

 <p>Estd. 1962 "A" Accredited by NAAC(2021) With CGPA 3.52</p>	<p>SHIVAJI UNIVERSITY, KOLHAPUR - 416004, MAHARASHTRA PHONE : EPABX – 2609000, www.unishivaji.ac.in, bos@unishivaji.ac.in शिवाजी विद्यापीठ, लिहापूर - ४१६००४, महाराष्ट्र दूरध्वनी - ईपीएबीएक्स - २६०९०००, अभ्यासमंडळे विभाग दूरध्वनी विभाग २३१-२६०९०९३/९४</p>	
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SU/BOS/Science/ *M2*

Date: 17/ 10/ 2022

To,
The Principal,
All Affiliated Concerned Science Colleges/Institutions
Shivaji University, Kolhapur.

Subject :- Regarding syllabi of M. Sc. & B.Sc. Part- I (NEP-2020) degree programme under the Faculty of Science and Technology as per National Education Policy 2020 .

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the syllabi and Nature of question paper of **M. Sc. & B.Sc. Part- I Information Technology** under the Faculty of Science and Technology as per National Education Policy 2020 .

Sr. No.	Faculty of Science and Technology	Programme/ Course
1	Geography & Geology	M. A./M.Sc Part-I Geography,
		M.Sc. Part -I Geology,
		B.Sc. Part-I Geology,
		B.Sc Part-I Geography,

This syllabi and nature of question paper shall be implemented from the Academic Year 2022-2023 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in (students Online Syllabus)

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,

Yours faithfully,

[Signature]
By Registrar

Copy to:

1	The Dean, Faculty of Science & Technology	7	Appointment Section
2	Director, Board of Examinations and Evaluation	8	P.G.Seminar Section
3	The Chairman, Respective Board of Studies	9	Computer Centre (I.T.)
4	B.Sc. Exam	10	Affiliation Section (U.G.)
5	Eligibility Section	11	Affiliation Section (P.G.)
6	O.E. I Section	12	P.G.Admission Section

Shivaji University, Kolhapur
Department of Geography
(Faculty of Science and Technology)



Revised Syllabus (CBCS) (as per NEP 2020) of
M.A./M.Sc. in Geography (2 Years) (Level 8 & 9)

Implemented From...

Academic Year 2022-23 onwards

(i.e., from June 2022)

Phone: +91-0231-2609194
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Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP – 2020)
M.A./M.Sc. Geography Programme Structure
M.A./M.Sc. Part – I (Level 8)

SEMESTER-I (Duration- Six Month)											
	Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
CGPA	1	CC-101	4	4	4	80	32	3	20	8	1
	2	CC-102	4	4	4	80	32	3	20	8	1
	3	CC-103	4	4	4	80	32	3	20	8	1
	4	CC-104	4	4	4	80	32	3	20	8	1
	5	CCPr-105	16	16	8	200	80	*	--	--	*
Total (A)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	AEC-106	2	2	2	--	--	--	50	20	2
SEMESTER-II (Duration- Six Month)											
CGPA	1	CC-201	4	4	4	80	32	3	20	8	1
	2	CC-202	4	4	4	80	32	3	20	8	1
	3	CCS-203	4	4	4	80	32	3	20	8	1
	4	CCS-204	4	4	4	80	32	3	20	8	1
	5	CCPr-205	16	16	8	200	80	*	--	--	*
Total (B)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	SEC-206	2	2	2	--	--	--	50	20	2
Total (A+B)					48	1040	--	--	160	--	--

Note(s):

<ul style="list-style-type: none"> •Student contact hours per week : 32 Hours (Min.) •Theory and Practical Lectures : 60 Minutes Each •CC- Core Course •CCS- Core Course Specialization •CCPr- Core Course Practical •AEC- Mandatory Non-CGPA compulsory Ability Enhancement Course •SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course 	<ul style="list-style-type: none"> •Total Marks for M.A./M.Sc.-I : 1200 •Total Credits for M.A./M.Sc.-I (Semester I & II) : 48 •Practical Examination is annual. •Practical courses are divided into 2 or 3 sections. •*Duration of practical examination as per respective BOS guidelines. •Separate passing is mandatory for Theory, Internal and Practical examination.
<p>•Requirement for Entry at Level 8: Completed all requirements of the Bachelor's Degree (Level 7) with Geography as principal / major subject.</p>	
<p>•Exit Option at Level 8: Students can exit after Level 8 with Post Graduate Diploma in Geography if he/she completes the course equivalent to minimum of 48 credits.</p>	

Choice Based Credit System with Multiple Entry and Multiple Exit Option (NEP – 2020)
M.A./M.Sc. Geography Programme Structure
M.A./M.Sc. Part – II (Level 9)

SEMESTER-III (Duration- Six Month)											
	Sr. No.	Course Code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures (Per week)	Hours (Per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
CGPA	1	CC-301	4	4	4	80	32	3	20	8	1
	2	CCS-302	4	4	4	80	32	3	20	8	1
	3	DSE-303	4	4	4	80	32	3	20	8	1
	4	DSE-304	4	4	4	80	32	3	20	8	1
	5	CCPr -305	16	16	8	200	80	*	--	--	*
Total (C)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	AEC-306	2	2	2	--	--	--	50	20	2
	2	EC (SWM MOOC)-307 /OE-307	Number of lectures and credit shall be as specified on SWAYAM-MOOC or as specified in OE								
SEMESTER-IV (Duration- Six Month)											
CGPA	1	CC-401	4	4	4	80	32	3	20	8	1
	2	CCS-402	4	4	4	80	32	3	20	8	1
	3	DSE-403	4	4	4	80	32	3	20	8	1
	4	DSE-404	4	4	4	80	32	3	20	8	1
	5	CCPr-405	16	16	8	200	80	*	--	--	*
Total (D)			--	--	24	520	--	--	80	--	--
Non-CGPA	1	SEC-406	2	2	2	--	--	--	50	20	2
	2	GE-407	2	2	2	--	--	--	50	20	2
Total (C+D)					48	1040	--	--	160	--	--

Note(s):

<ul style="list-style-type: none"> •Student contact hours per week : 32 Hours (Min.) •Theory and Practical Lectures : 60 Minutes Each •CC- Core Course •CCS- Core Course Specialization •CCPr- Core Course Practical and Project •DSE- Discipline Specific Elective •AEC- Mandatory Non-CGPA compulsory Ability Enhancement Course •SEC- Mandatory Non-CGPA compulsory Skill Enhancement Course •EC (SWM MOOC) - Non-CGPA Elective Course •OE- Open Elective •GE- Multidisciplinary Generic Elective 	<ul style="list-style-type: none"> •Total Marks for M.A./M.Sc.-II : 1200 •Total Credits for M.A./M.Sc.-II (Semester III & IV): 48 •Practical Examination is annual. •Practical courses are divided into 2 or 3 sections. •*Duration of practical examination as per respective BOS guidelines. •Separate passing is mandatory for Theory, Internal and Practical examination.
<p>•Requirement for Entry at Level 8:</p> <ol style="list-style-type: none"> 1) Completed all requirements of the relevant Post Graduate Diploma (Level 8) in Geography 2) Bachelor's Degree (Honours / Research) (Level 8) in Geography 	
<p>•Exit Option at Level 8: Students can exit after Level 9 with Master's Degree in Geography if he/she completes the course equivalent to minimum of 96 credits.</p>	

	M.A./M.Sc.-I	M.A./M.Sc.-II	Total
Marks	1200	1200	2400
Credits	48	48	96

I. CGPA Courses:

1. There shall be 12 Core Courses (CC) of 64 Credits (including 32 credits for 4 practical courses)
2. There shall be 04 Core Course Specialization (CCS) of 16 credits.
3. There shall be 04 Discipline Specific Elective (DSE) courses of 16 credits.
4. Total credits for CGPA courses shall be of 96 credits.

II. Mandatory Non-CGPA Courses:

1. There shall be 02 Mandatory Non-CGPA compulsory Ability Enhancement Course (AEC) of 02 credits each.
2. There shall be 02 Mandatory Non-CGPA compulsory Skill Enhancement Course (SEC) of 02 credits each.
3. There shall be one Elective Course (EC) (SWAYAM MOOC). The credits of this course shall be as specified on SWAYAM MOOC.
4. If there is no compatible SWAYAM MOOC course then OE shall be offered.
5. There shall be one Multidisciplinary Generic Elective (GE) course of 02 credits. Each student has to take generic elective preferably from the department other than parent department.
6. For Non-CGPA courses the total credits shall be of 10 + the credits of EC or OE as per availability.
7. The credits assigned to the course and the programme are to be earned by the students and shall not have any relevance with the work load of the teacher.

Programme and Course Guidelines (for CGPA Courses):

1. Title of the Course: M.A./M.Sc. in Geography

2. Year of Implementation: Revised syllabus will be implemented from academic year 2022-23.

3. Programme Duration: The M.A./M.Sc. programme duration is of two years comprising of four semesters. Each semester spanning for 6 months of minimum 120 working days (minimum 90 teaching days).

4. Scheme of Examination:

Paper Type	*Internal Assessment	University Assessment	Total Marks	Credit per Course	No. of Course	Total Credits
Theory	20	80	100	04	16	64
Practical / Project	--	200	200	08	04	32

*Note: Internal marks for each theory course - 20 marks (Class Test: 10 marks; Assignment/Seminar: 10 marks)

5. Course Structure (CBCS):

Paper No.	Course Title	Teaching hours per week	Credits
<i>M.A./M.Sc. Geography Sem. I (Level 8)</i>			
CC-101	Fundamentals of Geomorphology	4	4
CC-102	Principles of Climatology	4	4
CC-103	Economic Geography	4	4
CC-104	Geography of Population and Human Resource Development	4	4
CCPr-105 (Annual)	105.1 Practicals in Geomorphology and Surveying	16	8
	105.2 Analysis of Climatic Data		
	105.3 Analysis of Socio-economic Data		
CGPA - Total Credit (Cumulative)			24 (24)
AEC-106	Ability Enhancement Course	--	2
Non-CGPA - Total Credit (Cumulative)			02 (02)
<i>M.A./M.Sc. Geography Sem. II (Level 8)</i>			
CC-201	Development of Modern Geographical Thought	4	4
CC-202	Geohydrology and Oceanography	4	4
CCS-203	Advanced Cartography and Surveying	4	4
CCS-204	Social and Cultural Geography	4	4
CCPr-205 (Annual)	205.1 Computer Applications in Geography	16	8
	205.2 Statistical Techniques in Geography		
	205.3 Quantitative Techniques in Geography		
CGPA - Total Credit (Cumulative)			24 (48)
SEC-206	Skill Enhancement Course	--	2
Non-CGPA - Total Credit (Cumulative)			02 (04)
<i>M.A./M.Sc. Geography Sem. III</i>			
<i>M.A./M.Sc. Geography Sem. IV</i>			

6. Nature of Question Paper in University Assessment*

I. Nature of Theory Question Paper:

Question No.	Type of Question	Number of Questions to be Asked	Number of Questions to be Answered	Marks per Question	Total Marks
Q1.	Objective type (MCQ)	08	08	02	16
Q2.	Short Answer (Definition type)	04	04	04	16
Q3.	Short Notes (Descriptive type)	03	02	08	16
Q4.	Long Answer/ Essay type	02	01	16	16
Q5.	Long Answer/ Essay type	02	01	16	16
Total = 05	--	--	--	--	80

II. Nature of Practical Question Paper for Course No. 105 and 205:

Question No.	Type of Question/ Assessment	No. of Questions	Total Marks/ Course
Section 1: Q1 and Q2	Practical/ Lab Assessment	02	50
Section 2: Q3 and Q4	Practical/ Lab Assessment	02	50
Section 3: Q5 and Q6	Practical/ Lab Assessment	02	50
Q7.	Practical Assignment (External)	01	25
Q.8.	Viva-voce (External)	01	25
Total = 08	--	--	200

- Nature of question paper may be different than specified here in case of online assessment.

7. Equivalence in Accordance with Title and Content of Courses (for revised syllabus):

Sr. No.	Title of Old Course (2019-20)	Title of New Course (2022-23)
1.	CC-101: Fundamentals of Geomorphology	CC-101: Fundamentals of Geomorphology
2.	CC-102: Principles of Climatology	CC-102: Principles of Climatology
3.	CC-103: Economic Geography	CC-103: Economic Geography
4.	CC-104: Geography of Population and Human Resource Development	CC-104: Geography of Population and Human Resource Development
5.	CC-201: Applied Geomorphology	--
6.	CC-202: Applied Climatology and Climate Change	--
7.	CC-401: Development of Modern Geographical Thought	CC-201: Development of Modern Geographical Thought
8.	CC-301: Geohydrology and Oceanography	CC-202: Geohydrology and Oceanography
9.	CCS-203: Advanced Cartography and Surveying	CCS-203: Advanced Cartography and Surveying
10.	CCS-204: Social and Cultural Geography	CCS-204: Social and Cultural Geography
11.	CCPr-105: Practical I 105.1 Practicals in Geomorphology and Surveying 105.2 Analysis of Climatic Data 105.3 Analysis of Socio-economic Data	CCPr-105: Practical I 105.1 Practicals in Geomorphology and Surveying 105.2 Analysis of Climatic Data 105.3 Analysis of Socio-economic Data
12.	CCPr-205: Practical II 205.1 Computer Applications in Geography 205.2 Statistical Techniques in Geography 205.3 Quantitative Techniques in Geography	CCPr-205: Practical II 205.1 Computer Applications in Geography 205.2 Statistical Techniques in Geography 205.3 Quantitative Techniques in Geography

8. Program Educational Objectives (PEOs):

1. To enhance students' ability to apply their specialized knowledge in the geographical domain.
2. To develop employability skills and competencies to serve the job requirements in the society.
3. Inspire students to develop the abilities among them to offer services in the entrepreneurial environment.
4. To cultivate the interest among students to conduct research activities in the discipline of Geography.

9. Programme Outcomes (POs):

1. Students will have comprehensive knowledge in the discipline of Geography.
2. They will have ability of making comprehensive analysis, interpret spatial problems, and suggest proper solutions by using theoretical, methodological, and instrumental knowledge of Geography.
3. Good employability skills as per current need of the society to compete in the competitive world.
4. They will have good understanding about proper utilization of natural resources through geographical knowledge.
5. Aware about the regional and national environmental issues, recent trends, and technological advancements in the discipline of Geography.
6. Develop research interest to solve critical and emerging societal issues related to geography and the surrounding environment.

CC-101: Fundamentals of Geomorphology

Course Outcomes (COs): After completing the course, students will be able to

1. Understand the development of geomorphic thought throughout the time with a review of fundamental concepts of geomorphology.
2. Look into the evolution of continents and ocean basins with continental drift theory.
3. Know the endogenetic and exogenetic forces controlling landform development with special reference to the denudational processes.
4. See the mountain building activities through different theories.

Unit: 1

15 Lectures

Nature and scope of geomorphology, Evolution of geomorphological thought, Contribution of American and European school of Geomorphology, Brief review of geomorphic concept, Principle of Uniformitarianism.

Unit: 2

15 Lectures

Evolution of continents and ocean basins: Continental drift theory of Taylor, Continental Drift theory of Wegener, Theory of Plate Tectonics.

Unit: 3

15 Lectures

Factors controlling landform development: Endogenetic and Exogenetic forces, Denudational processes, Weathering, Erosion and Mass wasting.

Unit: 4

15 Lectures

Mountain building activities, Geosynclinal theory of Kober, Holms Convectional current theory, Theory of Isostasy.

References:

1. Allaby, Michael (2008): Oxford Dictionary of Earth Science, Oxford University Press, New York.
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3. Chorley, R.J. Schumm, S.A. & Sugden, D.E. (1985): Geomorphology, Methuen & Co. Ltd., London, New York.
4. Brierley, G.J. & Fryirs, K.A. (2005): Geomorphology and River Management, Blackwell Publishing, Oxford UK.
5. Briggs, K. (1985): Physical Geography Process and System, Hodder and Stoughton, London.
6. Christopherson, R.W. (1995): Elemental Geosystems: A Foundation in Physical Geography, Prentice Hall Englewood Cliffs, New Jersey.
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9. Fairbridge, R.W., ed. (1968): Encyclopaedia of Geomorphology Reinhold, New York.
10. Hart, M.G. (1986): Geomorphology Pure and Applied, George Allen and Unwin, London.
11. Leopold, L.B. Wolman, M.G. & Miller, J.P. (1964): Fluvial Processes in Geomorphology, W.H. Freeman, San Francisco.
12. Lobeck, A.K. (1939): Geomorphology, McGraw Hill, New York. .
13. Moor, W.G. (1949): A Dictionary of Geography, Penguin Books, England.
14. Morgan, R.S. & Wooldridge S.W (1959): Outline of Geomorphology the Physical basis of Geography, Longmans Green, London.
15. Robinson, Harry (1969): Morphology and Landscape, University Tutorial Press Ltd. London.
16. Singh, Savindra (1998): Geomorphology, Prayag Pustak Bhavan, Allahabad.
17. Singh, Savindra (1991): Environmental Geography, Prayag Pustak Bhavan, Allahabad.
18. Spark, B. W. (1986): Geomorphology, Longman, London.
19. Strahler, A.N (1969): Physical Geography. John Wiley & Sons Inc., New York.
20. Thomas, M.F. (1974): Tropical Geomorphology, Macmillan, London.
21. Thornbury, W.D. (1969): Principles of Geomorphology, Wiley Eastern Ltd. New Delhi.
22. Wadia, D.N. (1993): Geology of India, Tata McGraw Hill Edition, New Delhi.
23. Worcester, P. G. (1948): Textbook of Geomorphology, Princeton, D. Van, Norstrand.

CC-102: Principles of Climatology

Course Outcomes (COs): After completing the course, students will be able to

1. Distinguish the weather and climate with an understanding of structure and composition of Atmosphere;
2. Understand the variations of weather systems in terms of Stability and Instability of atmosphere;
3. Enable the students to understand the vertical and horizontal distribution of atmospheric air;
4. Get complete information about Atmospheric Disturbances in terms of cyclones and anti-cyclones;
5. Know the significance of synoptic Climatology in pollution studies and navigation;

Unit - 1:

15 Lectures

Introduction to Climatology: Significance of Climatology, Modern Climatological studies, Origin and evolution of the earth's atmosphere, Structure and Composition of Atmosphere, Insolation, Heat transfer- Radiation, Convection and conduction, Terrestrial heat balance.

Unit - 2:

15 Lectures

Moisture in the Atmosphere: Changes of state, Processes that cause changes of state, Humidity, Humidity measurements, Adiabatic temperature change in atmosphere, Stability and Instability of atmosphere, Condensation- Clouds and fogs, Precipitation - precipitation processes, types and forms.

Unit - 3:

12 Lectures

Motion in the Atmosphere: Air Pressure, Pressure measurement and distribution, Factors affecting wind, Pressure belts, Classification of Wind, Planetary winds, Monsoon and Local winds.

Unit - 4:

18 Lectures

Air Masses and Atmospheric Disturbances: Classification and modifications of Air Masses, Fronts: characteristics and types, Tropical Cyclones, Anticyclones, Thunderstorms, Tornadoes, Hurricanes, Water spouts; Application of Synoptic Climatology in pollution studies and navigation.

References:

Books & Reports:

1. **Aguado, E.**, and Burt, J.E. (2013): *Understanding Weather and Climate*, Pearson, New York, 552pp.
2. **Anderson, T. R.**, Hawkins, E., and Jones, P. D. (2016). CO₂, the greenhouse effect and global warming: from the pioneering work of Arrhenius and Callendar to today's earth system models. *Endeavour*, 40(3):178-187.
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9. **Lal, D.S.**: *Climatology*. Prayag pustak Bhavan, Allahabad.
10. **Lutgens, F.K.**, and Tarbuck, E.J. (2013): *The Atmosphere – An Introduction to Meteorology*. Prentice Hall, Boston, 506pp.
11. **Mather J. R.** (1975): *Climatology: Fundamentals & Applications*. Mc Graw Hills Book Co., New York.
12. **Miller A., et. al.** (1983); *Elements of Meteorology*, Merrill, Columbus.
13. **Oliver J. E.** (1973): *Climate & Mans Environment*, John Wiley & Sons; New York.
14. **Robert V. Rohli, Anthony J. Vega**, (2017): *Climatology*, Jones & Bartlett Learning; 4 edition, 418 pp.
15. **Robinson, P. J.**, & Henderson-Sellers, A. (2014). *Contemporary climatology*. Routledge.
16. **Singh, Savindra.** (2006): *Climatology*, Prayag Pustak Bhavan, Allahabad.
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18. **Vlado Spiridonov, Mladjen Ćurić.** (2021): *Fundamentals of Meteorology*, Springer Nature, Switzerland, pp 437.
19. **Williams Sellers**, (2014): **Physical Climatology**, New India Publishing Agency, 280 pp.

Journals:

Bulletin of the American Meteorological Society (<https://journals.ametsoc.org/toc/bams/current>)

Climate Dynamics (<https://link.springer.com/journal/volumesAndIssues/382>)

International journal of Climatology (<https://rmets.onlinelibrary.wiley.com/journal/10970088>)

Journal of Climate (<https://journals.ametsoc.org/toc/clim/current>)

Nature Climate Change (<https://www.nature.com/nclimate/>)

Weather and Climate Extremes (<https://www.sciencedirect.com/journal/weather-and-climate-extremes>)

CC-103: Economic Geography

Course Outcomes (COs): After completing the course, students will be able to

1. Understand the concepts and basis of economic processes
2. Get acquainted with theories and models in economic geography
3. Get comprehensive knowledge of World energy resources, situation and distribution
4. Know about the Nature, scope and Principles of Industrial Geography
5. Understand transport and Trade policies of country
6. Get detail knowledge of economic power determinants of country and able to analyze the economic development of country.

Unit-1: Basics of Economic Geography

15 Lectures

Nature and scope; Approaches to the study of economic geography; Basis of economic processes: Production, exchange & consumption, Classification and characteristics of economic activities. World economic development: measurement and problems; Special Economic Zones; Global city.

Unit-2: Energy Resources

10 Lectures

Concept of resources, Classification of resources, Renewable & Non-renewable energy resources, World energy situation and distribution; Sources of Energy: Coal, Oil, Natural gas and Nuclear energy, OPEC-energy crisis, India: Current Energy Scenario.

Unit- 3: Industrial Geography

15 Lectures

Nature and scope of Industrial Geography, Factors of Industrial Location, Principles of Industrial Location: – Profit maximization, Least cost location- A. Weber & A. Losch- industrial location theories, Rostow's model, Industrial regionalization; World industries: locational patterns and problems; New industrial policies of India; Indian Transnational Corporations (TNCs).

Unit-4: Transportation & Trade

20 Lectures

Modes of transportation, Accessibility and connectivity; Interregional and Intraregional: Ullman's triad- Complementarily- Intervening Opportunity- Transferability, Trade Policy; Export processing zones, International Trade Characteristics, patterns of world trade, Regional Trade blocks EEC, EFTA, & WTO.

References:

1. Alexander J.W. (1976): Economic Geography, Prentice Hall of India. New Delhi.
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3. Berry, Conkling & Ray (1988): Economic Geography Prentice Hall of India, New Jersey.
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5. Dicken, P. (2007): Global Shift: Mapping the Changing Contours of the World Economy (London: Sage, 2007) fifth edition [ISBN 9781593854362].
6. Dicken, P. and P. Lloyd (1990): Location in Space: Theoretical Perspectives in Economic Geography. (New York: Harper Collins Publishers, 1990) third edition [ISBN 9780060416775].
7. Haggett, Peter: Modern Synthesis in Geography.
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9. Hurst Elliott (1986): Geography of Economic Behaviour, Unwin, London.
10. Johnson R.J. & Taylor D.J. (1989): A world in crisis, Basil-Blackwell, Oxford.
11. Knox, P. and J. Agnew (2008): The Geography of the World Economy. (London: Arnold;
12. Losch (1954): Economics of Location, Yale University Press New York.

13. MacKinnon, D. and A. Cumbers (2007): An Introduction to Economic Geography: Globalization, Uneven Development and Place. (Harlow: Pearson/Prentice Hall, 2007) [ISBN 9780131293168].
14. Redcliff, M. (1987): Development & the environmental crisis. Methuen. London.
15. Robinson H & Bamford C. G. (1978): Geography of Transport, Macdonald & Evans USA.
16. Sinha B.N.(1971): Industrial geography of India
17. Watts H.D. (1987): Industrial Geography, Longman scientific and Technical, New York.

CC-104: Geography of Population and Human Resource Development

Course Outcomes (COs): After completing the course, the students will develop an aptitude to:

1. Infer factors influencing population distribution and growth.
2. Acquire skill to describe regional patterns of population composition.
3. Compute and explore fertility, mortality, migration and human development levels for micro, meso and macro regions.
4. Analyse the population-resource regions and discover problems arising due to over and under population.
5. Understand and create awareness about provincial aspects of gender equity, social well-being and quality of life.

Unit-1: Introduction

15 Lectures

Meaning, nature, scope and significance of Population Geography; Sources of population data; Factors influencing population distribution and density-global perspective; Population distribution and growth – measures, patterns and determinants with reference to World, India and States; Population composition and change: India and States - Demographic, Socio-Cultural, Economic, Health.

Unit-2: Population Processes

20 Lectures

Fertility: Concepts, Determinants, Measures, Trends and Methods of estimation - India; Mortality: Concepts, Determinants, Measures, Trends and Methods of estimation - India; Migration: Types, Determinants and consequences; Measures and methods of estimations.

Unit-3: Population Theories

10 Lectures

Theories of population growth: Malthus, Marx, Demographic Transition Model; Migration theories: Ravenstein and Everette Lee; Epidemiological Transition.

Unit-4: Population Development and Policies

15 Lectures

Population as resource, concepts of over, under and optimum population, population and development debate, population as ecosystem, Limits to Growth, Population resource regions, Human development: Concepts, Pillars, Approaches; Human development pattern - World & India, Gender Equity; Social well-being and quality of life, Status of Women – social, economic and health; Population Policies - perspectives from developed and developing world, National Population Policy of India.

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International Migration Review: <https://journals.sagepub.com/home/mrx>

Journal of Population Research: <https://link.springer.com/journal/12546>

Population and Environment: <https://link.springer.com/journal/11111>

Population Bulletin: <https://www.prb.org/population-bulletins/>

Population Development Review: <https://onlinelibrary.wiley.com/loi/17284457>

Population, Space, and Place: <https://onlinelibrary.wiley.com/journal/15448452>

Population Studies: <https://www.tandfonline.com/loi/rpst20>

Studies in Family Planning: <https://onlinelibrary.wiley.com/journal/17284465>

The Professional Geographer: <https://www.tandfonline.com/loi/rtpg20>

Useful Websites:

Census of India: <http://censusindia.gov.in/>

National Commission for Women: <http://ncwapps.nic.in/default.aspx>

Population Council: <https://www.popcouncil.org/>

Population Division of United Nations: <https://www.un.org/en/development/desa/population/index.asp>

Population Reference Bureau: www.prb.org

The World Bank: www.worldbank.org

United Nations Development Program: <http://hdr.undp.org/en/>

CCPr-105.1: Practicals in Geomorphology and Surveying

Course Outcomes (COs): After completing the course, students will be able to

1. Know the methods of representation of relief.
2. Understanding the topographical maps.
3. Identification and mapping of drainage patterns.
4. Look into the drainage basin morphometry.
5. Understand the field surveying methods.

Unit-1: Maps, Relief Representation and Mapping of Landforms**25 Hrs.**

1. Map definition and types of maps.
2. Classification of maps based on scale.
3. Classification of maps based on purpose.
4. Indexing of Topographical sheets.
5. Methods of Representation of Relief: Pictorial, Hachures, Hill shading, Shadow method.
6. Mathematical. Spot height, Bench marks, Trigonometrical station, Contours, Formlines etc.
7. Identification and Mapping of Landforms from Topographical Maps: Ridge; Saddle; Col.; Pass; Spur; Plateau; Escarpment; Cliff; Waterfall; River Terraces; 'U' shaped Valley; 'V' shaped Valley.
8. Profiles: Analysis of Cross Profiles, Profile projected, Profile superimposed, Profile composite.
9. Longitudinal Profile.

Unit-2: Drainage Basin Analysis**25 Hrs.**

- 10-14. Identification & Mapping of Drainage Patterns: Dendritic; Trellis, Radial Drainage Patterns.
15. Sinuosity Index of Straight Channel.
16. Sinuosity Index of Sinuous Channel.
17. Sinuosity Index of meandering channels.
18. Drainage Basin Morphometry.
19. Strahler Stream Order system.
20. Calculation of Bifurcation Ratio.
21. Calculation of Drainage density.
22. Calculation of Stream Frequency.

Unit-3: Field Surveying**30 Hrs.**

23. Introduction to field surveying.
- 24-27. Theodolite survey: Components and working principle of instrument, Measurement of Distance, Height and Area.
- 28-31. Total Station Survey: Components and working principle of instrument, Measurement of Distance, Height and Area.
- 32-35. DGPS Survey: Components and working principle of instrument, Measurement of Distance, Height and Area.
36. Introduction to drone surveying.

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14. Singh, S. (1998): Geomorphology, Prayag Pustak Bhawan, Allahabad.
15. Goudie, A. (1990): Geomorphological Techniques, Routledge, London

CCPr-105.2: Analysis of Climatic Data

Course Outcomes (COs): After completing the course, students will be able to

1. Identify various sources of climate data
2. Understand the formats of Indian daily weather report and reading of weather signs and symbols
3. Represent meteorological elements diagrammatically and interpretation of results.
4. Know methods of measurement of meteorological elements
5. Analyse interrelationship between various meteorological elements
6. Analyse present and future trends of meteorological elements.

Unit-1: Basics of Climatic Data Analysis**20 Hrs.****Practical Exercise(s):**

- 1-2: Climatic data: Sources and measurements.
- 3: Weather details: Weather Signs & symbols.
- 4-6: Reading and interpretation of weather maps of representative seasons.

Unit-2: Diagrammatic Depiction of Meteorological Elements**30 Hrs.****Practical Exercise(s):**

- 7-10: Construction and interpretation of Wind Rose Diagrams- Simple, Compound, Octagonal.
- 11: Interpolation of Isoleth.
- 12-14: Depiction and Interpretation of Comfort diagrams- Climograph, Hythergraph, Climatograph.
- 15-17: Time series analysis- Preparation of trend graphs- Moving averages (three years and five years), Semi-average line.

Unit-3: Analysis of Interrelationship: Meteorological Elements**30 Hrs.****Practical Exercise(s):**

- 18: Spatial correlation of climatic variables: Graphical analysis.
- 19: Water budget: Graphical analysis.
- 20: Hydrograph.
- 21: Analysis of upper air data- Tephigram (Temperature Height diagram).
- 22: Ergographs (Crop Calendar).
- 23-24: Dispersion graphs: Temperature and rainfall dispersion Diagram.

References:

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2. Carbone Greg (2015): Exercises for Weather & Climate (9th Edition) ISBN-10: 0134041364, ISBN-13: 978-0134041360.
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Websites:

- *India Meteorological Department: <http://www.imd.gov.in>*
- *Intergovernmental Panel on Climate Change: <https://www.ipcc.ch/>*
- *NASA-Climate Change and Global Warming: <https://climate.nasa.gov/>*
- *NCDC-NOAA: <https://www.ncdc.noaa.gov/sotc/>*
- *World meteorological organization: <http://worldweather.wmo.int>*
- *India water portal: <https://www.indiawaterportal.org>*

CCPr-105.3: Analysis of Socio-Economic Data

Course Outcomes (COs): After completing the course, students will be able to

1. Identify the importance of population studies regarding the fertility, mortality.
2. Understand the socio-economic structure of population.
3. Study various statistical methods for analysis of Agricultural activities.
4. Determine the agriculture productivity and analyze results.
5. Get basic understanding of the economic data and its analysis.

Unit-1: Population Data Analysis**40 Hrs.****Practical Exercise(s):**

- 1: Choropleth maps: Mapping of Socio-Economic Phenomena.
- 2: Dot method & its relevance to distribution maps.
- 3: Maps with proportional circles.
- 4: Maps with divided proportional circles.
- 5: Maps with proportional spheres.
- 6-7: Fertility measures- Crude Birth Rate, General Fertility Rate.
- 8-9: Mortality measures- Crude Death Rate, Infant Mortality Rate.
- 10-11: Literacy measures-Crude Literacy Rate, Gross Enrolment Ratio.
- 12-13: Measures of population Growth.
- 14-15: Age & Sex Pyramid: Compound and Superimposed pyramid.

Unit-2: Agricultural Data analysis**20 Hrs.****Practical Exercise(s):**

- 16-17: Calculation of Crop Concentration index: Locational quotient method by Bhatia, Jasbir Singh Method.
- 18: Calculation of Crop Diversification index: Bhatia's Method.
- 19-20: Identification and interpretation of Crop Combination index by Weaver and Doi methods.

Unit-3: Economic Data analysis**20 Hrs.****Practical Exercise(s):**

- 21-22: Trade area delimitation- Breaking Point Theory, Law of Retail Gravitation.
- 23: Construction of Flow line charts & maps of transport flows.
- 24-25: Logarithmic & Semi-logarithmic graphs.

References:

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2. Mishra, R.P. (1982): Fundamentals of cartography, Prasaranga, University of Mysore.
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CC-201: Development of Modern Geographical Thought

Course Outcome (COs): After completion of this course, the students will

1. Acquire knowledge about the historical development of the subject during different time scales.
2. Apprehend the place of geography in the field of science, social science and natural science.
3. Understand all the concepts of philosophy in geography.
4. Recognize different types of dualism and find solutions to terminate them by applying various types of scientific explanations.

Unit-1 Introduction

20 Lectures

General nature of geographic knowledge during the Ancient and Medieval period; Field of Geography; its place in classification of science; geography as a social and natural science; relationship of geography with other disciplines; concepts in philosophy of geography; Areal differentiation and Spatial organization.

Unit-2 Dualism in Geography

10 Lectures

Dualism in Geography: systematic and regional; physical and human; idiographic and nomothetic; concept of determinism and possibilism.

Unit-3 Modern Geography

10 Lectures

Founders of Modern Geography with special reference to: i) Bernhardus Varenius, ii) Immanuel Kant, iii) Alexander Von Humboldt, iv) Friedrich Ratzel, v) Carl Ritter, vi) Richard Hartshorne. Trends in development of geography as a discipline in India.

Unit-4 Scientific Explanations and Approaches

20 Lectures

Scientific Explanations: routes to scientific explanations (inductive / deductive); types of explanations (cognitive, description, cause and effect, temporal); theories, laws and models; quantitative revolution; Approaches: Humanism, Behaviouralism, and Feminism; Recent trends in Geography.

References:

Books & Reports:

1. **Abler**, Adams, J. & Gould, P. (1971): Spatial Organization. The Geographer's View of the World, Prentice Hall, New Jersey.
2. **Adhikari**, Sudeepta (1972): Fundamentals of Geographic Thought, Chaitanya Publishing House, Allahabad.
3. **Amedeo**, Douglas (1971): An Introduction to Scientific Reasoning in Geography, John Wiley, U.S.A., 1971.
4. **Braithwaite**, E.B (1960): Scientific Explanation, Harper Torch Books, New York.
5. **Chorley & Haggett** (1968) Models in Geography, Methuen & Co. Ltd. London
6. **Dickinson**, R.E. (1969): The Makers of Modern Geography, Hall Book Depot, Bhopal Prentice-Hall of India, New Delhi. (English and Hindi).
7. **Dikshit**, R. D. (2018): Geographical Thought: A Contextual History Of Ideas, PHI Learning, Delhi.
8. **Dixit**, R.D. (1999): The Arts and Science of Geography, Integrated Readings; Prentice Hall Of India Private Ltd, New Delhi.
9. **Freeman**, T.W. (1965): Geography As Social Science, Harper International Edition Harper & Row, Publishers, New York.
10. **Gold**, J.R. (1980): An Introduction to Behavioural Geography, Oxford University Press, Oxford.
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27. **Pickles, I. (1985)**: Phenomenology, Science and Geography: Spatiality and The Human Sciences, Cambridge, Cambridge University Press.
28. **Singh, R.L. (2008)**: Fundamentals of Human Geography, Sharada Pustak Bhawan, Allahabad.
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30. **Taylor, G (1951)**: Geography in the 20th Century, Methuen and Co. Ltd., London
31. **Unwin, T. (1992)**: The Place of Geography, Longman, UK.

Journal Articles:

1. **Brosseau, M. (1994)** 'Geography's literature', *Progress in Human Geography*, 18: 333-53.
2. **Bunge, W. (1979)** The Science of Geography, *Annals, Association of American Geographers*, 69:128-32.
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5. **Fennemen, N.M. (1919)** The circumference of Geography, *Annals of Association of American Geographers*, IX. Pp 3-11
6. **Peet, R. (1985)**: The Social Origin of Environmental Determinism, *Annals of Association of American Geographers*, 75:309-83.
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CC-202: Geohydrology and Oceanography

Course Outcomes (COs): After completing the course, students will be able to

1. To know about the development of methods of scientific observation in hydrology and Oceanography;
2. To understand the origin, importance and distribution of water on Earth;
3. To learn about the hydro-geological, coastal and marine processes, landforms and resources;
4. To recognize the role of oceans to deal with the vulnerability of the dynamic earth system;
5. To comprehend about the recent trends in research in Geohydrology and Oceanography;

Unit-1: Groundwater and Basin Hydrology

15 Lectures

Introduction to Geohydrology; Distribution of surface and subsurface water resources on Earth; Hydrological cycle; Groundwater: occurrence, movement and management; Hydrological characteristics of aquifers; Basin hydrology: precipitation, evaporation, infiltration and run-off; Unit hydrograph; Groundwater regimes in India and Maharashtra.

Unit-2: Applied Geohydrology

10 Lectures

Groundwater exploration and water pollution with special reference to India; Problems related to water use; Fresh and salt water relationship in coastal and inland areas; Conservation and planning for the development of water resources; Watersheds and Wetlands in India.

Unit-3: Geological Oceanography

15 Lectures

Introduction to Oceanography; Origin and evolution of ocean basins: theory of plate tectonics and seafloor spreading; Topography of the ocean floor: continental shelf, slope, rise, submarine channels, hills, ridges, trenches and abyssal plains; Bottom relief of Pacific, Atlantic and Indian Ocean; Origin and evolution of island arcs; Estuarine & coastal processes and landforms.

Unit-4: Physical, Chemical and Biological Oceanography

20 Lectures

Air-sea interaction and ocean circulation: currents, waves and tides; Currents of Pacific, Atlantic, & Indian Ocean; Properties of oceanic water: chemical composition, salinity, temperature, and density; Major water masses of the World's Ocean; Thermohaline circulation and the oceanic conveyor belt; Biological productivity in the Ocean; Origin and growth of coral reefs; Ocean deposits: origin, type and distribution; Sea level changes; Oceanic regions; Marine resources; Marine pollution.

References:

Books & Reports:

1. **Cech, T.V. (2009):** *Principles of Water Resources: History, Development, Management, and Policy (3rd Ed.)*, Wiley, Hoboken, New Jersey, 576pp.
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Research Journals:

Advances in Water Resources (<https://www.sciencedirect.com/journal/advances-in-water-resources>)
Annual Review of Marine Science (<https://www.annualreviews.org/journal/marine>)
Hydrology and Earth System Sciences: <https://www.hydrol-earth-syst-sci.net/>
Hydrogeology Journal: <https://www.springer.com/journal/10040>
ICES Journal of Marine Science: <https://academic.oup.com/icesjms>
Indian Journal of Geo-Marine Sciences: <http://nopr.niscair.res.in/handle/123456789/3>
Journal of Geophysical Research: <https://agupubs.onlinelibrary.wiley.com/journal/21562202>
Journal of Hydrology: <https://www.sciencedirect.com/journal/journal-of-hydrology>
Journal of Water Resource Planning and Management: <https://ascelibrary.org/journal/jwrmd5>
Limnology and Oceanography: <https://aslopubs.onlinelibrary.wiley.com/journal/19395590>
Marine and Petroleum Geology: <https://www.sciencedirect.com/journal/marine-and-petroleum-geology>
Nature Geoscience: <https://www.nature.com/ngeo/>
Oceanography: <https://www.tos.org/oceanography/>
Progress in Oceanography: <https://www.sciencedirect.com/journal/progress-in-oceanography>
Water Research: <https://www.sciencedirect.com/journal/water-research>
Water Resources Research: <https://agupubs.onlinelibrary.wiley.com/journal/19447973>

Websites:

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Central Water Commission, India: <http://cwc.gov.in/>
National Ocean Service (NOAA): <https://oceanservice.noaa.gov/>
UN Atlas of the Oceans: <http://www.oceansatlas.org/>
NGDC-NOAA, Marine Geology & Geophysics: <https://www.ngdc.noaa.gov/mgg/>
Indian National Centre for Ocean Information Services: <https://www.incois.gov.in/>

CCS-203: Advanced Cartography and Surveying

Course Outcomes (COs): After completing the course, students will be able to

1. Understand basic principles of cartography and surveying
2. Gain understandings of various cartographic methods and techniques
3. Acquaint with the skills of digital cartography
4. Identify sources and types of errors occurs during surveying
5. Get familiar with the basic aspects of linear, vertical and angular measurements of surveying.

Unit - 1: Fundamentals of Cartography

15 Lectures

Definition, nature and scope of cartography, History of cartography, Basics of geodesy, Scale- definition, types & importance, Concept of datum- vertical and horizontal, Co-ordinate systems- geographical and projected, Map- definition, types and significance, Cartographic methods and techniques for representation of data.

Unit - 2: Digital Cartography

20 Lectures

Introduction to digital cartography, Manual cartography vs. Digital cartography, Cartographic data and its sources, Cartographic database, Design principles of cartography, Map design, Symbolization, Visualization and generalization, Digital cartography- hardware and software, Advantages and disadvantages, Applications of digital cartography.

Unit - 3: Fundamentals of Surveying

10 Lectures

Definition, classification and principles of surveying, Nature of surveying work- field work and office work, Sources and types of errors, Precision and accuracy, Units of measurements.

Unit - 4: Surveying Measurements

15 Lectures

Linear measurement-types of ranging, Methods- approximate, direct, optical and electronic, Errors and applications, Angular measurement-types of measured angles, Compass, Meridian, Bearings and azimuths, Errors, Corrections and precautions, Vertical measurement-types and methods of leveling, Contouring- definition, characteristics, methods and interpolation.

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Websites:

Indian Institute of Surveying & Mapping: <http://www.iism.nic.in/>

Survey of India Department of Science & Technology: <http://www.surveyofindia.gov.in/>

Indian National Cartographic Association: <https://incaindia.org/>

Bhuvan Indian Geo Platform of ISRO: <https://bhuvan.nrsc.gov.in/>

CCS-204: Social and Cultural Geography

Course outcomes (Cos): After completing the course, students will be able to

1. Study and identify the philosophical base, problems associated with society & its culture.
2. Know about the culture, cultural regions, hearths and their diffusion, realms, and distribution of races.
3. Study and knowing of socio-cultural diversity of India, and processes of social changes.
4. Understand the social justice and well-being of society, to find out the level of well-being in India.

Unit-1: Social Geography

15 Lectures

Philosophical bases of Social and Cultural Geography. Definition, scope, and significance of Social and Cultural Geography. Roots of Social Geography and social problem, housing space and society, and geography of poverty.

Unit-2: Races and Culture

15 Lectures

Concept of race. Basis of racial classification and their physical characteristics. Races of India. Griffith Taylor and C.S. Coon's Theories of distribution of races of mankind in the world. Concept of culture, culture areas and culture regions, Cultural hearths and their diffusion, World Culture Realms.

Unit-3: Socio-cultural Diversity

15 Lectures

Concept of Dialects and ethnicity. Distribution of Religion, Caste, Tribe, Languages in India. Concept of social areas, North-South Socio-Cultural diversity of India, Processes of Social changes: Modernization, Sanskritization and Globalization.

Unit-4: Social Justice and Well-being

15 Lectures

Concept of social Justice and fair society, Equality and welfare, social development and well-being, Indicators for measurement, Levels of well-being in India, Women empowerment, Social status of women in India.

References:

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CCPr-205.1: Computer Applications in Geography

Course Outcomes (COs): After completing the course, students will be able to

1. Learn the representation of geographic data using various computational methods;
2. Develop writing, editing, and presentation skill for representation of geographical information;
3. Compute statistical parameters with the help of computer;
4. Prepare and design maps and graphs with the help of computer software;
5. Apply computational techniques relevant in the discipline of Geography;
6. Know about sources and uses of online educational resources and e-learning methods;

Unit-1: Geographic data: types and sources; Computer hardware and software; Writing / formatting of texts, graphs, tables, and references using MS word; Preparation of power point presentation using MS power point; Computation of statistical parameters using MS excel. **40 Hrs.**

Practical Exercise(s):

- 1: Description with examples about geographic data types and sources.
- 2: Illustration of computer hardware and their uses.
- 3: Demonstration of useful software packages/ programs and their application.
- 4: Writing / formatting of text paragraphs.
- 5: Inserting, creating, and editing of text box, smart art, pictures and graphs.
- 6: Construction and editing of tables (with and without formatting).
- 7: Reference writing styles using MS word with examples.
- 8: Preparation of MS power point presentation.
- 9: Measures of central tendency: Computation of average, median and mode.
- 10: Measures of central tendency: Calculation of weighted mean.
- 11: Measures of position: Estimation of quartiles, deciles, and percentiles.
- 12: Measures of variation: Computation of range, variance, and standard deviation.
- 13: Calculation of co-relation coefficient.

Unit-2: Presentation and analysis of geographic data (physical and socio-economic) using graphs, charts, maps and map labeling with the help of computer. **25 Hrs.**

Practical Exercise(s):

- 14-18: Presentation and analysis of geographic data using MS Excel – preparation of graphs/charts (bar graph, line graph, pie diagram, scatter diagram and trend line).
- 19: Co-relation and regression analysis using MS Excel.
- 20: Presentation and illustration of geographic data – preparation of maps with labeling.
- 21-22: Presentation and analysis of geographic data using Origin and SPSS.

Unit-3: Online educational resources; E-learning.

15 Hrs.**Practical Exercise(s):**

- 23: Identification, browsing, and storing/ retrieving of online educational resources.
- 24: Comprehensive browsing and listing of useful geographical websites.
- 25: E-learning objectives, methods, and listing of open online e-learning websites.
- 26: E-learning through e-content: e-PG Pathshala.
- 27: E-learning through open online courses: MOOCS – SWAYAM.

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e-PG Pathshala: <https://epgp.inflibnet.ac.in/>

MOOCS - NPTEL: <https://nptel.ac.in/>

MOOCS - SWAYAM: <https://swayam.gov.in/>

National Digital Library of India: <https://ndl.iitkgp.ac.in/>

Shivaji University Library (E-Resources): <http://www.unishivaji.ac.in/library/E-Resources>

CCPr-205.2: Statistical Techniques in Geography

Course Outcomes (COs): After completing the course, students will be able to

1. Understand the importance and use of statistical techniques in geography
2. Form frequency distributions tables and graphically interpret the results.
3. Measure central tendency and dispersion of data.
4. Examine relationship between two or more variables with correlation and regression analysis.
5. Apply comprehensive knowledge of statistics for analysis of geographical data

Unit-1: Basics of Statistics**20 Hrs.****Practical Exercise(s):**

- 1: Definitions of statistics
- 2: Importance and use of statistical techniques in geography
- 3: Types and sources of statistical data in geography
- 4: Formation of frequency distribution table
- 5-8: Graphical representation of frequency distribution using Histogram, Frequency Polygon, O give curve, Cumulative percentage curve

Unit-2: Measures of Statistics**30 Hrs.****Practical Exercise(s):**

- 9-12: Measures of central tendency using simple, discrete and continuous data: Mean, Median and Mode.
- 13-15: Measures of position: Estimation of quartiles, deciles and percentiles.
- 16-19: Measures of dispersion: Absolute measurements- Mean deviation, Quartile deviation, and Standard deviation.
- 20-24: Relative measurements: Coefficient of mean deviation, Coefficient of quartile deviation, Coefficient of variations, Index variability and Relative variability.

Unit-3: Analysis of Statistical Relationship**30 Hrs.****Practical Exercise(s):**

- 25-26: Skewness: Karl Pearson's and Bowley's methods
- 27: Kurtosis
- 28-30: Correlation analysis: Spearman's rank order correlation and Pearson product moment correlation, Kendall rank correlation coefficient.
- 31-32: Regression analysis: Simple and Multiple Regression
- 33: Least square method.

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CCPr-205.3: Quantitative Techniques in Geography

Course Outcomes (COs): After completing the course, students will be able to

1. Understand correlation and regression among spatio-temporal data
2. Learn what is Spatial Analysis
3. The Measurement Levels and Spatial Data
4. Measures probability
5. Become expert in techniques for analysis of data in research
6. Exploratory Data Analysis

Unit-1: Introduction to Quantitative Techniques and Probability Distribution**30 Hrs.**

1. Elementary Probability Theory
2. Random Variables and Probability Distribution
3. Normal Distribution
4. Binomial Distribution
5. Poisson Distribution
6. Baye's Theorem

Unit-2: Hypothesis Testing in a Geographical Context, Use of Non-parametric Tools in Spatial Analysis.**35 Hrs.**

7. Point and Interval Estimation
8. Key Steps in Testing Hypothesis
9. PROB-Value Method of Hypothesis Testing
10. Statistical Significance
11. Two Samples: The t Test
12. Analysis of Variance (ANOVA)
13. Sign Test
14. Man – Whitney test
15. Kruskal – Wallis analysis of variance
16. Chi-square test
17. Kolmogorov-Smirnov D. Contingency Tables

Unit-3: Models & Theories in Geography**15 Hrs.**

18. Importance of models in geography
19. Models as quantitative techniques
20. Simulation models
21. Gravity models
22. Transportation model

Reference:

1. **Cole, J.P. & King, C.A.M.** (1968): *Quantitative Techniques in Geography*. John Wiley & sons Inc. New York.
2. **R Hammond & P S McCullagh** (1978): *Quantitative techniques in Geography An Introduction (2nd Ed.)*, Oxford University Press, USA, 384pp.
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