باسمه تعالی

Modern Cosmology 1
Winter 2025

Lecturer: Prof. Movahed
TA: Mr. Mohammad Al-Akhras
Venue: Sunday and Tuesday, 13:30-15:30

1) **The course mark includes 6 points for (Exercises), 14 points for exams, 1 point for Quiz and other bonus activities**
2) **Main References:**

1- Dodelson, Scott, and Fabian Schmidt. Modern cosmology. Elsevier, 2024.
2- Baumann, Daniel. Cosmology. Cambridge University Press, 2022.
3- Weinberg, Steven. Cosmology. OUP Oxford, 2008.
4- Mukhanov, Viatcheslav. Physical foundations of cosmology. Cambridge university press, 2005.
5- Carroll, Bradley W., and Dale A. Ostlie. An introduction to modern astrophysics. Cambridge University Press, 2017.

3) **Other relevant References**

6- Peacock, John A. Cosmological physics. Cambridge university press, 1998.
7- Mo, Houjun, Frank Van den Bosch, and Simon White. Galaxy formation and evolution. Cambridge University Press, 2010.
8- Martinez, Vicent J., and Enn Saar. Statistics of the galaxy distribution. Chapman and Hall/CRC, 2001.
9- Lesgourgues, Julien, et al. Neutrino cosmology. Cambridge University Press, 2013.
10- Durrer, Ruth. The cosmic microwave background. Cambridge University Press, 2020.
11- Bertschinger, Edmund. "Cosmological dynamics." arXiv preprint astro-ph/9503125 (1995).
12- LESGOURGUES, J. "Cosmological perturbations." arXiv preprint arXiv:1302.4640 (2013).

4) **Also check my talk and presentation trough http://facultymembers.sbu.ac.ir/movahed/index.php/talks-a-presentations**
5) **For more details about the research methods, visit http://facultymembers.sbu.ac.ir/movahed/index.php/courses/159-research-methods-course**
6) **First midterm will be held on 1403/12/23 (13/03/2025) at 9:00 am**
7) **Second midterm will be held on 1404/02/11 (13/05/2025) at 9:00 am**
8) **Third midterm will be held on 1404/03/29 (19/06/2025)**
9) **Final exam will be held on Khordad 1404**
10) **Overall necessities for doing exercises**

For each set of exercise, you should take care about due date. Delivering the answer sheets after due date is not acceptable. In exceptional case, the proper punishment will be considered

11) **I provided some scripts for plotting available via:**

http://facultymembers.sbu.ac.ir/movahed/attachments/Python_plot.zip
http://facultymembers.sbu.ac.ir/movahed/attachments/Mathematica_plot.zip

Overall timetable of teaching program

Exam	Subjects	Date/no.
First midterm exam	Introduction, Scientific Methodology and Methods, road map, Our universe from current observations 1	Lecture 1
	Our universe from current observations 2: Challenges and Tensions	Lecture 2
	LCDM model in nutshell with brief on History	Lecture 3
	Special Relativity and Review on GR 1: metric (Space-time), Generalized coordinate systems, and Covariant form of Physics laws	Lecture 4
	Review on GR 2: Geodesic equation, comoving length, curvature	Lecture 5
	Einstein Equations, Cosmological Redshifts	Lecture 6
	Hubble's law, Peculiar velocity, Horizons, age of Universe, Angular diameter distance and other observable quantities	Lecture 7
	Distance modulus and SNIa 1	Lecture 8
	Distance modulus and SNIa 2	Lecture 9
	Alcock-Paczyński effect, BAO, CMB Shift parameter,	Lecture 10
Second midterm exam	Dynamics: Field equations	Lecture 11
	Friedmann equations 1	Lecture 12
	Friedmann equations 2	Lecture 13
	Standard Model of Cosmology 1	Lecture 14
	Standard Model of Cosmology 2	Lecture 15
	Inflation 1	Lecture 16
	Inflation 2	Lecture 17
	Thermal History of the Universe 1	Lecture 18
	Thermal History of the Universe 2	Lecture 19
Third midterm exam	Big-Bang Nucleosynthesis	Lecture 20
	Boltzmann Equations 1	Lecture 21
	Boltzmann Equations 2	Lecture 22
	The origin of species	Lecture 23
	Stochastic field	Lecture 24
Final exam	Physics of CMB 1	Lecture 25
	Physics of CMB 2	Lecture 26
	Physics of CMB 3	Lecture 27
	Physics of CMB 4	Lecture 28
	Physics of CMB 5	Lecture 29
	Large Scale Structures 1	Lecture 30
	Large Scale Structures 2	Lecture 31
	Large Scale Structures 3	Lecture 32
	Concluding Remarks	Lecture 33

سیدمحمدصادق موحد

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