

CMSC 502 Parallel Algorithms Syllabus

Catalog listing:	CMSC 502
Course Level:	Graduate
Prerequisites:	CMSC 401 and CMSC 312; graduate student standing or acceptance into the five-year accelerated B.S. and M.S. program in computer science
Instructor:	Preetam Ghosh
Office:	E4248
Phone:	804-827-3995
Fax:	804-828-2771
email:	pghosh@vcu.edu
Classroom:	ONLINE
Class website:	Canvas
Office Hours:	T 9:00-11:00AM

1.0 – Overview (Catalog Course Description):

Semester course; 3 lecture hours. 3 credits. Prerequisites: CMSC 312 and CMSC 401, graduate student standing or acceptance into the five-year accelerated B.S. and M.S. program in computer science. Software and hardware mechanisms for providing mutual exclusion in uniprocessor and multiprocessor environments. Architectural issues including pipeline design, superscalar computers, multiprocessors, memory systems, peripherals, interfacing techniques, networks, performance and software issues. Design and uses of parallel algorithms to solve concurrency problems in a distributed environment including message passing and remote procedure calls. Students will work in teams (as well as on individual projects) to design and implement parallel algorithms.

2.0 – Course Structure:

Lecture hours/week – 3 Lab hours/week – 0

3.0 – Course Goals

The course is designed as a fundamental systems level course. The students will be expected to work in UNIX and C/C++ languages for best learning outcomes. Other programming languages can also be used in the assigned projects. The students will also be expected to have mathematical modeling and analytical reasoning abilities.

Upon successful completion of this course, the student will be able to understand:

- Software and hardware mechanisms for providing mutual exclusion in uniprocessor and multiprocessor environments.
- Architectural issues including pipeline design, superscalar computers, multiprocessors, memory systems, peripherals, interfacing techniques, networks, performance and software issues.
- Design and use of parallel algorithms to solve concurrency problems in a distributed environment including message passing and shared memory calls.

4.0 – ABET Criteria Addressed:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

Other Criteria Addressed:

- Substantial coverage of at least one general-purpose programming language.
- A major project that requires integration and application of knowledge and skills acquired in earlier course work.

5.0 – Major Topics Covered:

- Parallel architectures, data structures and communication operations
- Parallel performance metrics
- Using MPI and Posix Threads
- Dense matrix algorithms
- Parallel sorting
- Parallel graph algorithms
- Distributed dynamic programming algorithms
- Parallel discrete optimization algorithms

6.0 – Textbook(s):

Introduction to Parallel Computing, 2nd Edition, Grama, Gupta, Karypis and Kumar, ISBN: 0-201-64865-2

7.0 – Class Schedule (ONLINE modality):

- Lecture: 3

8.0 – Evaluation:

General Instructions:

There will be **2 programming assignments**. These assignments will be worth 20% (10+10) of the final grade. All assignments will be electronically submitted. Each assignment will be due at the specified due date and time-slot.

There will be **1 test** which will be comprehensive with emphasis on recent topics and worth 20% of the final grade.

There will be a total of **FOUR homeworks and/or online quizzes** worth 20% (5+5+5+5) of the final grade. Due dates for homeworks or quiz assignments will be communicated at least a week ahead of time.

Research paper presentations will be worth 10% of the grade. Additionally, there will be a **separate research project** worth 30% of the final grade.

Grading Scale

90 – 100 %	A
75 – 89 %	B
60 – 74 %	C
50 – 59 %	D
50 %	and below F

Class Participation: To be successful in both projects and exams a regular interaction with the instructor is necessary. Please attend the office hours and/or discussion boards on Discord.

Grading:

Category	% weight
Assignments	20%
Homeworks/Quizzes	20%
Research Paper presentation	10%
Test	20%
Research Project	30%

Health and safety

Public health information

Health advisories, including information about COVID-19 testing, vaccination, supplies and other public health measures, can be found at **the Safety and Risk Management website**. Visit this site to stay informed about recommendations for VCU and surrounding communities. Additional links to health, wellness and safety information are on the **Life at VCU webpage**.

Campus emergency information

Sign up to receive at VCU Alerts. It is essential to keep your information up-to-date within VCU Alert and to keep your permanent address and emergency contact information current in **eServices**. VCU uses a variety of communication methods to alert the campus community about emergency situations and safety threats. Learn more about **types of alerts** online. Know the emergency phone number for the VCU Police (828-1234), and report suspicious activities and objects.

Managing stress

Students may experience situations or challenges that can interfere with learning and interpersonal functioning including stress, anxiety, depression, alcohol and/or other drug use, concern for a friend or family member, loss, sleep difficulties, feeling hopeless or relationship problems. There are numerous campus resources available to students including **University Counseling Services** (804-828-6200 MPC Campus, 804-828-3964 MCV Campus) which provides brief therapy treatment, **University Student Health Services** (MPC 804 828-8828, MCV Campus 804 828-9220) and the **Department of Recreation & Well-Being (RecWell)** (804-828-9355). 24 hour emergency mental health support is available by calling (804) 828-6200 or utilizing the **National Suicide Prevention Lifeline** (dial 988).

Mandatory responsibility of faculty members to report incidents of sexual misconduct

All VCU faculty members are Responsible Employees as defined by University policy. Responsible employees have a duty to report alleged policy violations to the Title IX Coordinator. This includes incidents of sexual harassment, sexual assault, dating & domestic violence, stalking, sexual exploitation, and related retaliation. Responsible employees may report information through this form or by

emailing titleix@vcu.edu. For confidential support, contact **University Counseling Services**, (804-828-6200 for MP Campus/804-828-3964 for MCV Campus) For more information, visit **our Title IX webpage**.

Reading Days

No classes or exams are held on Reading Day (Friday, Oct. 21, 2022) except in instances where a student is involved in clinical and field placements, practica, co-ops, internships and other work-related experiential learning activities. Faculty may not give an examination or an assignment on those days. Instead, students are encouraged to use these days for relaxation, study and/or review of class materials.

Academic Success and Integrity

Honor System: upholding academic integrity

The VCU Honor System policy describes the responsibilities of students, faculty and administration in upholding academic integrity. According to this policy, "Members of the academic community are required to conduct themselves in accordance with the highest standards of academic honesty, ethics and integrity at all times." **Students are expected to read the policy in full and learn about requirements.**

Early academic alerts

VCU's **Early Notification Program** supports student success. If as an instructor I am concerned about your academic engagement or performance in the first few weeks of class, you may receive a Progress Report email encouraging you to reach out to me after class or during student hours (office hours) for additional support. As a community of care, your **academic advisor**, the **Writing Center**, and the **Campus Learning Center** may also follow up to provide additional layers of support.

Students with disabilities

VCU is committed to ensuring that all students maintain equal access to all aspects of the university, including educational experiences through the provision of reasonable accommodations and academic adjustments. In addition to being a requirement under Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act, this speaks directly to VCU's mission of inclusion, equity, and access. To receive accommodations or other disability-related supports, students must register with the Office of Student Accessibility and Educational Opportunity on the Monroe Park Campus (828-2253) or the Division

for Academic Success on the MCV campus (828-9782). Students and faculty can visit the **Student Accessibility and Educational Opportunity website** and/or the **Division for Academic Success website** for additional information. Once students have completed the registration process, they will be provided with a letter of accommodation. They should provide a copy to their instructor(s) and attempt to schedule a meeting to discuss the implementation of accommodations as early in the semester as possible.

Career Services

Looking for ways to tie what you are learning in your class to your future career or professional goals? **VCU Career Services** provides career planning services for all current VCU students and alumni. Career Services can help students with finding a work-study job on/off campus, resume writing, internship development, interviewing, preparing for graduate school, networking, or job searching. Students are invited to attend career events and workshops, and schedule individualized career advising appointments.

VCU Libraries

Use **VCU Libraries** to find and access library resources, spaces, technology and services that support and enhance all learning opportunities at the university.

Registration, Attendance and Financial Responsibilities

Class registration required for attendance

Students may attend only those classes for which they have registered. Faculty may not add students to class rosters. If students are attending a class for which they have not registered, they must stop attending.

Attendance and consequences of poor attendance

The instructional programs at VCU are based upon a series of class meetings involving lectures, discussions, field experiences, special readings and reporting assignments. Therefore it is important for each student to be in attendance on a regular basis. A student who misses a class session is responsible for completing all material covered or assignments made during the absence.

- Students having attendance problems should contact their instructor to explain the reasons for nonattendance and to discuss the feasibility of continuing in the course. If the student has fallen so far behind that the successful completion of the course is impossible, the student should withdraw from the course before the end of the first 10 weeks of classes (by Oct. 28, 2022).

- If the student continues to miss class and does not officially withdraw from the course, the instructor may withdraw the student for nonattendance with a mark of "W" before the end of the first 10 weeks of classes or may assign an academic grade at the end. Withdrawals are not permitted after the end of the first 10 weeks of classes. For classes that do not conform to the semester calendar, the final withdrawal date occurs when half of the course has been completed.

Withdrawal from classes

Before withdrawing from classes, students should consult their instructor as well as other appropriate university offices. Withdrawing from classes may negatively impact a student's financial aid award and his or her semester charges. To discuss financial aid and the student bill, contact the **Student Financial Management Center (RAMQ)** regarding the impact on your financial aid.

Military short-term training or deployment

If military students receive orders for short-term training or for deployment/mobilization, they should inform and present their orders to Military Student Services and to their professor(s). For further information on policies and procedures contact **Military Student Services** at 828-5993.

Students representing the university – excused absences

Students who represent the university (athletes and others) do not choose their schedules. All student athletes should provide their schedules to their instructors at the beginning of the semester. The Intercollegiate Athletic Council strongly encourages faculty to treat missed classes or exams (because of a scheduling conflict) as excused absences and urges faculty to work with the students to make up the work or exam.

Student financial responsibility

Students assume the responsibility of full payment of tuition and fees generated from their registration, all charges for housing and dining services and other applicable miscellaneous charges. Students are ultimately responsible for any unpaid balance on their account as a result of the University Financial Aid Office or their third party sponsor canceling or reducing their award(s).

Technology

Computer and network use

All students are expected to know and comply with **VCU's Computer and Network Use policy.**

Student email standard

Email is considered an official method for communication at VCU. Students are expected to check their official VCU email on a frequent and consistent basis (the university recommends daily) in order to remain informed of university-related communications. Students are responsible for the consequences of not reading, in a timely fashion, university-related communications sent to their official VCU student email account. Mail sent to the VCU email address may include notification of university-related actions, including disciplinary action. **Students must read this standard in its entirety.**

Faculty communication about students

VCU instructional faculty, administrators and staff maintain confidentiality of student records and disclose information in accordance with the Family Educational Rights and Privacy Act (FERPA). This means that VCU officials may disclose student record information without the consent of the student in certain situations. To support university operations, for example, VCU officials share information about students with other educational officials as necessary to perform their job duties. FERPA permits this disclosure to school officials who have a legitimate educational interest in the student information. In addition, VCU officials have obligations to report information shared by a student depending on the content of that information, for example, in compliance with VCU's policy on the duty to report. Unless FERPA permits a certain disclosure, VCU generally requires consent from a student to disclose information from their education record to another individual. You may find additional information on the **VCU FERPA website.**

Important dates

Important dates for the current and future semesters are listed in the **VCU Academic Calendar.**