



ANNA UNIVERSITY, CHENNAI
NON AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS – 2021

B.E. GEOINFORMATICS ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- I. To prepare the students for successful careers in Geospatial Industries and Information Technology that meet the needs of India and other Countries.
- II. To develop the professional ability among the students to collect various Geospatial relates from various platform, data, analysis and synthesis that create user oriented real world applications.
- III. To provide an opportunity for students to work as part of teams on multidisciplinary projects.
- IV. To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering and multidisciplinary problems and to prepare them for graduate studies.
- V. To promote students awareness of the life-long learning and to introduce them to professional ethics and codes of professional practice.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs)

Graduates of B.E. Geoinformatics students will be able to

PSO1 Knowledge of Geoinformatics discipline

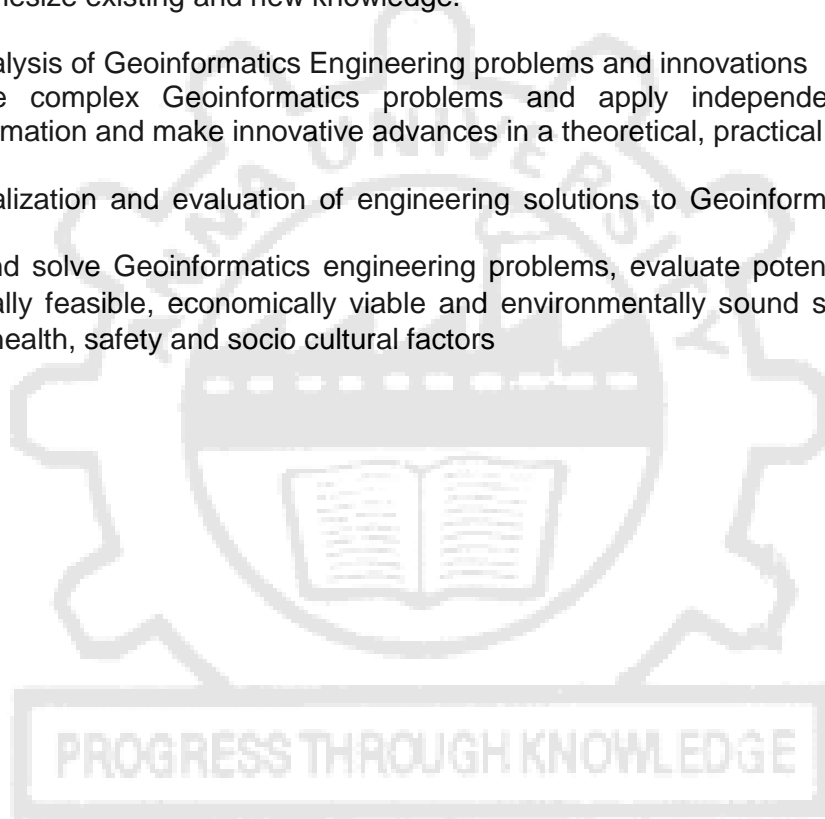
Demonstrate in-depth knowledge of Geoinformatics engineering discipline with an ability to evaluate, analyze and synthesize existing and new knowledge.

PSO2 Critical analysis of Geoinformatics Engineering problems and innovations

Critically analyze complex Geoinformatics problems and apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical policy context.

PSO3 Conceptualization and evaluation of engineering solutions to Geoinformatics engineering issues

Conceptualize and solve Geoinformatics engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety and socio cultural factors



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**CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS III AND IV
SEMESTER I**

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IP3151	Induction Programme	-	-	-	-	-	0
THEORY								
2.	HS3151	Professional English - I	HSMC	3	0	0	3	3
3.	MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4.	PH3151	Engineering Physics	BSC	3	0	0	3	3
5.	CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6.	GE3151	Problem Solving and Python Programming	ESC	3	0	0	3	3
7.	GE3152	அறிவியல் தமிழ் / Scientific Thoughts in Tamil	HSMC	1	0	0	1	1
PRACTICALS								
8.	GE3171	Problem Solving and Python Programming Laboratory	ESC	0	0	4	4	2
9.	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10.	GE3172	English Laboratory [§]	EEC	0	0	2	2	1
TOTAL				16	1	10	27	22

[§] Skill Based Course

SEMESTER II

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	HS3251	Professional English - II	HSMC	2	0	0	2	2
2.	MA3251	Statistics and Numerical Methods	BSC	3	1	0	4	4
3.	PH3203	Physics for Geoinformatics Engineering	BSC	3	0	0	3	3
4.	BE3252	Basic Electrical, Electronics and Instrumentation Engineering	ESC	3	0	0	3	3
5.	GI3201	Geoinformatics Systems	PCC	3	0	0	3	3
6.	GE3251	Engineering Graphics	ESC	2	0	4	6	4
7.		NCC Credit Course Level 1 [#]	-	2	0	0	2	2 [#]
8.	GE3252	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
9.	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
10.	BE3272	Basic Electrical, Electronics and Instrumentation Engineering Laboratory	ESC	0	0	4	4	2
11.	GE3272	Communication Laboratory / Foreign Language [§]	EEC	0	0	4	4	2
TOTAL				17	1	16	34	26

* NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

§ Skill Based Course

SEMESTER III

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA3302	Transforms and Statistics	BSC	3	1	0	4	4
2.	GI3301	Spatial Database Management system	PCC	3	0	0	3	3
3.	GI3302	Surveying	PCC	3	0	0	3	3
4.	GI3303	Remote Sensing	PCC	3	0	0	3	3
5.	GI3304	Geodesy	PCC	3	0	0	3	3
6.	GI3391	Photogrammetry	PCC	3	0	0	3	3
PRACTICALS								
8.	GI3311	Surveying Laboratory I	PCC	0	0	4	4	2
9.	GI3312	Remote Sensing and Photogrammetry Laboratory	PCC	0	0	2	2	1
10.	GE3361	Professional Development §	EEC	0	0	2	2	1
TOTAL				18	1	8	27	23

§ Skill Based Course

SEMESTER IV

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3401	Sensors and Data products	PCC	3	0	0	3	3
2.	GI3402	Digital Image Processing	PCC	3	0	0	3	3
3.	GI3403	Microwave Remote Sensing	PCC	3	0	0	3	3
4.	GI3491	Cartography and GIS	PCC	3	0	0	3	3
5.	GI3492	Total Station and GPS Surveying	PCC	3	0	0	3	3
6.	GE3451	Environmental Sciences and sustainability	BSC	2	0	0	2	2
7.		NCC Credit course level 2 [#]		3	0	0	3	3 [#]
PRACTICALS								
8.	GI3411	Total Station and GPS Surveying Laboratory	PCC	0	0	4	4	2
9.	GI3412	Cartography and GIS Laboratory	PCC	0	0	2	2	1
10.	GI3413	Digital Image Processing Laboratory	PCC	0	0	4	4	2
TOTAL				17	0	10	27	22

[#] NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

SEMESTER V

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3501	Spatial Analysis and Applications	PCC	3	0	0	3	3
2.	GI3502	Mapping toolboxes for Geomatics	PCC	3	0	0	3	3
3.		Professional Elective I	PEC	3	0	0	3	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Professional Elective IV	PEC	3	0	0	3	3
7.		Mandatory course-I ^{&}	MC	3	0	0	3	0
PRACTICALS								
9.	GI3511	Mapping toolboxes Laboratory	PCC	0	0	2	2	1
TOTAL				21	0	6	27	19

[&] Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

SEMESTER VI

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3601	Geospatial analysis with R programming	PCC	2	0	2	4	3
2.	GI3691	Airborne and Terrestrial Laser Mapping	PCC	3	0	0	3	3
3.		Open elective-I [*]	OEC	3	0	0	3	3
4.		Professional Elective V	PEC	3	0	0	3	3
5.		Professional Elective VI	PEC	3	0	0	3	3
6.		Professional Elective VII	PEC	3	0	0	3	3
7.		Mandatory course-II ^{&}	MC	3	0	0	3	0
		NCC Credit course level 3 [#]	-	3	0	0	3	3 [#]
PRACTICALS								
8.	GI3611	Spatial Analysis and Applications Laboratory	PCC	0	0	4	4	2
9.	GI3612	Survey Camp (2 Weeks)	EEC	-	-	-	-	1
TOTAL				20	0	6	26	21

^{*}Open Elective – I shall be chosen from the emerging technologies

[&] Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC-II)

[#] NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

SEMESTER VII/VIII*

S. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	GI3701	Spatial data adjustment	PCC	3	0	0	3	3
2.	GI3702	Web GIS	PCC	3	0	0	3	3
3.	GE3791	Human Values and Ethics	HSMC	2	0	0	2	2
4.	GE3752	Total Quality Management	HSMC	3	0	0	3	3
5.		Open Elective II**	OEC	3	0	0	3	3
6.		Open Elective III***	OEC	3	0	0	3	3
7.		Open Elective IV***	OEC	3	0	0	3	3
PRACTICALS								
8.	GI3711	Customization laboratory	PCC	0	0	2	2	1
TOTAL				20	0	2	22	21

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VII

**Open Elective – II shall be chosen from the emerging technologies

***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes)

SEMESTER VIII/VII*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	GI3811	Project Work/Internship	EEC	0	0	20	20	10
TOTAL				0	0	20	20	10

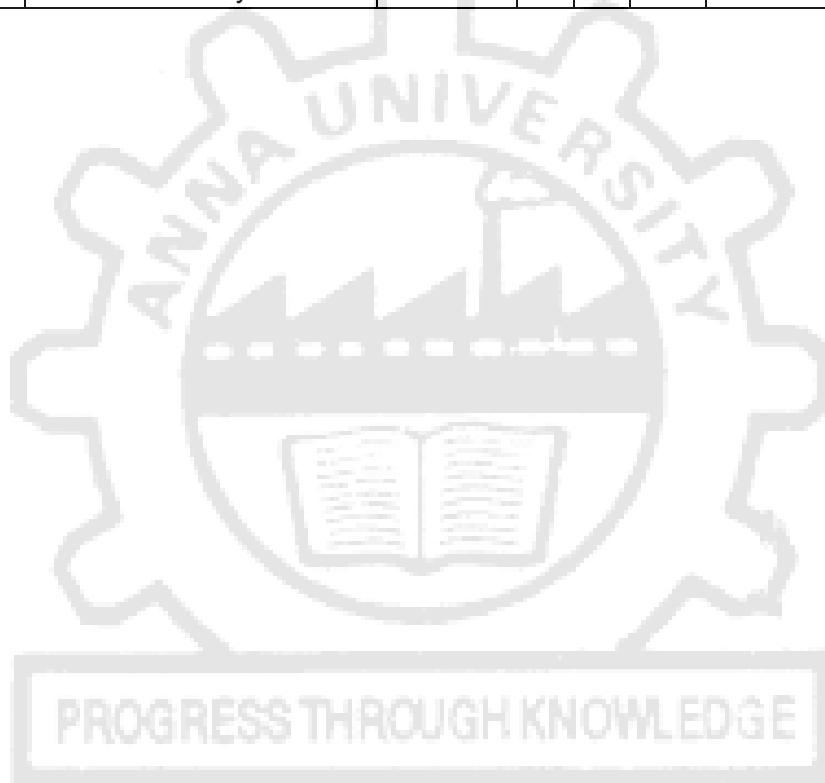
*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII

TOTAL NO. OF CREDITS: 164

MANDATORY COURSES I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3	0
2.	MX3082	Elements of Literature	MC	3	0	0	3	0
3.	MX3083	Film Appreciation	MC	3	0	0	3	0
4.	MX3084	Disaster Management	MC	3	0	0	3	0

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MX3085	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	MC	3	0	0	3	0
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3	0
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3	0
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3	0
5.	MX3089	Industrial Safety	MC	3	0	0	3	0



PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I (Surveying & Mapping)	VERTICAL II (Geospatial Data Analytics)	VERTICAL III (Image Processing and Analysis)	VERTICAL IV (Geo Spatial Applications)	VERTICAL V (Geodesy)
Terrestrial and Close Range Photogrammetry	GIS Customization and Scripting	Soft Computing Techniques	Environmental Geoinformatics	Advanced Geodesy
GPS Surveying	Open Source GIS	Thermal, Hyperspectral and Planetary Remote Sensing	Geomatics for Urban Infrastructure	Satellite Geodesy
Terrestrial and Bathymetric Laser Scanning	Location Based GIS	Polarimetry and Interferometry	Geomatics for Hydrology and Water Resources	Physical Geodesy
Unmanned Aerial Vehicle (UAV) for Large Scale MAPPING	Enterprise GIS	AI / DL for image Processing	Satellite Meteorology	Geodetic Interferometry
Sub surface Survey Methods	GIS based Utility and Asset Management	Pattern Recognition (Satellite, Aerial, UAV)	Geomatics for Disaster and Risk Mitigation	Environmental Geodesy
Cadastral Surveying	Geo Computing	Raster Data Modelling	Geomatics for Agriculture and Forestry	Geodetic Control Survey and Adjustment
Advanced Surveying Techniques	Geo Spatial Modeling & Simulation	SDG and Geomatics	Geomatics for ocean and Coastal Applications	Geodetic Astronomy

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialization. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E./B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.

PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL I: SURVEYING & MAPPING

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3001	Terrestrial and Close Range Photogrammetry	PEC	3	0	0	3	3
2.	GI3002	GPS Surveying	PEC	3	0	0	3	3
3.	GI3003	Terrestrial and Bathymetric Laser Scanning	PEC	3	0	0	3	3
4.	GI3004	Unmanned Aerial Vehicle (UAV) for Large Scale Mapping	PEC	3	0	0	3	3
5.	GI3005	Sub Surface Survey Methods	PEC	3	0	0	3	3
6.	GI3006	Cadastral Surveying	PEC	3	0	0	3	3
7.	GI3007	Advanced surveying Techniques (Mining, Hydrology, Route, Astronomy)	PEC	3	0	0	3	3

VERTICAL II: GEOSPATIAL DATA ANALYTICS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3008	GIS Customization and Scripting	PEC	3	0	0	3	3
2.	GI3009	Open Source GIS	PEC	3	0	0	3	3
3.	GI3010	Location Based GIS	PEC	3	0	0	3	3
4.	GI3011	Enterprise GIS (API, rest soap SOA, SAS, OGC, Web services)	PEC	3	0	0	3	3
5.	GI3012	GIS based Utility and Asset Management	PEC	3	0	0	3	3
6.	GI3013	Geo Computing	PEC	3	0	0	3	3
7.	GI3014	Geo Spatial Modeling and Simulation	PEC	3	0	0	3	3

VERTICAL III: IMAGE PROCESSING AND ANALYSIS

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3015	Soft Computing Techniques	PEC	3	0	0	3	3
2.	GI3016	Thermal Hyperspectral & Planetary Remote Sensing	PEC	3	0	0	3	3
3.	GI3017	Polarimetry and Interferometry	PEC	3	0	0	3	3
4.	GI3018	AI / DL for image Processing	PEC	3	0	0	3	3
5.	GI3019	Pattern Recognition (Satellite, Aerial, UAV)	PEC	3	0	0	3	3
6.	GI3020	Raster Data Modelling	PEC	3	0	0	3	3
7.	GI3021	SDG and Geomatics	PEC	3	0	0	3	3

VERTICAL IV: GEO SPATIAL APPLICATIONS

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3022	Environmental Geoinformatics	PEC	3	0	0	3	3
2.	GI3023	Geomatics for Urban Infrastructure	PEC	3	0	0	3	3
3.	GI3024	Geomatics for Hydrology and Water Resources	PEC	3	0	0	3	3
4.	GI3025	Satellite Meteorology	PEC	3	0	0	3	3
5.	GI3026	Geomatics for Disaster and Risk Mitigation	PEC	3	0	0	3	3
6.	GI3027	Geomatics for Agriculture and Forest	PEC	3	0	0	3	3
7.	GI3028	Geomatics for Ocean and Coastal Applications	PEC	3	0	0	3	3

VERTICAL V: GEODESY

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GI3029	Advanced Geodesy	PEC	3	0	0	3	3
2.	GI3030	Satellite Geodesy	PEC	3	0	0	3	3
3.	GI3031	Physical Geodesy	PEC	3	0	0	3	3
4.	GI3032	Geodetic Interferometry	PEC	3	0	0	3	3
5.	GI3033	Environmental Geodesy	PEC	3	0	0	3	3
6.	GI3034	Geodetic Control Survey and Adjustment	PEC	3	0	0	3	3
7.	GI3035	Geodetic Astronomy	PEC	3	0	0	3	3

OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

OPEN ELECTIVE I AND II (EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OCS351	Artificial Intelligence and Machine Learning Fundamentals	OEC	2	0	2	4	3
2.	OCS352	IoT Concepts and Applications	OEC	2	0	2	4	3
3.	OCS353	Data Science Fundamentals	OEC	2	0	2	4	3
4.	OCS354	Augmented and Virtual Reality	OEC	2	0	2	4	3

OPEN ELECTIVES – III

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS351	English for Competitive Examinations	OEC	3	0	0	3	3
2.	OMG352	NGOs and Sustainable Development	OEC	3	0	0	3	3
3.	OMG353	Democracy and Good Governance	OEC	3	0	0	3	3
4.	OME353	Renewable Energy Technologies	OEC	3	0	0	3	3
5.	OME354	Applied Design Thinking	OEC	2	0	2	4	3
6.	OMF351	Reverse Engineering	OEC	3	0	0	3	3
7.	OMF353	Sustainable Manufacturing	OEC	3	0	0	3	3
8.	OAU351	Electric and Hybrid Vehicle	OEC	3	0	0	3	3
9.	OAS352	Space Engineering	OEC	3	0	0	3	3
10.	OIM351	Industrial Management	OEC	3	0	0	3	3
11.	OIE354	Quality Engineering	OEC	3	0	0	3	3
12.	OSF351	Fire Safety Engineering	OEC	3	0	0	3	3
13.	OML351	Introduction to non-destructive testing	OEC	3	0	0	3	3
14.	OMR351	Mechatronics	OEC	3	0	0	3	3
15.	ORA351	Foundation of Robotics	OEC	3	0	0	3	3
16.	OAE352	Fundamentals of Aeronautical engineering	OEC	3	0	0	3	3

17.	OCE353	Lean Concepts, Tools And Practices	OEC	3	0	0	3	3
18.	OAI351	Urban Agriculture	OEC	3	0	0	3	3
19.	OEN351	Drinking Water Supply and Treatment	OEC	3	0	0	3	3
20.	OEE352	Electric Vehicle technology	OEC	3	0	0	3	3
21.	OEI353	Introduction to PLC Programming	OEC	3	0	0	3	3
22.	OCH351	Nano Technology	OEC	3	0	0	3	3
23.	OCH352	Functional Materials	OEC	3	0	0	3	3
24.	OBT352	Biomedical Instrumentation	OEC	3	0	0	3	3
25.	OFD352	Traditional Indian Foods	OEC	3	0	0	3	3
26.	OFD353	Introduction to food processing	OEC	3	0	0	3	3
27.	OPY352	IPR for Pharma Industry	OEC	3	0	0	3	3
28.	OTT351	Basics of Textile Finishing	OEC	3	0	0	3	3
29.	OTT352	Industrial Engineering for Garment Industry	OEC	3	0	0	3	3
30.	OTT353	Basics of Textile Manufacture	OEC	3	0	0	3	3
31.	OPE351	Introduction to Petroleum Refining and Petrochemicals	OEC	3	0	0	3	3
32.	OPE352	Energy Conservation and Management	OEC	3	0	0	3	3
33.	OPT351	Basics of Plastics Processing	OEC	3	0	0	3	3
34.	OEC351	Signals and Systems	OEC	3	0	0	3	3
35.	OEC352	Fundamentals of Electronic Devices and Circuits	OEC	3	0	0	3	3
36.	OBM351	Foundation Skills in integrated product Development	OEC	3	0	0	3	3
37.	OBM352	Assistive Technology	OEC	3	0	0	3	3
38.	OMA352	Operations Research	OEC	3	0	0	3	3
39.	OMA353	Algebra and Number Theory	OEC	3	0	0	3	3
40.	OMA354	Linear Algebra	OEC	3	0	0	3	3

OPEN ELECTIVES – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS352	Project Report Writing	OEC	3	0	0	3	3
2.	OMA355	Advanced Numerical Methods	OEC	3	0	0	3	3
3.	OMA356	Random Processes	OEC	3	0	0	3	3

4.	OMA357	Queuing and Reliability Modelling	OEC	3	0	0	3	3
5.	OMG354	Production and Operations Management for Entrepreneurs	OEC	3	0	0	3	3
6.	OMG355	Multivariate Data Analysis	OEC	3	0	0	3	3
7.	OME352	Additive Manufacturing	OEC	3	0	0	3	3
8.	OME353	New Product Development	OEC	3	0	0	3	3
9.	OME355	Industrial Design & Rapid Prototyping Techniques	OEC	2	0	2	4	3
10.	OMF352	Micro and Precision Engineering	OEC	3	0	0	3	3
11.	OMF354	Cost Management of Engineering Projects	OEC	3	0	0	3	3
12.	OAU352	Batteries and Management system	OEC	3	0	0	3	3
13.	OAU353	Sensors and Actuators	OEC	3	0	0	3	3
14.	OAS353	Space Vehicles	OEC	3	0	0	3	3
15.	OIM352	Management Science	OEC	3	0	0	3	3
16.	OIM353	Production Planning and Control	OEC	3	0	0	3	3
17.	OIE353	Operations Management	OEC	3	0	0	3	3
18.	OSF352	Industrial Hygiene	OEC	3	0	0	3	3
19.	OSF353	Chemical Process Safety	OEC	3	0	0	3	3
20.	OML352	Electrical, Electronic and Magnetic materials	OEC	3	0	0	3	3
21.	OML353	Nanomaterials and applications	OEC	3	0	0	3	3
22.	OMR352	Hydraulics and Pneumatics	OEC	3	0	0	3	3
23.	OMR353	Sensors	OEC	3	0	0	3	3
24.	ORA352	Foundation of Automation	OEC	3	0	0	3	3
25.	ORA353	Concepts in Mobile Robotics	OEC	3	0	0	3	3
26.	OMV351	Marine Propulsion	OEC	3	0	0	3	3
27.	OMV352	Marine Merchant Vehicles	OEC	3	0	0	3	3
28.	OMV353	Elements of Marine Engineering	OEC	3	0	0	3	3
29.	OAE353	Drone Technologies	OEC	3	0	0	3	3
30.	OCE354	Basics of Integrated Water Resources Management	OEC	3	0	0	3	3
31.	OAI352	Agriculture Entrepreneurship Development	OEC	3	0	0	3	3

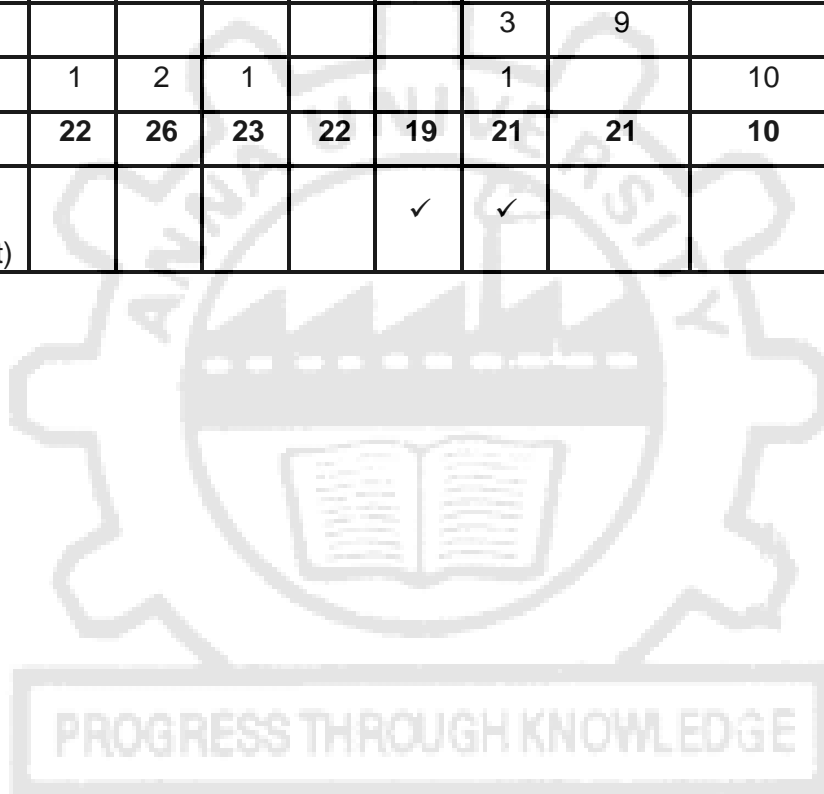
32.	OEN352	Biodiversity Conservation	OEC	3	0	0	3	3
33.	OEE353	Introduction to control systems	OEC	3	0	0	3	3
34.	OEI354	Introduction to Industrial Automation Systems	OEC	3	0	0	3	3
35.	OCH353	Energy Technology	OEC	3	0	0	3	3
36.	OCH354	Surface Science	OEC	3	0	0	3	3
37.	OBT353	Environment and Agriculture	OEC	3	0	0	3	3
38.	OFD354	Fundamentals of Food Engineering	OEC	3	0	0	3	3
39.	OFD355	Food safety and Quality Regulations	OEC	3	0	0	3	3
40.	OPY353	Nutraceuticals	OEC	3	0	0	3	3
41.	OTT354	Basics of Dyeing and Printing	OEC	3	0	0	3	3
42.	OTT355	Fibre Science	OEC	3	0	0	3	3
43.	OTT356	Garment Manufacturing Technology	OEC	3	0	0	3	3
44.	OPE353	Industrial safety	OEC	3	0	0	3	3
45.	OPE354	Unit Operations in Petro Chemical Industries	OEC	3	0	0	3	3
46.	OPT352	Plastic Materials for Engineers	OEC	3	0	0	3	3
47.	OPT353	Properties and Testing of Plastics	OEC	3	0	0	3	3
48.	OEC353	VLSI Design	OEC	3	0	0	3	3
49.	OEC354	Industrial IoT and Industry 4.0	OEC	2	0	2	4	3
50.	OBM353	Wearable devices	OEC	3	0	0	3	3
51.	OBM354	Medical Informatics	OEC	3	0	0	3	3

PROGRESS THROUGH KNOWLEDGE

Padeepz App

SUMMARY

S.No.	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII/VIII	VIII/VII	
1.	HSMC	4	3					5		12
2.	BSC	12	7	4	2					25
3.	ESC	5	11							16
4.	PCC		3	18	20	7	8	7		63
5.	PEC					12	9			21
6.	OEC						3	9		12
7.	EEC	1	2	1			1		10	15
	Total	22	26	23	22	19	21	21	10	164
8.	Mandatory Course (Non Credit)					✓	✓			



ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

For more details please refer clause 4.10 of Regulations 2021.

VERTICALS FOR MINOR DEGREE (In addition to all the verticals of other programmes)

VERTICAL I	VERTICAL II	VERTICAL III	VERTICAL IV	VERTICAL V
Fintech and Block Chain	Entrepreneurship	Public Administration	Business Data Analytics	Environment and Sustainability
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building and Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurship	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL 1: FINTECH AND BLOCK CHAIN

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG331	Financial Management	PEC	3	0	0	3	3
2.	CMG332	Fundamentals of Investment	PEC	3	0	0	3	3
3.	CMG333	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	CMG334	Introduction to Blockchain and its Applications	PEC	3	0	0	3	3
5.	CMG335	Fintech Personal Finance and Payments	PEC	3	0	0	3	3
6.	CMG336	Introduction to Fintech	PEC	3	0	0	3	3

VERTICAL 2: ENTREPRENEURSHIP

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG337	Foundations of Entrepreneurship	PEC	3	0	0	3	3
2.	CMG338	Team Building and Leadership Management for Business	PEC	3	0	0	3	3
3.	CMG339	Creativity and Innovation in Entrepreneurship	PEC	3	0	0	3	3
4.	CMG340	Principles of Marketing Management for Business	PEC	3	0	0	3	3
5.	CMG341	Human Resource Management for Entrepreneurship	PEC	3	0	0	3	3
6.	CMG342	Financing New Business Ventures	PEC	3	0	0	3	3

VERTICAL 3: PUBLIC ADMINISTRATION

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG343	Principles of Public Administration	PEC	3	0	0	3	3
2.	CMG344	Constitution of India	PEC	3	0	0	3	3
3.	CMG345	Public Personnel Administration	PEC	3	0	0	3	3
4.	CMG346	Administrative Theories	PEC	3	0	0	3	3
5.	CMG347	Indian Administrative System	PEC	3	0	0	3	3
6.	CMG348	Public Policy Administration	PEC	3	0	0	3	3

VERTICAL 4: BUSINESS DATA ANALYTICS

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG349	Statistics for Management	PEC	3	0	0	3	3
2.	CMG350	Datamining for Business Intelligence	PEC	3	0	0	3	3
3.	CMG351	Human Resource Analytics	PEC	3	0	0	3	3
4.	CMG352	Marketing and Social Media Web Analytics	PEC	3	0	0	3	3
5.	CMG353	Operation and Supply Chain Analytics	PEC	3	0	0	3	3
6.	CMG354	Financial Analytics	PEC	3	0	0	3	3

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CES331	Sustainable infrastructure Development	PEC	3	0	0	3	3
2.	CES332	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	CES333	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	CES334	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	CES335	Green Technology	PEC	3	0	0	3	3
6.	CES336	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	CES337	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	CES338	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3

UNIT I FOURIER SERIES

9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Root mean square value - Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM

9 + 3

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III RANDOM VARIABLES

9 + 3

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

UNIT IV TWO-DIMENSIONAL RANDOM VARIABLES

9 + 3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT V ESTIMATION THEORY

9 + 3

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

- CO 1** Apply Fourier series techniques used in wide variety of situations in which the functions used are not periodic and to solve boundary value problems.
- CO 2** Apply the Fourier transform techniques to solve boundary value problems.
- CO 3** To understand and apply the concept of Probability and random variables in Statistics which is central to many geometric applications.
- CO 4** To apply the basic concepts of two dimensional random variables.
- CO 5** To understand the knowledge of applying the concept of estimation theory which plays an important role in real life problems.

TEXTBOOKS:

1. Grewal. B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.
2. John E. Freund's "Mathematical Statistics with Applications", 8th Edition, Pearson Education, New Delhi, 2017.
3. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.

REFERENCES:

1. James. G., "Advanced Modern Engineering Mathematics ", 4th Edition, Pearson Education, New Delhi, 2016.
2. Kreyszig. E, "Advanced Engineering Mathematics", John Wiley & Sons, 10th Edition, New Delhi, 2014.
3. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Thomson Brooks/Cole, International Student Edition, New Delhi, 8th Edition, 2012.
4. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 5th Edition, 2014.
5. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, New Delhi, 2004.

OBJECTIVES:

- Introduce the students to the concepts of DBMS, Spatial Database Management System (SDBMS), Spatial Database design, basic application program development and user interfaces.

UNIT I INTRODUCTION 9

Data — Information - File system Vs DBMS — Database Management Systems — Database architectures, users and administrators — Classification of Database Management Systems – Spatial Data - Points, Lines, Polygons – definition of SDBMS – user classes of SDBMS – Multilayer architecture of SDBMS – GIS and SDBMS.

UNIT II SPATIAL CONCEPTS AND DATA MODELS 9

Field based model – object based model – spatial data types – operations on spatial objects - Entity Relationship Model (ER Model) – Relational Model – Constraints and Normal forms of Relational Model - mapping ER model to Relational model – ER model with spatial concepts – Object-oriented data modeling with Unified Modeling Language(UML).

UNIT III QUERY LANGUAGE 9

SQL — Data Definition — Data Manipulation - Basic structure of SQL — Set operations — Aggregate Functions – Simple queries – spatial Vs non spatial - Nested sub queries – Complex queries – Views – Trigger - OGIS standard for extending SQL - example spatial SQL queries – Object relational SQL.

UNIT IV SPATIAL STORAGE AND INDEXING 9

Disk geometry — Buffer manager – Field-Record — File — File Structure — Clustering – Basic concepts of file organizations, indexing – Spatial Indexing – Grid files – R Tree – Concurrency support – Spatial Join index – Database recovery techniques – Database Security.

UNIT V SPATIAL DATABASE SYSTEMS AND APPLICATION DESIGN AND DEVELOPMENTS 9

Exploring Spatial Geometry – Organizing spatial data - spatial data relationships and functionalities of any one commercial and one FOS SDBMS each – Application program and user Interfaces.

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

- CO1** Understand the concepts, classification, architectures of DBMS, SDBMS
- CO2** Provide the information on Field Based, Object Based, ER, Relational and UML models.
- CO3** Enable the SQL, Extended SQL for handling Spatial and Non-Spatial Queries.
- CO4** Show the methods of Storing, Indexing, Database Recovery and Data Security concepts
- CO5** Give the Design and Development Environment of Spatial Data

TEXTBOOKS:

1. Shashi Shekhar, Sanjay Chawla, "Spatial Databases a Tour" Prentice Hall, 1st edition, 2003.
2. Philippe Rigaux, Michel Scholl, Agnès Voisard "Spatial Databases" Morgan Kaufmann, 2001

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", 7th edition, McGraw Hill, 2020.
2. Ravi Kothuri, Albert Godfrind, Euro Beinat "Pro Oracle Spatial for Oracle Database 11g", Apress, 2019.
3. Regina, Leo Hsu "Post GIS in Action", Oreilly&AssociatesInc., third edition (2021).
4. Vijay Gandhi; James Kang; Shashi Shekhar, "Spatial Databases." Minnesota univ minneapolis dept of electrical and computer engineering, 2007
5. Albert K. W. Yeung & G. Brent Hall, " Spatial Data and Spatial Database Systems", 2007

OBJECTIVES:

- To introduce the rudiments of surveying and its principles to Geoinformatics Engineers.
- To learn the various methods of surveying to solve the real-world problems.
- To introduce the concepts of control surveying
- To introduce the basics of cadastral Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING

9

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging – well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction - Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits - Radiation – Intersection – Resection – Plane table traversing.

UNIT II LEVELLING

9

Level line – Horizontal line – Datum – Benchmarks – Levels and Staves - Temporary and Permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling – Contouring – Methods of interpolating Contours – Characteristics and uses of Contours – Areas enclosed by straight lines – Irregular figures – Volumes – Earth work calculations.

UNIT III THEODOLITE SURVEYING

9

Theodolite – Types – Horizontal and Vertical angle measurements - Temporary and Permanent adjustments – Trigonometric Levelling - Heights and distances – Single Plane method – Double Plane method – Geodetic observation - Tacheometric surveying – Stadia Tacheometry – Subtense method –Tangential Tacheometry.

UNIT IV CONTROL SURVEYING AND ADJUSTMENT

9

Horizontal and Vertical control – Methods – Triangulation – Base line – Instruments and accessories – Corrections – Satellite station – Traversing – Coordinate computation – Gale's table – Omitted measurement – Trilateration – Concepts of measurements and errors – weight of an observation – law of weight – adjustment methods – angles, lengths and levelling network – simple problems

UNIT V CADASTRAL SURVEYING

9

History of cadastral survey – Land Records - FMB Sketch -Tax – Real Property- Legal Cadastral – Graphical and Numerical Cadastre - Legal Characteristics of Records - Torrens System. Cadastral map reproduction – Map projection for cadastral maps - Automated Cadastral map – Land Information System.

TOTAL:45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
- CO 1** Understand the rudiments of various surveying and its principles.
- CO 2** Gain knowledge in computation of levels of terrain and ground features
- CO 3** Understand the concepts of Theodolite Surveying for complex surveying operations
- CO 4** Understand the procedure for establishing horizontal and vertical control
- CO 5** Gain knowledge on cadastral survey

TEXTBOOKS:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2010, 24th edition.
2. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001.
3. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004.
4. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice Hall of India 2004.
5. K. R. Arora, Surveying Vol I & II, Standard Book house, 2019
6. C. Venkatramaiah, Textbook of Surveying, Universities Press, Second Edition, 2011.

GI3303

REMOTE SENSING

L T P C

3 0 0 3

OBJECTIVES:

- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition — components of RS — History of Remote Sensing — Merits and demerits of Data Collation between conventional and remote sensing methods — Electromagnetic Spectrum — Radiation principles - Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law, Kirchhoff's law — Radiation sources: active & passive — Radiation Quantities.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile — main atmospheric regions and its characteristics — interaction of radiation with atmosphere — Scattering, absorption and refraction — Atmospheric windows — Energy balance equation — Specular and diffuse reflectors — Spectral reflectance&emittance— Spectroradiometer — Spectral Signature concepts — Typical spectral reflectance curves for vegetation, soil and water — solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS 9

Motions of planets and satellites — Newton's law of gravitation — Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types — Orbital perturbations and maneuvers — Types of remote sensing platforms - Ground based, Air borne platforms and Space borne platforms — Classification of satellites — Sun synchronous and Geosynchronous satellites — Lagrange Orbit.

UNIT IV SENSING TECHNIQUES 9

Classification of Remote Sensors — Resolution concept: spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners — Optical-infrared sensors — Thermal sensors — Microwave sensors — Calibration of sensors — High Resolution Sensors - LIDAR, UAV — Orbital and sensor characteristics of live Indian earth observation satellites.

UNIT V DATA PRODUCTS AND INTERPRETATION 9

Photographic and Digital products — Types, levels and open-source satellite data products — selection and procurement of data — Visual interpretation: basic elements and interpretation keys - Digital interpretation — Concepts of Image rectification, Image enhancement and Image classification.

TOTAL:45 PERIODS

COURSE OUTCOMES:

• On completion of the course, the student is expected to

- CO 1** Understand the concepts and laws related to remote sensing
- CO 2** Understand the interaction of electromagnetic radiation with atmosphere and Earth material
- CO 3** Acquire knowledge about satellite orbits and different types of satellites.
- CO 4** Understand the different types of remote sensors.
- CO 5** Gain knowledge about the concepts of interpretation of satellite imagery.

TEXTBOOKS:

1. Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc., New York, 2015.
2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018.

REFERENCES:

1. Stanley A Morain; Amelia M Budge; Michael S Renslow. Manual of Remote Sensing. Vol. I, American Society for Photogrammetry and Remote Sensing, Virginia, USA, 2019, 4th edition
2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 2022 first edition.
3. Paul Curran P. J. Principles of Remote Sensing Longman, RLBS, 1996.
4. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2021 Edition 3, Wiley Publication.
5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2020 third edition.

GI3304

GEODESY

L T P C
3 0 0 3

OBJECTIVES:

- To understand the geometry of the earth, Gravity, and its relationship with nature.

UNIT I FUNDAMENTALS

9

Definitions - Classifications, Problem of Geodesy and purpose of Geodesy Historical development and Organization of Geodesy. Reference Surfaces and their relationship. Applications, Engineering, Lunar, Planetary and interferometric Synthetic aperture radar Geodesy – Local and International Spheroid.

UNIT II GEOMETRIC GEODESY

9

Geometry of ellipsoid, fundamental mathematical relationship of ellipsoid, Geodetic, Geocentric and Reduced latitudes and their relationship. Ellipsoidal Co-ordinates in terms of Reduced, Geodetic and geocentric latitude. Radius of curvature in the meridian & prime vertical and their relationship. Mean Radius of curvature in any azimuth, Length of the meridian arcs and arcs of parallel and Area of trapezium on the ellipsoid. Curves on the ellipsoid, properties of Geodesic.

UNIT III CO-ORDINATE SYSTEMS

9

Natural or Astronomical Co-ordinate System, Geodetic or Geographical co-ordinate System, Rectangular or Cartesian Co-ordinate System and relationship between them. Curvilinear Co-ordinate System. Deflection of Vertical, Spherical excess. Astro-Geodetic method of determining the reference Spheroid.

UNIT IV PHYSICAL GEODESY

9

Basics - INGN -the significance of gravity measurements, Gravity field of earth, Concept of equipotential, Geo potential and Sphero potential Surface - Normal gravity and its computations, Methods of measuring Absolute and Relative gravity- Gravimeters - Reduction of gravity measurements, terrain and Isostasy corrections. Gravity networks. Gravity anomaly and Gravity disturbance - Fundamental equation of Physical Geodesy. Gravimetric determination of Geoid and Deflection of Vertical - Gravimetric satellite.

UNIT V GEODETIC ASTRONOMY

9

Celestial Sphere – Astronomical triangle – celestial coordinates systems and its relationship with Cartesian Co-ordinates and Transformation between them - Special star positions, Major 44 constellations - time systems (sidereal, Universal, atomic and standard) rising and setting of Stars with respect to Declination, hour angle and Azimuth, Culmination, Prime Vertical Crossing and Elongation.

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

- CO 1** Learn about the fundamentals of Geodesy
- CO 2** Understand the concepts of geoid, ellipsoid and their interrelationship
- CO 3** Know about the various types of coordinate systems and relationship between them
- CO 4** Learn about the methods for measurement of gravity and gravity network
- CO 5** Understand the concepts of geodetic astronomy

TEXTBOOKS:

1. Wolfgang Torge, Geodesy, Walter De Gruyter Inc., Berlin, 2015 2nd edition.
2. Guy Bomford//Geodesyll Nabu Press, 2015, ISBN 1172029091.

REFERENCES:

1. PetrVanicek and Edward J. Krakiwsky, Geodesy: The concepts, North-Holland Publications Co., Amsterdam, 2014 2nd edition.
2. Tom Herring, Geodesy Elsevier,2009, ISBN: 0444534601
3. Schwarze, V.S. Geodesy: The challenge of the 3rd millennium, Springer verlag, and 2003.
4. James R.Smith, Introduction to Geodesy, John wiley & Sons Inc. 1997

GI3391

PHOTOGRAMMETRY

L T P C
3 0 0 3

OBJECTIVES:

- To introduce basics and concepts of optics, aerial photography acquisition and mapping from aerial photographs.

UNIT I PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY

9

History - Definition, Applications – Types of Photographs, Classification – Photographic overlaps –Camera: metric vs. non-metric, Digital Aerial cameras – Multiple frame and Line cameras – Linear array scanner – Flight Planning – Crab & Drift– Computation of flight plan - Photogrammetry project Planning.

UNIT II GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS

9

Photo coordinate measurement – Vertical photographs -geometry, scale, Coordinate system, Relief displacement – Stereoscopes – Stereoscopic parallax – parallax equations -Geometry, Scale, Coordinate system – Relief displacement -- Photo Interpretation.

UNIT III STEREOPLOTTERS & ORIENTATION

9

Projection system, Viewing, Measuring and Tracing system Stereo plotters–Classification: Analog, semi analytical, Analytical and Digital systems – Interior orientation - Relative orientation – Absolute orientation - Collinearity condition and Coplanarity condition - Orientation: Two-dimensional coordinate transformations –Three-dimensional conformal coordinate transformation

UNIT IV AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO

9

Neat model – Strip and blocks of photographs – Aerotriangulation: strip adjustment, independent model triangulation, Bundle block Adjustment and GPS Aerotriangulation (INS and GNSS integration) - feature collection – DTM generation and Contour mapping – ortho rectification - mono plotting – stereo plotting

UNIT V DIGITAL PHOTOGRAMMETRY

9

Photogrammetric Scanner – Digital Photogrammetry WorkStation – Work Station Basic system function – Storage System – Stereoscopic Viewing and Measuring System – Image properties - Image matching: template matching, feature based matching - DEM and DSM - Satellite photogrammetry principles

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

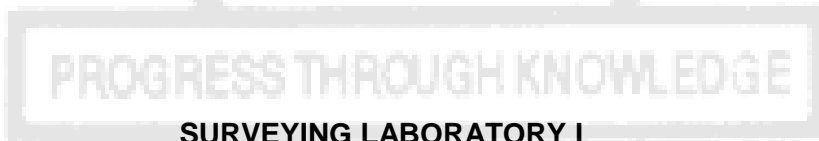
- CO1** Understand and appreciate the importance of photography as means of mapping, functional and physical elements of photography.
- CO2** Understand the need of the photogrammetric mapping and the relevance of accuracy standards and means to achieve them for precise large-scale maps with scientific methods.
- CO3** Evaluate the standards of map based on the state-of-the-art tool and techniques and assess the production standards for photogrammetric map making.
- CO4** Acquire knowledge on the current development, issues methods and solutions in map making and evaluate methods of production.
- CO5** Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation and integration of mapping technology.

TEXTBOOKS:

1. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4thEdition, 2014.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.

REFERENCES:

1. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.
2. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co.2nd Edition, 2007.
3. Manual of Photogrammetry – American society of Photogrammetry & R. S by Albert. D, 1980.
4. Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.
5. Digital Photogrammetry by – Y. Egels& Michel Kasser, Taylor & Francis group, 2003.



GI3311

SURVEYING LABORATORY I

**L T P C
0 0 4 2**

OBJECTIVES:

- To familiarize with the various surveying instruments and methods.

EXERCISES:

1. Chain traversing
2. Compass traversing
3. Centre line marking of a building
4. Planimetric Mapping of an Area using Plane Table Surveying (Radiation, Intersection)
5. Map updation using Plane Table Surveying through Resection (Graphical Method)
6. Plane table surveying – Two point problem
7. Fly and Check Levelling using dumpy level / tilting level
8. Determination of horizontal and vertical angles using theodolite
9. Determination of tacheometric constants using horizontal and inclined line of sight
10. Single plane method using theodolite
11. Double plane method using theodolite

12. Determination of RL of a point on sloping terrain using tacheometric surveying
13. Preparation of Planimetric Map using stadia tacheometry

TOTAL: 60 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
- CO 1** Gain knowledge on the usage of basic surveying instruments like chain/tape, compass, plane table and leveling instruments
- CO 2** Use levelling instrument for surveying operations
- CO 3** Use theodolite for various surveying operations
- CO 4** Carry out the necessary surveys for social infrastructures
- CO 5** Prepare the planimetric maps

REFERENCES:

1. T. P. Kanetkar and S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 24th Reprint, 2010.
2. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 17th Edition, 2016.
3. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, McGraw Hill 2001
4. Bannister and S. Raymond, Surveying, Seventh Edition, Longman 2004 a. David Clark, Plane and Geodetic Surveying for Engineers, Volume I, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
5. David Clark and James Clendinning, Plane and Geodetic Surveying for Engineers, Volume II, Constable and Company Ltd, London, CBS, 6th Edition, 2004.
6. S. K. Roy, Fundamentals of Surveying, Second Edition, Prentice 'Hall of India 2004
7. K. R. Arora, Surveying Vol. I & II, Standard Book house, 2019.

GI3312

REMOTE SENSING AND PHOTOGRAMMETRY LABORATORY

L T P C

0 0 2 1

OBJECTIVES:

- To facilitate the students with hands on experience on visual interpretation of satellite data products and conventional and digital interpretation of aerial photographs.

REMOTE SENSING EXERCISES

1. Preparation of Base Map from Survey of India Topo sheets
2. Introduction to various satellite data products and image interpretation keys
3. Preparation of Land use/land cover map using Satellite Data / Aerial Photograph.
4. Spectral measurements using spectroradiometer and processing for
 - a. Water & Soil
 - b. Vegetation
 - c. Various surfaces and land cover

PHOTOGRAMMETRY EXERCISES

1. Testing stereovision with Stereogram card
2. Mirror stereoscope- base line, orientation of aerial photographs and Photo Interpretation
3. To find the height of point using Parallax bar
4. Scale of vertical photographs
5. Aerial Triangulation using digital photogrammetry
6. Bundle Block adjustment
7. Generation and editing of DTM and Contour
8. Orthophoto generation and Mosaic
9. Preparation of Planimetric map

TOTAL: 30 PERIODS

The following instruments and software are required

Sl. No.	Instrument	Numbers
1.	Light Table	10
2.	Computer	10
3.	Spectroradiometer	1
4.	Pocket Mirror Stereoscope	10
5.	Mirror Stereoscope	10
6.	Parallax bar	10
7.	Digital Photogrammetry Software (Free software also available) (licenses)	5
8.	Anaglyphic Glass	20
9.	CAD software (Free software also available) (licenses)	5

COURSE OUTCOMES:

• On completion of the course, the student is expected to

- CO 1** Identify different features from satellite images
- CO 2** Interpret images to prepare thematic maps
- CO 3** Determine geometrical elements of aerial photograph
- CO 4** Analyze the aerial Photograph
- CO 5** To generate Digital Elevation Model and Ortho photo from Stereo models

TEXTBOOKS:

1. Thomas M. Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc., New York, 2015.
2. Paul. R Wolf., Bon A. De Witt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014.

REFERENCES:

1. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 2022 first edition.
2. Paul Curran P. J. Principles of Remote Sensing Longman, RLBS, 1996.
3. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2021 Edition 3, Wiley Publication
4. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 2nd Edition, 2014.
5. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.

GI3401

SENSORS AND DATA PRODUCTS

L T P C

3 0 0 3

OBJECTIVES:

- To familiarize the students with principle and operation of available sensing system, access protocols and its applicability.

UNIT I OPTICAL AND IR SENSORS

9

Land observation satellites, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series – data formats

UNIT II MICROWAVE AND THERMAL SENSORS

9

Use of Microwave data - SeaWiFS, OCR, CZCs studies -chlorophyll production index -sea surface temperature (SST) sensors -NIMBUS, RADARSAT, CASI - MESSR, OCTS ATSR -Sensors - OCEANSAT ATSR on ERS TOPEX/Poseidon satellite data – NASA earth data, ESA, NCEL, GLOVIS, NEO, USGSEE - GOOGLE EARTH- SARAL.

UNIT III HYPERSPECTRAL SENSORS

9

Scanner types and characterization - specifications of various sensors Spectrographic imagers- hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, NASA Terra Moderate Resolution Imaging Spectrometer (MODIS), Hyperion - VEDAS

UNIT IV GEO PORTALS

9

Open sources satellite imagery - USGS Earth Explorer - NASA Earth data Search - NOAA Data Access Viewer - Bhuvan Indian Geo-Platform of ISRO – Google Earth Engine - Copernicus Open Access Hub – up scaling and downscaling – sample data download and appraisal

UNIT V APPLICATION AREAS

9

Data download – climatic data- oceanic data – coastal data – land data – rainfall data; applications – rainfall vs NDVI, PPI- LST vs land use – wind vector and oceans current; mini project

TOTAL: 45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

- CO 1** Gain knowledge on the current and historic satellite missions and sensors national and international importance and their relevance in the resource application
- CO 2** Gain information on the various types of primary and derived satellite data for earth resource management and their specifications
- CO 3** Acquire the knowledge about open geoportals that offer satellite data and related resource data and their applicability
- CO 4** Acquire knowledge on the methods to download satellite data or how to procure them from the authorized geoportals
- CO 5** Analyze critically and evaluate the quality, standards of satellite data and to use them for various applications.

TEXTBOOKS:

1. Introduction to Satellite Remote Sensing (Atmosphere, Ocean, Land and Cryosphere Applications), Bill Emery, Adriano Camps, First edition, 2017.
2. Landsat Data Continuity Mission(L1) Data format Control Book – USGS
3. Eni G.Njoku, "Surface waves and Fluxes: Chapter-Satellite Remote Sensing of Sea Surface Temperature", 1990, Volume 8, ISBN: 978-94-010-6769-0.

REFERENCES:

1. Fundamentals of Satellite Remote Sensing: An Environmental Approach, Emilio Chuvieco, Third Edition, 2020.
2. Hyperspectral Remote Sensing: Principles and Applications, Marcus Borengasser, First Edition, 2007.
3. Advances in Environmental Remote sensing: QihaoWeng, 1st Edition. 2017.

GI3402

DIGITAL IMAGE PROCESSING

L T P C

3 0 0 3

OBJECTIVES:

- To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING

9

Definition - Image Representation - Steps in DIP— Components – Elements of Visual Perception – Image Formation - Image Sampling and Quantization- Image acquisition, storage and retrieval — Relationships between pixels - Color image fundamentals - RGB, HSI models- data products – satellite data formats – Digital Image Processing Systems – Hardware and software design consideration.

UNIT II PREPROCESSING 9

Image Characteristics – Histograms – Scattergrams – Initial statistics – Univariate and multivariate statistics-Initial image display- Ideal display, types, Sensor models - spatial, spectral, radiometric, temporal - IFOV, GIFOV & GSI - geometry and Radiometry – Sources of Image degradation and Correction procedures - Atmospheric, Radiometric, Geometric Corrections- Image Geometry Restoration-Interpolation methods and resampling techniques.

UNIT III IMAGE ENHANCEMENT 9

Image characteristics- point, local and regional operation – contrast, spatial feature and multi-image manipulation techniques – level slicing, contrast stretching, spatial filtering, edge detections - Fourier transform-FFT, DFT - Band ratio - Principal Component Analysis (PCA) – Scale-space transform-multi-image fusion.

UNIT IV IMAGE CLASSIFICATION 9

Pattern recognition concepts – Bayes approach – spectral Signature and training sets – Separability test – Supervised Classification – stages – Minimum distance to mean, Parallelepiped, MLC – Unsupervised classifiers – ISODATA, K-means-Support Vector Machine – sub-pixel classifier– Error matrix -Accuracy assessment – accuracy metrics: Kappa statistics, ERGAS, RMS.

UNIT V ADVANCED CLASSIFIERS 9

Texture based classification -Segmentation (Spatial, Spectral)-regions Fuzzy set classification – Object based classifiers – Deep Learning - Artificial Neural nets: Hebbian leaning - Adaline, Madaline, BPN – hybrid classifiers – Neuro - Fuzzy models- Expert system – Knowledge based systems,

TOTAL:45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to

CO 1 To understand various components and characteristics of image processing systems

CO 2 To familiarize the concepts of image geometry and radiometry corrections

CO 3 To acquire knowledge about different types of image enhancement techniques used for satellite image processing

CO 4 To gain knowledge about Image classification and accuracy assessment of various classifiers

CO 5 To acquaint with various advanced classification techniques available for feature extraction

TEXTBOOKS:

1. John,R.Jensen, Introductory Digital Image Processing, Prentice Hall, NewJersey, 2021 Fourth edition.
2. Robert,A.Schowengerdt, Techniques for Image Processing and classification in Remote Sensing,1983.

REFERENCES:

1. Robert, G. Reeves,-Manual of Remote Sensing Vol.I &II- American Society of Photogrammetry ,Falls ,Church, USA,1983.
2. John.A Richards, Remote sensing digital Image Analysis – An Introduction Springer-Verlag, Fifth Edition, 2014.
3. Digital Image Processing by Rafael C. Gonzalez, Richard Eugene Woods - Pearson/Prentice Hall,Fourth edition, 2022.
4. Fundamentals of Digital Image Processing by Annadurai Pearson Education (2007)

OBJECTIVES:

- To impart the knowledge on Microwave Remote Sensing and its applications.

UNIT I FUNDAMENTALS AND ACTIVE SYSTEM 9

Introduction–Radar frequency bands – SLAR - Antenna System – SLAR Imaging Geometry – RADAR equation – Resolution concepts: Range and Azimuth resolution – Synthetic Aperture Radar - Geometric Distortions – Multilook averaging and speckle correction.

UNIT II RADAR INTERACTION WITH EARTH FEATURES 9

System parameters - target parameters: roughness scales and criteria, dielectric constant and penetration depth – Surface backscattering models: Clapp, Facet, Bragg resonance models and Hard targets – Volume backscattering – RADAR Image signatures.

UNIT III IMAGING AND NON IMAGING SENSING 9

SAR Interferometry-Basics- Differential SAR Interferometry-applications polarimetry- Introduction - Polarization Ellipse - Polarization types – Synthesis and signatures – Polarimetric parameters- Information extraction – Polarimetric Image Interpretation and applications. Altimetry - Principle – Frequency bands – Location Systems- missions, Scatterometry- Scatterometer types and calibration - missions

UNIT IV SAR APPLICATIONS 9

Airborne, Space borne – different platforms and sensors- History- ENVISAT, ASAR, ALOS / PALSAR- RADARSAT , RISAT, GRACE and Sentinel 3 missions - SAR Data products and selection procedure - Applications in Agriculture- Forestry - Geology –Hydrology – snow cover mapping-snow depth estimation – Landuse/landcover mapping – Ocean related studies.

UNIT V PASSIVE SYSTEM 9

Radiometry- Passive microwave sensing components - Blackbody radiation and Grey body radiation – Emissivity, Radiometers – Components - Brightness temperature - Antenna temperature - Power-temperature correspondence, passive microwave interaction with atmospheric constituents - Emission characteristics of various earth features – Data products and Applications - Passive missions-DMSP, TRMM, Aqua missions, AMSR-E, AMSU.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
- CO 1** Understand the fundamentals of microwave remote sensing system such as SLAR, RAR and SAR
- CO 2** Learn the interaction mechanism of Radar with target features
- CO 3** Understand the principles and applications of Imaging and Non-Imaging observation
- CO 4** Learn the about the satellite sensing system and applicability of SAR
- CO 5** Understand the concepts of passive microwave systems and applications

TEXTBOOKS:

- Ulaby, F.T., Moore, R.K, Fung, A.K, "Microwave Remote Sensing; active and passive, Vol. 1,2 and 3, Addison - Wesley publication company, 2001.
- John R.Jensen,"Remote Sensing of the Environment: An Earth Resource Perspective",Pearson Education India, 2013.
- John A.Richards,"Remote Sensing with Imaging RADAR", Springer,2009.

REFERENCES:

1. Prashant Srivastava, Dillep Gupta, Tanvir Islam, Dawei Han, Rajendra Prasad, "RADAR Remote Sensing Application and Challenges", Elsevier, 2022.
2. Pranab Kumar Karmakar Microwave Propagation And Remote Sensing Atmospheric Influences With Models And Applications, Taylor & Francis, CRC Press, 2020
3. Alessandro Ferretti, "Satellite InSAR data: Reservoir monitoring from Space", EAGE Publications, 2014.
4. Jhon R. Schott, Fundamentals of Polarimetric Remote Sensing, SPIE press, 2010
5. Woodhouse Iain. H, "Introduction to Microwave Remote Sensing" Taylor & Francis, 2006.

GI3491

CARTOGRAPHY AND GIS

L T P C

3 0 0 3

OBJECTIVES:

- To introduce concepts of Cartography and GIS
- To expose the process of map making and production
- To introduce GIS data structures, data input and data presentation

UNIT I ELEMENTS OF CARTOGRAPHY

9

Definition of Cartography – Maps – Functions – Uses and Types of Maps – Map Scales and Contents – Map Projections – Shape, Distance, Area and Direction Properties – Perspective and mathematical Projections – Indian Maps and Projections – Map Co-ordinate System – UTM and UPS References.

UNIT II MAP DESIGN AND PRODUCTION

9

Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine Transformations.

UNIT III FUNDAMENTALS OF GIS

9

Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data, People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster Data Compression – Vector Data Structures – Raster Vs Vector Models – TIN and GRID data models.

UNIT IV DATA INPUT AND TOPOLOGY

9

Scanner – Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input – Digitizer – Datum Projection and Reprojection – Coordinate Transformation – Topology - Adjacency, Connectivity and containment – Topological Consistency – Non topological file formats – Attribute Data Linking – Linking External Databases – GPS Data Integration – Raster to Vector and Vector to Raster Conversion.

UNIT V DATA QUALITY AND OUTPUT

9

Assessment of Data Quality - Basic Aspects - Completeness, Logical Consistency, Positional Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards – Interoperability – OGC - Spatial Data Infrastructure – Data Output – Map Compilation – Chart / Graphs.

TOTAL:45 PERIODS

COURSE OUTCOMES:

• On completion of the course, the student is expected to

- CO 1** Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall able to compile and design maps for their required purpose.
- CO 2** Be familiar with co-ordinate and Datum transformations
- CO 3** Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression
- CO 4** Understand the concepts of spatial data quality and data standard
- CO 5** Understand the concept of spatial data inputs

TEXTBOOKS:

1. Arthur H. Robinson et al, "Elements of Cartography", 7th Edition, Wiley, 2002.
2. Kang – Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, Fourth Edition, 2017.
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, "An Introduction to Geographical Information Systems, Pearson Education, Fourth Edition, 2011.

REFERENCES:

1. John Campbell, "Introductory Cartography", Wm. C. Brown Publishers, 3rd Edition, 2004
2. Chor Pang LO, Albert K. W. Yeung, "Concepts and Techniques of Geographic Information Systems", Pearson Education, 2nd Edition, November 2016. ISBN: 9789332581883.

GI3492

TOTAL STATION AND GPS SURVEYING

**L T P C
3 0 0 3**

OBJECTIVES:

- To understand the working of Total Station and GPS and solve the surveying problems.

UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies – Refractive index (RI) – factors affecting RI -Computation of group for light and near infrared waves at standard and ambient conditions – Computation of RI for microwaves at ambient condition – Reference refractive index -Real-time application of first velocity correction. Measurement of atmospheric parameters - Mean refractive index – Second velocity correction -Total atmospheric correction - Use of temperature -pressure, transducers.

UNIT II ELECTRO-OPTICAL AND MICROWAVE 9

Electro - optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments.

Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments.

COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land survey applications.

UNIT III SATELLITE SYSTEM 9

Basic concepts of GPS – Historical perspective and development – applications -Geoid and Ellipsoid – satellite orbital motion – Keplerian motion – Kepler's Law – Perturbing forces -Geodetic satellite – Doppler effect – Positioning concept – GNSS and IRNSS – SBAS: GAGAN and WAAS Different segments - space, control and user segments – satellite configuration – GPS signal structure – Orbit determination and representation – Anti Spoofing and Selective Availability -Task of control segment – GPS receivers.

UNIT IV GPS DATA PROCESSING

9

GPS observables – code and carrier phase observation – linear combination and derived observables – concept of parameter estimation – downloading the data – RINEX Format–Differential data processing – software modules - solutions of cycle slips, ambiguities - Multi path and other observational errors – satellite geometry and accuracy measures – Continuously Operating Reference System (CORS)– long base line processing - use of different processing software's: Open Source, Scientific and Commercial.

UNIT V SURVEYING METHODS AND APPLICATIONS

9

Total Station: Traversing and Trilateration measurement and adjustment –Planimetric map and Contour map and Topography Mapping.

GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing -Topography mapping using PPK and RTK methods

Total Station and GNSS applications

TOTAL:45 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

CO 1 Learn about the fundamental concept of Total station.

CO 2 Provide knowledge about electromagnetic waves and its usage in Total station and GNSS.

CO 3 Gain Knowledge on basic concepts of GNSS

CO 4 Understand the measuring and working principle of electro optical and Microwave Total station and GPS

CO 5 Gain knowledge about Total station and GNSS data processing and Mapping.

TEXTBOOKS:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,1996.
2. SatheeshGopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition,2017. isbn: 978-81317 00679.
3. Gunter Seeber , Satellite Geodesy, Walter De Gruyter, Berlin, 2nd Edition, 2003

REFERENCES:

1. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3rdEdition,2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

PROGRESS THROUGH KNOWLEDGE

GE3451

ENVIRONMENTAL SCIENCE AND SUSTAINABILITY

L T P C

2 0 0 2

UNIT I ENVIRONMENT AND BIODIVERSITY

6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION

6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY

6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT

6

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES

6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL:30 PERIODS

TEXTBOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

GI3411

TOTAL STATION AND GPS SURVEYING LABORATORY

L T P C

0 0 4 2

OBJECTIVES:

- To train the students to acquire skill in making precise measurements and obtaining accurate results with Total Station and GPS.

EXERCISES:

1. Temporary adjustment of Total station and Angle, Distance and Coordinate measurement
2. Establishment of Horizontal control point by Traversing
3. To determine the instrument station coordinate by Resection method (Angles only and Distances only)
4. Application COGO function: Area, MLM / Inverse function, REM and offsets

5. Planimetric mapping using Total Station
6. Preparation of Contour map using Total Station
7. Setting out: by Coordinates, by Distance and angle, Points at equal length
8. Navigation and Feature collection using handheld GPS
9. GNSS Planning
10. Accuracy evaluation of baseline with different common observation times
11. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Lee Frog Method
12. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Trilateration method
13. Preparation of Planimetric map using Post Processed Kinematic (PPK) method
14. Network Adjustment of GNSS observation

TOTAL: 60 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

CO 1 Gain the basic idea about Total station and GNSS.

CO 2 Acquire knowledge about establishment of horizontal control point using Total station and GNSS.

CO 3 Impart Knowledge in preparation of contour map using Total station and GNSS.

CO 4 Understand the various coordinate geometry function in Total station and GPS

CO 5 Gain knowledge about Total station and GNSS data processing, network adjustment and Mapping.

REFERENCES:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition, 1996.
2. Satheesh Gopi, rasathishkumar, N.madhu, — Advanced Surveying , Total Station GPS and Remote Sensing — Pearson education , 2nd Edition, 2017. isbn: 978-81317 00679.
3. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin, 2003
4. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
5. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983
6. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin, 3rd Edition, 2016.
7. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.

GI3412

CARTOGRAPHY AND GIS LABORATORY

L T P C
0 0 2 1

OBJECTIVES:

- Hands on experience of basics of cartography and GIS.
- Designing the map
- Development of GIS database and populating attribute data

EXERCISES:

1. Simple conical, cylindrical and planar projection for the reduced earth having 2 to 4 cm radius – aspect and secant demo.
2. Graded symbolization and isopleth/choropleth map
3. Map compilation and Design
4. Data Input – Onscreen Digitization – Creation of Point, Line and Polygon layers
5. Projection, Reprojection and Coordinate Transformation of Maps
6. Attribute data input and Measurement of Distance, Area
7. Linking External Database and Tabular Data Analysis using SQL commands
8. Generating Graphs, Charts and Diagrams from Tabular data
9. Data Conversion – Vector to Raster and Raster to Vector
10. Map Joining, Edge Matching and Layout Design

TOTAL: 30 PERIODS

Padeepz App

COURSE OUTCOMES:

•On completion of the course, the student is expected to

- CO 1** Design and produce thematic maps with suitable projection, symbols and color codes
- CO 2** Compile and develop digital maps
- CO 3** Create spatial database and non-spatial databases in GIS environment
- CO 4** Analyze spatial database and generate reports, maps
- CO 5** Represent spatial data in a professional format

REFERENCES:

1. Arthur, H. Robinson, Elements of Cartography, Seventh Edition, John Wiley and Sons, 2002.
2. C.P. Lo Albert K.W. Yeung, "Concepts and Techniques of Geographic Information Systems", Pearson Education, Second Edition, 2016.

LIST OF EQUIPMENTS

1. i7 computer system with minimum 4GB RAM, 500GB HDD-15 Numbers for 30 students
2. Standard GIS Software-15 user licenses.

GI3413

DIGITAL IMAGE PROCESSING LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To familiarize the undergraduate level students in the regular Image Processing Software.

EXERCISES:

1. Image reading and writing
2. Pre-processing techniques: radiometric correction
3. Random and Periodic Noise removal
4. Pre-processing techniques: Ground control and rectification
5. Enhancements – histogram, filters
6. Band ratioing and normalization – NDVI, SAVI & NDWI
7. PCA
8. Image fusion
9. Classification – supervised & unsupervised
10. Sub pixel classification
11. Classification using Neural Network and Fuzzy Logic
12. Accuracy assessment – correlation, RMSE & kappa
13. Crop conditioning assessment/ inundation damage assessment/ forest fire/ change dynamic analysis

TOTAL: 60 PERIODS

COURSE OUTCOMES:

•On completion of the course, the student is expected to

- CO 1** Enhance satellite imagery through filtering, band ratioing, PCA etc
- CO 2** Georeference and project the satellite imagery
- CO 3** Classify and assess accuracy of classification.
- CO 4** Perform advanced classifier
- CO 5** Carry out mini project in any of the application

TEXT BOOK

1. Richards, Remote sensing digital Image Analysis –An Introduction Springer-Verlag 1993.

LIST OF EQUIPMENTS

1. Number of i7 Computer system - 15 for 30 students (two students per system).
2. Standard Satellite image processing software - 15 user licenses.
3. Satellite data indifferent spatial resolution and corresponding Toposheets.
4. A1 size Scanner and Color plotter.