PES UNIVERSITY	**PES University, Bangalore** (Established under Karnataka Act No. 16 of 2013)	**UE18CS205**

December 2019: END SEMESTER ASSESSMENT (ESA) B.TECH.

UE18CS205 – Discrete Mathematics & Logic

Time: 3 Hrs | Answer all the questions | Max Marks: 100

1	a)	Let p,q,r be the propositions, p:Grizzly bears have been seen in the area. q:Hiking is safe in the trail. r:Berries are ripe along the trail. Write these propositions using p,q and r and logical connectives. i)For hiking on the trail to be safe ,it is necessary that berries not be ripe along the trail and for grizzly bears not to be have been seen in the area. ii)Hiking is not safe on the trail whenever grizzly bears have been seen in the area and berries are ripe along the trail.	6
	b)	Let the universe of discourse for the variable n be N (all integers ≥ 0) and p(n)="n is prime" e(n)= "n is even." Write the following in ordinary English (do not say it in terms of n and m): (i) $\forall_n \exists_m ((\neg e(n) \wedge n \neq m) \rightarrow e(n+m))$ (ii) $\forall_m \forall_n ((p(m) \wedge p(n) \wedge m \neq 2 \wedge n \neq 2) \rightarrow e(m+n))$	6
	c)	Show that $p \leftrightarrow q$ and $(p \wedge q) \vee (\neg p \wedge \neg q)$ are logically equivalent.(using laws of logic).	4
	d)	Show that the following argument is valid: If today is Tuesday,I have a test in mathematics or economics. If my economics professor is sick ,i will not have a test in economics.Today is tuesday and my economics professor is sick .Therefore i have a test in mathematics. Let T denote 'Today is Tuesday',M denote 'I have a test in mathematics' and S denote 'my economics professor is sick'.	4
2.	a)	From 50 students taking examinations in Mathematics, Physics and Chemistry, each of the students has passed in at least one of the subjects, 37 passed Mathematics, 24 Physics and 43 Chemistry. At most 19 passed Mathematics and Physics, at most 29 Mathematics and Chemistry and at most 20 Physics and Chemistry. What is the largest possible number that could have passed all three examinations?	6
	b)	A relation R on Z where xRy if and only if 3 x − 5 y is even. Prove R is reflexive, symmetric and transitive.	6
	c)	Let set A be { A, B, C, D, E, F, G } and set B be {1, 2, 3, 4, 5, 6, 7}. How many functions are there from set A to set B? How many of these functions are injective? How many are surjective? How many are bijective?	8

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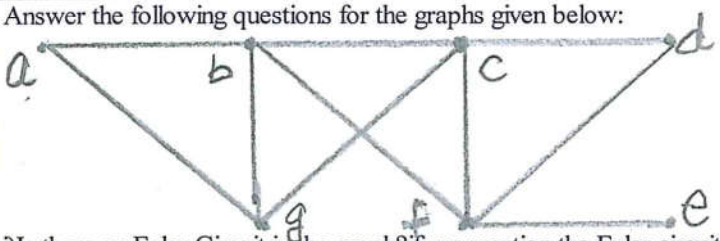
3.	a)	How many strings of three decimal digits i)do not contain the same digit three times? ii)begin with an odd digit? iii)have exactly two digits that are 4's?	6
	b)	Find the coefficient of x^{10} in $(\frac{1}{x}+2x)^{100}$.	6
	c)	In a small village, there are 87 families, of which 52 families have at most 2 children. In a rural development programme 20 families are to be chosen for assistance, of which at least 18 families must have at most 2 children. In how many ways can the choice be made?	8
4.	a)	Using mathematical induction prove that if n>=1,then 1.1!+2.2!+3.3!+.....+n.n!=(n+1)!-1	6
	b)	Answer the following questions for the graphs given below:  i)Is there an Euler Circuit in the graph?if yes mention the Euler circuit. ii)Is there an Euler path (but not a circuit)? if yes,give the Euler path. iii)Is there a Hamilton path in the graph ?if yes mention the Hamilton path..	6
	c)	What is the solution (closed form) of $a_n = -a_{n-1}+6a_{n-2}$, where n>=2 and $a_0=-1$, $a_1=8$.	8
5.	a)	Consider the following multiplication table for a group G and answer the following questions.	6

o	e	a	b	c	d	f
e	e	a	b	c	d	f
a	a	e	d	f	b	c
b	b	c	e	a	f	d
c	c	b	f	d	e	a
d	d	f	a	e	c	b
f	f	d	c	b	a	e

i)Is G is commutative?(Yes/No)
ii) Is G is cyclic?(Yes/No)
iii)Find the inverse of d.
iv)Find all subgroups of size 2.

	b)	Let $v = \frac{1+\sqrt{3}\,i}{2}$ and let $A_6=\{1,v,v^2,v^3,v^4,v^5\}$. (Note:The term 'i' is not a part of the square root.) i)Show that $(A_6,.)$ is a group. ii)Is $(A_6,.)$ cyclic? iii)Is $(A_6,.)$ abelian?	6
	c)	Explain even parity ,majority vote encoding and decoding techniques and mention one drawback for each.	8