UNIVERSITY OF MUMBAI

No.UG/ 474 of 2005

CIRCULAR:

The Principals of the affiliated colleges in Arts, Science and Commerce, Professor-cum Director, Institute of Distance Education are hereby informed that the recommendation made by the Ad-hoc Board of Studies in Geology at its meeting held on 12th July, 2005 has been accepted by the Academic Council at its meeting held on 6th August, 2005 *vide* item No.4.4 and subsequently approved by the Management Council at its meeting held on 19th August, 2005 *vide* item No.3 and that in accordance therewith the one year Post-Graduate Diploma Course in Remote Sensing Technology and Geographic Information Systems has been introduced by the University with effect from the academic year 2005-2006.

Further that in exercise of the powers conferred upon Management Council under Section 54 (i) and Section 55 (i) of the Maharashtra Universities Act 1994, it has made Ordinances 5557 and 5558 and Regulations 5245, 5246, 5247, 5248, 5249,5250, 5251, 5252, 5253, 5254, 5255, 5256 , 5257, and 5258 including scheme of examination, syllabus and standard of passing relating to the One Year Post-Graduate Diploma Course in Remote Sensing Technology and Geographic Information Systems is as per *Appendix* and that the same has been brought into force with effect from the academic year 2005-2006.

Mumbai 400 032,
25th November, 2005.

for REGISTRAR.

A.C.4.4/06.08.2005
M.C.3/19.08.2005

To,

The Principals of the affiliated colleges in Arts, Science and Commerce, Professor-cum Director, Institute of Distance Education.

****

No.UG/ 474-A of 2005 25th November, 2005.

Copy forwarded with Compliments for information to :-

1) The Dean Faculty of Arts, Science and Commerce.
4) The Chairman, Ad-hoc Board of Studies Geology.

O. 5557 - 5555. 6/8/10
R. 5246 - 6258.

UNIVERSITY OF MUMBAI

ORDINANCES, REGULATIONS, SCHEME OF EXAMINATION AND SYLLABUS FOR THE

ONE YEAR POST GRADUATE DIPLOMA COURSE IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

(With effect from the academic year 2005-2006)

PREAMBLE

i. Identify areas in various disciplines with respect to educational, national and global priorities.

ii. Encourage new ideas and innovations and support their implementation.

iii. Identify institutions and support them to develop (i) specialized courses at Under - Graduate and Post Graduate levels in emerging areas and (ii) accommodate original/new ideas and innovative proposals to influence teaching, research, academic excellence and societal development of relevance.

iv. Consider steps to encourage, promote and make use of brilliant ideas for promoting scientific and technological applications for the benefit of society.

v. Identify user departments / institutions who may actively participate and derive benefit from the course or programme and trained personnel, and also sponsor students for the course.

vi. Nurture and strengthen such courses in emerging areas in the university, institute and college at the Master's/Bachelor's level or special paper at Master's level.

vii. Provide financial support for the above purposes in bringing innovation in various disciplines and excellence in emerging areas.

----------x----------x----------x----------x----------

UNIVERSITY OF MUMBAI

ORDINANCES, REGULATIONS, SCHEME OF EXAMINATION AND SYLLABUS RELATING TO THE **ONE YEAR POST GRADUATE DIPLOMA** COURSE IN **REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS**

----------x----------x----------x----------x----------

0.5557 **TITLE :** THE COURSE SHALL BE TITLED AS **"ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS"**

ELIGIBILITY :

0.5558 · A candidate shall have to fulfill minimum admission criterion for the **One Year Post Graduate Diploma Course** as given below, considering the contents of such **course** and the minimum maturity level of the candidates to grasp, appreciate and derive maximum benefits from such course:

Name of Post Graduate Diploma Course	Duration	Minimum Entry/Admission level Required
One Year Post Graduate Diploma in Remote Sensing Technology and Geographic Information Systems	TWO (2) SEMESTERS FULL TIME	**Any of the Following** 1. Graduate in Geology, Geography, IT, Engg., & Civil Diploma Holders With minimum 45 percent marks **OR** 2. Graduate with minimum 45 percent marks and with a valid Certificate / Diploma /Advanced Diploma in Remote Sensing & GIS of 60/120/240 hours resply. **OR** 3. Post Graduate degree/diploma in any stream with minimum 45 percent marks

DURATION :

R. 5245 The **One Year Post Graduate Diploma Course** will be a **FULL TIME** Course and shall be conducted for 24 weeks each in **Two** Semesters of One academic year.

R. 5246 Notwithstanding anything contained above in R. 5245 the Summer / Diwali / X-mas, vacation if need be, shall be suitably utilized for the completion of the One Year Post Graduate Diploma Course.

R. 5247 **No. of students :** A batch shall consist of a minimum of 20 students

R. 5248 The **One Year Post Graduate Diploma Course** contained in O. 5558 shall consist of six theory papers and one special theory paper and second semester of Industrial visit and project work completed in the Institution/Industry/Research Organisation.

R. 5249 One day / two day Orientation course for those needing it, may be conducted by the college at the beginning of the course, so that students opting for this course are better prepared to receive the intended course work

R. 5250 **FEES**

Each Student shall pay **Rs. 20,000 per year** as fees for the **One Year Post Graduate Diploma Course** contained in **O.** 5558 above.

TEACHER QUALIFICATION:

Qualifications For Teaching One Year Post Graduate Diploma Course:

R. 5251 Minimum Masters degree essential (or higher desirable) in Geology, Physics, Geography, GIS, Remote Sensing, I.T., Diploma, in Civil Engg.., Engineering and any other subject related to the subjects offered in the One Year Post Graduate Diploma Course as per UGC guidelines

R. 5252 SCHEME OF EXAMINATION

a) The **One Year Post Graduate Diploma Course** contained in **O.** 5555 shall consist of **SIX Theory Papers** (100 marks each x 6=600 marks), **SIX Practicals** (50 marks each x 6 =300 marks), **One Special theory Paper** (100 marks x 1=100 marks) **Industrial visit** and its **report** (30 marks), **Project** (250 marks), and **Viva Voce** (20 marks), thus **totalling to 1300 marks.**

b) The **One Year Post Graduate Diploma** Course contained in **O.** 5555 shall be covered in **210 lectures** (30 lectures per paper i.e. 04 lectures per unit), **48 Practicals** (4 hours per week for 48 weeks) and **48 hours of project guidance** per batch

c) The examination shall be conducted at the end of **each Semester 24 weeks** after the commencement of the **One Year Post Graduate Diploma Course** as contained in the **O.** 5555

d) The examination shall consist of the following **Heads of Passing.** Maximum marks assigned to each head and minimum marks required for passing in each head as detailed in the following table:

No	Subjects	Lect. /wk	Pract. /wk	Paper			Practical		Total	
Note: Instructions To Examiners: Set Six (6) Questions / For Each Paper Including All The Units/Divisions Of The Paper Instructions To Candidates: Answer Any Four				Hours	Marks Max	Min	Marks Max	Min	Marks Max	Min
	SEMESTER I									
I	Principles Of Satellite Remote Sensing	4	4	3	100	40	50	20	150	60
II	Principles Of Aerial Photography And Photogrammetry	4	4	3	100	40	50	20	150	60
III	Computer Methods And Programming	4	4	3	100	40	50	20	150	60
IV	Statistical Methods And Computing	4	4	3	100	40	50	20	150	60
	TOTAL (SEM I)	16	16		400	160	200	80	600	240
	SEMESTER II									
V	Digital Image Processing	4	4	3	100	40	50	20	150	60
VI	Geographic Information Systems	4	4	3	100	40	50	20	150	60
VII	Special Paper On Project Implementation	4		3	100	40	-	-	100	40
VIII	PROJECT				250	100	-	-	250	100
		Industrial Visit Field report			30	12	-	-	30	12
			Viva Voce		20	08	-	-	20	08
	TOTAL (SEM II)	12	8		600	240	-	-	700	280
	TOTAL (SEM I+SEM II)				1000	400			1300	520

R: 5253 FORMAT OF THEORY PAPER

a) There shall be Seven theory papers of 100 marks each
b) Each theory paper shall be divided into 6 units (Units 1 to 6) of 25 marks each

R: 5254 FORMAT OF QUESTION PAPER

a) Each theory paper shall be of three hour's duration
b) Each theory paper shall contain 6 questions based on Units 1 to VI
c) Students must answer **4 out of 6** questions
d) All questions shall be compulsory carrying 25 marks each
e) Each question shall have three sub-questions viz. (i), (ii) and (iii) carrying 10, 05 and 05 marks respectively
f) Sub questions (i), (ii) and (iii) shall have internal options
g) Sub questions (i) shall be Objective Type, sub-question (ii) for Short Notes/Short Answers, and sub-questions (iii) for long/Descriptive Answers

R: 5255 FORMAT OF PRACTICALS

For the One Year Post Graduate Diploma Course contained in O:___ , there shall be 48 Practicals (4 Hours Per Week For 48 Weeks)

a) Each Candidate shall maintain a Journal as a record of the Practicals performed
b) Each Journal, satisfactorily completed shall be certified by the teachers and the Head of Department

R: 5256 FORMAT OF PRACTICAL EXAM

a) Practical Exam shall be of **FIVE** hours' duration
b) The distribution of experiments shall be as follows

	Experiment	Marks
(i)	One long experiment	30
(ii)	One Short Experiment	10
(iii)	Journal (duly certified)	10
	Total	**50**

R: 5257 VIVA-VOCE

a) Each candidate shall have to appear for a viva-voce exam carrying 20 marks
b) Viva-voce exam shall be based on the industrial visit and project report.
c) The subject teacher shall conduct viva-voce exam on the specified day after the conclusion of theory and practical exam and the submission of Industrial Visit Report and the Project Report.

SEMESTER I (Papers I – IV)

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS

PAPER I PRACTICAL I	PRINCIPLES OF SATELLITE REMOTE SENSING
PAPER II PRACTICAL II	PRINCIPLES OF AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY
PAPER III PRACTICAL III	COMPUTER METHODS AND PROGRAMMING
PAPER IV PARACTICAL IV	STATISTICAL METHODS AND COMPUTING

SEMESTER I DETAILED SYLLABUS

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER - I - PAPER I **4hrs/wk / 100 Marks**

Instruction to Examiners:Set Six (6) Questions Including Topics from all divisions
Instruction to Candidates: Answer any Four (4) Questions

PRINCIPLES OF SATELLITE REMOTE SENSING

UNIT NO	TOPIC NO	TOPICS
I	1	**Overview of Remote Sensing Technology – An Introduction** History, Concepts, Conventional methods of survey, Advantages of Remote Sensing. **Physics of Remote Sensing** – Electromagnetic energy, EMR interaction-atmospheric, atmospheric scattering, skylight & Haze, Solar and Terrestrial Radiation. **Spectral Response Patterns** – reflectance of Earth surface features in different wavelength regions of the EMR
II	2	**History of Space Imagery** - Sensors, Types of Satellites, Meteorological Satellites, Remote Sensing in India, Future Missions. Overview of imageries from various satellites- LANDSAT, IRS series, SPOT, MODIS, TERRA, IKONOS, ERS Etc.
III	3	**Data Acquisition systems** – IFOV, Scanners and Scanning mechanisms, Data formats, Satellite Orbits. **Optical Remote Sensing** – Types of Resolution, Types of sensors and Platforms
IV	4	**Thermal Remote Sensing:** Basics concepts, **Thermal Inertia:** Temperature From Radiance Values - Thermal Sensors, Scanners, Optomechanical CCD Arrays.
V	5	**Microwave Remote Sensing** : Basic Concepts, Micro Wave Sensors - Micro Wave Radiometers - Geometric Characteristics, Spectral, Spatial resolution, SLAR, SAR Satellite Altimeters - Scatterometer and Airborne Sensors.
VI	6	**Principles of Image Interpretation:** Decoding of Different Imagery - Elements of Image Interpretation - Techniques of Visual Interpretation.

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I - PAPER I - PRACTICAL I - 4hrs/wk / Marks-50

INTERPRETATION OF SATELLITE DATA

TOPIC NO	TOPICS
1.	Satellite Data procurement
2.	Decoding of Different Satellite Data.
3.	Study Of Various Visual Remote Sensing Equipment's
4.	Study Of Different Satellite Data Products
5.	Ground Radiometric Survey, Collection Of Spectral Reflectance From Terrestrial, Objects And Analysis, Ground Truth Collection.
6.	Interpretation Of Black And White And Multiband Imagery, Interpretation Of False Colour Composite.
7	. Interpretation Of Thermal Data, Interpretation Of Micro Wave Data.

REFERENCES
SATELLITE REMOTE SENSING

1. Alexay Bunkin & Konstantin Volia.K, - Laser Remote Sensing of the Ocean Methods & Publications. John & Wiley & Sons, N.Y.
2. American Society Of Photogrammetry, 1983: Manual Of Remote Sensing (2nd Edition), ASP Falls Church, Virginia
3. Barrett, E.C. And L.R.Curits, 1976: Introduction To Environmental Remote Sensing, Halstged Press, Wiley, NY.
4. Burney, S.S 1988: Application Of Thermal Imaging, Adam Hilger Publications.
5. Curran, P. 1985 : Principles Of Remote Sensing, Longman, London.
6. Drury S.A, 1990: A Guide To Remote Sensing - Interpreting Images Of Earth, Oxford Science Publications, Oxford.
7. Floyd M. Henderson; Principles & Applications of Imaging Radar, John Wiley & Sons, N.Y.
8. Hord R.Michel, 19866: Remote Sensing Methods And Application, John Wiley And Sons.
9. Lillisand, T.M. And P.W.Kiefer, 1986: Remote Sensing And Image Interpretation, John Wiley & Sons, New York.
10. Lintz, J. And L.S.Simonett (Eds), 1976: Remote Sensing Of Environment, Addition-Wesley, Readings; Mass.
11. Lo.C.P. 1986: Applied Remote Sensing, Longman, London.
12. Richadson, B.F.Jr.(Ed), 1978; Introduction To Remote Sensing Of The Environment, Kendall / Hunt, Dubuque, Iowa.
13. Sabins, F.F.Jr., 1978: Remote Sensing Principles And Interpretation, Freeman, Sanfrancisco.
14. Schanda,E. (Ed), 1976 : Remote Sensing For Environmental Science, Springerverlag.

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I - PAPER II — **4hrs/wk / 100 Marks**

Instruction to Examiners:Set Six (6) Questions Including Topics from all divisions

Instruction to Candidates: Answer any Four (4) Questions

PRINCIPLES OF AERIAL PHOTOGRAPHY AND PHOTOGRAMMETRY

UNIT NO.	TOPIC NO	TOPICS
I	1.	**Overview of Aerial Photography** – An Introduction, History, Concepts, Conventional methods of survey, Advantages of Aerial Phototography
II	2.	**Cameras Films, Filters** - Camera as a Remote Sensor, Types of Camera systems, Types of Photography, Film exposure, Films and Filters, Lens Speed, Viewing angles, Ground Distance
III	3.	**Photogrammetry Principles** – Types of Stereoscopes, Stereo viewing, Stereograms , Vertical Exaggeration Stereomodels, Stereoscopic parallax, Height Measurement Using Stereoscopic Methods. **Satellite Stereo imaging** – DEM, Orthophoto Generation and image restoration
IV	4.	**Aerial photographs** – Classification, Geometry, Photo Mosaics, Aerial Triangulation. **Scales** – Definition, Determination of Scales, Displacements, Distortions
V	5.	**Photo Interpretation Keys And Elements:** Definition, Key sets, Types of Study ,Photo Interpretation Elements, Geotechnical / Geomorphic elements, Landforms, Drainage, Erosional pattern, Vegetative cover, Landuse, shape & size of objects).
VI	6.	**Digital Photogrammetry:** Data capturing (Digital Camera, operation principles, scanners for analog to digital conversion)- Digital photogrammetric equipments and processes(equipments, stereo-viewing, image measurements, co-ordinate systems, image transformations, image orientation) – applications(DEM and Orthophoto)

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I- PAPER II - PRACTICAL II - 4hrs/wk / Marks-50

AERIAL PHOTO INTERPRETATION

TOPIC NO	TOPICS
1.	Stereo Vision Test Using Test Cards and Anatomy of Pocket, Prism And Mirror Stereoscopes.
2.	Decoding, Marking and Transfer of Principal Points, Baseline Drawing, Flight Line, Marking, Fixing Photos For 3 D Observation, Marking North and Tracing of, Details From Aerial Photographs and Transfer the same from air photos to base map.
3.	Determination of Flight Procedure, Determining number of photographs required for a project area
4.	Determination of Scales of Aerial Photographs.
5.	Preparation of Mosaics - Aerial Triangulation and Controls
6.	Height And Slope Measurements. .

REFERENCES

AERIAL PHOTOGRAPHY

1. Bhatt. A.B., Aerial Photography & Remote Sensing
2. Burside, C.D., 1985 : Mapping From Aerial Photographs, Collins Publishers.
3. Colwell, Robert, 1960: Manual Of Photographic Interpretation, American Society Of Photogrammetry, ASP Falls Church, Virginia.
4. David Paine; Aerial Photography and Image Interpretation for Resource Management, John Wiley & Sons, N.Y.
5. John, T. Smith Jr, 1968: Manual Of Colour Aerial Photography, I Edition, American Society Of Photogrammetry, ASP Falls Church, Virginia.
6. Moffit H.F. And Edward, M.M, 1980 : Photogrammetry, 3rd Edition, Harper And Row Publishers, New York.
7. Qiheyans, Map Projection transformation, Principles and its Applications.
8. Rampal; Handbook of Aerial Photography and Interpretation, Concept publishing.
9. Wolf, P.R.1974 : Elements Of Photogrammetry Mcgraw Hill Book Co., Tokyo
10. Lillisand, T.M. And P.W.Kiefer, 1986: Remote Sensing And Image Interpretation, John Wiley & Sons, New York.
11. Sabins, F.F.Jr., 1978: Remote Sensing Principles And Interpretation, Freeman, Sanfrancisco.

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I - PAPER III – 4hrs/wk / 100 Marks

Instruction to Examiners: Set Six (6) Questions Including Topics from all divisions
Instruction to Candidates: Answer any Four (4) Questions

COMPUTER METHODS AND PROGRAMMING

UNIT NO.	TOPIC NO	
I	1	**Computer and Programming Concepts:** Sample Model of a Computer – Algorithms and Flow Charts, **File handling**, Different Operating Systems DOS, WINXT LINUX, UNIX etc.
II	2	**Computer Network and Security** - Data Communications, Standard Protocols, Standard Computer Architecture, Security, Attacks, Computer Criminals, Method of defense
III	3	**Computer Simulation and Modeling**- Introduction, General Principles, Simulation software, Statistical Models in Simulation
IV	4	**Database Management Systems, design,** Programming in Oracle
V	5	**Development of Front end using VB,** Programming in Visual Basic
VI	6	**Internet**: Basic Concepts, Introduction, **Internet GIS**, E-mail, Internet browsing, Search Engines. Programming in Java **Web Designing** Introduction – HTML – authorising tools, Optimising graphics and maps – Web server access – Website maintenance.

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I - PAPER III - PRACTICAL III - 4hrs/wk / Marks-50

COMPUTER METHODS AND PROGRAMMING

UNIT NO	TOPIC NO	TOPICS
I	1	Overview of MSOffice Advanced EXCEL
II	2	Sample VB code for mathematical calculator
III	3	Designing Database Schema for sample GIS application
IV	4	Preparing a sample HTML home page
V	5	Designing a prototype front end for internet GIS

REFERENCES
COMPUTER METHODS AND PROGRAMMING

1. Jerry Banks, John Carson, Barry Nelson, David Nichol, Discrete Event System Simulation, McGraw Hill
2. Paul Raj Ponnian, Data Warehousing fundamentals, John Wiley
3. M.H.Dunhan, Data Mining Introductory and Advanced topics, Pearson Education
4. Han,Kamber, Data Mining Concepts and Techniques, Morgan Kaufmann
5. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education
6. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw Hill
7. Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw Hill
8. Peter Rob and Coronel Database Systems, Design, Implementation & Management, Thompson Learning
9. C. J. Date, Longman, Introduction to Database Systems, Pearson Education
10. Timothy Budd, OOP , TMG
11. Bahrami, OOP
12. Omran A. Bukhares and A.K. Elmagarmid, Object Oriented Multidatabase System, Prentice Hall
13. Vijay Mukhi, Working with UNIX, BPB Publications
14. Galgotia, UNIX the Complete Book, A Guide for Professional users
15. Milan Milenkovic, Operating Systems Concepts and design, TMG
16. Achyut S. Godbole, Operating Systems with Case Studies in UNIX, NETWARE, WIN NT, TMG
17. Douglas E Comer, Computer Networks and Internets, 2nd Ed. Adiison Wesley
18. William A. Sahay, Brooks/Cole, Understanding Data Communications and Networks, Thompson Learning
19. Evangelos Petroutsos, Mastering Visual Basic, BPB Publications
20. Introduction to Visual Basic 6.0/VB.Net, BPB Publications
21. Stallings, Cryptography and Network Security; Principles and Practice
22. C.P. Pfleeger and S.L. Pfleeger, Security in computing, Pearson Education
23. Matt Bishop, Computer Security,; Art and Science Pearson Education
24. Eric Maywald, Network Security; A Beginners Guide, TMG

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I - PAPER IV — **4hrs/wk / 100 Marks**

Instruction to Examiners:Set Six (6) Questions Including Topics from all divisions

Instruction to Candidates: Answer any Four (4) Question

STATISTICAL METHODS AND COMPUTING

UNIT NO	TOPIC NO	TOPICS
I	1.	**Background** –Definition, Functions and Importance, Planning a Statistical inquiry, Collection of data, **Data Editing** – Classification and tabulation
II	2	Simple derivatives, **Basic Statistics** - Statistical Averages, Dispersion, Time series analysis
III	3	Regression, Correlation, Interpolation, Probability & Sampling
IV	4	Diagrammatic and graphical representation
V	5	Association of attributes, Forecasting, Indexes
VI	6	Test of hypothesis, Interpretation of data

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – I - PAPER IV – PRACTICAL IV - 4hrs/wk / Marks-50

STATISTICAL METHODS AND COMPUTING

TOPIC NO	TOPICS
1.	Data Collection and Sampling
2	Calculation of Simple derivatives
3	Calculation of Regression and Correlation Coefficients
4	Diagrammatic and graphical representation
5	Statistical Modeling and Trend analysis
6	Test of hypothesis

REFERENCES

STATISTICAL METHODS AND COMPUTING

1. Urray R. Spiegel, 1972: Theory And Problems Of Statistics, Schaum's Outline Series - Mcgraw Hill Book Company.
2. Sizeh, B, 1987: Use And Abuse Of Statistical Methods In The Earth Science, Oxford University Press, Oxford.
3. Taxali, 1987: PC Software Made Simple, Tata McGrawhill Publications.
4. Duda, Hart and Stock, Pattern Classification, John Wiley and Sons
5. Averill Law, W.David Kelton, Simulation Modeling and Analysis, McGraw Hill
6. Welling, Tulpule, Saraph, Diwanji, Statistical Techniques Manan Publications
7. Welling, Tulpule, Saraph, Diwanji, Mathematical Techniques Manan Publications
8. V.M.Mathew, Neena Joshi, Venkataramani, Ujwala Deshmukh, S.V.Kelkar, Trishala Jain, Poonam Deshpande, Business Statistics, Reliable Publications

SEMESTER II (PAPERS V-VII, PROJECT, INDUSTRIAL VISIT)

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

PAPER V PRACTICAL V	DIGITAL IMAGE PROCESSING
PAPER VI PRACTICAL VI	GEOGRAPHIC INFORMATION SYSTEMS
PAPER VII	SPECIAL PAPER ON PROJECT IMPLEMENTATION
PROJECT	PROJECT REPORT
INDUSTRIAL VISIT	INDUSTRIAL VISIT REPORT

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – II – THEORY PAPER V – 4hrs/wk / 100 Marks

Instruction to Examiners:Set Six (6) Questions Including Topics from all divisions
Instruction to Candidates: Answer any Four (4) Questions

DIGITAL IMAGE PROCESSING

UNIT NO	TOPIC NO	TOPICS
I	1.	**Principles of Image Processing:** Basic Concepts, Digital Image Formats (BIL,BSQ,RLE). Components of Image Processing System, Input – Output Devices, Raster And Vector Files.
II	2	**Enhancement Techniques:** Basic Concepts, **Single Band Data:** Image Reduction and Magnification, Contrast, Stretching, Filtering, (Sobel And Laplatian Filters, High And Low Pass Filters) – Histogram Equalisation - Edge Enhancement. **Multiband Data:** Band Ratioing Techniques - Generation of False Color Composites
III	3	**Radiometric Corrections In Image Processing:** Need For Correction Data Accuracy. **Geometric Corrections** in Image Processing: Earth Curvature and Projection Methods - Satellite Pass Sytem and Image Warpening - Skew Corrections -Resampling Interpolation Methods - Panoramic Distortion – Error Accumulation And Corrections - Data Accuracy.
IV	4.	**Pattern Recognition & feature extraction :** Basic Concepts (Pattern Recognition, Linear And Non Linear Discriminant Functions) - Image Classification Techniques noise Removal,.Edge detection.
V	5.	**Spectral Transformation Techniques :** Principal Component Analysis – Vegetation Indices – Fourier Transformations, Texture Transformations.
VI	6.	**Merging of Image data:**Principles and Techniques of Multisensor and Multimode Data fusion, Principles of Change Detection: Image Registration

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS	
SEMESTER – II - PAPER V - PRACTICAL V 4hrs/wk / Marks-50	
DIGITAL IMAGE PROCESSING	
TOPIC NO	TOPICS
1.	Study Of Digital Image Processing System.
2	Histogram Generation / Equalization
3	Generation Of Linearly Stretched And Non-Linearly Stretched Outputs And Their Analysis
4.	Generation Of Different Filtered Outputs And Analysis
5.	Generation Of Ratio images
6.	Generation Of PC1, PC2 And PC3
7	Satellite Image Merging, Change Detection.
8	Supervised Classification Using Image Processing System.
9	Automated Scripting Tools for elementary functions using Visual Basic, JAVA, HTML

REFERENCES
DIGITAL IMAGE PROCESSING

1. B. Chanda, D.Dutta Majumder, Digital Image Processing & Analysis, PHI
2. Duda, R.D And P.E.Hart 1972: Pattern Classification And Scene Analysis, Wiley Interscience, NY.
3. Hord M.P, 1982: Digital Image Processing Or Remotely Sensed Data, Academic Press.
4. Jain AK 1989: Fundamentals Of Digital Image Processing, Prentice Hall, N.J
5. Jensen,J.R 1986: Introductory Digital Image Processing: A Remote Sensing Perspective, Prentice-Hall, NY
6. Levialdi, S (Ed) 1984: Digital Image Analysis, Pitman, London.
7. Nilblack, W 1986: An Introduction To Digital Image Processing, III Edition, Prentice Hall International.
8. P. Nag & M. Kudrat; Digital Remote Sensing, Concept Publishing.
9. Pratt, S.K.1978: Digital Image Processing, Wiley - Inter Science, New York.
10. Richard, J.A 1986: Remote Sensing Digital Image Analysis, Springier Verlag, Berlin, Heidelberg.
11. Rosenfeld, A And A.C.Kek, 1982: Digital Picture Processing, Academic Press, New York.
12. Rosenfield A 1976: Topics In Applied Physics Digital Picture Analysis, Springier Verlag, Berlin, Heridelberg.
13. Schowengerdt, R.A 1983: Techniques For Image Processing And Classification In Remote Sensing, Academic Press, NY.
14. Schowergerdt, R.A., Remote Sensing Models and Methods & Image Processing, academic Press.
15. Shera, Tim, D 1984: Artificial Intelligence Tools, Techniques And Applications, Harper And Row Publishers.
16. Swainphillip, H 1978: Remote Sensing The Quantitative Approach, Mcgraw Hill International Book Co.,
17. Wilson,W.J 1980: Principles Of Artificial Intelligence, Springier Verlas, Berlin, Heidelberg.
18. Gose, Johnsonbaugh & Jost, Pattern Recognition and Image Analysis PHI

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – II – THEORY PAPER VI– 4hrs/wk / 100 Marks

Instruction to Examiners:Set Six (6) Questions Including Topics from all divisions
Instruction to Candidates: Answer any Four (4) Questions

GEOGRAPHIC INFORMATION SYSTEMS

UNIT NO	TOPIC NO	TOPICS
I	1.	Overview of GIS: Introduction, Basic Concepts, components of GIS, Advantages of GIS, Social and institutional context of GIS. Spatial and Non-spatial Data
II	2	Data Types and GIS data structures, Data input /output processes and devices, Data verification, Correction and storage.Data base structures, Data Conversion, (Vectorisation and rasterisation).
III	3	Digital data acquisition and sampling, Spatial Data Analysis and Modelling, DEM, TIN, Advantages of DEM/DTM.Network analysis, Raster and Vector based GIS Data Processing, Analysis and Visualization, Methods Of Spatial Global,Local,Optimal Interpolation, Kriging for Large Areas
IV	4.	Data Analysis and Spatial Modelling: Simple Data Retrieval, Map Overlaying, Cartographic Modelling, Disadvantages Of Cartographic Modelling, Data Quality And Errors, Classification Methods, Multivariate Analysis.
V	5.	Cartographic Principles, Scale, Resolution, Coordinate Systems and Projections.Digital Cartography: Input data types,Data, sources, Modelling devices, cartographic process, Storage devices-out put devices- special merits of digital cartography
VI	6.	Advanced GIS: Object Oriented GIS, ANN, Data Mining methods, GPS : Concepts of GPS - GPS Instruments - Applications of GPS. Decision Support System (DSS)

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS
SEMESTER – II - PAPER VI - PRACTICAL VI - 4hrs/wk / Marks-50
GEOGRAPHIC INFORMATION SYSTEMS (USING GIS SOFTWARE)

TOPIC NO	TOPICS
1.	Scanning, Georeferencing, projection, data sources: Toposheet, Maps, images, aerial photo etc.
2	On screen Digitisation and preparation of vector image
3	On Screen Digitisation and raster image preparation
4.	Linking of spatial and Non-spatial data.
5.	GIS analysis (buffering, overlay, proximity search, etc)
6.	GIS data presentation.
7.	Automated Scripting Tools for elementary functions using Visual Basic, JAVA, HTML
8.	Thematic Maps

REFERENCES
GEOGRAPHIC INFORMATION SYSTEMS

1. Burrough, P.A 1986: Principles Of Geographical Information Systems For Land Resources Assessment, Clarandone Press, Oxford.
2. Campbell, J 1984: Introductory Cartography, Printers Hall Englewood Cliffs, N.J
3. Dent B.D 1985: Principles Of Thematic Map Design, Addition - Wesley, Reading, Mass.
4. Freeman, H And GG.Pieroni 1980: Map Data Processing, Academic Press, New York.
5. Graeme F. & Bonham – Carter; Geographic Information Systems for Geoscientists;. Modelling with GIS, Pergamon.
6. Monmonier, M.A 1982: Computer Assisted Cartography - Principles And Prospects, Prentic Hall, Englewood Cliffs, NJ
7. Tomlinson, R.F Calkins, H.S And D.F.Marble 1976: Computer Handling Of Geographic Data, UNESCO, Geneva.
8. R.P.Gupta Remote Sensing Technology And Geographic Information Systems Springer and Veslen.

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – II - PAPER VII– 100 Marks

Instruction to Examiners:Set Six (6) Questions Including Topics from all divisions

Instruction to Candidates: Answer any Four (4) Questions

SPECIAL PAPER ON PROJECT IMPLEMENTATION

UNIT NO	TOPIC NO	TOPICS
I	1.	Case Study (Disaster Management; Transportation; AM/FM in Utilities)
II	2	**Project Management:** Requirement Assessment, Requirement Specifications, Project Design; Project scheduling
III	3	**Project Execution:** Project tracking; Project installation
IV	4.	Acceptance testing; Defects detection
V	5.	Defects correction; final roll out
VI	6.	Risk identification and mitigation
VII	7	Intellectual Property Rights, Contracts, Legal issues, Sub-contracting, Service Level Agreements

INDUSTRIAL VISIT – 30 MARKS

Visit to any industry, Government Organization, Research Laboratories, implementing Remote Sensing and GIS Technologies in and around Mumbai. The students should submit a 10 page report , highlighting the knowledge gained.

INDUSTRIAL / FIELD VISIT AND REPORT

a) Each batch of students shall go for a one day visit along with the subject teacher for a Field visit or to an Industrial Organisation or a Research Institution

b) Each student shall prepare a report (approx. 10 pages) of the Industrial visit and submit it to the subject teacher for evaluation out of 30 marks

c) Each Industrial/Field visit Report shall be duly certified by the subject teacher and the Head of the Department

d) Each Industrial/Field Visit Report shall have to be submitted for evaluation within one week of the conclusion of the theory or practical exam whichever is later .

REFERENCES
SPECIAL PAPER ON PROJECT IMPLEMENTATION

Mordechai Ben – Menachemm, Garry S.Marlis, Software Quality, Thompson
David Baumer, J. C. Poindexter, Cyber Law and E Commerce,TMG
Vivek Sood, Cyber law Simplified TMG
Sundeep Oberoi, E-Security, Electronic Authentication and Information Systems, Security, TMG
Richard E, Fairley, Software Engineering Concepts, TMG

ONE YEAR POST GRADUATE DIPLOMA IN REMOTE SENSING TECHNOLOGY AND GEOGRAPHIC INFORMATION SYSTEMS

SEMESTER – II – PROJECT - 250 Marks

Projects may be selected from the following topics listed below:

SCIENCES: Environmental Management –Assessment- Pollution (air, water, soil), incidence of diseases Hydrology, Natural Resources, Mining Exploration, Mapping of wetlands, Mangroves, Biodiversity and Biomass,

I.T/COMPUTER SCIENCE: Digital Image processing techniques, e-governance, website implementation, networking,

CIVIL DIPLOMA: route mapping **Telecommunications, Utilities, Facilities Mapping, Asset Management, real estate management**

ARTS & COMMERCE: Retail Modeling, Insurance, Banking, Crime mapping, Demographic analysis, Socio Economic Analysis-Literacy Programmes, Social Upliftment, Slum Rehabilitation

PROJECT

a) Each candidate shall undertake a project (100-150 pages) carrying 250 marks
b) The project may be undertaken within the College or in any Industry/Institute approved by the University/College
c) The project will be for a duration of One Semester (24 weeks only), the Project should demonstrate the use of GIS and RS techniques in solving a problem
d) Each project shall be duly certified by the subject teacher and the Head of the Department
e) Each project shall have to be submitted for evaluation within one week of the conclusion of the theory or practical exam whichever is later

R: 5258 STANDARD OF PASSING

For Semester I : A candidate shall be declared to have successfully passed the **Semester I** of the **One Year Post Graduate Diploma in Remote Sensing and GIS** as contained in O.5558 above.

a) Candidate must obtain 40% marks in each Theory/Practical subject for Semester I examination

b) A candidate shall be allowed to keep terms for Semester II if he/she passes in Semester I, OR if he/she fails in not more than two theory papers/practicals of Semester I

c) If a candidate fails to score minimum marks for passing in any two or more Heads of Passing, he/she will be declared unsuccessful for the award of the certificate.

d) However, the candidate shall be given the exemption in the heads in which he/she has passed and he/she shall be allowed to appear for the examination again only for the Heads in which he/she has failed.

For Semester II: A candidate shall be declared to have successfully passed the Semester II of the **One Year Post Graduate Diploma Course in Remote Sensing and GIS** as contained in O.5558 above.

a) Award of Class: As per the prevailing norms for other science subjects

Award of Class		
Pass Class	40%	Marks of SEM I & II taken together
Second Class	50%	Marks of SEM I & II taken together
First Class	60%	Marks of SEM I & II taken together
First Class With Distinction	75%	Marks of SEM I & II taken together

The class will not be awarded to the candidates who are repeaters.

♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠ ♠