New Trends in Coloring in Graphs

Course ID-2700084 March 24-28, 2025

Course Overview	Graph coloring is a central topic in graph theory, which itself is a significant area of discrete mathematics with broad applications in computer science, biology, social sciences, and many other fields. At its core, graph coloring involves the assignment of labels, traditionally called colors to the vertices, edges, or regions of a graph according to certain rules. This course will delve into the fundamental principles of graph coloring, including vertex coloring, edge coloring, and face coloring, as well as more advanced topics like critical graphs, list coloring, odd coloring, conflict-free coloring. We will explore classical theorems such as the Four Color Theorem and Brooks' Theorem, and examine modern developments and unsolved problems in the field. Through a combination of theoretical exploration and practical problem-solving, students will gain a comprehensive understanding of graph coloring and its significance in various contexts.
Course Objectives	By the end of this course, students will achieve a deep and nuanced understanding of graph coloring principles and techniques. Specifically, students will be able to: • Define and explain the key concepts and terminology associated with graph coloring, including chromatic number, and chromatic index. • Apply classical theorems and algorithms to solve graph coloring problems and prove related properties. • Analyze and critique various graph coloring strategies and their efficiency in different scenarios. • Explore the application of graph coloring in real-world problems such as scheduling, resource allocation, and network design. • Investigate current research trends and open problems in graph coloring, preparing them for further study or research in the field. • Develop and present solutions to complex graph coloring problems, both individually and in collaborative settings, enhancing their mathematical communication and problem-solving skills.
Course Contents	**Day 1:** Bounds by Delta and Brooks Theorem, triangle-free graphs with large chromatic number, practical applications of graph colorings, degenericity, critical graphs
	Day 2: Planar graphs and discharging method. The Four Color Theorem and its (possible) generalizations beyond planarity.
	Day 3: Various new and old colorings: Acyclic coloring, total coloring, cyclic coloring, face coloring. Odd coloring, conflict-free coloring, proper conflict-free coloring.
	Day 4: Edge colorings of simple graphs and multigraphs, Snarks, Normal coloring
	Day 5: List colorings: Brooks, planar graphs, bipartite graphs. Thomassen's 5-choosability Theorem. Graphs with a higher choice number than chromatic number.

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Course Schedule	**March 24-28, 2025** **Number of participants for the course will be limited to fifty.**
You Should Attend If...	• You are a postdoctoral fellow/research associate or a Ph.D. scholar or a student have enrolled for one of the following degree programmes: MA/BA/M.Tech/B.Tech/MSc/BSc or completed. • You are a faculty member/executive/business analyst/financial analyst/banker/scientist. Some background in Mathematics/Computer Science may be an advantage.
Course Fee	The participation fees for taking the course is as follows (inclusive of GST): **Participants from abroad: US $ 350** **Industry/Research Organizations: Rs. 2950** **Academic Institutions:** **a) Faculty: Rs. 2950** **b) Ph.D. Scholar/Postdocs: Rs. 2360** **c) UG/PG Student: Rs. 1180** The above fees include all instructional materials kit, certificate, use of computer facilities for tutorials and assignments, 24-hour free internet facility. The participants will be provided accommodation on payment basis.
Accommodation	**IIT (ISM) Guest House** A/C room on twin sharing basis Per Day (Exclusive of food): INR 708 **Hostel** Non-A/C room Per Day (Exclusive of Food): INR 236
Registration Details	**Bank Details** Name of Bank- Canara Bank Account Name- IIT(ISM) SPECIAL Fund Account Number- 0986101024896 IFSC Code- CNRB0000986 **QR Code**

The Faculty

Prof. Riste Škrekovski is currently working as a Professor at the Department of Mathematics, University of Ljubljana, Slovenia. He completed his PhD under Professor Bojan Mohar at the University of Ljubljana in 2000, followed by postdoctoral research at Charles University in Prague and Simon Fraser University in Burnaby, Canada. Currently, he is a leading researcher at the Faculty of Information Studies in Novo Mesto, Slovenia, and also teaches discrete mathematics at the University of Ljubljana. Recently, he joined Rudolfovo, a Slovenian research center, where he holds a partial appointment. His research encompasses a broad range of topics in classical graph theory, alongside interdisciplinary fields like chemical graph theory and complex networks. With over 200 publications, he has made substantial contributions to these areas. He regularly leads multiple bilateral projects, facilitating international research collaboration through reciprocal visits with co-authors. He has supervised seven PhD students and serves on the editorial boards of several academic journals. Additionally, he has initiated and organized annual mathematical events in North Macedonia and Montenegro to promote research development in these regions. Further details about his academic and research credentials can be seen on https://users.fmf.uni-lj.si/skreko/

Prof. Dinabandhu Pradhan is currently working as an Associate Professor in the Department of Mathematics & Computing, Indian Institute of Technology (Indian School of Mines) Dhanbad, India. He obtained his PhD in 2012 from IIT Delhi, India. He subsequently was a postdoctoral fellow in the Department of Computer Science and Automation, IISc Bangalore, a postdoctoral fellow in the Department of Computer Science, University of Saskatchewan, Canada. He was an Assistant Professor in IIT Jodhpur before joining his current place of work. His research focusses on graph theory and graph algorithms. He has published numbers of research papers in web of science listed journals. Further details about his academic and research credentials can be seen on https://mnc.iitism.ac.in/mnc_current_faculty

Course Registration Link:

https://forms.gle/6TD6u9aBhTJT3kVn6

Course ID-2700084

Course Coordinator

Dr. Dinabandhu Pradhan

Associate Professor

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GLOBAL INITIATIVE OF ACADEMIC NETWORKS

शिक्षा मंत्रालय
MINISTRY OF
EDUCATION

Five Day GIAN Course on
New Trends in Coloring in Graphs (Course ID-2700084)
(March 24-28, 2025)

Registration cum Accommodation Request

(Send the soft copy of this form to course coordinator through e-mail)

Paste your soft copy of recent photograph

1. **Full Name:** _____
2. **Date of Birth:**_____ **Category (Gen/OBC/SC/ST)**_____
3. **Participation type (Industry/Academic/Student):**_____
4. **Qualification/Degree Programme:** _____
5. **Organization:** _____
6. **Address:** _____

   _____

   _____
7. **E-mail ID:** _____ **Mobile No.:** _____
8. **Fee Detail:**

   i) Transaction No. (e-transfer/RTGS/NEFT):_____Date:_____ Amount:_____

   ii) Demand Draft No. (If paid by Demand Draft): _____Date:_____ Amount:_____
9. **Accommodation Required:** Yes/No: _____in Hostel/Guest House _____

   (Hostel will be provided as per institute norms, it might be free or with nominal charges, however guest house charges will be Rs 600/- plus GST per day on sharing basis.)

Place :_____

Date : _____ **Signature of the Applicant:** _____