COURSE APPROVAL FORM, Graduate School
University of Arkansas for Medical Sciences

This form and attached materials are due in the Graduate School Office on the first Monday of the month. All forms will be submitted to the UAMS Graduate Council Curriculum Committee for review and approval prior to consideration by the Graduate Council.

This form is not required for minor stylistic or editorial corrections to the title or course descriptions. These may be made when revising the catalog copy.

1. **Program:** Department of Biomedical Informatics | D | B | M | I | | | | | (Department / Alpha (Department) Code)

2. **Action proposed** (indicate one or more items): Effective term: Fall 2018

- ■ Add course
- ☐ Eliminate course (No outline needed)
- ☐ Change title
- ☐ Change credit hours from: _____ to _____
- ☐ Change course number from: _____ to _____
- ☐ Change description

3. **Course ID, title and description:**

B	M	I	G	5	0	0	1
prefix				number			

Data Information
title (20 characters)

Data Information and Knowledge Representation
catalog name (40 characters)

Scheduled offering: ☒ Fall ☐ Spring ☐ Summer ☒ On demand

To cross list a course, use the Course Cross Listing Form.

Describe the course in sentence form using 50 words or less **as it is to appear in the catalog**. List prerequisites, co-requisites and possible off-site instructional opportunities or requirements.

This course provides students with the foundational ideas of how information is modelled to facilitate easy access to knowledge. The course defines data, information and knowledge and explains how the three are connected.

4. **Justification:**

Justify this change in terms of course needs or curriculum improvement. State the effect of this change on any degree programs. Identify the courses to be eliminated, if any, if this course is approved. (Course Approval Forms must also be submitted for these courses) Identify any existing course or courses that would extensively overlap or be duplicated if the proposed curricular change occurs. Provide statements of concurrence with the change from the chairperson(s) and dean(s) of the programs/areas offering the affected courses.

The course introduces students to basic information modelling methodologies both in relational databases (RDB) and graph data bases, in particular semantic web technologies. Particular emphasis is on the introduction of principles of formal logic and the relevance of formal logic to information modelling and knowledge representation. The course introduces different types of logics, their expressivity, and limitations and basics of Metalogic which provide a foundation for the higher level courses in our curriculum.

INSTRUCTIONS FOR COMPLETION OF THE UAMS GRADUATE SCHOOL COURSE APPROVAL FORM

1. Please save this PDF to your computer for editing.

2. The form has been designed with fields for your responses, and these are indicated in blue and gray shading. Please complete all fields. Use the "tab" key to move between fields. A 'beep' will sound if you attempt to enter a response that contains more characters than is permitted. IF YOU NEED HELP IN ANY OF THE FIELDS, PRESS THE F1 KEY AND A HELP WINDOW WILL OPEN.

3. Print the document, and then obtain the appropriate signatures before submitting the form to the Graduate Office.

SYLLABUS

COURSE NUMBER: BMIG 5001

COURSE TITLE: Data Information and Knowledge Representation

COURSE DESCRIPTION:

This course provides students with the foundational ideas of how information is modelled to facilitate easy access to knowledge. The course defines data, information and knowledge and explains how the three are connected. The course introduces students to basic information modelling methodologies both in relational databases (RDB) and graph data bases, in particular semantic web technologies. Particular emphasis is on the introduction of principles of formal logic and the relevance of formal logic to information modelling and knowledge representation. The course introduces different types of logics, their expressivity, and limitations and basics of Metalogic. In addition, the course introduces the ontologies and their role in information modelling. Finally, the course includes an introduction to representing knowledge in a system. While not having a lab section the course will include numerous exercises and homework and grading will include exams demonstrating the skills acquired through those exercises.

PRE-REQUISITES: None

GENERAL INFORMATION:

CREDITS: 3 credit hours

SEMESTER: Fall

LOCATION: Campus and Online (hybrid)

FACULTY: Mathias Brochhausen, PhD

SPECIAL ASSISTANCE: Students who believe they may need accommodations in this class based on mental or physical impairments must contact the Associate Dean for Academic Affairs at (501) 686-5730 to schedule an appointment to discuss your needs. Please make arrangements as soon as possible so accommodations can be made in a timely manner.

COURSE OBJECTIVES:

Upon successful completion of this course, the student is able to:

1. Articulate and understand the definition of data, information, and knowledge based on current information theory approaches.
2. Articulate, understand, and apply definitions of formal language, model theory, and proof theory.
3. Understand and apply propositional calculus
4. Understand and apply predicate calculus
5. Understand and apply the basics of Description Logics
6. Understand and apply the basics of ER Models

7. Understand and apply the basics of UML
8. Understand and apply the basics of RDF
9. Understand and apply the basics of modelling rules.

MAJOR TOPICS:

Introduction to Information Theory
What is data?
What is information (including MCT) ?
What is knowledge?

Information Modelling in Relational Databases
ER Models
UML class diagrams

Information Modelling using graph-based systems
RDF
Why does logic matter in knowledge representation?
What is logic
Preliminaries of Metalogic
Propositional Calculus
Predicate Calculus
Description Logic

Procedural knowledge
ARDEN Syntax
Rule-based systems (CLIPS rules engine exercises?)
Other rule representations

COURSE OUTLINE:

Week 1 Aug 15, 17 **Introduction to Information Theory**

Lecture: What is information and what it is relation to knowledge and data.

Reading: Floridi, Chapter 1-3

Week 2 **UML and Relational Modelling**

Lecture: Review of modelling information in relational databases: referential integrity, UML and Entity-Relationship diagrams, and normalization

Reading: Seidl et al., Teorey et al.

Week 3 **Normalization, Syntax, and Grammar**

Lecture: Five Normal Forms. Syntax and Grammar.

Reading: Kent; Rosen

Week 4 **Logic and its role in information modelling**

Lecture: What is logic? What is the role of logic in information modelling.

Introduction to Metalogic

Reading: Brachmann & Levesque, Hunter (§1-10)

Week 5 **Propositional Calculus: Symbolization, Syntax, Semantics**

Lecture: Introduction to symbolization in Logic, Syntax and Semantics of the Propositional Calculus. Including exercises.

Reading: Nolt et al.

Week 6 **Propositional Calculus: Truth-trees**

Lecture: Truth-trees including exercises

Reading: Nolt et al.

Week 7 **Propositional Calculus: Derivations I**

Lecture: Introduction of derivations in propositional logic including exercises.

Reading: Nolt et al.

Week 8 **Propositional Calculus: Derivations II**

Lecture: Introduction of derivations in propositional logic including exercises.

Reading: Nolt et al.

Week 9 **Predicate Calculus: Symbolization, Syntax, Semantics**

Lecture: Introduction to symbolization in Logic, Syntax and Semantics of the Propositional Calculus. Including exercises.

Reading: Nolt et al.

Week 10 **Predicate Calculus: Truth-trees**

Lecture: Truth-trees for predicate calculus including exercises

Reading: Nolt et al.

Week 11 **Predicate Calculus: Derivations I**

Lecture: Introduction of derivations in predicate logic including exercises.
Reading: Nolt et al.

Week 12 **Predicate Calculus: Derivations II**

Lecture: Introduction of derivations in predicate logic including exercises.
Reading: Nolt et al.

Week 13 **Description Logic**

Lecture: Basics of DL, why is DL necessary and how is it implemented
Reading: Krötsch et al.

Week 14 **Semantic representation strategies, RDF**

Lectures: Introducing semantic information and the RDF
Reading: Floridi, Chapter 4, Manola et al.

Week 15 **Ontologies**

Lectures: Introducing formal ontologies, OWL
Reading: TBA

Week 16 **Representation of rules and introduction to SWRL**

Lectures: Introducing the need and methodologies of representing rules in information system, demonstrate difference between rules and logic. This will be done by using SWRL as the example language

Reading: Horrocks et al.

Week 17 **Review for final**
Lectures: Class sessions will be devoted to a Q&A session to get any last questions before the final.

Week 18 **Last Week of Class (Exam week)**

Reading week, review for final

Lectures: No class sessions.

Reading: exam study

Final Exam

Weekly quizzes: Weekly quizzes are a formative evaluation, i.e., they are meant to help you check and improve your learning.

Final exam: Present an overview in poster format of your assigned Biomedical Informatics History topic. Describe the theories and pioneering people and systems, application area or BMI challenge addressed, and how the advance reflected the Tower of Achievement and achieved the Fundamental Theorem.

Participation: While the nature of this course is didactic, the learning objective hinge on active participation by the students. There are exercises to be done and there will be group discussions. Participation includes but is not restricted to these two forms of participation. Additional forms are: posting about the content of a session providing further inside or a question not raised before (needs to be novel to the forum), content-related contributions during the session via chat.

ACADEMIC HONESTY:
Academic honesty is expected at all times. All graded work must be your own unless otherwise specified in the assignment. Fair credit must be given to others for their work on team assignments by including a statement of contributorship (see ICMJE guidelines for authorship).

Academic dishonesty such as but not limited to cheating, plagiarism, using the work of others without permission and acknowledgement and forgery will result in an automatic zero for the assignment and may result in a failing grade in the course, loss of graduate funding and dismissal from your degree program.

EVALUATION:

This is a graded course. Grades will be assigned based on the course average according to the following scale: A (93-100), B (85-92), C(75-84), D(65-74), Fail (lower than 64).

The course average for the didactic portion of the course will be comprised of course assignments, weekly quizzes, the course project, and the final exam. The didactic portion of the course represents three of the four credit hours.

Participation.....10%
Weekly quizzes.....45%
Final exam.....45%

The grades for the weekly quiz portion of the course will be averaged and evenly weighted.

Course material:

Brachmann RJ, Levesque HJ: Knowledge Representation and Reasoning. Morgan Kaufmann: 2004.

Floridi L. Information – A Very Short Introduction. Oxford University Press, Oxford, UK, 2010.

Horrocks I, Patel-Schneider PF, Boley H, Tabet S, Grosof B, Dean M: SWRL: A Semantic Web Rule Language Combining OWL and RuleML. https://www.w3.org/Submission/SWRL/

Hunter G. Metalogic. An Introduction to the Metatheory of Standard First Order Logic. University of California Press, Berkeley, 1971. (Necessary sections will be made available electronically).

Kent, W. 1983. "A Simple Guide to Five Normal Forms in Relational Database Theory". Commun. ACM 26.2, 120–125. (Necessary sections will be made available electronically).

Krötzsch M, Simancík F, Horrocks I: A Description Logic primer. arXiv:1201.4089v3, 2013.

Manola, F, Miller, E, and McBride, B. 2014. "RDF 1.1 Primer"., Cambridge, MA. https://www.w3.org/TR/2014/NOTE-rdf11-primer-20140624/.

Nolt J, Rohatyn D, Varzi A. Logic. 2nd edition. Schaum's Outlines Series, McGrawHill, New York, 2011.

Seidl, M, Scholz, M, Huemer, C, and Kappel, G. 2015. "The Class Diagram". In UML @ Classroom: An Introduction to Object-Oriented Modeling. Eds. M. Seidl, M. Scholz, C. Huemer, and G. Kappel. Cham, 49–84. (Necessary section will be made available electronically)

Rosen, K H. 1988. "Languages and Grammars". In Discrete Mathematics and its Applications. New York, 552–563. (Necessary section will be made available electronically)

Teorey, T J, Yang, D, and Fry, J P. 1986. "A logical design methodology for relational databases using the extended entity-relationship model". ACM Comput. Surv. 18.2, 197–222. (Necessary section will be made available electronically)

Additional optional reading material:

Baader F, Calvanese D, McGuinness DL, Nardi D, Patel-Schneider PF. The Description Logic Handbook. Theory, Implementation, and Applications, 2nd edition, Cambridge: Cambridge University Press, 2007.

Bergmann M, Moor J, Nelson J: The Logic Book, 6th edition. McGrawHill: New York, 2014. (Contains numerous additional exercises!)

University of Arkansas for Medical Sciences
Office of the University Registrar
GUS Course Catalog Form

This form should be used for courses offered at UAMS. If a course addition will change the curriculum for one or multiple degree plans, you will be asked to update a curriculum template for each degree program affected. Please remember to submit a copy of the syllabus with this form.

Course Changes and Additions Submission Timeline

Fall Semester	February 1st (same calendar year)
Spring Semester	September 1st (preceding calendar year)
Summer Semester	December 1st (preceding calendar year)

This request is for a: New Course ☒ Course Change ☐ Course Retirement ☐ (skip to p. 4)

College: Graduate School

Department/Program: Biomedical Informatics

Course Title: Data Information and Knowledge Representation

Course Description: This course provides students with the foundational ideas of how information is modelled to facilitate easy access to knowledge. The course defines data, information and knowledge and explains how the three are connected. The course introduces students to basic information modelling methodologies both in relational databases (RDB) and graph data bases, in particular semantic web technologies. Particular emphasis is on the introduction of principles of formal logic and the relevance of formal logic to information modelling and knowledge representation. The course introduces different types of logics, their expressivity, and limitations and basics of Metalogic. In addition, the course introduces the ontologies and their role in information modelling. Finally, the course includes an introduction to representing knowledge in a system. While not having a lab section the course will include numerous exercises and homework and grading will include exams demonstrating the skills acquired through those exercises.

Course Instructor: Mathias Brochhausen, PhD

Course Instructor Email: MBrochhausen@uams.edu Course Instructor Phone: (501) 603-1766

Additional Instructors: Click here to enter additional instructor names and email addresses

Click here to enter additional instructor names and email addresses

Click here to enter additional instructor names and email addresses

GENERAL COURSE INFORMATION

First term course will be offered/changed: Fall ☒ Spring ☐ Summer ☐

First year course will be offered/changed: Fall 2018

Meeting dates differ from standard semester? Yes ☐ No ☒

If yes, describe meeting pattern: (i.e. last 4 weeks of semester, 8 Wednesdays beginning 2nd week, etc.)

Grading Basis: Letter Grade Number of Units: 3

If Variable Credit, list the maximum number of units: *Choose an item.*

Component Type: *Lecture*

Repeat for credit? Yes ☒ No ☐

If yes, limit to number of enrollments allowed per student: *Click here to enter max enrollments.*

Preferred Catalog Number: BMIG 5001
*Note: Preferred Catalog Numbers are not guaranteed to be used.

ENROLLMENT CONTROLS

PREREQUISITES

Subject Area	Catalog #	Course Title	Course ID (if known)
			Course ID
			Course ID
			Course ID
			Course ID

CO-REQUISITES

Subject Area	Catalog #	Course Title	Course ID (if known)
Subj. Area	*Catalog #*	*Course Title*	*Course ID*
Subj. Area	*Catalog #*	*Course Title*	*Course ID*
Subj. Area	*Catalog #*	*Course Title*	*Course ID*
Subj. Area	*Catalog #*	*Course Title*	*Course ID*

Please list any other non-course prerequisites attached to this course (e.g. minimum GPA, exam, year in program)
Click here to enter text.

Minimum Number of Students to Enroll: *Click to enter number*
Maximum Number of Students who may Enroll: *Click to enter number*

Is enrollment in this course limited to certain groups of students (i.e. PhD students only)? Yes ☐ No ☒

Please describe enrollment limits by groups: *Click here to enter max enrollments.*

Is advisor or instructor consent required for students to take this course? No consent required

INSTRUCTION MODE

Please provide information about the first semester this course will be offered. You will have the opportunity to change this information if this form is provided prior to the last date for scheduling requests.

INSTRUCTION INFORMATION

Instruction Mode: *Online - 51-4% some face/face*

FOR ONLINE COURSES ONLY: Will this course be offered to students out of state? Yes ☒ No ☐

Please select all locations where this course will be taught:

Main Campus ☒ Northwest Campus ☐ UAMS Southwest ☐ Other ☐

If "Other" Location, please describe: *Click here to enter text.*

EXAM AND PROGRESSION

Will the course have a final exam? Yes ☒ No ☐

Will the final exam occur during the normally scheduled course time? Yes ☒ No ☐

Is there a minimum grade required for the student to progress? Not Required

ADDITIONAL INFORMATION

Are any degrees affected by this course addition? Yes ☒ No ☐

If "Yes," please list all degrees affected by this change: Certificate, MS, and PhD program in Biomedical Informatics

Does this course address/include:

Service Learning[1]:	Partially ☐	100% ☐	Does not address ☐
Inter-professional Education[2] (IPE)	Partially ☐	100% ☐	Does not address ☐
Cultural competency[3]	Partially ☐	100% ☐	Does not address ☐
Patient-Family Centered Care[4]	Partially ☐	100% ☐	Does not address ☐
Interdisciplinary Education[5]	Partially ☐	100% ☒	Does not address ☐

[1] ~~A structured learning experience that combines community service with preparation and reflection. Students engaged in service~~ learning provide community service in response to community-identified concerns and learn: the context in which the service is provided, the connection between their service and their academic coursework, and their roles as citizens.

[2] Defined as students of two or more professions engaged in learning with, from and about each other.

[3] An ability to interact effectively with people of different cultures and ethnic backgrounds. Comprises four components: Awareness of one's own cultural worldview, attitude towards cultural differences, knowledge of different cultural practices and worldviews, and cross-cultural skills. Developing cultural competence results in an ability to understand, communicate with, and effectively interact with people across cultures.

[4] An approach to the planning, delivery, and evaluation of health care that is grounded in mutually beneficial partnerships among health care providers, patients, and families. It redefines the relationships in health care. The core concepts include: Dignity and respect, information sharing, participation, and collaboration.

[5] Defined as the degree to which individuals have the capacity to obtain, process and understand basic health information and services need to make appropriate health decisions.

ADDITIONAL INFORMATION:

Click here to enter text.

COURSE RETIREMENT ONLY – Course Additions and Changes can skip to pg. 5

College: *Choose an item.*
Department/Program: *Click here to enter text.*
Course Title: *Click here to enter the current title.*
Catalog Name and Number: *Click here to enter text.*
Course ID (if known): *Click here to enter text.*

What semester and year will this course be retired? *Click here to enter text.*

Are any degrees affected by this course retirement? Yes ☐ No ☐

If "Yes," please list all degrees affected by this change (updated Curriculum Templates for any degree that will change as a result of this retirement are required to be submitted to the Office of the University Registrar):

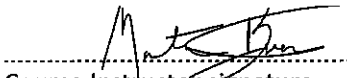
Click here to enter text.

ADDITIONAL INFORMATION:

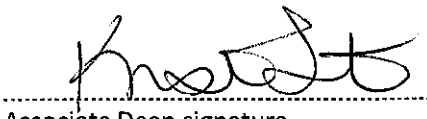
Click here to enter text.

APPROVALS

Proposal will not be processed without all required signatures.



Course Instructor signature — Mathias Brochhausen, PhD



Associate Dean signature — Kristen Sterba, PhD

Today's Date: April 20, 2018 — Preparer's Name: Tremaine Williams

Preparer's Email: tbwilliams@uams.edu

Please submit this form and a copy of the syllabus to:
Angela Wilson, Registrar
Email: awilson5@uams.edu
Mail Slot #767
Questions? 501-526-6612

Office use only	**Notes/Follow-up:**
Received: _____	
Entered into GUS ☐	
Entered into Schedule of Courses ☐	
Curriculum Registrar Initials: ___	
Schedule Registrar Initials:___	