Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER BTECH. (INFORMATION TECHNOLOGY/COMPUTER AND COMMUNICATION ENGINEERING) END SEMESTER EXAMINATIONS, DEC. 2021
SUBJECT: PROGRAM ELECTIVE – IV SEMANTIC WEB [ICT 4036]
REVISED CREDIT SYSTEM
(27/12/2021)
PART B

TIME: 75 Minutes **MAX. MARKS: 20**

Instructions to candidates
- Answer **ALL** questions.
- Missing data, if any, may be suitably assumed.

Q.No.	Questions	M	C	A	B
1A.	Develop an OWL ontology that models the following. Draw a RDF graph and write the equivalent in RDF/XML. i. Consider three classes: Student, Institute, and Teacher ii. Institute and Teacher should have properties name (xsd:string) and email (xsd:string) iii. Each Student should have a name (xsd:string) and a roll number (xsd:int). The roll number should unambiguously identify a Student. iv. A Teacher should have a property mentee (range: Student) and a Student should have a property mentor(range: Teacher) respectively. v. Instances of class Institute that enrols more than 1000 Students should belong to a new class BigInstitute. vi. A Student must not be an Institute. vii. Instances that are both, Teacher and Student should belong to a class TeacherAndStudent.	**5**	4	C1, C2 C3, C5 C6	3
1B.	Consider the following predicate Logic Formulas. Represent these in Conjunctive Normal Form and list the Clauses. i. $\forall x\,(CY(x) \rightarrow \exists y\,(RR(y) \wedge CH(x,y)))$ ii. $\forall x\,(RR(x) \wedge BP(x) \rightarrow SM(x))$ iii. $\neg\,\exists x\,\exists y\,(CY(x) \wedge RR(y) \wedge SM(y) \wedge CA(x,y))$ iv. $\forall x\,(CY(x) \wedge \exists y\,(RR(y) \wedge CH(x,y) \wedge \neg\,CA(x,y)) \rightarrow FR(x))$	**3**	3	C1, C3, C4, C5, C6	3
1C.	Express the following sentence in RDFa. *TajMahal is located in Agra which is part of India.*	**2**	1	C1, C3, C5	3
2A.	Given the RDFS document that keeps track of the cars and bookings. Assume that the namespaces ex, rdf, xsd and rdfs are defined. ex:Car rdf:type rdfs:Class. ex:BookedCar rdf:type rdfs:Class. ex:BookedCar rdfs:subClassOf ex:Car. ex:destination rdfs:domain ex:BookedCar.	**5**	3	C1, C3, C4, C5, C6	4

ex:destination rdfs:range ex:City.
ex:traveller rdfs:range ex:Person.
ex:Owner rdfs:range ex:Person.
ex:passenger rdfs:subPropertyOf ex:traveller.
ex:driver rdfs:subPropertyOf ex:traveller.
ex:TravelDate rdfs:range xsd:dateTime.
ex:KA1111 ex:destination ex:Manipal;
ex:driver ex:Bob;
ex:passenger ex:Alen;
ex:passenger dlv:Mary;
dlv:owner ex:Jack.
ex:travelDate "2021-12-25T21:00:00" .
ex:KL2222 ex:destination ex:Cochin .
ex:driver ex:Alex .
ex:passenger ex:Harry .
ex:Owner ex:John .
ex:travelDate "2021-12-24T15:00:00" .
ex:TN3333 rdf:type ex:Car .

For each of the triples below, determine whether it is derivable from the statements in the document. Justify your answer.

i. ex:KA1111 rdf:type ex:BookedCar .
ii. ex:KA1111 rdf:type ex:Car .
iii. ex:TN3333 rdf:type ex:BookedCar .
iv. ex:Manipal rdf:type ex:City .
v. ex:Cochin rdf:type ex:City .
vi. ex: ex:traveller ex:LinnLarsson .
vii. ex:KL2222 ex:traveller ex:LinnLarsson .
viii. _ :blank ex:traveller ex:Jill .
ix. _:blank ex:traveller _:blank .
x. ex:destination rdf:type rdf:Property .

2B. Consider the following OWL-ontology: **3** 3 C1, C3, C4, C5, C6 4

```
<!DOCTYPE rdf:RDF [
<!ENTITY owl "http://www.w3.org/2002/07/owl#">]>
<rdf:RDF xmlns:owl ="http://www.w3.org/2002/07/owl#"
xmlns:rdf ="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#">
<owl:Class rdf:ID='H'/>
<owl:Class rdf:ID='G'/>
<rdfs:subClassOf rdf:resource='H' />
</owl:Class>
<owl:ObjectProperty rdf:ID='F'/>
<owl:ObjectProperty rdf:ID='E'>
<rdfs:subPropertyOf rdf:resource='F' />
</owl:ObjectProperty>
<owl:DatatypeProperty rdf:ID='D' />
<owl:ObjectProperty rdf:ID='C'>
<rdf:type rdf:resource="&owl;TransitiveProperty" />
</owl:ObjectProperty>
<owl:ObjectProperty rdf:ID='B'>
<rdf:type rdf:resource="&owl;SymmetricProperty" />
```

```
</owl:ObjectProperty>
<owl:Class rdf:ID='A'>
<owl:equivalentClass>
<owl:Restriction>
<owl:onProperty rdf:resource='F' />
<owl:minCardinality
rdf:datatype="&xsd;nonNegativeInteger">
1 </owl:minCardinality>
</owl:Restriction>
</owl:equivalentClass>
</owl:Class>
</rdf:RDF>
```

The identifiers in the ontology above (ex. "A", "B", etc.) are not very descriptive.
Map the identifiers A,B,C,D,E,F,G,H with the correct descriptive identifiers given below with proper justifications.
Age, isTallerThan, Person, isFriendOf, Parent, hasDaughter, Man, hasChild

2C.	i.	Represent the following rule in RuleML. hasSon(?x1,?x2) ^ hasDaughter(?x1,?x3) → IsSibling(?x1,?x3)	**2**	3	C1, C3, C4, C5, C6	3
	ii.	Represent the following in SPIN :StudentAndTeacher rdf:type owl:Class ; owl:IntersectionOf (:Student :Teacher).				

M--Marks, C--CLO, A--AHEP LO, B --Blooms Taxonomy Level