AMS
AMERICAN MATHEMATICAL SOCIETY

M A N U A L

FOR ORGANIZERS AND LECTURERS

AMS SHORT COURSE SERIES

TOPICS IN APPLIED MATHEMATICS

Introduction

Purpose and Overview of the Short Courses

The purpose of the Short Course is to provide a diverse audience of professional and in-training mathematicians an introduction to an area of applied mathematics that can:

- Satisfy the curiosity of those new to the subject
- Provide an entrée to new research topics
- Inspire new methods of problem solving
- Be part of the participants' professional development and continuing education

Each course is focused on an area of mathematics that is applicable or actually used in the study of problems in such areas as physics, chemistry, biology, social sciences, technology, or business. Spanning two days in January immediately preceding the Joint Mathematics Meeting, the activities typically include lectures by recognized experts in the topic and may incorporate discussions among presenters and participants, panels, or hands-on sessions focused on problem solving or computational demonstrations. The mathematical background of the participants is assumed to be that represented by a sound undergraduate education in mathematics, but ordinarily there is a wide range in the mathematical knowledge and sophistication of the participants.

The organizers select the speakers and work closely with them to develop the scientific program, and AMS staff provide logistical and promotional support. Typically, there are between four and eight speakers, and this group may include some or all of the organizers.

Ideally, the Short Course lectures, discussions, and other activities begin with an introductory perspective and lead gradually to an indication of the "state of the art." It is important to provide participants with rich and meaningful illustrations of how the mathematics is applied, and at the same time to highlight some of the potentially productive directions for future research on the topic. The mathematical background and experience of the participants vary greatly—novice to specialist, graduate student (or even undergraduate or high school student) to senior professor, college (two- or four-year) teacher to researcher. Lectures should begin at a level as elementary as possible with something everyone can follow, while going into enough technical detail to enable the audience to see the whole topic in perspective and determine whether they wish to pursue the subject further. **Please refer to the October 2020 issue of the *Notices of the AMS* (pages 1474 – 1476) to review the announcement giving details of the 2021 Short Course:**

https://www.ams.org/journals/notices/202009/202009FullIssue.pdf

If you would like to review other Short Course announcements, they appear in the October issue of the year preceding the course. Information from the *Notices* announcement, and other information about the Short Course is posted on the AMS Short Course webpage: https://www.ams.org/meetings/shortcourse/short-course-general.

In advance of the two-day course meeting, lecture notes are posted on the web for registered participants. To further the impact of the course itself, the organizers are invited to prepare a volume in the AMS's series *Proceedings of Symposia in Applied Mathematics* (see http://www.ams.org/books/psapm/year/2010-2019/ for some recent volumes in this series).

Selection of the topic

During the fall and winter, the Short Course Subcommittee receives proposals, and typically by the beginning of March selects the topic(s) for the next year. Then the committee recommends the organizers and topic to the AMS Secretary, and the AMS Executive Director approves the topic and budget.

The Subcommittee welcomes suggestions for possible topics from past organizers and lecturers. Although it is recommended that the Short Course topics vary from year to year, it is not uncommon for similar topics of timely interest to be repeated (see Attachment A).

Preparation of a Short Course Program

Organizers' responsibilities

A. Speaker selection

Course organizers are responsible for choosing and coordinating the speakers whose lectures will comprise the course program. Organizers are urged to bear in mind the 1973 AMS Council resolution encouraging organizers of sessions at AMS meetings to include women in their programs, when possible. During initial conversations with prospective speakers, the organizer should outline the lecturers' responsibilities.

The AMS has a set total budget for defraying speaker and organizer travel costs, and the AMS Short Course Staff work with the organizers to allocate these funds among the speakers and organizers traveling to the Course site. Typically, the support can cover airfare, lodging, and meals for up to three nights for six individuals. Organizers should apprise speakers of these constraints and encourage them to utilize other sources of support when possible. Organizers and speakers register for the Short Course at no cost, and they are not required to register for the Joint Mathematics Meetings in conjunction with the Short Course. However, the organizers will not be reimbursed for JMM registration.

B. Program

Organizers have considerable flexibility as to format, activities, and the schedule of lectures. Although the timetable and the number and length of the talks vary with each course, a typical Short Course incorporates up to six lectures, each sixty or seventy-five minutes in length, each including an overview of ten to twenty minutes. The course may also include a panel discussion by the speakers and breakout sessions for problem solving or computational demonstrations. If participants need special software, then the organizer should confer with AMS staff well in advance of the course to ensure that arrangements for downloads are made.

The organizer should coordinate lectures to present the course theme in a coherent, well-developed fashion, avoiding excessive thematic overlap and striving for as much uniformity in notation and terminology as possible.

C. Lecture notes and synopses

The organizer is responsible for coordinating the preparation of a synopsis of each lecture, and suggested reading lists, for publication in the *Notices of the AMS* with the announcement of the Short Course. **As an organizer, please stress to the speakers the importance of reviewing the *Notices* announcement mentioned previously in this document**.

If appropriate, the organizer is asked to provide a formal recommendation to participants for pre-course preparation, typically a one-to-three item bibliography, for publication with the synopses and reading lists.

The organizer also ensures that each speaker prepares Lecture Notes. Speakers are required to submit them to the AMS in .pdf format. Lecture notes are posted on the web for registered participants to preview prior to the course.

D. Communication

The organizer should communicate with the lecturers on a regular basis, to ensure that any problems that may arise are handled quickly and to reinforce the importance of complying with the appropriate deadlines, especially with regard to supplying the material to be printed (synopses and reading lists, and lecture notes). The AMS staff is closely involved with the collection of synopses and lecture notes, and has occasionally found it necessary to enlist the organizer's assistance in obtaining needed materials and information in a timely manner.

E. Proceedings

It is anticipated that a proceedings volume based on the lectures given at the Short Course will be published in the AMS series *Proceedings of Symposia in Applied Mathematics* (PSAPM), and the organizers will be responsible for editing this volume. Speakers will be required to submit their final manuscripts to the organizers. Detailed information, including manuscript preparation and deadlines, will be provided by the AMS Acquisitions Department at least two months before the Short Course. All final manuscripts need to be sent to outside referees and copies of the referee reports as well as the manuscripts will be required by the PSAPM Editorial Committee as part of the approval process for the volume. The PSAPM Editorial Committee strongly recommends publication of the proceedings within eighteen (18) months after the Short Course.

AMS Staff responsibilities

A. Formal invitations to speakers

After approvals by the Committee, AMS Secretary, and AMS Executive Director, the AMS staff prepare a draft of the speaker invitation letter, and the organizers review it before formal invitations are issued by the AMS staff. The letter ordinarily contains:

- information on time and place of the Short Course sessions
- tentative program schedule of lectures
- a request for synopses and reading lists, with a deadline for publication in the *Notices*
- a request for Lecture Notes (to be posted on the web before the Short Course for pre-registrants), with information on deadlines
- copy of the AMS policy on travel and subsistence reimbursement
- information about audio-visual equipment and other supplies available for use by the lecturers.

The inclusion of this information in the letter of invitation is intended to give formal status to the arrangements and to place in writing the Society's understanding of the terms of its commitments.

B. General assistance

Members of the AMS staff provide assistance in all phases of the Short Course: writing the proposal and budget approval (from material provided by the organizer), issuing formal invitations to speakers, blocking the Short Course schedule with the Meetings staff, assisting the organizer in the advance planning (scheduling of talks and preparation of announcements), collection of material from speakers (synopses, reading lists, and lecture notes), arranging for announcements in the *Notices* and other promotional releases, posting links to a webpage for lecture notes and other materials for registrants before the Short Course, alerting the organizer to potential problems, providing expense vouchers, and making provisions for audio-visual equipment requested. Staff members also take care of Short Course registration at the meeting and "housekeeping" chores to ensure the smooth progress of the lectures, and final cleanup details afterwards.

C. Announcements and Promotion

Because of long lead times for publications, it is necessary to prepare news releases as early as possible. Calendar announcements are inserted in *Notices of the AMS* and other publications suggested by the organizer.

A detailed announcement and program of the Short Course appears in the *Notices*, accompanying the announcement of the meeting in conjunction with which it is to be held, as well as in the final program of the meeting. A draft of the announcement is prepared by Providence staff and sent to the organizer with a request to supply information for inclusion about the content of the course, the mathematical topics involved, and any specific background information that participants should bring to the course. At this time the schedule and order of speakers are usually resolved.
Speaker responsibilities

Information on deadlines for material requested from lecturers will be sent to speakers with the formal invitation letter. Overall timetables for Short Course programs are outlined in Attachment B. Periodic reminders of impending deadlines will be sent to speakers from the AMS staff.

A particularly crucial deadline is the date by which Lecture Notes are required from lecturers: speakers must get their lecture notes to Providence by the deadline given in their invitation letter (usually two months prior to the Short Course), to allow for posting on the Web in a timely manner for pre-registrants to review.

A. Thematic Preparation of Lectures

Lecturers are reminded that the expected audience comes with diverse backgrounds, depth and breadth of knowledge. The targeted audience consists of such different types as:

- Neophytes, those who are curious but know few specifics of the field beyond a layperson's or graduate student's familiarity
- Peripheralists, those who have limited experience but have read some articles and have enough pieces of detailed information to desire a broad perspective on the field
- Early-career specialists and prospective teachers, who want to grasp key methodologies and central concepts sufficiently to engage in research themselves or to incorporate concepts of the area into courses they teach

Lecturers are asked to prepare their lectures with this diversity of the audience in mind. Specifically, lecturers are asked to attend to the following:

- All terms should be defined
- Lectures should start at a very elementary level (an *American Mathematical Monthly* expository article is a good paradigm)
- Lectures should move swiftly to the "gems" of the field, avoiding the temptation to linger at points of interest only to specialists
- A simple example or a well-conceived set of examples should be carried through the lecture to illustrate the main ideas, as often it is only such an example that the participant retains after the lecture
- A brief history which led up to each topic is strongly encouraged
- Key bibliographic references should be included
- A statement of some open problems, when appropriate, should be included.
- Utilize inclusive language

B. Presentation of Lectures

While definitions and key elementary results may be consolidated into a proper subset of the lecture notes, each lecture itself should start at an elementary level and review all definitions and key elementary results used in that lecture.

During the spoken presentations lecturers are asked to be particularly sensitive to participant "overload" and "burnout" which result from lectures that move too fast or contain too many details.

The short course venue is set up with a projection screen and a computer projector for laptop presentations. Speakers are required to bring their own laptops and any adapters needed to connect to the projector. Because the venue is typically large enough to accommodate a sizeable audience, lavalier microphones are provided, and speakers should expect to wear and use them.

Attachment A
American Mathematical Society Short Course Series

AMS Meeting	Date	Topic	Organizers
Missoula, MT	Aug-73	Computing	J.T. Schwartz
San Francisco, CA	Jan-74	Computing	J.T. Schwartz
Washington, DC	Jan-75	Operations Research	A.J. Goldman
Kalamazoo, MI	Aug-75	Applied Combinatorics	D.R. Fulkerson
San Antonio, TX	Jan-76	Energy Production and Distribution	P.D. Lax
New York, NY	Apr-76	Computing	S. Winograd
Toronto, Canada	Aug-76	Mathematical Economics	G. Debreu and H.F. Sonnenschein
St. Louis, MO	Jan-77	Statistics	E. Parzen
Seattle, WA	Aug-77	Applied Combinatorics	R.L. Graham
Atlanta, GA	Jan-78	Numerical Analysis	G. Golub and J. Oliger
Providence, RI	Aug-78	Systems and Control Theory	W.H. Fleming
Biloxi, MS	Jan-79	Game Theory	W.F. Lucas
Duluth, MN	Aug-79	Operations Research	S.I. Gass and R. Disney
San Antonio, TX	Jan-80	Statistics	R.V. Hogg
Ann Arbor, MI	Aug-80	Computer Algebra	D.Y.Y. Yun
San Francisco, CA	Jan-81	Cryptology	R. Lipton
Pittsburgh, PA	Aug-81	Networks	S. Burr
Cincinnati, OH	Jan-82	Tomography	L. Shepp
Toronto, Canada	Aug-82	Statistical Data Analysis	R. Gnanadesikan
Denver, CO	Jan-83	Computer Communications	B. Gopinath
Albany, NY	Aug-83	Population Biology	S. Levin
Louisville, KY	Jan-84	Mathematics of Information Processing	M. Anshel and W. Gewirtz
Eugene, OR	Aug-84	Environmental and Natural Resource Mathematics	R. McKelvey
Anaheim, CA	Jan-85	Fair Allocation	H.P. Young
Laramie, WY	Aug-85	Actuarial Mathematics	J.C. Hickman, R. McKelvey, and E. Shiu
New Orleans, LA	Jan-86	Approximation Theory	C. de Boor
San Antonio, TX	Jan-87	Moments in Mathematics	H.J. Landau
Atlanta, GA	Jan-88	Computational Complexity	J. Hartmanis
Providence, RI	Aug-88	Chaos and Fractals	R. Devaney and L. Keen
Phoenix, AZ	Jan-89	Matrix Theory & Applications	C.R. Johnson
Boulder, CO	Aug-89	Cryptology & Computational Number Theory	C. Pomerance
Louisville, KY	Jan-90	Mathematical Questions in Robotics	R. Brockett

Columbus, OH	Aug-90	Combinatorial Games	R.K. Guy
San Francisco, CA	Jan-91	Probabilistic Combinatorics and its Applications	B. Bollobas
Orono, ME	Aug-91	The Unreasonable Effectiveness of Number Theory	S.A. Burr
Baltimore, MD	Jan-92	New Scientific Applications of Geometry and Topology	D. Sumners
San Antonio, TX	Jan-93	Wavelets and Applications	I. Daubechies
Cincinnati, OH	Jan-94	Complex Dynamics: The mathematics behind the Mandelbrot & Julia Sets	R. Devaney and L. Keen
San Francisco, CA	Jan-95	Coding Theory	A. Calderbank
		Knots and Physics	L. Kauffman
Orlando, FL	Jan-96	Artificial Intelligence	F. Hoffman
San Diego, CA	Jan-97	Applications of Computational Algebraic Geometry	D. Cox and B. Sturmfels
		Mathematical Finance	D. Heath and G. Swindle
Baltimore, MD	Jan-98	Singular Perturbations	R. O'Malley and J. Scanlon
San Antonio, TX	Jan-99	Non-Linear Control	K. Grasse and H. Sussman
Washington, D.C.	Jan-00	Quantum Computation Environmental Mathematics	S. Lomonaco and V. Manoranjan
New Orleans, LA	Jan-01	Mathematical Biology	J. Sneyd
San Diego, CA	Jan-02	Symbolic Dynamics	S. Williams
Baltimore, MD	Jan-03	Public-Key Cryptography	D. Lieman
Phoenix, AZ	Jan-04	Trends in Optimization	S. Hosten, J. Lee, and R. Thomas
Atlanta, GA	Jan-05	The Radon Transform and Applications to Inverse Problems	G. Olafson and T. Quinto
San Antonio, TX	Jan-06	Modeling And Simulation of Biological Networks	R. Laubenbacher
New Orleans, LA	Jan-07	Aspects of Statistical Learning	C. Rudin and M. Dudik
San Diego, CA	Jan-08	Applications of Knot Theory	D. Buck and E. Flappan
Washington, D.C.	Jan-09	Quantum Computation	S. Lomonaco
San Francisco, CA	Jan-10	Markov Chains and Mixing Times	D. Levin, Y. Peres, and E. Wilmer
New Orleans, LA	Jan-11	Evolutionary Game Dynamics and Computational Topology	A. Zomorodian and K. Sigmund
Boston, MA	Jan-12	Random Fields and Random Geometry	R. Adler
		Computing with Elliptic Curves using Sage	W. Stein
San Diego, CA	Jan-13	Random Matrices	V. Vu
Baltimore, MD	Jan-14	Geometry and Topology in Statistical Inference	S. Mukherjee

San Antonio, TX	Jan-15	Finite Frame Theory: A Complete Introduction to Overcompleteness	K. Okoudjou
Seattle, WA	Jan-16	Rigorous Numerics in Dynamics	J-P. Lessard and J. Bouwe van den Berg
Atlanta, GA	Jan-17	Random Growth Models	Michael Damron and Firas Rassoul-Agha
San Diego, CA	Jan-18	Discrete Differential Geometry	Keenan Crane
Baltimore, MD	Jan-19	Sum of Squares: Theory and Applications	Pablo Parrilo and Rekha Thomas
Denver, CO	Jan-20	Mean Field Games: Agent-Based Models to Nash Equilibria	François Delarue
Virtual	Jan-21	Mathematical and Computational Methods for Complex Social Systems	Alexandria Volkening, Heather Zinn-Brooks, Michelle Feng, Mason Porter
Virtual	Jan-22	3D Printing: Challenges and Applications	Maria Trnkova and Andrew Yarmola

Attachment B
Timetable for Short Course Proposals and Preparation

Step	Who	Task	Time (months in advance)
1	Subcommittee	Recruitment of possible organizers and proposals	Sep – Dec (–17 to –14 months)
2	Proposing Organizers	Preparation of tentative programs, draft proposals, informal approaches to speakers	Oct – Dec (–15 to –13 months)
3	Chair	Submission of draft proposals to AMS for subcommittee meeting	Dec (–13 months)
4	Chair, subcommittee	Committee deliberations on draft proposals and submissions of revised proposals	Jan (–12 months)
5	Chair, subcommittee	Committee selection of final proposal(s)	Feb (–11 months)
6	Secretary/AMS AD/AMS Staff	Approval of Subcommittee's recommended course(s); staff send letter notifying organizer	March (–10 months)
7	AMS Staff	Formal invitations and manuals sent to speakers; includes sample notes and publications information	Apr - Jun (–7 months)
8	Speakers	Deadline for receipt (by AMS) of synopses and reading lists for October *Notices*	July (–6 months)
9	Organizers	Deadline for receipt (by AMS) of article for November *Notices* announcement	July 1 (–6 months)
10	Speakers	Deadline for receipt of lecture notes (to AMS) in pdf format and special A/V requests	November (–2 months)
11	Speakers	Short Course offered	January (–0 months)