

**Rayat Shikshan Sanstha's**  
**SADAGURU GADAGE MAHARAJ COLLEGE KARAD**  
Accredited By NAAC with 'A+' Grade  
**An Autonomous College**  
**Department of Geography**



**[Affiliated to Shivaji University, Kolhapur]**



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

**Implemented From...**

**Part II (Level 9): Academic Year 2024 -25 onwards**

**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)**

<b>SEMESTER-III (Duration- Six Month)</b>										
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
1	N-GEOC22-26	4	4	4	80	32	3	20	8	1
2	N-GEOC22-27	4	4	4	80	32	3	20	8	1
3	N-GEOO22-23	4	4	4	80	32	3	20	8	1
4	N-GEOP22-25	4	8	4	100	40	5	--	--	--
5	N-GEOP22-26	2	4	2	50	20	2:30	--	--	--
6	N-GEORP22-21	4	8	4	80	32	4	20	8	*
<b>Total (C)</b>		--	<b>32</b>	<b>22</b>	<b>470</b>	<b>--</b>	<b>--</b>	<b>80</b>	<b>--</b>	<b>--</b>
<b>SEMESTER-IV (Duration- Six Month)</b>										
1	N-GEOC22-28	4	4	4	80	32	3	20	8	1
2	N-GEOC22-29	4	4	4	80	32	3	20	8	1
3	N-GEOO22-24	4	4	4	80	32	3	20	8	1
4	N-GEOP22-27	4	8	4	100	40	5	--	--	--
5	N-GEORP22-22	6	12	6	120	48	6	30	12	*
<b>Total (D)</b>		--	<b>32</b>	<b>22</b>	<b>460</b>	<b>--</b>	<b>--</b>	<b>90</b>	<b>--</b>	<b>--</b>
<b>Total (C+D)</b>				<b>48</b>	<b>930</b>	<b>--</b>	<b>--</b>	<b>170</b>	<b>--</b>	<b>--</b>

**Note(s):**

•Student contact hours per week : <b>32 Hours (Min.)</b>	•Total Marks for M.A./M.Sc.-II: <b>1100</b>
•Theory Lectures <b>60 Minutes</b> Each and Practical Lectures <b>120 Minutes</b> Each	•Total Credits for M.A./M.Sc.-II (Semester III & IV): <b>44</b>
<ul style="list-style-type: none"> <li>•MT- Mandatory Theory Course</li> <li>•ET- Elective Theory Course</li> <li>•MP- Mandatory Practical Course</li> <li>•EP- Elective Practical Course</li> <li>•FP/OJT- Field Project / On Job Training</li> <li>•RP- Research Project</li> </ul>	<ul style="list-style-type: none"> <li>• Theory and Practical examination will be conducted at the end of respective semester.</li> <li>•Practical courses may be divided into sub-sections.</li> <li>•*Duration of practical examination as per respective BOS guidelines.</li> <li>•<i>Separate passing is mandatory for Theory and Practical examination as well as University and Internal assessment.</i></li> </ul>
<b>•Requirement for Entry at Level 9:</b> <ol style="list-style-type: none"> <li>1) Completed all requirements of the relevant Post Graduate Diploma (Level 8) in Geography</li> <li>2) Bachelor's Degree (Honours / Research) (Level 8) in Geography</li> </ol>	
<b>•Exit Option at Level 9:</b> Students can exit after Level 9 with Master's Degree in Geography if he/she completes the course equivalent to minimum of 88 credits.	

**Course Structure (CBCS): M.A./M.Sc. Geography Part-I ( Level-8) and Part – II (Level-9)**

Course Type	Subject Code	Subject/ Title of Paper	Teaching Hrs/Week	Credits
<b>Semester - I</b>				
Mandatory Theory	N-GEOC22-21	Geomorphology	4	4
	N-GEOC22-22	Principles of Climatology	4	4
	N-GEOC22-23	Economic Geography	4	4
Elective Theory	N-GEOO22-21	Population Geography and Human Resource Development	4	4
Mandatory Practical	N-GEOP22-21	Research Methodology in Geography	8	4
	N-GEOP22-22	Computer Applications in Geography	4	2
<b>Total Credits Cumulative</b>				<b>22 (22)</b>
<b>Semester - II</b>				
Mandatory Theory	N-GEOC22-24	Advanced Cartography and Surveying	4	4
	N-GEOC22-25	Climate Change and Disaster Management	4	4
Elective Theory	N-GEOO22-22	Fundamentals and Applications of GIS and GPS	4	4
Elective Practical	N-GEOP22-23	Introduction to GIS Software and GPS	8	4
Mandatory Practical	N-GEOP22-24	Advanced Surveying	4	2
Field Project / On Job Training	N-GEOFP22-21	Field Project / On Job Training (during vacation)	8	4
<b>Total Credit (Cumulative)</b>				<b>22 (44)</b>
<b>Semester - III</b>				
Mandatory Theory	N-GEOC22-26	Geohydrology and Oceanography	4	4
	N-GEOC22-27	Fundamentals of Remote Sensing and DIP	4	4
Elective Theory	N-GEOO22-23	Geography of Environment	4	4
Mandatory Practical	N-GEOP22-25	Photogrammetry, Remote Sensing and DIP	8	4
	N-GEOP22-26	Statistical Techniques in Geography	4	2
Research Project	N-GEORP22-21	Research Project – I	8	4
<b>Total Credit (Cumulative)</b>				<b>22 (66)</b>
<b>Semester - IV</b>				
Mandatory Theory	N-GEOC22-28	Regional Planning and Development	4	4
	N-GEOC22-29	Development of Geographical Thought	4	4
Elective Theory	N-GEOO22-24	Agricultural Geography	4	4
Elective Practical	N-GEOP22-27	Geographical Data Representation Methods	8	4
Research Project	N-GEORP22-22	Research Project II (Dissertation)	12	6
<b>Total Credit (Cumulative)</b>				<b>22 (88)</b>

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**M.A./M.Sc. Geography (Part II) (Level – 6.5) (Semester III)**  
**(NEP – 2020)**

**Title of Course: Geohydrology and Oceanography**

**Course Code: N-GEOC22-26**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Know about the development of methods of scientific observation in hydrology and Oceanography;
2. Understand the origin, importance and distribution of water on Earth;
3. Learn about the hydro-geological, coastal and marine processes, landforms and resources;
4. Recognize the role of oceans to deal with the vulnerability of the dynamic earth system;
5. 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 characteristics of aquifers; Groundwater: occurrence, movement and management; Basin hydrology and hydrological cycle: precipitation, evaporation, infiltration and run-off; Hydrograph; Groundwater regimes in India and Maharashtra.

**Unit-2: Applied Geohydrology**

**09 Lectures**

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

**Unit-3: Geological Oceanography**

**14 Lectures**

Introduction to Oceanography; Origin and evolution of ocean basins; 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**

**22 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.
  2. **Chow, V.T., Maidment, D.R., and Mays, L.W. (2010):** *Applied Hydrology*, McGraw-Hill, Chennai, 572pp.
  3. **Christopherson, R.W. (2012):** *Geosystems: An Introduction to Physical Geography (8th Ed.)*, Prentice Hall, New Jersey, 693pp.
  4. **Davie, T., and Quinn, N.W. (2019):** *Fundamentals of Hydrology (3rd Ed.)*, Routledge, New York, 285pp.
  5. **Davis, R., and Fitzgerald, D. (2003):** *Beaches and Coasts*, Wiley-Blackwell, Hoboken, New Jersey, 432pp.
  6. **Day, T. (2008):** *Oceans (Rev. Ed.)*, Facts on File, New York, 337pp.
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7. **Fitts, C.R. (2002):** *Groundwater Science*, Academic Press, 450pp.
  8. **Garrison, T. (2009):** *Essentials of Oceanography (5th Ed.)*, Brooks/Cole, Belmont, California, 463pp.
  9. **Garrison, T. and Ellis, R. (2016):** *Oceanography: An Invitation to Marine Science (9th Ed.)*, Cengage Learning, Boston, 604pp.
  10. **Han, D. (2010):** *Concise Hydrology*, Dawai Han and Ventus Publishing, 145pp.
  11. **Pinder, G.F., and Celia, M.A. (2006):** *Subsurface Hydrology*, Wiley, Hoboken, New Jersey, 485pp.
  12. **Pinet, P.R. (2009):** *Invitation to Oceanography (5th Ed.)*, Jones and Bartlett Publishers, Sudbury, Massachusetts, 609pp.
  13. **Raghunath, H.M. (2006):** *Hydrology: Principles, analysis and Design (2nd Ed.)*, New age International, New Delhi, 477pp.
  14. **Schwartz, F.W., and Zhang, H. (2002):** *Fundamentals of Ground Water*, Wiley, Hoboken, New Jersey, 592pp.
  15. **Skinner, B.J., and Murck, B.W. (2011):** *The Blue Planet: An Introduction to Earth System Science (3rd Ed.)*, Wiley, Hoboken, New Jersey, pp. 221-319.
  16. **Sverdrup, K., and Armbrus, V. (2008):** *Introduction to the World's Oceans (10th Ed.)*, McGraw-Hill, New York, 528pp.
  17. **Sverdrup, K.A., and Kudela, R.M (2020):** *Investigating Oceanography (3rd Ed.)*, McGraw-Hill, New York, 511pp.
  18. **Todd, D.K., and Mays, L.W. (2012):** *Groundwater Hydrology (3<sup>rd</sup> Ed.)*, Wiley India, New Delhi, 636pp.
  19. **Trujillo, A.P., and Thurman, H.V. (2018):** *Essentials to Oceanography (12th Ed.)*, Pearson, Boston, 597pp.
  20. **Viessman, W., and Lewis, G.L. (2002):** *Introduction to Hydrology (5th Ed.)*, Prentice Hall, New Jersey, 612pp.

#### **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:**

*Central Ground Water Board (CGWB), India*: <http://cgwb.gov.in/>  
*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/>

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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester III)  
(NEP – 2020)**

**Title of Course: Fundamentals of Remote Sensing and DIP**

**Course Code: N-GEOC22-27**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Understand the principles and concepts of remote sensing and its role in capturing and analyzing Earth's data.
2. Describe the different types of remote sensing platforms, sensors, and image acquisition systems used in the field.
3. Interpret and analyze aerial photographs and satellite images using visual interpretation techniques.
4. Apply digital image processing techniques for feature extraction, including texture, shape, and spectral indices.
5. Explore emerging trends and technologies in remote sensing and digital image processing.

**Unit-1: Introduction & Principles of Remote Sensing**

**20 Lectures**

Definition and scope of remote sensing; History and development of remote sensing technology; Electromagnetic radiation (EMR) and electromagnetic spectrum; EMR interaction with atmosphere and earth surface; Atmospheric window and spectral reflectance curve; Resolutions in remote sensing; Types of remote sensing; Principles and applications of optical remote sensing.

**Unit-2: Aerial Photography**

**12 Lectures**

Aerial photographs: types, scale, & resolution; Types of aerial cameras and photographic films; Geometry of aerial photographs; Parallax, relief displacement, orthophotos; Elements of visual image interpretation.

**Unit-3: Satellite Remote Sensing**

**14 Lectures**

Satellite: types and their characteristics; Types of Sensors; Orbital and sensor characteristics of major earth resource satellites: LANDSAT, SPOT, Sentinel & Quickbird; Recent developments of Indian remote sensing satellite programme.

**Unit-4: Digital Image Processing**

**14 Lectures**

Introduction to digital image and image processing; Sources of Errors: Geometric and radiometric; Image rectification; Image classification: supervised and unsupervised.

**References:**

**Books & Reports:**

1. Aber, J.S., Marzolf, I., and Ries, J. (2010): *Small-Format Aerial Photography: Principles, Techniques and Geoscience Applications*, Elsevier, Amsterdam, 268pp.
  2. Campbell, J.B., and Wynne, R.H. (2011): *Introduction to Remote Sensing (5th Ed.)*, Guilford Press, New York, 667pp.
  3. Jensen, J.R. (2006): *Remote Sensing of the Environment: An Earth Resource Perspective (2nd Ed.)*, Prentice Hall, New Jersey, 608pp.
  4. Konecny, G. (2003): *Geoinformation: Remote sensing, Photogrammetry and Geographic Information Systems*, Taylor & Francis, London, 266pp.
  5. Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. (2007): *Remote Sensing and Image Interpretation (6th Ed.)*. Wiley, New Jersey, 804pp.
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6. Morgan, D., and Falkner, E. (2001): *Aerial Mapping: Methods and Applications (2nd Ed.)*, CRC Press, Boca Raton, Florida, 216pp.
  7. Quattrochi, D.A., and Goodchild, M.F. (1997): *Scale in Remote Sensing and GIS*, CRC Press, Boca Raton, Florida, 432pp.
  8. Reddy, M.A. (2008): *Textbook of Remote Sensing and Geographical Information System (3rdEd.)*, BS Publications, Hyderabad, 476p
  9. Sabins, F.F. (2007): *Remote Sensing: Principles and Interpretation (3rd Ed.)*, Waveland Press, Long Grove, Illinois, 512pp.
  10. Schowengerdt, R.A. (2006): *Remote Sensing: Models and Methods for Image Processing (3rdEd.)*, Elsevier, Amsterdam, 560pp.
  11. Wolf, P., DeWitt, B., Wilkinson, B. (2012): *Elements of Photogrammetry with Application in GIS (4th Ed.)*, McGraw-Hill, New York, 640pp.

**Research Journals:**

*Remote Sensing of Environment*

*ASPRS Photogrammetric Engineering and Remote Sensing*

*IJPRS Journal of Photogrammetry and Remote Sensing*

*International Journal of Remote Sensing*

*IEEE Transactions on Geosciences and Remote Sensing*

*IEEE Letters on Geosciences and Remote Sensing*

*Journal of the Indian Society of Remote Sensing*

**Websites:**

*Indian Space Research Organisation (ISRO), India: <http://www.isro.org>*

*National Remote Sensing Centre (NRSC), India: <http://www.nrsc.gov.in>*

*National Aeronautics and Space Administration (NASA), USA: <http://www.nasa.gov>*

*National Oceanic and Atmospheric Administration (NOAA), USA: <http://www.noaa.gov>*

*United States Geological Survey (USGS), USA: <http://www.usgs.gov>*

*International Society for Photogrammetry and Remote Sensing (ISPRS): <http://www.isprs.org>*

*Wikimapia: <http://www.wikimapia.org>*

*Bhuvan: <http://www.bhuvan.nrsc.gov.in>*

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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester III)**  
**(NEP – 2020)**

**Title of Course: Photogrammetry, Remote Sensing and DIP**

**Course Code: N-GEOP22-25**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Understand the fundamental principles and concepts of photogrammetry, remote sensing, and digital image processing.
2. Describe the various sensors, platforms, and techniques used in photogrammetry and remote sensing.
3. Apply photogrammetric techniques to extract three-dimensional information from aerial photographs and digital images.
4. Apply digital image processing techniques for enhancing and analyzing remote sensing data.
5. Apply the knowledge of remote sensing and DIP in various thematic studies

**Unit-1: Practicals in Photogrammetry**

**60 Hrs.**

Exercise-1: Indexing of aerial photographs.

Exercise-2: Introduction to stereoscopes

2.1: Orientation & construction of 3-D model under Pocket stereoscope

2.2: Stereoscopic Vision test

Exercise-3: Determination of scale

3.1: By establishing relationship between Photo distance and Ground distance

3.2: By establishing relationship between Photo distance and Map distance

3.3: By establishing relationship between Focal length and Flying height

3.4: Determination of Average Scale of Vertical Aerial Photograph

Exercise-4: Relief Displacement

4.1: Calculation of Relief Displacement

Exercise-5: Parallax

5.1: Object height determination from Parallax

Exercise-6: Calculation of Photo Coverage Area with Drone deploy

Exercise-7: Introduction to Photogrammetry software and generation of 3D model

**Unit-2: Practicals in Satellite Remote Sensing**

**20 Hrs.**

Exercise-8: Study of satellite image browsing system

8.1: USGS Earth Explorer

8.2: Bhuvan Data Portal

8.3: Copernicus Open Access Hub

Exercise-9: Visual interpretation of satellite images (True Color, FCC and Thermal)

**Unit-3: Practicals in DIP**

**40 Hrs.**

Exercise-10: Introduction to DIP software

Exercise-11: Loading of image data, study of histogram and layer information

Exercise-12: Layer stacking and Interpretation of FCC image

Exercise-13: Supervised Classification

Exercise-14: Unsupervised classification Exercise-15: Accuracy assessment

**References:**

1. American Society of Photogrammetry, (1983). Manual of Remote Sensing, (2nd edition), ASP, Falls Church, Virginia.
  2. Agarwal, C.S. and Garg, P.K. 2000. Textbook of Remote Sensing in Natural Resources Monitoring and Management. New Delhi: Wheeler Publishing.
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3. Avery, T.E. 1985. Interpretation of aerial Photographs. Minneapolis, Minnesota: Burgess Publishing Company.
  4. Bakker, Wim H., et al. 2001. Principles of Remote Sensing – An Introductory Textbook. Enschede, The Netherlands: ITC.
  5. Banerjee, R.K. and Banerjee, B. 2000. Remote Sensing for Regional Development. New Delhi: Concept Publishing Company.
  6. Campbell, James B. 1996. Introduction to Remote Sensing (Second Edition). London: Taylor & Francis.
  7. Colwell, Robert N. (ed.) 1983. Manual of Remote Sensing, Second Edition, Volume 1 and 2. Falls Church, Virginia: American Society of Photogrammetry.
  8. Gibson, Paul J. (2000). Introductory Remote Sensing – Principles and Concepts. Routledge.
  9. Jensen, John R. 2000. Remote Sensing of the Environment – An Earth Resource Perspective. Pearson Education (First Indian Edition, 2003).
  10. Hord, R. Michael I. 1986. Remote Sensing – Methods and Applications. (A Wiley-Interscience Publication). New York: John Wiley & Sons.
  11. Lillesand, T.M., Kiefer, R.W., and Chipman, J.W. 2004. Remote Sensing and Image Interpretation (5th Ed.). Wiley. (Wiley Student Edition).
  12. Miller, V.C. 1961. Photogeology. New York: McGraw-Hill, Book Company, Inc.
  13. Moffit, H.F., and Edward, M.M., 1980. Photogrammetry, Harper and Row Publishers, New York.
  14. Paine, D.P. 1981. Aerial Photography and Image Interpretation for Resource Management. John Wiley & Sons.
  15. Panda, B.C. 2005. Remote Sensing – Principles and Applications. New Delhi: Viva Books Private Limited.8
  16. Rampal, K.K. 1999. Handbook of Aerial Photography and Interpretation. New Delhi: Concept Publishing Company.
  17. Rashid, S.M. (Ed.) 1993. Remote Sensing in Geography. Delhi: Manak Publications, Pvt. Ltd.
  18. Reddy, M.A. 2006. Textbook of Remote Sensing and geographical Information Systems. Hyderabad: B.S. Publications.
  19. Sabins F.F Jr.1987, Remote Sensing: Principles and Interpretation, W.H.Freeman& Co., New York.
  20. Wolf. P .R., 1974 .Elements of Photogrammetry, McGraw Hill books Co., London.
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester III)**  
**(NEP 2020)**

**Title of Course: Statistical Techniques in Geography**

**Course Code: N-GEOP22-26**

**Total Credits: 02**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Understand the importance and use of statistical techniques in geography
2. Examine relationship between two or more variables with correlation and regression analysis
3. Learn statistical methods and techniques using computer
4. Apply comprehensive knowledge of statistics for analysis of geographical data

**Unit-1:**

**40 Hrs.**

**Basics of Statistics**

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

**Measures of Statistics**

- 4: Measures of central tendency using simple, discrete and continuous data: Mean, Median and Mode.
- 5: Measures of position: Estimation of quartiles, deciles and percentiles.
- 6: Measures of dispersion: Absolute measurements- Mean deviation, Quartile deviation, and Standard deviation.
- 7: Relative measurements: Coefficient of mean deviation, Coefficient of quartile deviation, Coefficient of variations, Index variability and Relative variability.

**Unit-2**

**Analysis of Statistical Relationship**

**20 Hrs.**

- 8: Skewness: Karl Pearson's and Bowley's methods
- 9: Kurtosis
- 10: Correlation analysis: Spearman's rank order correlation and Pearson product moment correlation
- 11: Regression analysis: Simple and Multiple Regression
- 12: Least square method.

**References:**

1. Alvi, Z. (1995): Statistical Geography: Methods and Applications, Rawat Publications, Jaipur
  2. Cole, J.P. & King, C.A.M. (1968): Quantitative Techniques in Geography. John Wiley & sons Inc. New York.
  3. Elhance, D.N. (1972): Fundamentals of statistics, Kitab Mahal, Allahabad.
  4. Gregory, S. (1968): Statistical methods and the geographer. Longman, London.
  5. Gupta, C.B. (1978); An introduction to statistical Methods, Vikas Pub. House, New Delhi.
  6. Hemawati: Statistical Methods for Geographers.
  7. Hoel P.G.: Elementary Statistics, Wiley, New York.
  8. King, L.J. (1991): Statistical Analysis in geography. Prentice Hall, Englewood Cliff N.J.
  9. Mahmood, A. (1977): Statistical Methods in Geographical Studies, Rajesh Publications, New Delhi
  10. Singh R. L. (1979): Elements of Practical Geography.
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester III)**  
**(NEP – 2020)**

**Title of Course: Geography of Environment**

**Course Code: N-GEOO22-23**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Know about contents and methods of Geography of Environment as an academic and professional discipline.
2. Understand elements of environment and acquire knowledge about biodiversity
3. Get knowledge about natural hazards and management
4. Understand the various environmental issues and policies

**Unit-1:**

**15 Lectures**

Concept of environment: Major elements of environment; Functioning of environmental systems: role of biotic and abiotic elements; Biodiversity: meaning, factors influencing biodiversity.

**Unit-2:**

**15 Lectures**

Ecosystem (geographic classification) terrestrial and aquatic ecosystems - location, types and characteristics; Energy flow in an ecosystem; food chain, food web and Ecological pyramids; succession; Biogeochemical cycles (carbon, nitrogen and oxygen).

**Unit-3:**

**15 Lectures**

Pollution and Environment Degradation, Meaning and concept- environmental degradation and pollution, sources, types, effects and measures of pollution in Air, Water, land, soil. Natural hazards and its impact on environment, Global Warming, International Programmes and Polices (Brundtland Commission, Kyoto Protocol, Agenda 21, Sustainable Development Goals, Paris Agreement).

**Unit-4:**

**15 Lectures**

Conservation and management of environment; Concept of sustainable development; Environment impact assessment; Meaning, Importance, needs of EIA, Environmental issues and policies in India, wild life Management, solid waste Management.

**References:**

**Books & Reports:**

1. Abbott, P.L: Natural Disasters, McGraw-Hill, London.
  2. Botkin, D.B., Keller, E.A. (2007): Environmental science: Earth as a Living Planet. John Wiley and Sons, New York.
  3. Cunningham, W. Cunningham, Mary: Environmental Science: A Global Concern (2010). MacGraw-Hill, London.
  4. Government of India (2010): Status of Environment Report. New Delhi.
  5. Keller, E.A, Vecchio, D.E.de: Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes. Prentice Hall, New York.
  6. Marsh, W.M., Grossa, J. (2005): Environmental Geography: Science, land use, and Earth Systems. John Wiley, New York.
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  19. MoEF (2006): National Environmental Policy-2006, Ministry of Environment and Forests, Government of India, New Delhi
  20. Singh, S. (1997): Environmental Geography, PrayagPustakBhawan, Allahabad
  21. UNEP (2007): Global Environment Outlook: GEO4: Environment For Development, United Nations Environment Programme

**Research Journals:**

*Energy & Environmental Science*

*Frontiers in Ecology and the Environment*

*Global Environmental Change-Human and Policy Dimensions*

*Annual Review of Environment and Resources*

*Environment International*

*Review of Environmental Economics and Policy*

*Environmental Research Letters*

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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester III)  
(NEP – 2020)**

**Title of Course: Research Project – I**

**Course Code: N-GEORP22-21**

**Total Credits: 04**

**Course Outcomes (COs):** *Upon successful completion of this course, students will be able to:*

1. *Recognize the objectives and significance of research work;*
2. *Formulate research design and methods;*
3. *Organize and carry out field visits, collect field data and/or conduct review of literature;*
4. *Effective writing, maintaining research ethics and academic integrity;*
5. *Preparation and dissemination of research output having scientific and/or social relevance.*

**Unit-1: Research Project:**

**90 Hrs**

Research topic should be related to finding, reporting and/or disseminating geographical knowledge having scientific and/or social relevance.

**Unit-2: Study Tour / Geographical Excursion**

**30 Hrs.**

Study tours and visits to places having important geographical features/ landforms and/or social & cultural relevance.

**Total Contact Hours: 120 Hrs.**

**Note (s):**

1. *Projects will be in batches of students in group.*
  2. *Students are required to select a research topic of geographical importance based on empirical evidences of literature.*
  3. *They are expected to carry out field work and use primary and/or secondary data, analyze it and prepare / submit the dissertation / project report for evaluation.*
  4. *Students are also expected to present / publish the research output.*
  5. *Allotment of guides / supervisor (teaching faculty) will be made at the beginning of the semester III.*
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester IV)**  
**(NEP – 2020)**

**Title of Course: Regional Planning and Development**

**Course Code: N-GEOC22-28**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Understand the basic concepts in regional planning
2. Understand different methods in order to compute regional development
3. Get acquainted with theories and models for regional development
4. Get a specialized knowledge of policies and experiences of regional planning in India.

**Unit-1: Concepts in Regional Planning**

**15 Lectures**

Region-Concept, types and hierarchy of regions - planning- concept and types, Planning region- concept and characteristics of a planning region, Delineation of planning region, Indicators for measuring development, Development- meaning, growth versus development, Measurement of regional development.

**Unit-2: Theories and Models for Regional Development**

**15 Lectures**

Theories and models for regional development: spread and backwash concept. Core and periphery concept, Central place theory, Growth pole, Growth foci approach, Ebenezer Howard's Garden City Concept; Green Belt Concept.

**Unit-3: Policies and Experiences of Regional Planning**

**15 Lectures**

Policies and experiences of regional planning in India, Institutional framework from national planning level to regional development plans, Tennessee valley authority (USA), Damodar valley corporation (India).

**Unit-4: Regional planning in India**

**15 Lectures**

Regional planning in India- rural and urban planning. Regional disparities in India, Planning for tribal area, Hilly area, Command area, and Drought-prone area development. GIS based decision making process, spatial data infrastructure and spatial information system, GIS applications in planning: population estimation, identification of illegal encampments, sources of pollution.

**References:**

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  2. Alden, J. and Morgan, (1974): Regional Planning: A Comprehensive View, Leonard Hill Books, Beds.
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  29. Whyntes, Charles & Hammand (1979): Elements of Human Geography, George Aflen & Unwin, London.

#### **Web Sites**

1. <http://planningcommission.gov.in/>
  2. <https://plan.maharashtra.gov.in/>
  3. <https://dtp.maharashtra.gov.in/en>
  4. <http://planningcommission.nic.in/>
  5. <http://ncrpb.nic.in/>
  6. <http://dda.org.in/ddaweb/index.aspx>
  7. <https://mmrda.maharashtra.gov.in/home/>
  8. <http://www.cmdachennai.gov.in/>
  9. <http://www.kmdaonline.org/>
  10. <http://www.bmrda.kar.nic.in/>
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester IV)**  
**(NEP – 2020)**

**Title of Course: Development of Geographical Thought**

**Course Code: N-GEOC22-29**

**Total Credits: 04**

**Course Outcome (COs):** *Upon successful completion of this course, students will be able to:*

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. *Acquire knowledge about the historical development of the subject during different time scales.*
4. *Understand all the concepts of philosophy in geography.*
5. *Recognize different types of dualism and find solutions to terminate them by applying various types of scientific explanations.*
6. *Become acquainted with the variety of perspectives in Geography.*

**Unit-1: Field of Geography**

**10 Lectures**

Definition and meaning of Geography; Field of Geography: its place in social and natural science; concepts and philosophy of geography: distributions, relationships, interactions, areal differentiation and spatial organization; Changes in major geographic traditions: Earth science, man-environment relationship, area studies, spatial analysis.

**Unit-2: Evolution of Geographical Thought**

**20 Lectures**

Ancient Period: Contributions of Greeks, Romans, Arabs, Chinese and Ancient Indian scholars, Dark age: Medieval period; Impact of Explorations and Discoveries; Modern Geographical Thought - Contributions of: Bernhardus Varenius, Immanuel Kant, Alexander Von Humboldt, Carl Ritter, Schaefer and Richard Hartshorne, William Morris Davis, Ellen Churcchill, Semple and Ellsworth Huntington, Halford J Mackindell, Herbertson. Impact of Darwinian theory on geographical thought.

**Unit-3: Dualism in Geography**

**10 Lectures**

Systematic and regional; physical and human; idiographic and nomothetic; qualitative and quantitative; concept of determinism and possibilism.

**Unit-4: Scientific Explanations and paradigm shift and perspectives in geography**

**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; Perspectives: Positivism, Behaviouralism, Humanism, Structuralism, Feminism, and Post modernism; Recent trends in Geography.

**References:**

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  14. Gold, J.R. (1980): *An Introduction to Behavioural Geography*, Oxford University Press, Oxford.
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  21. Johnston, R.J., Gregory, D., Smith, D.M. (Ed)(1986): *The Dictionary of Human Geography*, Blackwell.
  22. Johnston R. J. & Sidaway, J. D. (2004): *Geography and Geographers*, 6th Edition, Edward Arnold, London.
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  37. Unwin, T. (1992): *The Place of Geography*, Longman, UK.

#### **Journal Articles:**

1. Bunge, W. (1968): Fred K. Shaeffer and The Science of Geography, Harvard Papers in Theoretical Geography, Harvard University, Harvard.
  2. Bunge, W. (1979): Fred K. Schaefer and the science of Geography, *Annals, Association of American Geographers*, 69:128-32.
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  4. Burton, I (1963): The Quantitative Revolution And Theoretical Geography, *The Canadian Geographer* 7:151-62.
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester IV)**  
**(NEP – 2020)**

**Title of Course: Agricultural Geography**

**Course Code: N-GEOO22-24**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Know about nature, scope and significance of agricultural geography as an academic and professional discipline.
2. Understand the fundamental concept, crop combination, diversification, agricultural productivity and study the determinants of agricultural patterns.
3. Get knowledge about agricultural systems of the world.
4. Understand the agrarian revolution, socio-economic constraints, agricultural problems and policies

**Unit-1:** **15 Lectures**

Definition, nature, scope and significance of agricultural geography; Origin and dispersion of agriculture; Approaches to the study of agricultural geography.

**Unit-2:** **15 Lectures**

Determinants of agricultural patterns-physical, economic and technological; Agricultural systems of the world - location, distribution, types & characteristics of agriculture.

**Unit-3:** **15 Lectures**

Concept & techniques of delimitation of agricultural regions- Crop combination, Crop diversification; Measurement and determinants of agricultural Productivity, Agricultural land use theory- Von Thunen's model of Land Use planning.

**Unit-4:** **15 Lectures**

Agricultural Revolution in India (Green, White) Nature, Socio-economic constraints in the adoption, performance, Problems & prospects. Land use survey, Land classification and land capability, Dry land Agriculture, Food Security, Organic farming. Impact of climate change on agriculture. Agricultural Policies in India.

**References:**

1. AlkaGautam (2012): Agricultural Geography, Sharda PustakBhawan, Allahabad.
  2. Brown, L.R. (1990): The Changing World Food Prospects - The Nineties and Beyond. World Watch Institute, Washington D.C.,
  3. Dyson, T. (1996): Population and Food - Global Trends and Future Prospects. Routledge, London,.
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  6. Bhatt, M.S (ed.) 2004: Poverty and Food Security in India Problems and Policies. Akkar Books, New Delhi.
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  10. Bhatia B.M. (1977): Poverty Agriculture & Economic Growth, Vikas New Delhi.
  11. Chorley, R. & Haggett P (1971): Socio-Economic Models in Geography, Methuen, London.
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12. Grigg, D.B. (1973): *The Agricultural systems of The World*, Cambridge University Press.
  13. Hagerstrand, T (1968): *Innovation Diffusion as a spatial process*, University of Chicago Press.
  14. Hussain, M. (1999): *Systematic Agricultural Geography*, Rawat publications, Jaipur.(India)
  15. Shafi M. (1983): *Agricultural Productivity and Regional Imbalances a Study of Uttar Pradesh*, Concept, New Delhi.
  16. Symon, L. (1968): *Agricultural Geography*, London.
  17. Sauer, C.O. (1969): *Agricultural Origins and Dispersals*. M.I.T. Press, Mass, U.S.A.
  18. Sharma, T.C., Coutinho, O. (1989): *Green Revolution Gaps: A Geographical Analysis*, Indian Council of Social Science Research, New Delhi.

**Research Journals:**

1. *Global Food Security - Agriculture Policy Economics and Environment*
  2. *Agriculture Ecosystems & Environment*
  3. *Journal of the Science of Food and Agriculture*
  4. *Agricultural Systems*
  5. *Journal of Agricultural and Food Chemistry*
  6. *Agricultural Water Management*
  7. *Journal of Agricultural Economics*
  8. *Agricultural Economics*
  9. *International Journal of Agricultural Sustainability*
  10. *Journal of Agricultural & Environmental Ethics*
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester IV)**  
**(NEP – 2020)**

**Title of Course: Data Representation Methods: Physical Geography**

**Course Code: N-GEOP22-27**

**Total Credits: 04**

**Course Outcomes (COs):** Upon successful completion of this course, students will be able to:

1. Know the methods of representation of relief.
2. Understand the topographical maps.
3. Identify and map relief features.
4. Analyse drainage basin morphometry.
5. Understand the formats of Indian daily weather report and reading of weather signs and symbols
6. Represent meteorological elements diagrammatically and interpretation of results.
7. Know methods of measurement of meteorological elements
8. Analyse interrelationship between various meteorological elements
9. Analyse present and future trends of meteorological elements.

**Unit-1: Relief Representation and Mapping of Landforms**

**30 Hrs.**

**Practical Exercise(s):**

- 1-3: Relief representation method: Pictorial and Mathematical.  
4-5: Map: Definition and types.  
6: Indexing of Topographical sheets.  
7-9: 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.

**Unit-2: Drainage Basin Analysis**

**30 Hrs.**

**Practical Exercise(s):**

- 10-12: Quantitative Analysis of Channel Planform: Sinuosity Index of Straight, Sinuous and meandering channel.  
13: Drainage Basin Morphometry.  
14-15: Calculation of Bifurcation Ratio, Drainage Density and Stream Frequency.  
16-17: Analysis of Cross Profiles & Longitudinal Profile of River; projected, superimposed and composite profile.

**Unit-3: Diagrammatic Depiction of Meteorological Elements**

**30 Hrs.**

**Practical Exercise(s):**

- 18: Weather details: Weather Signs & symbols  
19-21: Reading and interpretation of weather maps of representative seasons.  
22: Interpolation of Isopleth  
23-25: Depiction and Interpretation of Comfort diagrams- Climograph, Hythergraph, Climatograph

**Unit-4: Analysis of Interrelationship: Meteorological Elements**

**30 Hrs.**

**Practical Exercise(s):**

- 26: Spatial correlation of climatic variables: Graphical analysis  
27: Water budget: Graphical analysis  
28: Analysis of upper air data- Tephigram (Temperature Height diagram)
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29: Ergographs (Crop Calendar)

30-31: 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.
3. Critchfield: Principles of Climatology.
4. Davis, Peter, (1974): Science in Geography Data Description & Presentation, Vol.3, Oxford University Press, London.
5. Dunlop Storm (2014): Meteorology Manual: The Practical Guide to the Weather Hardcover, Haynes Publishing UK; First edition, ISBN-10: 0857332724, ISBN-13: 978-0857332721
6. Goudie, A. (1990): Geomorphological Techniques, Routledge, London
7. Hanwell, J.D. & Newson, M.D. (1973): Macmillan Education Ltd., London.
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12. Mather J.R. (1974) Climatology, Fundamentals and applications. Mc Grew Hill Book co., New York
13. Mishra, R.P. (1973): Elements of Cartography. Prasaranga, University of Mysore.
14. Monkhouse, F.J.R and: Maps and Diagrams, Wilkinson, H.R. Methuen and Co. London.
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16. Punmia, B.C. (2016), *Surveying Volume 1, 2, 3– 16th Edition*, Laxmi Pulications (P) Ltd.
17. R.L. Singh & Rana p.B.Singh: Element of Practical Geography. Kalyani Pub. New Delhi (1999).
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19. Sarakar, A.: Practical Geography A systematic approach. Orient Longman Limited, Kolkatta.
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22. Singh, S. (1998): Geomorphology, Prayag Pustak Bhawan, Allahabad.
23. Stacey, F.W. (1919): Practical exercises on the weather and climate of the British Isles and Northwest Europe Hardcover, P ublisher: University Press, ASIN: B00089JQMG
24. Strahler, A. N. (1964): Quantitative Geomorphology of Drainage Basins and Channel Networks, In: Handbook of Applied Hydrology, Ven Te Chow, Ed., Section 4-II, McGrawHill Book Company, New York.
25. Trewartha G.T.: An Introduction to climate McGraw – Hill Book Co. New York.
26. Ward DeCourcy R. (2010): Practical Exercises In Elementary Meteorology, Publisher: Cole Press, ISBN-10: 1445532034, ISBN-13: 978-1445532035
27. Wilks D.S.(1965): Statistical Methods in the Atmospheric Sciences, Volume 59: An Introduction (International Geophysics) Series: International Geophysics, Publisher: Academic Press, ISBN-10: 0127519653, ISBN-13: 978-0127519654.

### 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>*
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**M.A./M.Sc. Geography (Part II) (Level - 6.5) (Semester IV)**  
**(NEP – 2020)**

**Title of Course: Research Project – II (Dissertation)**

**Course Code: N-GEORP22-22**

**Total Credits: 06**

**Course Outcomes (COs):** *Upon successful completion of this course, students will be able to:*

1. *Recognize the objectives and significance of research work;*
2. *Formulate research design and methods;*
3. *Organize and carry out field visits, collect field data and/or conduct review of literature;*
4. *Effective writing, maintaining research ethics and academic integrity;*
5. *Preparation and dissemination of research output having scientific and/or social relevance.*

**Topic:** Research topic should be related to finding, reporting and/or disseminating geographical knowledge having scientific and/or social relevance.

**Total Contact Hours: 180 Hrs.**

**Note (s):**

1. *Research topic and work for Research Project- II (Dissertation) preferably should be different for each student.*
  2. *Students are required to select a research topic of geographical importance based on empirical evidences of literature.*
  3. *They are expected to carry out field work and use primary and/or secondary data, analyze it and prepare / submit the dissertation / project report for evaluation.*
  4. *Students are also expected to present / publish the research output.*
  5. *Allotment of guides / supervisor (teaching faculty) will be made at the end of the semester III.*
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**9. Scheme of Teaching:** Scheme of teaching and time table for lectures, tutorials and practicals will be notified before start of every semester.

**10. Examination Pattern** and Requirement before appearance for University Assessment:

Course Type	University Assessment Marks (pl. check scheme of marking)	Internal Assessment Marks (Class Test + Seminar/ Assignment)	During University Assessment				Supervisor's Report (for Internal Marks)
			Seminar Presentation	Assignment /Journal	Project Reports	Study Tour Report	
Theory	80	20	Required	--	--	--	--
Practical – 4 Credits	100	Nil	--	Required	--	--	--
Practical – 2 Credits	50	Nil	--	Required	--	--	--
Field Project / On Job Training – 4 Credits	60	40	Required	--	Required	--	40
Research Project – 4 Credits	80	20	Required	--	Required	Required	20
Research Project – 6 Credits	120	30	Required	--	Required	--	30

**11. Nature of Question Paper and Scheme of Marking for University Assessment:**

**I. Nature of Theory Question Paper (80 Marks):**

Question No.	Type of Question (Word limit)	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	04	04	04	16
Q3.	Short Notes	03	02	08	16
Q4.	Long Answer/ Essay type	02	01	16	16
Q5.	Long Answer/ Essay type	02	01	16	16
<b>Total = 05</b>	--	--	--	--	<b>80</b>

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**II(a). Nature of Practical Question Paper for Major Practical (100 Marks) Assessment:**

Question No.	Type of Question/ Assessment	Marks
Q1	Practical/ Lab Assessment	20
Q2	Practical/ Lab Assessment	20
Q3	Practical/ Lab Assessment	20
Q4.	Practical/ Lab Assessment	15
Q5.	Practical Assignment/ Journal	15
Q6.	Viva-voce	10
<b>Total = 06</b>	<b>–</b>	<b>100</b>

**II(b). Nature of Practical Question Paper for Minor Practical (50 Marks) Assessment**

Question No.	Type of Question/ Assessment	Marks
Q1.	Practical/ Lab Assessment	20
Q2.	Practical/ Lab Assessment	15
Q3.	Practical Assignment/ Journal	8
Q4.	Viva-voce	7
<b>Total = 04</b>	<b>–</b>	<b>50</b>

**III. Scheme of Examination for Field Project / Job Training (60 Marks)**

Question No.	Type of Question/ Assessment	Marks
Q1.	Seminar Presentation	20
Q2.	Evaluation of Project Report/ Job Report	20
Q3.	Viva-voce	20
<b>Total = 03</b>	<b>–</b>	<b>60</b>

**IV(a). Scheme of Examination for Research Project –I (80 Marks)**

Question No.	Type of Question/ Assessment	Marks
Q1.	Seminar Presentation	20
Q2.	Evaluation of Project Report	25
Q3.	Evaluation of Study Tour Report	15
Q4.	Viva-voce	20
<b>Total = 04</b>	<b>–</b>	<b>80</b>

**IV(b). Scheme of Examination for Research Project –II / Dissertation (120 Marks)**

Question No.	Type of Question/ Assessment	Marks
Q1.	Seminar Presentation	30
Q2.	Evaluation of Project Report	60
Q3.	Viva-voce	30
<b>Total = 03</b>	<b>–</b>	<b>120</b>

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

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