

# DSC3015: KNOWLEDGE GRAPH AND COGNITIVE COMPUTING

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## Effective Term

Semester A 2026/27

## Part I Course Overview

### Course Title

Knowledge Graph and Cognitive Computing

### Subject Code

DSC - Data Science

### Course Number

3015

### Academic Unit

Data Science (DS)

### College/School

College of Computing (CC)

### Course Duration

One Semester

### Credit Units

3

### Level

B1, B2, B3, B4 - Bachelor's Degree

### Medium of Instruction

English

### Medium of Assessment

English

### Prerequisites

CS3402 Database Systems

### Precursors

Nil

### Equivalent Courses

SDSC3015 Knowledge Graph and Cognitive Computing

### Exclusive Courses

Nil

## Part II Course Details

### Abstract

This course aims to introduce knowledge graphs, knowledge representations and reasoning, semantic web and ontologies, knowledge graph and its applications, and the cognitive computing technologies. Students will learn how to represent knowledge and process knowledge using programming skills. Students will master the basic ideas of ontologies, semantic web, reasoning, and cognitive computing. Students will be able to construct ontologies for real-world problems. Students will use ontologies to represent the knowledge and perform various reasoning tasks on ontologies. Students will be familiar with latest applications of knowledge graphs in cognitive computing, and state-of-the-art cognitive systems.

### Course Intended Learning Outcomes (CILOs)

| CILOs |                                                                                            | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|-------|--------------------------------------------------------------------------------------------|---------------------|--------|--------|--------|
| 1     | Explain the basic concepts of knowledge representation, semantic web and knowledge graphs. | 20                  | x      |        |        |
| 2     | Describe the relationship between knowledge graphs and cognitive computing.                | 20                  | x      | x      |        |
| 3     | Master the basics of ontologies and the reasoning on ontologies.                           | 30                  | x      | x      |        |
| 4     | Use a variety of AI methods to construct a cognitive system.                               | 30                  | x      | x      | x      |

#### A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

#### A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

#### A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

### Learning and Teaching Activities (LTAs)

| LTAs |                       | Brief Description                                                                                                                                  | CILO No.   | Hours/week (if applicable) |
|------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------|
| 1    | Lecture               | Learning through teaching is primarily based on lectures.                                                                                          | 1, 2, 3    | 39 hours/semester          |
| 2    | Take-home assignments | Learning through take-home assignments is primarily based on interactive problem solving and hand-on computer exercises allowing instant feedback. | 1, 2, 3, 4 | after class                |

### Assessment Tasks / Activities (ATs)

|   | ATs                 | CILO No. | Weighting (%) | Remarks ("- for nil entry)                                                                                                                                            | Allow Use of GenAI? |
|---|---------------------|----------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1 | Hand-in assignments | 2, 3, 4  | 30            | The assignments enable students to demonstrate their skills and understanding of concepts and methods for knowledge graphs and cognitive computing.                   | Yes                 |
| 2 | Course Project^     | 3, 4     | 30            | The course project provides students the chance to demonstrate their achievements on practical use of knowledge graphs learned in this course for practical problems. | Yes                 |

**Continuous Assessment (%)**

60

**Examination (%)**

40

**Examination Duration (Hours)**

2

**Minimum Continuous Assessment Passing Requirement (%)**

30

**Minimum Examination Passing Requirement (%)**

30

**Additional Information for ATs**

Note: To pass the course, apart from obtaining a minimum of 40% in the overall mark, a student must also obtain a minimum mark of 30% in both continuous assessment and examination components.

**Assessment Rubrics (AR)****Assessment Task**

Hand-in assignments

**Criterion**

1.1 Ability to learn the basic concepts of knowledge graph and cognitive computing.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

Hand-in assignments

**Criterion**

1.2 Capability to apply knowledge graph technologies to develop cognitive systems.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

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**Assessment Task**

Course Project

**Criterion**

Ability to solve real-world AI problems using knowledge graphs and cognitive computing techniques.

**Excellent (A+, A, A-)**

High

**Good (B+, B, B-)**

Significant

**Fair (C+, C, C-)**

Moderate

**Marginal (D)**

Basic

**Failure (F)**

Not even reaching marginal levels

## Part III Other Information

### Keyword Syllabus

Introduction to knowledge representations

Elements of ontologies

Development and basics of semantic web, linked data, and knowledge graphs

Reasoning on knowledge graphs

Concepts and implementation of graph database

Decision making with knowledge-enriched machine learning techniques

Elements of cognitive computing

Data-driven and knowledge-enriched cognitive computing techniques

Introduction to the IBM Watson cognitive computing systems and various applications

Introduction to the IBM Developer Cloud, an AI platform for business and other applications.

Building simple cognitive computing applications using the free version of IBM Developer Cloud.

### Reading List

#### Compulsory Readings

| Title |                                                                                                  |
|-------|--------------------------------------------------------------------------------------------------|
| 1     | R Brachman and H Levesque, Knowledge Representation and Reasoning, Elsevier, ISBN: 9781558609327 |
| 2     | Lecture notes and recent papers                                                                  |

#### Additional Readings

| Title |     |
|-------|-----|
| 1     | Nil |