



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Information Technology

Choice Based Credit System (CBCS) in the light of NEP-2020
B.Tech. (CSE- Artificial Intelligence and Machine Learning - Microsoft)
SEMESTER-VI (2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCS601N	DCC	Compiler Design	60	20	20	30	20	2	1	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. To introduce the major concept areas of language translation and compiler design
2. To enrich the knowledge in various phases of compiler and its use
3. To provide understanding of steps of programming necessary for constructing a compiler

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Ability to apply the knowledge of lex tool & yacc tool to develop a scanner & parser
2. Ability to design and develop software system for backend of the compiler
3. Ability to comprehend and adapt to new tools and technologies in compiler design

SYLLABUS

UNIT I

8 HOURS

Introduction: Compiler, Compilers analysis of the source program, Phases of a compiler, Cousins of the Compiler, Grouping of Phases and Compiler construction tools, Lexical Analysis, Role of Lexical Analyzer, Input Buffering and Specification of Tokens.

UNIT II

10 HOURS

Syntax Analysis: Role of the parser, Writing Grammars, Context-Free Grammars, Top-Down parsing, Recursive Descent Parsing, Predictive Parsing, Bottom-up parsing, Shift Reduce Parsing, Operator Precedent Parsing, LR Parsers, SLR Parser – Canonical LR Parser – LALR Parser.

UNIT III

9 HOURS

Intermediate Code Generation: Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Three Address code, Back patching, Procedure calls.

UNIT IV

10 HOURS

Code Optimization and Run Time Environments: Introduction, Principal Sources of Optimization, Optimization of basic Blocks, DAG representation of Basic Blocks - Introduction to Global Data Flow Analysis, Runtime Environments, Source Language issues, Storage Organization, Storage Allocation strategies, Access to non-local names, Parameter Passing, Error detection and recovery.

UNIT V

9 HOURS

Code Generation: Issues in the design of code generator, The target machine, Runtime Storage management, Basic Blocks and Flow Graphs, Next-use Information, A simple Code generator, Peephole Optimization.

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TEXTBOOKS:

1. Alfred V. Aho, Jeffrey D. Ullman, *Compilers: Principles, Techniques and Tools*, Pearson Education Asia, 2012
2. Jean Paul Tremblay, Paul G Serenson, *The Theory and Practice of Compiler Writing*, BS Publications, 2005

REFERENCE:

1. Allen I. Holub, *Compiler Design in C*, Prentice Hall of India, 2003
2. C. N. Fischer and R. J. LeBlanc, *Crafting a compiler with C*, Benjamin Cummings, 2003
3. Henk Alblas and Albert Nymeyer, *Practice and Principles of Compiler Building with C*, PHI, 2001
4. Kenneth C. Loudon, *Compiler Construction: Principles and Practice*, Thompson Learning, 2003
5. D. M. Dhamdhere, *Compiler Construction Principles and Practice*, 2nd Ed., Macmillan India Ltd., New Delhi, 2008

LIST OF PRACTICALS

1. To study the Lex Tool.
2. To study the Yacc Tool.
3. Write a program to implement Lexical Analyzer to recognize few patterns of C.
4. Write a program to implement the Recursive Descent Parser.
5. Write a program to implement the Computation of FIRST and FOLLOW of variables of grammar.
6. Write a program to compute the leading and trailing symbols of grammar.
7. Write a program to implement Operator Precedence Parser.
8. Write a program to implement SLR parser.
9. Write a program to check the data types.
10. Write a program to implement the generation of three address code.
11. Write a program to implement the computation of postfix notation.
12. Write a program to implement the computation of Quadruple.

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BTCS602 N	DCC	Object Oriented Analysis and Design	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability to:

1. To learn the concept of Object-Oriented Software Development Process
2. To get acquainted with UML Diagrams
3. To understand Object Oriented Analysis Processes

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Understand Object Oriented Software Development Process
2. Gain exposure to Object Oriented Methodologies & UML Diagrams
3. To apply Object Oriented Analysis Processes for projects

SYLLABUS

UNIT I

10 HOURS

Introduction: Object Oriented Technology, Development and OO Modeling History. Modeling Concepts: Modeling design Technique, Three Models, Class Model, State Model and Interaction model.

UNIT II

9 HOURS

Class Modeling: Object and class concepts, link and association, Generalization and Inheritance, Advanced class modeling- aggregation, Abstract class meta data, constraints. State Modeling: Event, state, Transition and conditions, state diagram, state diagram behavior, concurrency, Relation of Class and State models. Interaction Modeling: Use case Models, sequence models, activity models

UNIT III

8 HOURS

Analysis and Design: Development Life cycle, Development stages, Domain Analysis-Domain class model, domain state model, domain interaction model, Iterating and analysis. Application Interaction model, Application class model, Application state Model, Adding operation.

UNIT IV

7 HOURS

System Design: Estimating Performance, Making a reuse plan, breaking system into sub systems identifying concurrency, allocation of subsystems, management of data storage, Handling Global resources, choosing a software control strategy, Handling boundary condition, common Architectural style.

UNIT V

8 HOURS

Class design: Overview of class design, designing algorithms recursing downward, refactoring, design optimization, Adjustment of Inheritance, Rectification of Behavior.

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TEXTBOOKS:

1. Michael Blaha and J. Rumbaugh, *Object oriented Modeling and design with UML*, Pearson Education

REFERENCE:

1. Satzinger, Jackson and Burd, *Object oriented Analysis and design with the Unified Process*, CENGAGE Learning.
2. O. Docherty, *Object Oriented Analysis and Design Understanding, System Development with UML2.0*, Wiley India.

LIST OF PRACTICALS

1. How to write a Problem Statement
2. Perform the system analysis: Requirement analysis, SRS.
3. Perform the function oriented diagram: DFD and Structured chart.
4. Perform the user's view analysis: Use case diagram.
5. Draw the structural view diagram: Class diagram, object diagram.
6. Draw the behavioral view diagram: Sequence diagram, Collaboration diagram.
7. Draw the behavioral view diagram: State-chart diagram, Activity diagram.
8. Draw the implementation view diagram: Component diagram.
9. Draw the environmental view diagram: Deployment diagram.

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BTCS603 N	DCC	Introduction to Cloud Computing	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability to:

1. Analyze the SAAS, PAAS IAAS services of Cloud Computing to represent how engineering agility in an organization can be created.
2. Assess the exploitation of web services from cloud computing.
3. Configure essential infrastructural components used for implementing Cloud.
4. Significantly study case studies to derive the most excellent practice model to be appropriate when deploying cloud-based applications.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Investigate the trade-offs among deploying applications in the cloud and over the local infrastructure.
2. Compute real-world problems security, privacy issues using cloud computing through group collaboration.
3. Development and Deployment applications over commercial cloud computing infrastructures.
4. Analyze and investigation of application & hardware performance, scalability, and availability of the underlying cloud technologies and software.

SYLLABUS

UNIT I

10 HOURS

Overview of Cloud Computing: Introduction- Evolution, Shift from distributed computing to cloud computing; principles and characteristics of cloud computing- IaaS, PaaS, SaaS; service-oriented computing and cloud environment, Advantages, Service & Deployment Models, Infrastructure, and Consumer View, Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud Services, Industrial Applications.

UNIT II

8 HOURS

Cloud Computing Technology- Client systems, Networks, server systems and security from services perspectives, security and privacy issues; accessing the cloud with platforms and applications; Cloud storage

UNIT III

9 HOURS

Working with Cloud: Infrastructure as a Service – conceptual model and working, Platform as a Service – conceptual model and functionalities. Software as a Service –conceptual model and working. Trends in Service provisioning with clouds. Working on Microsoft Azure & IBM Smart Cloud.

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UNIT IV

9 HOURS

Using Cloud Services: Cloud collaborative applications and services – case studies with calendars, schedulers, and event management; cloud applications in project management. Amazon Web Services & applications, AWS EC2, S3, Cloud Analytics, Cloud Open Stack

UNIT V

8 HOURS

Case studies- Microsoft Azure, Google App Engine, IBM Smart Cloud and Open source clouds,-Open-Nebula, Sales force and Eucalyptus, Cloud Simulation

TEXTBOOKS:

1. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, *Cloud Computing: A Practical Approach*, The McGraw-Hill, 2010.

REFERENCE:

1. Kumar Saurabh, *Cloud Computing*, Wiley Pub, 2012.
2. Krutz, Vines, *Cloud Security*, Wiley Pub, 2013.
3. Sosinsky, *Cloud Computing*, Wiley Pub, 2012.
4. Murray Woodside, John Chinneck and Marin Litiou, *Adaptive Cloud Deployment Using Persistence Strategies and Application Awareness*, Page(s): 277–290, IEEE Xplore, 2017.
5. Buyya, Selvi, *Mastering Cloud Computing*, The McGraw-Hill.
6. Michael Miller, *Cloud computing – Web based Applications*, Pearson Publishing, 2011

LIST OF PRACTICALS

1. Service deployment & Usage over cloud using Virtual Box.
2. Performance evaluation of services over cloud using VMware tool.
3. Working of Goggle Drive to make spreadsheet.
4. Working on Heroku for Cloud application deployment.
5. Working on Aneka services for Cloud application.
6. Working on services of Google App Engine.
7. Working on Application deployment & services of Microsoft Azure.
8. Working on Application deployment & services of IBM Smart Cloud.
9. Working and configuration of Euceliptus.
10. Deployment & Services of Amazon Web Services.

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BTAIML6 02M	DSC	Architecting Data Science Solution	60	20	20	30	20	2	0	2	3

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COURSE OBJECTIVES:

The student will have ability to:

- CEO1: Understand the fundamental concepts and principles of machine learning (ML) on the Azure platform
- CEO2: Gain hands-on experience in designing, building, and deploying ML solutions using Azure Machine Learning services.
- CEO3: Learn to leverage Azure's tools and resources for data preparation, model training, hyperparameter tuning, and model evaluation.
- CEO4: Develop skills in monitoring, managing, and operationalizing ML models in production environments.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

- CO1: Design and implement a comprehensive data ingestion strategy for ML projects on Azure
- CO2: Create, configure, and utilize Azure Machine Learning workspaces, compute targets, and environments for ML workflows.
- CO3: Experiment with various ML algorithms, employ automated ML, and track model training progress using ML flow
- CO4: Optimize ML model training through hyperparameter tuning, utilize pipelines, and deploy models to online and batch endpoints.

SYLLABUS

UNIT I

Design a machine learning solution: Design a data ingestion strategy for machine learning projects: Identify your data source and format, choose how to serve data to machine learning workflows, Design a data ingestion solution. Design a machine learning model training solution: Identify machine learning tasks, choose a service to train a machine learning model, Decide between compute options. Design a model deployment solution: Understand how model will be consumed, Decide on real-time or batch deployment. Design a machine learning operations solution: Explore an ML Ops architecture, Design for monitoring, Design for retraining.

UNIT II

Experiment with Azure Machine Learning: Find the best classification model with Automated Machine Learning: Preprocess data and configure featurization, Run an Automated Machine Learning experiment, Evaluate and compare models. Track model training in Jupyter notebooks with ML flow: Configure ML flow for model tracking in notebooks, Train and track models in notebooks

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UNIT III

Explore and configure the Azure Machine Learning workspace : Explore Azure Machine Learning workspace resources and assets: Create an Azure Machine Learning workspace, Identify Azure Machine Learning resources, Identify Azure Machine Learning assets, Train models in the workspace. Explore developer tools for workspace interaction: Explore the studio, Explore the Python SDK, Explore the CLI. Make data available in Azure Machine Learning: Understand URIs, create a datastore, Create a data asset. Work with compute targets in Azure Machine Learning: Choose the appropriate compute target, Create and use a compute instance, Create and use a compute cluster. Work with environments in Azure Machine Learning: Understand environments, Explore and use curated environments, Create and use custom environments.

UNIT IV

Optimize model training with Azure Machine Learning : Run a training script as a command job in Azure Machine Learning: Convert a notebook to a script, run a script as a command job, Use parameters in a command job. Track model training with ML flow in jobs: Track metrics with ML flow, View metrics and evaluate models. Perform hyperparameter tuning with Azure Machine Learning: Define a search space, configure a sampling method, configure early termination, use a sweep job for hyperparameter tuning. Run pipelines in Azure Machine Learning - Create components, create a pipeline, Run a pipeline job.

UNIT V

Manage and review models in Azure Machine Learning : Register an ML flow model in Azure Machine Learning: Log models with ML flow, Understand the ML flow model format, Register an ML flow model. Create and explore the Responsible AI dashboard: Understand Responsible AI, Create the Responsible AI dashboard, Evaluate the Responsible AI dashboard. Deploy a model to a managed online endpoint- Explore managed online endpoints, deploy your ML flow model to a managed online endpoint, deploy a model to a managed online endpoint, Test managed online endpoints. Deploy a model to a batch endpoint -Understand and create batch endpoints, deploy your ML flow model to a batch endpoint, deploy a custom model to a batch endpoint, Invoke and troubleshoot batch endpoints.

REFERENCE:

1. <https://learn.microsoft.com/en-us/credentials/certifications/azure-data-scientist/?practice-assessment-type=certification>.

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List of Experiments:

1. Explore the Azure Machine Learning workspace
2. Explore developer tools for workspace interaction
3. Make data available in Azure Machine Learning.
4. Work with compute resources in Azure Machine Learning
5. Work with environments in Azure Machine Learning.
6. Train a model with the Azure Machine Learning Designer.
7. Find the best classification model with Automated Machine Learning
8. Track model training in notebooks with ML flow
9. Run a training script as a command job in Azure Machine Learning
10. Use ML flow to track training jobs.
11. Perform hyper parameter tuning with a sweep job
12. Run pipelines in Azure Machine Learning.
13. Create and explore the Responsible AI dashboard
14. Log and register models with ML flow
15. Deploy a model to a batch endpoint.
16. Deploy a model to a managed online endpoint

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BTCS708 N	DC C	Introduction to Data Science	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability to:

1. The objective of this course is to impart necessary knowledge of the mathematical foundations needed for data science and develop programming skills required to build data science applications.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Demonstrate understanding of the mathematical foundations needed for data science.
2. Collect, explore, clean, munge and manipulate data.
3. Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees, neural networks and clustering.
4. Build data science applications using Python based toolkits.

SYLLABUS

UNIT I

Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis, Reporting.

UNIT II

Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction

UNIT III

Mathematical Foundations: Linear Algebra: Vectors, Matrices, Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation, Probability: Dependence and Independence, Conditional Probability, Bayes' Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem, Hypothesis and Inference: Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference.

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UNIT IV

Machine Learning: Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression-model assumptions, regularization (lasso, ridge, elastic net), Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks-Learning And Generalization, Overview of Deep Learning.

UNIT V

Case Studies of Data Science Application: Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

TEXTBOOKS:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media.
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media.
3. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
4. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi
5. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi
6. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
7. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press
<http://www.deeplearningbook.org>
8. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publishers

LIST OF PRACTICALS:

1. Write a program in Python to predict the class of the flower based on available attributes
2. Write a program in Python to predict if a loan will get approved or not.
3. Write a program in Python to predict the traffic on a new mode of transport
4. Write a program in Python to predict the class of user.
5. Write a program in Python to identify the tweets which are hate tweets and which are not
6. Write a program in Python to predict the age of the actors
7. Mini project to predict the time taken to solve a problem given the status of the user.

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Choice Based Credit System (CBCS) in the light of NEP-2020
B.Tech. (CSE- Artificial Intelligence and Machine Learning - Microsoft)
SEMESTER-VI (2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCS607N	PW	Minor Project	0	0	0	60	40	0	0	4	2

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Course Objectives:

This course is the masters by coursework Minor Project.

A Minor Project is a substantial work of supervised research or development, requiring the equivalent of about four to six months full-time work from start to finish. A Project involves identifying a task or problem, searching and reviewing relevant literature, a proposed, implemented, and critically analyzed solution to the task or problem, and a written report describing the problem, the relevant literature, the solution, and its relation to other work in the area.

Note: This course includes a work integrated learning experience in which your knowledge and skills will be applied and assessed in a real or simulated workplace context and where feedback from industry and/ or community is integral to your experience.

COURSE OUTCOMES

This course contributes to the following program learning outcomes:

□ Enabling Knowledge:

You will gain skills as you apply knowledge with creativity and initiative to new situations. In doing so, you will:

- Demonstrate mastery of a body of knowledge that includes recent developments in Information Technology

Recognize and use research principles and methods applicable to Information Technology.

You will learn to accurately and objectively examine, and critically investigate Information Technology (IT) concepts, evidence, theories or situations, in particular to:

- Analyze and model complex requirements and constraints for the purpose of designing and implementing software artifacts and IT systems
- Evaluate and compare designs of software artifacts and IT systems on the basis of organizational and user requirements.

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☐ **Problem Solving:**

Your capability to analyze complex problems and provide suitable solutions will be extended as you learn to: design and implement software solutions that accommodate specified requirements and constraints, based on analysis or modeling or requirements specification.

☐ **Communication:**

You will learn to communicate effectively with a variety of audiences through a range of modes and media, in particular to: interpret abstract theoretical propositions, choose methodologies, justify conclusions and defend professional decisions to both IT and non-IT personnel via technical reports of professional standard and technical presentations.

☐ **Responsibility:**

You will be required to accept responsibility for your own learning and make informed decisions about judging and adopting appropriate behavior in professional and social situations. This includes accepting the responsibility for independent life-long learning and a high level of accountability. Specifically, you will learn to: effectively apply relevant standards, ethical considerations, and an understanding of legal and privacy issues to designing software applications and IT systems.

☐ **Research and Scholarship:**

You will have technical and communication skills to design, evaluate, implement, analyze and theorize about developments that contribute to professional practice or scholarship; specifically you will have cognitive skills:

- To demonstrate mastery of theoretical knowledge and to reflect critically on theory and professional practice or scholarship
- To plan and execute a substantial research-based project, capstone experience and/or piece of scholarship.

Course Learning Outcomes

Upon successful completion of this course you should be able to:

- ☐ Identify a task or problem relevant to /or IT

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- ☐ Search and review of the relevant literature
- ☐ Propose a solution to the task or problem
- ☐ Develop a software and/or algorithmic solution to the task or problem
- ☐ Implement solutions to meet high quality requirements developed by the supervisor
- ☐ Carry out research under supervision
- ☐ Present the research in a written form like that used for published papers
- ☐ Present the research in an oral seminar.

Overview of Learning Activities

A Minor project is a substantial work of supervised research or software development. You will choose an academic staff member as your supervisor to work on a research project. To successfully complete the course, you must demonstrate research skills: ability to undertake research under supervision, ability to analyze, develop, and present the research in a written form like that used for published papers, and ability to present the research in an oral seminar.

In this course, you are expected to carry out research activities including implementing a complete solution to the problems identified by the supervisor, critical analysis of results, and completing a written Project. The major deadline for this course is the delivery of the Minor Project by the end of the semester.

Overview of Assessment

You must satisfactorily complete each of the following assessment tasks for this course:

- Research project comprising an implemented and critically analyzed solution to the task or problem.
- Written report (final Project) describing the problem, the relevant literature, the solution, and its relation to other work in the area
- Seminar on your research (of 20 minutes) soon after your Project is submitted.

The Minor Project is assessed on its merits as a research publication. Each Project is examined by two academics, usually from within the Institute.

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