(x) = 5x + 1, find\ f^{-1}(x)$.	4
(i)	Prove the idempotent law: $a * a = a$.	5
(j)	Describe complemented lattice with an example.	5

SECTION B

2. Attempt any *three* of the following: 10*3 = 30

Qno	Questions	CO
(a)	Determine the Laplace transform of periodic function defined by the triangular wave function with period of 2a, $f(t) = \begin{cases} \frac{t}{a} & 0 \leq t \leq a \\ \frac{2a-t}{a} & a \leq t \leq 2a \end{cases}$.	1
(b)	Determine the solution of the difference equation by Z-transform: $y_{k+1} + \frac{1}{4}y_k = \left(\frac{1}{4}\right)^k, k \geq 0, y(0) = 0$.	2
(c)	State and prove Lagrange's theorem.	3
(d)	Solve the recurrence relation $a_n = 2a_{n-1} - 3$ for $n > 0$, with the initial condition $a_0 = 4$.	4
(e)	(i) Minimize the following Boolean expression using k-map: $xy + x'y + y'x$. (ii) Explain AND Gate, OR Gate, NOT Gate, and also construct their logic circuits.	5

SECTION C

3. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Solve the following simultaneous equations using Laplace transform: $\frac{d^2x}{dt^2} + 5\frac{dy}{dt} - x = t$ & $2\frac{dx}{dt} - \frac{d^2y}{dt^2} + 4y = 2$.	1
(b)	Find inverse Laplace transform of $log\left(1 + \frac{1}{p^2}\right)$.	1

PAPER ID-421335

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM IV) THEORY EXAMINATION 2021-22
MATHS-III

4. Attempt any *one* part of the following: 10 *1 = 10

Qno	Questions	CO
(a)	Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, x > 0, t > 0$ subject to the conditions $(i) u = 0$, when $x = 0, t > 0$ (ii) $u = \begin{cases} 1, & 0 < x < 1 \\ 0, & x \geq 1 \end{cases}, t = 0.$	2
(b)	Using residue's method, determine $Z^{-1}\left(\frac{8z-z^3}{(4-z)^3}\right)$.	2

5. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Test the validity of the following argument. "It is not sunny and it is cold." "We will swim only if it is sunny." "If we do not swim, then we will canoe." "If we canoe, then we will be home early." Therefore "We will be home early".	3
(b)	Show by algebra of proposition: ¬(¬p → q) ∨ (p ∧ ¬q) ≡ ¬q, where ≡ represents logical equivalent.	3

6. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Prove the following by mathematical induction for all n∈ ℕ. $1.2.3 + 2.3.4 + \cdots \ldots + n(n+1)(n+2) = n(n+1)(n+2)(n+3)/4$	4
(b)	A large software development company employs 100 computer programmers. Of them, 45 are proficient in Java, 30 in C#, 20 in Python, six in C# and Java, one in Java and Python, five in C# and Python, and just one programmer is proficient in all three languages above. Determine the number of computer programmers that are not proficient in any of these three languages.	4

7. Attempt any *one* part of the following: 10*1 = 10

Qno	Questions	CO
(a)	Prove that a poset has at most one greatest element and one least element.	5
(b)	(i) Define Least and Greatest element of a Poset. (ii) Describe the power set of S = {a, b, c}. Draw the Hasse diagram of (P(S), ⊆) and write the greatest, least, maximal and least element of (P(S), ⊆). P(S) is denoting power set of S.	5