NAAC Criterion-I

Key Indicator – 1.1.3

Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the last five years

1.1.3 Evidences

Department of Computational Biology and Bioinformatics

Central University of Himachal Pradesh, Dharamshala, Kangra

Central University of Himachal Pradesh

(ESTABLISHED UNDER CENTRAL UNIVERSITIES ACT 2009)

Dharamshala, Himachal Pradesh-176215

INDEX

Department of Computational Biology and Bioinformatics

S. No.	Name of the Course	Course Code	Year of introduction (Average Percentage)	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Page No.
1	PG Programme Bioinformatics (CBB)	BIN 411 Machine Learning –I BIN 554 Machine Learning II BIN 461Elements of Data Sciences BIN 460 Biosafety issues BIN 405 Python Programing Lab I BIN 454 Python Programing Lab II	2020 (15%)	Coding Competetion, Free lancing Classes, open Book Coding Competition, Machine Learning challanges, Automated house price decider, Automated flower based species identification	1-7+

Central University of Himachal Pradesh
(Established under Central Universities Act 2009)

Temporary Academic Block. Shahpur. Distt. Kangra (HP) – 176206

Website: www.cuhimachal.ac.in

Course Title: Fundamentals of Machine Learning
Course Code: BIN.411
Credits earned: 2

Learning Outcomes: At the end of the course. the students will be able to understand the basics of Machine learning. The semester for offering Foundation courses can be altered as per departmental requirements.

Course Content

Unit 1
Class overview: Class organization. topics overview. software etc.
Introduction: what is ML: Problems, data, and tools: Visualization

Unit 2
Linear regression; SSE; gradient descent; closed form; normal equations; features
Overfitting and complexity; training, validation

Unit 3
Classification problems: decision boundaries: nearest neighbor methods
Probability and classification

Unit 4
Naive Bayes and Gaussian class-conditional distribution. Linear classifiers, Bayes' Rule and Naive Bayes Model

Transactional Modes: Lecture; Tutorial: Problem solving: Self-learning.

Suggectged Readings:

- Ethem Alpaydin, Introduction to Machine Learning, Second Edition , http://mitpress.mit.edu/catalog/item/default.asp?ttype=2&tid=12012.
- Stephen Marsland, Machine Learning: An Algorithmic Perspective. http://www.amazon.com/Machine-Learning-Algorithmic-PerspectiveRecognition/dp/1420067184
- Christopher M. Bishop. Pattern Recognition and Machine Learning. http://research.microsoft.com/en-us/um/people/cmbishop/prml/.
- Tom Mitchell, Machine Learning. http://www.cs.cmu.edu/~tom/mlbook.html.

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(Established under Central Universities Act 2009)

Temporary Academic Block, Shahpur, Distt. Kangra (HP) – 176206

Website: www.cuhimachal.ac.in

Course Title: Advance topics in Machine Learning
Course Code: BIN.554
Credits earned: 2

Course Content

Unit 1
Introduction: Overview of Machine Learning field with intro to statistics Data Cleaning, imputation, cross-validation

Unit 2
Unsupervised Methods: Clustering: Distance Metrics, K-Means, leader, Jarvis-Patrick, hierarchical clustering;
Clustering: Self-organized maps, EM-algorithm; Dimensionality Reduction: PCA, LDA, Sammon's

Unit 3
Supervised Methods: Classification: K-NN, naïve Bayes, decision trees, boosting and bagging;

Unit 4
Classification: Ensemble methods, random Forests; Support vector machines Neural networks; Introduction to Deep learning

Transactional Modes: Lecture; Tutorial; Problem solving; Self-learning.

Suggested Readings

1. Data Mining: Concepts and Techniques, Third Edition by Han, Kamber, and Pei, 2011.
2. Pattern Recognition and Machine Learning by Christopher Bishop; 2007.
3. Applied Predictive Modeling by Max Kuhn and Kjell Johnson; 2013.
4. An Introduction to Statistical Learning and Applications in R by James, Witten, Hastie, Tibshirani; 2014.
5. Python for Data Analysis by Wes McKinney; 2013.

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Website: www.cuhimachal.ac.in

Course Title:: Elements of Data Science
Course Code: 461
Credits earned: 2

Course Objectives: This course is designed to introduce students to the underlying concepts about the most demanding job of the 21ˢᵗ century – "The Data Scientist". Data is termed as the "new gold" and the students will learn about the science of extracting knowledge from the Big Data. The applications covered will span Weather predictions, Oil drilling, Seismic activities, Biological data analysis, Social media analytics among many others. Students are encouraged to gain technical know-how about the discussed concepts using Python. The semester for offering Foundation courses can be altered as per departmental requirements.

Course Contents:

Unit I: Big Data and Data Science
- How big is Big Data
- Facets of Data
- The Data Science process
- Data Scientist's Toolkit

Unit II: Basics of Python
- **The Basics:** Getting Python, The Zen of Python, Whitespace formatting, Modules, Arithmetic, Functions, Strings, Exceptions, Lists, Tuples, Dictionaries, Sets, Control Flow, Sorting, List Comprehensions, Generators and Iterators, Randomness, Regular expressions, etc.
- **Visualizing Data:** Matplotlib, Bar charts, Line charts, Scatterplots etc.

Unit III: Getting Data and Working with Data
- Reading files
- Scraping the web
- Using APIs
- Cleaning, Munging and Manipulating Data
- Rescaling the Data

Unit IV: Machine Learning
Supervised Learning:
- Classification: Naïve Bayes, Support Vector Machines, Decision Trees
- Regression: Linear, Polynomial, Logistic

Unsupervised Learning
- Clustering: k-means, Hierarchical
- Dimensionality Reduction: Principal Component Analysis

Unit V: Enabling technologies for Data Science
Brief introduction to the NoSQL, Hadoop, MongoDB and Cassandra, Map-Reduce, Hive, Pig

Text Books:
1. Joel Grus (2019). Data Science from Scratch, O'Reilly
2. Cielen, Meysman, Ali (2015). Introducing Data Science, Manning Publications.

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Website: www.cuhimachal.ac.in

Course Title: Biosafety Issues

Course Code: BIN.460

Credits earned: 2

Learning Outcomes: The course is designed to introduce students to biosafety guidelines of DBT, Ministry of Science & Technology, Government of India and the World Health Organization. The semester for offering Foundation courses can be altered as per departmental requirements.

Course Contents:

UNIT-I: Introduction
- Introduction to the biosafety guidelines
- Constitution of institutional biosafety committees (IBSCs) and its functions
- Microbiological risk assessment

UNIT-II: Biohazards and biosafety levels
- Biosafety level 1
- Biosafety level 2
- Biosafety level 3
- Biosafety level 4

UNIT-III: Laboratory biosecurity, equipment and good lab practices
- Laboratory biosecurity concepts2
- Biological safety cabinets and equipment
- Laboratory techniques
- Disinfection and sterilization
- Introduction to the transport of infectious substances

UNIT-IV: Scientific Considerations
- Biosafety and recombinant DNA technology
- Chemicals, fire, electrical, noise and ionizing radiation hazards
- Human health and environmental considerations
- Containment facilities

UNIT-V: National; International frameworks on biosafety
- Guidelines by Ministry of Environment and Forests (MoEF), & DBT Government of India
- International binding and non-binding instruments on Biosafety
- Potential overlaps and conflicts between treaties and trade concerns
- Competent authorities to regulate the biosafety issues
- Safety checklist

Transactional Modes: Lecture; Tutorial; Problem solving; Self-learning.

Suggectged Readings:
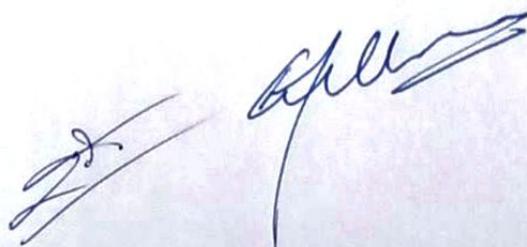
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Temporary Academic Block, Shahpur, Distt. Kangra (HP) – 176206

Website: www.cuhimachal.ac.in

Course Title: Python Programming Lab I
Course Code: BIN.405
Credits earned: 4

Learning Outcomes: Upon successfully completing this course, students will be able to "do something useful with Python".

- Identify/characterize/define a problem
- Design a program to solve the problem
- Create executable code
- Read most Python code
- Write basic unit tests

Course Content

1.   Working with Data. A detailed tour of how to represent and work with data in Python. Covers tuples, lists, dictionaries, and sets. Students will also learn how to effectively use Python's very powerful list processing primitives such as list comprehensions. Finally, this section covers critical aspects of Python's underlying object model including variables, reference counting, copying, and type checking.

2.   Program Organization, Functions, and Modules. More information about how to organize larger programs into functions and modules. A major focus of this section is on how to design functions that are reliable and can be easily reused across files. Also covers exception handling, script writing, and some useful standard library modules.

3.   Classes and Objects. An introduction to object-oriented programming in Python. Describes how to create new objects, overload operators, and utilize Python special methods. Also covers basic principles of object oriented programming including inheritance and composition.

4.   Inside the Python Object System. A detailed look at how objects are implemented in Python. Major topics include object representation, attribute binding, inheritance, memory management, and special properties of classes including properties, slots, and private attributes.

Transactional Modes: Laboratory based practicals; Problem solving; Self-learning.

Suggested Readings

- The Python Tutorial (https://docs.python.org/3/tutorial/): This is the official tutorial from the Python website. No more authoritative source is available.
- Code Academy Python Track (http://www.codecademy.com/tracks/python): Often cited as a great resource, this site offers an entertaining and engaging approach and in-browser work.
- Learn Python the Hard Way (http://learnpythonthehardway.org/book/): Solid and gradual. This course offers a great foundation for folks who have never programmed in any language before.

[Python 2]

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Website: www.cuhimachal.ac.in

Course Title: Python Programming Lab II
Course Code: BIN.454
Credits earned: 4

Learning Outcomes: Upon successfully completing this course, students will be able to "do something useful with Python".
- Identify/characterize/define a numerical problem
- Design a program to solve the data parsing problem
- Create Time series code
- Read most of the advanced Python code

Course Content
- Introduction to Numpy and Pandas
- Visualizations with Matplotlib and Seaborn
- Statistical analysis to understand our data
- Data cleaning and normalization.
- Advanced Pandas models
- Hierarchical indexing
- Data Wrangling and transformations
- Advanced visualizations
- Introduction to Machine Learning
- Intro to Regressions- Linear and logistic regression using Scikit Learn
- Intro to Classification- Classification with K nearest Neighbours- Decision Trees and Random Forest

Transactional Modes: Laboratory based practicals; Problem solving; Self-learning.

Suggested Readings
- Core Python Programming (http://corepython.com/): Only available as a dead trees version, but if you like to have book to hold in your hands anyway, this is the best textbook style introduction out there. It starts from the beginning, but gets into the full language. Published in 2009, but still in print, with updated appendixes available for new language features. In the third edition, "the contents have been cleaned up and retrofitted w/Python 3 examples paired w/their 2.x friends."
- Dive Into Python 3 (http://www.diveinto.org/python3/): This book offers an introduction to Python aimed at the student who has experience programming in another language.
- Python for You and Me (http://pymbook.readthedocs.org/en/latest/): Simple and clear. This is a great book for absolute newcomers, or to keep as a quick reference as you get used to the language. The latest version is Python 3.
- Think Python (http://greenteapress.com/thinkpython/): Methodical and complete. This book offers a very "computer science"-style introduction to Python. It is really an intro to Python in the service of Computer Science, though, so while helpful for the absolute newcomer, it isn't quite as "pythonic" as it might be.

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- Python 101 (http://www.blog.pythonlibrary.org/2014/06/03/python-101-book-published-today/) Available as a reasonably priced ebook. This is a new one from a popular Blogger about Python. Lots of practical examples. Also avaiable as a Kindle book: http://www.amazon.com/Python-101-Michael-Driscoll-ebook/dp/B00KQTFHNK

- Problem Solving with Algorithms and Data Structures (http://interactivepython.org/runestone/static/pythonds/index.html(Links to an external site.)Links to an external site.)

- Python Course (http://www.python-course.eu/python3_course.php(Links to an external site.)Links to an external site.)

References for getting better, once you know the basics

- Python Essential Reference (http://www.dabeaz.com/per.html): The definitive reference for both Python and much of the standard library.

- Hitchhikers Guide to Python (http://docs.python-guide.org/en/latest): Under active development, and still somewhat incomplete, but there is good stuff.

- Writing Idiomatic Python (https://www.jeffknupp.com/writing-idiomatic-python-ebook): Focused on not just getting the code to work, but how to write it in a really "Pythonic" way.

- Fluent Python (http://shop.oreilly.com/product/0636920032519.do): All python3, and focused on getting the advanced details right. Good place to go once you've got the basics down.

- Python 3 Object Oriented Programming (https://www.packtpub.com/application-development/python-3-object-oriented-programming (Links to an external site.)Links to an external site.): Nice book specifically about Object Oriented programming stucture, and how to do it in Python. From local Author and founder of the Puget Sound Programming Python (PuPPy) meetup group, Dusty Phillips.

प्रो. महेश कुल्हरिया / **Prof. Mahesh Kulharia**
Email ID: kulharia@hpcu.ac.in   Mobile: 9938428856

सन्दर्भ संख्या / Ref. No : CUHP/CBB/HoD/0012
दिनांक / Date : 27/3/23

Criteria Index Number	Criteria Details
1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the last five years

DVV-Kindly provide: 1)Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development along with their course outcomes 2)mapping of the courses to employability / entrepreneurship

1)Syllabus copies of the courses highlighting the focus on employability/ entrepreneurship/ skill development along with their course outcomes

Clarification /Justification and evidence
1)List of programs where syllabus revision has been carried out during the last five years as certified by the Registrar

Name of the Course	Course Code	Year of introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
PG Programme Bioinformatics (CBB)	BIN 411 Machine Learning –I BIN 554 Machine Learning II BIN 461Elements of Data Sciences BIN 460 Biosafety issues BIN 405 Python Programing Lab I BIN 454 Python Programing Lab II	2020	Coding Competetion, Free lancing Classes, open Book Coding Competition, Machine Learning challanges, Automated house price decider, Automated flower based species identification

Evidence: for "2"

List of Courses with Focus on Employability

In the revision were carried out in the 6th meeting of BoS held on 29 Dec 2020 and recorded in File No: LS/1-5(Vol II)/CUHP/12/.

S.No.	Course Name	Credits	Course Type	Industry/Job
1	BIN-411 Machine Learning –I	2	Coding Competetion, open Book Coding,Machine Learning	Data Science Industry/Research

निदेशक / **Director**
अभिकलनात्मक जीव विज्ञान एवं जैवसूचना विज्ञान केंद्र
Centre of Computational Biology and Bioinformatics
हिमाचल प्रदेश केंद्रीय विश्वविद्यालय, धर्मशाला /
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प्रो. महेश कुलहरिया / **Prof. Mahesh Kulharia**

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सन्दर्भ संख्या / Ref. No : CUHP/CBB/HOD/0013

दिनांक / Date :   27/3/23

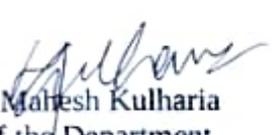|			challanges,	
2	BIN 554 Machine Learning II	2	Coding Competetion, open Book Coding,Machine Learning challanges,	Data Science Industry/Research
3	BIN 461Elements of Data Sciences	2	Free lancing Classes,	Data Science Industry/Research
4	BIN 460 Biosafety issues	2	Hands on tutorial	Research
5	BIN 405 Python Programing Lab I	4	Automated flower based species identification,	Data Science Industry/Research
6	BIN 454 Python Programing Lab II	2	Automated price decider	Data Science Industry/Research

The above facts are true to the best of departmental records and knowledge.

The following are the links for the employability evidences :

https://web.archive.org/web/20230313071303/bioinformaticshome.com/blog/jobs_landscape_2018_2020.html

https://web.archive.org/web/2/https://www.researchgate.net/publication/325586249_Bioinformatics_core_competencies_for_undergraduate_life_sciences_education/figures?lo=1%23fullTextFileContent

https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=7c8eb651516af4ad1b22e0524245d580dbfe66d7

Prof. Mahesh Kulharia
Head of the Department
Computational Biology and Bioinformatics

निदेशक / **Director**
अभिकलनात्मक जीव विज्ञान एवं जैवसूचना विज्ञान केंद्र
Centre for Computational Biology and Bioinformatics
हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय, धर्मशाला /
Central University of Himachal Pradesh,
Dharamshala-176215

पत्राचार का पता : हिमाचल प्रदेश केन्द्रीय विश्वविद्यालय, शाहपुर, जिला कांगड़ा (हि०प्र०) – 176206

Correspondence Address: Central University of Himachal Pradesh, Shahpur, Distt. Kangra (H.P.) – 176206

हिमाचल प्रदेश कट्राय विश्वावद्यालय

Central University of Himachal Pradesh
(Established under Central Universities Act 2009)
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प्रो. मंश कुल्हारिया / Prof. Mahesh Kulharia
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दिनांक / Date :   27/3/23

List of programs where <mark>syllabus revision</mark> has been carried out during the last five years as certified by the Registrar

Name of the Programme	Course Code	Year of introduction/Revision	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development
PG Programme Bioinformatics (CBB)	BIN 411 Machine Learning –I BIN 554 Machine Learning II BIN 461Elements of Data Sciences BIN 460 Biosafety issues BIN 405 Python Programing Lab I BIN 454 Python Programing Lab II	2020 (introduction) 2021 (revision) 2022 (revision)	Coding Competetion, Free lancing Classes, open Book Coding Competition, Machine Learning challanges, Automated house price decider, Automated flower based species identification

Evidence: for "2"

<mark>List of Courses with Focus on Employability</mark>

In the <mark>revision</mark> were carried out in the 6th meeting of BoS held on 29 Dec 2020 and recorded in File No: LS/1-5(Vol II)/CUHP/12/.

S.No.	Course Name	Credits	Course Type	<mark>Industry/Job</mark>
1	BIN-411 Machine Learning –I	2	Coding Competetion, open Book Coding,Machine Learning challanges,	Data Science Industry/Research
2	BIN 554 Machine Learning II	2	Coding Competetion, open Book Coding,Machine Learning challanges,	Data Science Industry/Research
3	BIN 461Elements of Data Sciences	2	Free lancing Classes,	Data Science Industry/Research
4	BIN 460 Biosafety issues	2	Hands on tutorial	Research
5	BIN 405 Python Programing Lab I	4	Automated flower based species identification,	Data Science Industry/Research

निदेशक / Director
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Central University of Himachal Pradesh
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Website: www.cuhimachal.ac.in

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मन्दर्भ संख्या / Ref. No : CUHPK03/400/0015
दिनांक / Date :   27/3/23

| 6 | BIN 454 Python Programing Lab II | 2 | Automated price decider | Data Science Industry/Research |

The above facts are true to the best of departmental records and knowledge.

The following are the links used for determining the employability requirements and are quoted as evidences :

https://web.archive.org/web/20230313071303/bioinformaticshome.com/blog/jobs_landscape_2018_2020.html

https://web.archive.org/web/2/https://www.researchgate.net/publication/325586249_Bioinformatics_core_competencies_for_undergraduate_life_sciences_education/figures?lo=1%23fullTextFileContent

https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=7c8eb651516af4ad1b22e0524245d580dbfe66d7

Prof. Mahesh Kulharia
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