ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
M.TECH (SPATIAL INFORMATION TECHNOLOGY)

(Effective for the students admitted from academic year 2021-2022 onwards)

CENTRE FOR SPATIAL INFORMATION TECHNOLOGY

JNTUH INSTITUTE OF SCIENCE AND TECHNOLOGY (AUTONOMOUS)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

Kukatpally, Hyderabad, Telangana State, INDIA-500085.

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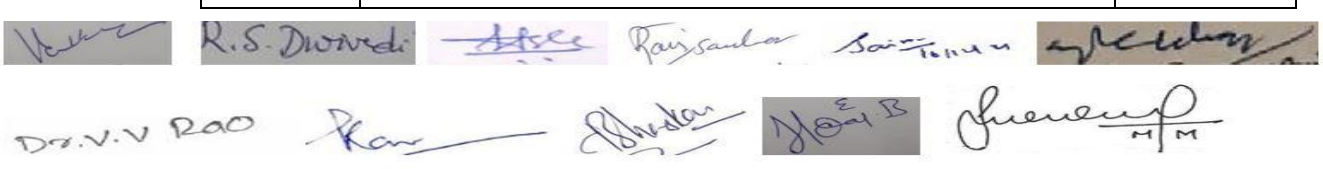

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Vision of the Institution

Imparting technical education that encourages independent thinking, develops strong domain of knowledge, hones contemporary skills and positive attitudes towards holistic growth of young minds.

Mission of the Institution

- Student-centered Teaching-learning processes and a stimulating R&D environment.
  - Providing Quality Education and ethics to students.
  - State-of-art Infrastructure for professional aspirants.

Vision of the Centre for Spatial Information Technology

- To emerge as a centre of excellence in geospatial technology and allied fields to cater to the larger interest of the society and nation at large.

Mission of Centre for Spatial Information Technology

- To strive for achieving and sustaining professionalism in Geospatial Technology in collaboration with Industry and academia.
- To nurture the spirit of innovation and creativity, and
- To harness and promote geospatial technology for national development.

Program Objectives (POS):

PO1: Ability to independently carry out research /investigation and development work to solve practical problems

PO2: Ability to write and present a technical report/document

PO3: Students should be able to demonstrate a higher degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO4: Shall be able to employ necessary techniques, advanced equipment and software tools for state of the art engineering methodologies for natural resources management.

Program Educational Objectives (PEOS):

PEO1: To prepare students to develop a strong background in geo-informatics, remote sensing and navigational surveying and in software development/IT, IT related areas/IoT.

PEO2: To train the students in developing practical solutions to the problems of the society using the cutting- edge technology.

PEO3: To develop professional competence in students through life-long learning and professional experience.

PEO4: To maintain state-of the art R&D facilities for constant improvement in the quality of education research and development.

BLOOM'S TAXONOMY

KNOWLEDGE LEVELS

Self-Assessment of a student is based on the answers given to the Blooms level of questions

The Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Facts	list	paraphrase	classify	outline	rank	categorize
Concepts	recall	explains	show	contrast	criticize	modify
Processes	outline	estimate	produce	diagram	defend	design
Procedures	reproduce	give an example	relate	identify	critique	plan
Principles	state	converts	solve	differentiates	conclude	revise
Meta-cognitive	proper use	interpret	discover	infer	predict	actualize

CENTRE FOR SPATIAL INFORMATION TECHNOLOGY
INSTITUTE OF SCIENCE & TECHNOLOGY (AUTONOMOUS)
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
M.Tech (Spatial Information Technology), COURSE STRUCTURE AND SYLLABUS (CBCS) -2021

M. TECH SEM -I

Course Number	Subject	Scheme of Studies per Week			Credits	Int Marks	Ext Marks
		L	T	P			
SIT – 01	**Programme Core-I** Photogrammetry and Remote Sensing	3	0	0	3	30	70
SIT-02	**Programme Core-II** Geographic Information Systems	3	0	0	3	30	70
SIT-03	**Programme Elective-I** 1. Large Scale Topographic Mapping 2. Concepts of Big Data and its Applications 3. Terrain Modelling	3	0	0	3	30	70
SIT-04	**Programme Elective –II** 1. Geodesy 2. WEB GIS 3. WEB Technologies	3	0	0	3	30	70
SIT -05	GIS Laboratory	0	0	4	2	30	70
SIT-06	Software Development Laboratory	0	0	4	2	30	70
SIT-07	Research methodology and IPR	2	0	0	2	30	70
SIT -08	Audit Course - I	2	0	0	0	-	-
		16	0	**08**	**18**	**210**	**490**

M. TECH SEM -II

Course Number	Subject	Scheme of Studies per Week			Credits	Int Marks	Ext Marks
		L	T	P			
SIT – 09	**Programme Core-III** Advanced Digital Image Processing	3	0	0	3	30	70
SIT- 10	**Programme Core-IV** Remote Sensing Applications	3	0	0	3	30	70
SIT- 11	**Programme Elective-III** 1. GNSS 2. Earth Observation Systems 3. Object Oriented Programming Concepts	3	0	0	3	30	70
SIT- 12	**Programme Elective –IV** 1. Spatial Database Creation 2. Python Script Programming 3. Advanced Geospatial technologies	3	0	0	3	30	70
SIT –13	Digital Image Processing Laboratory	0	0	4	2	30	70
SIT- 14	GNSS and In-situ Data Collection Laboratory	0	0	4	2	30	70
SIT- 15	Mini-Project with Seminar	2	0	0	2	30	70
SIT - 16	Audit Course -II	2	0	0	0	-	-
Total		**16**	0	**08**	**18**	**210**	**490**

***Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break**

M.TECH SEM -III

Course Number	Subject	Scheme of Studies per Week			Credits	Int Marks	Ext Marks
		L	T	P			
SIT – 17	**Programme Elective-V** 1. Drone Flying and Data Analysis 2. Statistics and Computation 3. WEB Development	3	0	0	3	30	70
SIT- 18	**Open Elective** 1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy 7. Global Earth Observation Systems (GEOSS) 8. Basics of Artificial Intelligence and Machine Learning for Geomatics	3	0	0	3	30	70
SIT- 19	Dissertation – I	0	0	20	10	0	0
	a) Project Review – I				0	0	0
	b) Project Review – II				0	100	0
		06	0	**20**	**16**	**160**	**140**

***Students going for Industrial project/Thesis will complete these courses through MOOCs.**

M.TECH SEM -IV

	Subject	Scheme of Studies per Week			Credits	Int Marks	Ext Marks
		L	T	P			
	a) Project Review – III b) Project Evaluation (Viva Voce)	0	0	32	16	**30**	**70**
		0	0	**32**	**16**	**30**	**70**

(L: Lecture periods, T: Tutorial periods, P: Practical periods)

Total credits of the Programme= 68

List of Audit Courses 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga Personality Development through Life Enlightenment Skills

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INSTITUTE OF SCIENCE & TECHNOLOGY (AUTONOMOUS)
Kukatpally, Hyderabad – 500 085

ACADEMIC REGULATIONS 2021-22

For CBCS Based M.Tech. (Regular/Full Time) Programmes

(Effective for the students admitted into I year from the Academic Year **2021-22**and onwards)

ACADEMIC REGULATIONS 2021-22

For CBCS Based M.Tech. (Regular/Full Time) Programmes

(Effective for the students admitted into I year from the Academic Year **2021-22**and onwards)

1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E & T):

JNTUH offers 2 Year (4 Semesters) full-time Master of Technology (M.Tech.) Degree Programmes, under Choice Based Credit System (CBCS) at its Autonomous Institute – Institute of Science & Technology with effect from the Academic Year **2021-22** onwards in different branches of Science & Technology with different specializations.

Eligibility for Admission:

Admissions to the PGPs shall be made subject to the eligibility, qualification and specializations prescribed by Institute of Science & Technology, JNT University Hyderabad, for each Specialization under each M.Tech. Programme, from time to time.

Admission to the PGP shall be made either on the basis of - the Rank/ Percentile earned by the candidate in the relevant qualifying GATE Examination/the Merit Rank obtained by the qualifying candidate at an Entrance Test conducted by the Telangana State Government (PGECET) for M.Tech. Programmes/an Entrance Test conducted by the Jawaharlal Nehru Technological University Hyderabad/on the basis of any other order of merit approved by the University, subject to reservations as prescribed by the Government from time to time.

The medium of instructions for all PG Programmes will be ENGLISH only.

M.Tech. Programme (PGP in E & T) Structure:

The M.Tech. Programmes in E & T of JNTUH-IST are of Semester Pattern, with 4 Semesters constituting 2 Academic Years, each Academic Year having TWO Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 Weeks duration (inclusive of Examinations), with a minimum of 90 Instructional Days per Semester.

3.2.0 The student shall not take more than four academic years to fulfill all the academic requirements for the award of M.Tech. degree from the date of commencement of first year first semester, failing which the student shall forfeit the seat in M.Tech. programme

UGC/ AICTE specified Definitions/ Descriptions are adopted appropriately for various terms and abbreviations used in these PGP - Academic Regulations, as listed below.

Semester Scheme:

Each Semester having - 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester.System (CBSS) as denoted are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' or 'COURSE' imply the same meaning here, and refer to 'Theory Subject', or 'Lab Course', or 'Mini Project with Seminar', 'Project', as the case may be.

Credit Courses:

All Subjects (or Courses) are to be registered by a student in a Semester to earn Credits. Credits shall be assigned to each Subject/ Course in a L: T: P: C (Lecture Periods: Tutorial Periods:

Practical Periods: Credits) Structure, based on the following general pattern … V-c

- One credit for One hour/ Week/ Semester for Theory/ Lecture (L) Courses; and,
- One credit for Two hours/ Week/ Semester for Laboratory/ Practical (P) Courses or Tutorials (T).

Other student activities like Study Tour, Guest Lecture, Conference/ Workshop Participation, Technical Paper Presentations etc., and identified Mandatory Courses if any, will not carry Credits.

Subject/ Course Classification:

The Institute has followed the guidelines issued by AICTE/UGC. All Subjects/Courses offered for the PGP in E&T are broadly classified as Program Core, Program Elective, Open Elective, Audit Course and Mini Project with Seminar, Industrial Training and Dissertation.

Course Nomenclature:

The Curriculum Nomenclature or Course-Structure Grouping for the M.Tech. Degree Programmes is as listed below …

S. No.	*Broad Course Classification*	*Course Group/ Category*	*Courses Description*
1.	Core Courses (CoC)	PC- Program Core	Includes core subjects related to the Parent Discipline/ Department/ Branch of Engg.
		Project work (Dissertation)	M.Tech. Project or PG Project or PG Major Project
		Mini Project with Seminar	Seminar based on core contents related to parent discipline/department/branch of Engineering
		Audit Courses	Mandatory courses (non credit)
2.	Elective Courses (EC)	PE– Program Electives	Includes Elective subjects related to the Parent Discipline/ Department/ Branch of Engg.
		OE-Open Electives	Elective subjects include inter- disciplinary subjects.

*** Students be encouraged to go to Industrial Training/Internship for at least 2-3 months during semester break.**

Course Work:

A Student, after securing admission, shall pursue and complete the M.Tech. PGP in a minimum period of 2 Academic Years (4 Semesters), and within a maximum period of 4 Academic Years (starting from the Date of Commencement of I Year I Semester).

Each student shall register for and secure the specified number of Credits required for the completion of the PGP and Award of the M.Tech. Degree in respective Branch of Engineering with the chosen Specialization.

I Year is structured to provide typically 18 Credits in each of the I and II Semesters, and II Year 16 credits in each of the III & IV semesters, totaling to 68 Credits for the entire M.Tech. Programme.

Course Registration:

A 'Faculty Advisor' shall be assigned to each M.Tech. Programme with respective Specialization, who will advise the Students about the M.Tech. Programme Specialization, its Course Structure and Curriculum, Choice/ Option for Subjects/ Courses, based on the competence, progress, pre-requisites and interest of the students.

A student may be permitted to register for subjects/courses of 'his choice' with a typical total of 18 credits per semester in I year (minimum being 15 credits and maximum being 21 credits, permitted deviation being ± 15%), and 16 credits (inclusive of project) per III semester in (II year) (minimum being 13 credits and maximum being 19 credits), 16 credits (inclusive of project) per IV semester in II year (minimum being 16 credits and maximum 21 credits), based on his interest, competence, progress, and 'pre-requisites' as indicated for various subjects/courses, in the centre course structure (for the relevant specialization) and syllabus contents for various subjects/ courses.

Choice for 'additional Subjects/Courses' in any Semester (above the typical 18/16 Credit norm, and within the Maximum Permissible Limit of 21/21 Credits, during I/ II Years as applicable) must be clearly indicated in the Registration, which needs the specific approval and signature of the Faculty Advisor/Counselor on hard-copy.

Withdrawal of Subjects/ Courses in any Semester of I Year may be permitted, ONLY AFTER obtaining prior approval and signature from the Faculty Advisor (subject to retaining a minimum of 15 Credits), 'within 15 Days of Time' from the beginning of the current Semester.

Attendance Requirements:

A Student shall be eligible to appear for the Semester End Examination (SEE) of any Subject, if he acquires a minimum of 75% of attendance in class work in that Subject for that Semester.

A Student's Mini Project with Seminar Report and Mini Project with Seminar Presentation shall be eligible for evaluation, only if he ensures a minimum of 75% of his attendance in Mini Project with Seminar Presentation Classes during that Semester.

Condoning of shortage of attendance up to 10% (65% and above, and below 75%) in each

Subject (Theory / Practicals / Mini Project with Seminar/project work, etc.) of a Semester may be granted by the Institute Academic Council on Medical grounds, based on the Student's representation with supporting evidence to be submitted by the student as and when such requirement arise, but not at the end of the semester. Such requests shall not be entertained once the percentage of attendance is calculated and displayed at the end of semester class work.

A stipulated fee per Subject, (Theory / Practicals / Mini Project with Seminar/Project work etc.) shall be payable towards condoning of shortage of attendance after getting the approval of Institute academic council for the same.

Shortage of Attendance below 65% in any Subject, (Theory / Practicals / Mini Project with Seminar etc.) shall in NO case be condoned.

A Student, whose shortage of attendance is not condoned in any Subject(s) , Lab or Mini Project with Seminar in any Semester, is considered as 'Detained in that Subject(s), Lab or Mini Project with Seminar', and is not eligible to write Semester End Examination

(s) of such Subject(s), Lab (and in case of Mini Project with Seminars, his/her Mini Project with Seminar Report or Presentation are not eligible for evaluation) in that Semester; and he/she has to seek Re-registration for those Subject(s), Lab or Mini Project with Seminar in subsequent Semesters, and attend the same as and when offered.

A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

Academic Requirements:

The following Academic Requirements have to be satisfied, in addition to the attendance requirements mentioned in Item No. 6**.** The performance of the candidate in each semester shall be evaluated subject – wise, with a maximum of 100 marks per subject/course (theory /practical), on the basis of Internal Evaluation and Semester End Examination.

A Student shall be deemed to have satisfied the academic requirements and earned the Credits allotted to each Subject/Course, if he/she secures not less than 40% Marks (28 out of 70 Marks) in the Semester End Examination, and a minimum of 50% of marks in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together; in terms of Letter Grades and this implies securing B Grade or above in that Subject.

A Student shall be deemed to have satisfied the academic requirements and earned the Credits allotted to - Mini Project with Seminar, if he/she secures not less than 50% of the total Marks to be awarded for each of them. The Student would be treated as failed, if he / she - (i) does not present the Mini Project with Seminar as required, or (ii) secures less than 50% of Marks (< 50 Mark) in Mini Project with Seminar. In such case of Mini Project with seminar, he/she has to reappear in the next subsequent semesters, as and when scheduled.

A Student shall - register for all Subjects covering 68 Credits as specified and listed in the Course Structure for the chosen PGP Specialization, put up all the Attendance and Academic requirements for securing 68 Credits obtaining a minimum of B Grade or above in each Subject and 'earn all 68 Credits securing Semester Grade Point Average (SGPA) ≥ 6.0 (in each Semester) and final Cumulative Grade Point Average (CGPA) (ie., CGPA at the end of PGP) ≥ 6.0, to successfully complete the PGP.

Note: (1) The SGPA will be computed and printed on the marks memo only if the candidate passes in all the subjects offered and gets minimum B grade in all the subjects.

(2) CGPA is calculated only when the candidate passes in all the subjects offered in all the semesters.

Marks and Letter Grades obtained in all those Subjects covering the above specified 68 Credits alone shall be considered for the calculation of final CGPA, which shall be indicated in the Grade Card/Marks Memo of II Year II Semester.

If a student registers for 'extra Subjects' (in the parent Centre or other Departments/ Branches of Engg.) other than those listed Subjects totaling to 68 Credits as specified in the Course Structure, the performances in those 'extra Subjects' (although evaluated and graded using the same procedure as that of the required 68 Credits) will not be taken into account while calculating the SGPA and CGPA. For such 'extra Subjects' registered, % marks and Letter Grade alone will be indicated in the Grade Card/Marks Memo as a performance measure, subject to completion of the Attendance and Academic Requirements as stated in Items 6 and 7.1 – 7.4 above.

Students who fail to earn 68 Credits as per the specified Course Structure, and as indicated above, within 4 academic years from the date of commencement of their I Year I Semester, shall forfeit their seats in M.Tech. Programme and their admissions shall stand cancelled.

When a Student is detained due to shortage of attendance in any Subject (s) (Theory/Practicals/Mini Project with Seminar etc.,) in any Semester, no Grade Allotment will be made for such Subject (s) (Theory/Practicals/Mini Project with Seminar etc.,) and SGPA/ CGPA calculations of that Semester will not include the performance evaluations of such Subject(s) (Theory/Practicals/Mini Project with Seminar etc.,) in which he got detained. However, he / she becomes eligible for re-registration of such Subject (s) (Theory/Practicals/Mini Project with Seminar etc.)/ in the subsequent Semester(s), as and when next offered, with the Academic Regulations of the Batch into which he /she gets re-registered , by paying the stipulated fees per Subject. In all these re-registration cases, the Student shall have to secure a fresh set of Internal Marks (CIE) and Semester End Examination Marks (SEE) for performance evaluation in such Subject(s), and subsequent SGPA/ CGPA calculations.

A Student eligible to appear in the Semester End Examination in any Subject, but absent at it or failed (failing to secure B Grade or above), may reappear for that Subject at the supplementary examination (SEE) as and when conducted. In such cases, his Internal Marks (CIE) assessed earlier for that Subject/ Course will be carried over, and added to the marks to be obtained in the supplementary examination (SEE), for evaluating his performance in that Subject.

Evaluation - Distribution and Weightage of Marks:

The performance of a Student in each Semester shall be evaluated Subject-wise (irrespective of Credits assigned) with a maximum of 100 Marks for Theory or Practicals or Mini Project with Seminar etc; however, the M.Tech. Project Work (Major Project) will be evaluated for 200 Marks.

For the theory subjects 70 marks shall be awarded for the performance in the Semester End Examination and 30 marks shall be awarded for Continuous Internal Evaluation (CIE) (25marks for mid exams and 5marks for assignment). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid-Term

Examinations conducted, first Mid-Term examinations in the middle of the Semester and second Mid-Term examinations during the last week of instruction. Each Mid-Term Examination shall be conducted for a total duration of 120 minutes with Part 'A' as compulsory consisting of 5 questions carrying 2 marks each (10 marks), and Part 'B' with 3 questions to be answered out of 5 questions, each question carrying 5 marks (15 marks). The details of the Question Paper pattern for Semester End Examination (Theory) are given below:

- The Semester End Examination will be conducted for 70 marks. It consists of two parts. i) Part A for 20 marks, ii) Part B for 50 marks.
- Part A is compulsory and consists of 5 questions, one from each unit andcarrying 4 marks each.
- Part B consists of 5 questions carrying 10 marks, each with internal choice. There will be two questions from each unit and only one should beanswered.

For Practical Subjects, there shall be a Continuous Internal Evaluation (CIE) during the Semester for 30 Internal Marks, and 70 Marks are assigned for Lab./ Practicals Semester End Examination (SEE). Out of the 30 Marks for Internals, day-to-day work assessment in the laboratory shall be evaluated for 15 Marks; and the performance in an internal Lab/Practical Test shall be evaluated for15 marks. The SEE for Lab./ Practicals shall be conducted at the end of the Semester by the concerned Lab teacher and another faculty member of the same Centre as assigned by the Head of the Department.

There shall be a Mini Project with Seminar Presentation in I Year II Semester, for the Seminar the Student shall collect the information on a specialized topic, prepare a Mini Project Report and submit to the Centre at the time of Mini Project with Seminar Presentation. The Continuous Internal Evaluation (CIE) -30Marks given by the faculty handling the Mini Project with Seminar. Mini Project with Presentation (along with the Mini Project Report) shall be evaluated by Departmental review committee (DRC) consisting of Head of the Department, Mini Project Guide and Senior faculty member assigned by Head of the Department for 70 marks.

a) Every student shall be required to do project work.

b) The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters.

c) **Registration of Project work** : Every Student must compulsorily register for his M.Tech. Project Work, within the 4 weeks after the completion of I year II Semester. After Registration, the Student has to present, in consultation with his Project Guide, the title, objectives and plan of action of his project work to the Project Review Committee (PRC) for approval within 4 weeks from the commencement of Second year First Semester. Only after obtaining the approval of the PRC, the student can initiate the Project work.

d) A Project Review Committee (PRC) shall be constituted with the Head of the Centre as Chairperson, Project Guide and one senior faculty member of the Departments offering the M.Tech. programme. (*Committee shall not be less than 3 members and constituted

with the Head of the Centre as Chairperson, Project Supervisor and one senior faculty member of the Centre offering the M. Tech. programme. In case HOD is a supervisor then one more senior faculty member will be included in the committee to maintain not less than 3 members) The PRC will monitor the progress of the Project Work and review, through Project work Review – I and Project work Review –II Presentations – one at the end of the II Year I Semester, and another before the submission of M.Tech. Project Work Report.

e) If a candidate wishes to change his Guide or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/Guide leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Guide or topic as the case may be.

f) A candidate shall submit his project progress report in two stages at least, with a gap of three months between them.

g) **The Project Work Review I** in II Year I Semester carries internal marks of 100. Evaluation should be done by the PRC. The PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain and progress of the dissertation. A candidate has to secure a minimum of 50% of marks to be declared successful in Project Work Review I. If he/she fails to obtain the minimum required marks, he/she has to reappear for Project Work Review-I as and when conducted.

h) **The project work Review II and Viva- voce:**

In II Year II Semester, Project work review II carries 30 internal marks and viva-voce, 70 external marks. The PRC will examine the overall progress of the Project Work during internal evaluation and decide whether the Project is eligible for final submission or not. A candidate has to secure a minimum 50%of marks to be declared successful in project.

i) **Project Work Review** I and II shall be conducted in phase I (Regular) and Phase II (Supplementary). Phase II will be conducted only for unsuccessful students in Phase I. The unsuccessful students in Project Work Review I (Phase II, supplementary) shall reappear for it at the time of Project Work Review II (Phase I, regular). The unsuccessful students in project work review II (phase I regular) shall reappear for it at the time of project review II (Phase II supplementary). The unsuccessful students in Phase II of Project work Review II have to reappear for it at the time of Project work review – I in the next academic year only.

j) After approval from the PRC, a soft copy of the thesis should be submitted to the Head of the Centre for the ANTIPLAGIARISM check and the Head of the Centre will submit the plagiarism report to the Director of the Institute. The project work report (Dissertation) will be accepted for submission, if the similarity index is less than **30%**. If the similarity index has more than the required percentage, the student is advised to modify accordingly and re-submit the soft copy of the Dissertation after one month. The maximum number of re-submissions of Dissertation after plagiarism check is limited to TWO. After three attempts, the admission is liable to be cancelled.

k) The Student shall be allowed to submit his Project Dissertation, only on the successful completion of all the prescribed PG Subjects (Theory and Practical's.), Mini Project with Seminar, etc. (securing B Grade or above), and after obtaining all approvals from PRC.

l) Before the submission of the Dissertation students are encouraged to submit a Research Paper related to Project Work in a UGC approved journal (students are encouraged to publish the work in peer reviewed journals). A copy of the submitted research paper may be attached to the project report Dissertation. Three copies of the Project Dissertation certified by the Guide shall be submitted to the Head of the Department.

m) The project report Dissertation will be adjudicated by an external examiner selected by the Institute. For this the Head of the Centre shall submit a panel of three examiners from among the list of experts in the relevant specialization as submitted with the help of supervisor concerned. In such cases, the M.Tech. Dissertations will be sent to an External Examiner nominated by the Director of the Institute, on whose 'approval', the Student can appear for the M.Tech. Project Viva-voce Examination, which shall be conducted by a Board, consisting of the PG Project Supervisor, Head of the Department, and the External Examiner who adjudicated the M.Tech. Project Work / Dissertation. The Board shall jointly declare the Project Work Performance as 'satisfactory', or 'unsatisfactory'; and in successful cases, the External Examiner shall evaluate the Student's Project Work presentation and performance for 70 Marks .

n) If the report of the external examiner is unsatisfactory, the candidate shall revise and resubmit the Thesis after ONE semester, or as per the time specified by the External examiner. If the resubmitted report is again evaluated by the external examiner and examiner is unsatisfactory again then the Dissertation shall be summarily rejected. No further correspondence in this matter will be entertained, if there is no specific recommendation for resubmission by the external examiner.

o) If the report of the examiner is satisfactory, the Head of the Centre shall coordinate and make arrangements for the conduct of Project Viva- Voce examination. The Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Centreand the external examiner who adjudicated the Dissertation. The candidate has to secure a minimum of 50% of marks in Project Evaluation (Viva-Voce) examination.

p) If he /she fails to fulfill the requirements as specified in 8.6 (n), he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, if he/she fails to fulfill the requirements, he/ she will not be eligible for the award of the degree, unless he/she is asked to revise and resubmit his project work by the board within a specified time period (within four years from the date of commencement of his first year first semester).

q) If the candidates oral presentation is not satisfactory, the board may defer it and the candidate has to re-appear for the oral presentation before the same board for the award of degree.

r) The Project Viva-Voce External examination marks must be submitted to the Institute on the day of the examination.

Re-Admission / Re-Registration:

Re-Admission for Discontinued Students:

Students, who have discontinued the M.Tech. Degree Programme due to any reasons what so ever, may be considered for 'Readmission' into the same Degree Programme (with same specialization) with the Academic Regulations of the Batch into which she/he gets readmitted, with prior permission from the concerned authorities, subject to Item 4.1.

Re-Registration for Detained Students:

When any Student is detained in a Subject (Theory / Practical / Seminar etc.) due to shortage of attendance in any Semester, he/she may be permitted to re-register for the same Subject in the 'same category' (Core or Elective Group) or equivalent Subject if the same Subject is not available, as suggested by the Board of Studies of that Department, as when offered in the sub-sequent Semester(s), with the Academic Regulations of the Batch into which he seeks re-registration , with prior permission from the concerned authorities, subject to Item 4.1.

Examinations and Assessment – The Grading System

Marks will be awarded to indicate the performance of each student in each Theory Subject, or Practical, or Mini Project with Seminar, Project, etc., based on the % marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 6 above, and a corresponding Letter Grade shall be given.

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a subject/Course(Class Intervals)	*Letter Grade (UGC Guidelines)*	*Grade Points*
Greater than or equal to 90%	*O (Outstanding)*	*10*
≥ 80 and less than 90%	*A+ (Excellent)*	*9*
≥ 70% and less than 80%	*A (Very Good)*	*8*
≥ 60% and less than 70%	*B+ (Good)*	*7*
≥ 50% and less than 60%	*B (Average)*	*6*
Below 50%	*F (FAIL)*	*0*
Absent	***Ab***	***0***

A student obtaining F Grade in any Subject shall be considered 'failed' and is be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when conduct. In such cases, his/her Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

If a student does not appear for the examinations, 'Absent' Grade will be allocated to him for any subject and shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted.

A Letter Grade does not imply any specific % of Marks, it is only the range of percentage of marks.

In general, a student shall not be permitted to repeat any subject / course (s) only for the sake of 'Grade Improvement' or 'SGPA/CGPA Improvement.

A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course (excluding Mandatory non-credit Courses). Then the corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (ΣCP) secured from ALL Subjects/ Courses registered in a Semester, by the Total Number of Credits registered during that Semester. SGPA is rounded off to TWO Decimal Places. SGPA is thus computed as

SGPA = $\{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$ …. For each Semester,

where 'i' is the Subject indicator index (takes into account all Subjects in a Semester), 'N' is the no. of Subjects 'REGISTERED' for the Semester (as specifically required and listed under the Course Structure of the parent Department), is the no. of Credits allotted to the i^{th} Subject, and C_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that i^{th} Subject. G_i

Illustration of calculation of SGPA

Course / Subject	Credits	Letter Grade	Grade Point	Credit Points
Course 1	3	A	8	3*8=24
Course 2	3	O	10	3*10=30
Course 3	4	B+	7	4*7=28
Course 4	3	B	6	3*6=18
Course 5	2	A+	9	2*9=18
Course 6	1.5	B	6	1.5*6=9
Course 7	1.5	O	10	1.5*10=15
	18			142

SGPA=142/18=7.89

The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over all Semesters considered for registration. The CGPA is the ratio of the Total Credit Points secured by a student in ALL registered Courses in ALL Semesters, and the Total Number of Credits registered in ALL the Semesters. CGPA is rounded off to TWO Decimal Places. CGPA is thus computed from the I Year second Semester onwards, at the end of each Semester, as per the formula

CGPA = $\{\sum_{j=1}^{M} C_j G_j\} / \{\sum_{j=1}^{M} C_j\}$ … for all S Semesters registered

(i.e., up to and inclusive of S Semesters, S ≥ 1),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the j^{th} Subject, and GP_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that j^{th} Subject. After registration and completion of I Year I Semester however, the SGPA of that Semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of CGPA

Semester	Credits	SGPA	Credits * SGPA
Semester I	18	7	18*7=126
Semester II	18	6	18*6=108
Semester III	16	6.5	16*6.5=104
Semester IV	16	8	16*8=128
	68		466

CGPA =466/68 =6.85

For Merit Ranking or Comparison Purposes or any other listing, ONLY the 'ROUNDED OFF' values of the CGPAs will be used. For Calculations listed in Item 10.7 – 10.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/ Courses will also be included in the multiplications and summations. However, Mandatory Courses (Audit Course) will not be taken into consideration.

A student shall be declared successful or 'passed' in a Semester, only when he/she gets a SGPA ≥ 6.00 (at the end of that particular Semester); and a student shall be declared successful or 'passed' in the entire PGP, only when gets a CGPA ≥ 6.00; subject to the condition that he/she secures a GP ≥ 6 (B Grade or above) in every registered Subject/ Course in each Semester (during the entire PGP) for the Award of Degree as required.

Passing Standards:

A Student shall be declared successful or 'passed' in a Semester, only when he/she gets a SGPA ≥ 6.00 (at the end of that particular Semester); and a Student shall be declared successful or 'passed' in the entire PGP, only when gets a CGPA ≥ 6.00; subject to the condition that he secures a GP ≥ 6 (B Grade or above) in every registered Subject/ Course in each Semester (during the entire PGP), for the Award of the Degree, as required.

10.14.2 After the completion of each Semester, a Grade Card or Grade Sheet (or Transcript) shall be issued to all the Registered Students of that Semester, indicating the Letter Grades and Credits earned. It will show the details of the Courses Registered (Course Code, Title, No. of Credits, Grade Earned), Credits earned SGPA and CGPA etc.

Declaration of Results:

Computation of SGPA and CGPA are done using the procedure listed in 10.7 – 10.10.

For Final % of Marks equivalent to the computed CGPA, the following formula may be used.

% of Marks = (CGPA – 0.5) x 10

10.0 Award of Degree and Class:

A Student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **68** Credits (with GP ≥ 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with specialization as he/she was admitted.A Student with final CGPA (at the end of the PGP)< 6.00 will not be eligible for the Award of Degree.

11.0 Withholding of Results:

If a Student has not paid fees to University/ Institute at any stage, or has pending dues against his name due to any reason whatsoever, or if any case of indiscipline is pending against him, the result of the Student may be withheld, and he/she will not be allowed to go into the next higher Semester. The Award or issue of the Degree may also be withheld in such cases.

12.0 Transitory Regulations:

A Student - who has discontinued for any reason, or who has been detained for want of attendance as specified, or who has failed after having undergone PGP, may be considered eligible for readmission to the same PGP with same set of Subjects/ Courses (or equivalent Subjects/ Courses as the case may be), and same Professional Electives (or from same set/category of Electives or equivalents as suggested), as and when they are offered (within the time-frame of 4 years from the Date of Commencement of his I Year I Semester).

Student Transfers:

There shall be no Branch/ Specialization transfers after the completion of Admission Process.

Scope:

I. Where the words "he", "him", "his", occur in the write-up of regulations, they include "she", "her", "hers".
II. Where the words "Subject" or "Subjects", occur in these regulations, they also imply "Course" or "Courses".
III. The Academic Regulations should be read as a whole, for the purpose of any interpretation.
IV. In case of any doubt or ambiguity in the interpretation of the above regulations, the decision of the Vice-Chancellor/ Director is final.
V. The Institute may change or amend the Academic Regulations, and/ or Course Structure, and/ or Syllabi at any time, and the changes or amendments made shall be applicable to all Students with effect from the dates as notified by the University/ Institute.

MALPRACTICES RULES:

	Nature of Malpractices	Punishment
	If the candidate:	
1 (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1 (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell Phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in

		connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the Institute campus or engages in any other act which in the opinion of the officer on duty amounts to use	In case of students of the Institute, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the Institute, who is not a candidate for the particular examination or any person not connected with the Institute indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the Institute expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the Institute will be handed over to police and, a 8police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.

11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester / year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institute for further action to award suitable punishment.	

GENERAL:

- **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.
- **Credit Point:** It is the product of grade point and number of credits for a course.
- The Academic Regulations should be read as a whole for the purpose of any interpretation.
- The University/Institute reserves the right of altering the Academic Regulations and/or Syllabus/Course Structure, as and when necessary. The modifications or amendments may be applicable to all the candidates on rolls, as specified by the University/Institute.
- Wherever the words 'he' or 'him' or 'his' occur in the above regulations, they will also include 'she' or 'her' or 'hers'.
- Wherever the word 'Subject' occurs in the above regulations, it implies the 'Theory Subject', 'Practical Subject' or 'Lab.' and 'Seminar'.
- In case of any ambiguity or doubt in the interpretations of the above regulations, the decision of the Director will be final.

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SEMESTER-I

PROGRAMME CORE-I / SIT- 01

PHOTOGRAMMETRY and REMOTE SENSING

OBJECTIVES:

1. To familiarize with the fundamentals of Remote sensing.
2. To provide an overview of various satellites and sensors.
3. To provide an exposure to LIDAR.
4. To familiarize with the fundamentals of photogrammetry.
5. To provide an introduction to Digital photogrammetry.

UNIT-I: Fundamentals of Photogrammetry: Introduction to Photogrammetry, Applications of Photogrammetry and its advantages and disadvantages over remote sensing, overlap concept, Scale concept, Relief displacement, B/H ratio ,parallax concept, various types of orientation, collinearity condition, coplanarity condition, scales restraint equation. Concept of bundle block adjustment and use of navigational parameters in bundle block adjustment, Physical Models, generalized models, Rational Function model, terrain dependent and terrain independent model for Rational Polynomial coefficient generation

UNIT-II: Introduction to remote sensing; Principle of remote sensing, energy sources; electromagnetic radiation laws; Energy matter interactions in atmosphere and at earth surface, atmospheric windows, Resolution (spatial, spectral, temporal, radiometric and angular resolution); Platforms-types of platforms and classification of sensors; Potential of satellite remote sensing and Drone aerial

UNIT-III: Satellites and Sensors: Introduction to satellites-LEO, MEO and HEO, Regional/GNSS;Orbital characteristics of geostationary and polar orbiting satellites; Various types of sensors-framing systems, imaging systems-whiskbroom, push-broom; stereoscopic viewing-along-track and across-track stereo viewing. Thermal sensors: thermal properties of materials; Thermal IR detection and imaging. Concept of hyper spectral remote sensing, Hyperion /HYSI data, Image cube; Hyper spectral data analysis, spectral library, Application of hyper spectral data.

UNIT–IV: Microwave Remote Sensing and LiDAR: Introduction to passive and active microwave sensors; Working principles of Real Aperture Radar and Synthetic Aperture Radar; Geometry of radar images; Factors affecting radar-backscattering; corner reflection. Introduction to LiDAR; acquisition of LiDAR data, applications of LiDAR in digital terrain model and digital surface model generation..

UNIT-V: Digital Photogrammetry: Introduction to Digital Photogrammetry**,**Orientation of digital images**,**GCPs**,** Advantages of digital photogrammetry over analogue and analytical photogrammetry, Digital Photogrammetry systems and software, Stereoscopic image acquisition, stereo viewing, vertical exaggeration, along -track and across-track stereo, pyramid, tie and pass points,digital image matching techniques; extraction of Digital Elevation Model, Digital Terrain Model, Digital Surface Model; break-lines, Definition and generation of ortho rectified images and uses.

COURSE OUTCOMES:

The student will be familiar with

CO 1. The basic concepts of remote sensing.
CO 2. Satellites and sensors.
CO 3.Working principles of and issues related to microwave sensors, LiDAR.
CO 4. The basics of photogrammetry, and
CO 5. The fundamentals and working principles of digital photogrammetry.

TEXT BOOKS:

1. Introduction to Modern Photogrammetry by Edward M Mikhail, James S Bethel
2. Text book of Surveying Part III- Paul Wolf
3. Elements of Photogrammetry by Paul Wolf…….., 4th Edition ISBN 007-123689-9
4. Remote Sensing and Image Interpretation Lillisand TM & Kiefer (2004) 4th edition John Wiley & Sons, New York
5. Introduction to Remote Sensing Campbell, J R Taylor and Francis
6. Fundamentals of Remote Sensing, 2nd edition George Joseph University Press Pvt Ltd

REFERENCE BOOKS:

1. Manual of American Society of Photogrammetry & Remote Sensing by Albert D
2. Digital Photogrammetry Michel Kasser & Yves Egles, Taylor & Francis
3. Digital Photogrammetry: An addendum to Manual of Photogrammetry Edited by Cliff Greve.
4. Photogrammetry Part III by B.C Punmia

PROGRAMME CORE-II/ SIT -02

GEOGRAPHIC INFORMATION SYSTEMS

OBJECTIVES:

1. To familiarize with the basics of GIS.
2. To provide an overview of various types of GIS data model including devices used to input the data into GIS.
3. To provide an exposure to various data input methods, storage and editing.
4. To introduce the concepts of DBMS and entity modeling,
5. To provide an introduction to concepts of data mining and data marts.

UNIT - I: Introduction to GIS & Data Structures: Spatial Elements/Developing spatial awareness, Spatial Measurement Levels, Spatial Location and Reference, Spatial Patterns, Geographic Data Collection, Populations and Sampling Schemes, Inferences from Samples, Map Scale and Map Characteristics, Map Projections, Grid Systems.

UNIT - II: Types of GIS Data Models: Graphic Representation of Entities and Attributes, GIS Data Raster and Vector Models, Reference Frameworks and Transformations, Digitizing Process and Map Preparation

UNIT - III: GIS Data Input Methods, Storage and Editing: Methods of Raster Input, Methods of Vector Input, GNSS Data input, Secondary data, Meta data and Meta data Standards. - Storage of GIS Databases, Detecting and Editing Errors: Raster and Vector, Attribute Errors: Raster and Vector, Dealing with Projection Changes, Edge Matching, Templating.

UNIT - IV: Database Systems & Entity Relationship Model: Definition, Purpose, Data abstraction, Instances and Schema, Data independence, Introduction to DDL, DML, Database manager, Database administrator, Database users, Overall system structure. Entity Relationship Model**:** Entities, Entity sets, Relationships, Relationship sets, Mapping constraints, Primary keys, E-R diagrams, Reduction of E-R diagrams to tables, Generalization, Aggregation.

UNIT - V: Data Structures: Computer Database Structures for Managing Data, Hierarchical Data Structures, Network Systems, Database Management Systems, RDBMS, Relational Model – Structure, Relational algebra, Relational calculus, Commercial query languages, SQL, Oracle, Query –by- Example

COURSE OUTCOMES:

The students will have sound background in the following aspects of GIS

CO 1. Fundamentals of GIS.
CO 2. Various types of GIS data model including devices.
CO 3. Familiarization with various data types, editing and storage.
CO 4. Concepts and components of DBMS and entity modeling, and
CO 5. Exposure to data mining and data marts.

TEXT BOOKS:

1. Fundamental of GIS by MICHAEL N DEMERS – Published by John Wiley & Sons Inc
2. Principles of GIS by P.A. Burrough and Rachael Mc Donnell
3. Principles of Geographical Information Systems for Land Resources Assessment by P.A. Burrough
4. Database System concepts by HENRY F. KORTH, Abraham Siberschatz et.al., Mc Graw Hill.

REFERENCE BOOKS:

1. Database Management Systems by Raghurama Krishnan and Johannes Gehrke, TATA McGrawHill 3rd Edition.
2. Data Warehousing, Data Mining & OLAP, by Alex Berson and Stephen J.Smith, "Tata McGraw – Hill Edition.

PROGRAMME ELECTIVE-I /SIT -03

LARGE SCALE TOPOGRAPHIC MAPPING

OBJECTIVES:

1. To familiarize with Fundamentals of Mapping:
2. To provide an overview of Map Projections
3. To provide an exposure to various types of surveys
4. To introduce the concepts of mapping,
5. To provide an introduction to cartography.

UNIT-I: Fundamentals: Introduction to mapping; Mapping scale, contours, magnetic and true north, Geoid and ellipsoid/spheroid models of the earth, Datum and coordinate reference systems.

UNIT-II: Map Projections: Introduction to map projection; various types of Map projections: Cylindrical Projections, Mercator projection, Azimuthal projections, Conical projections, UTM, Non-geometric projection, designing a map projection.

UNIT-III: Surveying: Principle of Surveying, Measurement Technology, traditional Survey methods, modern Surveys using Total station/GNSS.

UNIT-IV: Mapping: Planning an aerial/Drone Photo Mission,UAV- contemporary developments, Feature extraction and map generation, mapping standards, Various Map Accuracy Standards; Circular Error 90, Linear error 90, SOI Toposheets and map policy . Introduction to various elements of map design- Typography and lettering of maps, type size, type colors, positioning guidelines, Naming Conventions.

UNIT-V: Digital Cartography: Cartographic abstraction, selection and generalization principles, classification, simplification, exaggeration, Topfer Radical law, symbolization.

Common file formats for storing features; raster/vector and map composition, DXF, DLG, DGN, Postscript and encrypted postscript, .SHP. Tagged Image File, geo-tagged Image file and geo-pdf format.

Introduction to AutoCAD and Microstation, ArcGIS and QGIS, Grass, Quality control of vector data,capturing process; and Location-Based Services, Components of LBS-, and applications

COURSE OUTCOMES:

The student will have

CO 1.Exposure to concept and various facets of mapping.
CO 2.Familiarity with map projections.
CO 3.Acquaintance with various elements of surveying.
CO 4.Familiarity with mapping, and
CO 5.Insight into various steps involved in map preparation including cartography.

TEXT BOOKS:

1. Elementary Cartography by Arthur Robinson et al John Wiley & Sons.
2. Datum and Map Projections for remote Sensing GIS and Surveying byJonathathan Iliffe &Roger Lott CRC Press
3. Aerial MappingMethods and Applications by Edgar Falkner, Dennis Morgan Lewis Publishers.
4. Location based Services by Jochen Schilier, Agnes Voisard Elsevier, Morgan Kaufmann Publishers.

REFERENCE BOOKS:

1. Remote Sensing and Image Interpretation by Lillisand TM & Kiefer, 4th edition John Wiley & Sons, New York.
2. Map Projections A reference Manual by Bugayevskiy & Snyder Taylor & Francis.

PROGRAMME ELECTIVE-I /SIT -03

CONCEPTS OF BIG DATA AND ITS APPLICATIONS

OBJECTIVES:

1. To understand basic knowledge about **Big Data**
2. To learn about data sciences
3. To understand various case studies
4. To understand and solve problems using quering
5. To understand various applications of Big-data

UNIT I: Introduction to Big Data: Big data-concepts, Characteristics, V's Examples, Types and Challenges; general statistical concepts and principles; and impacts.

UNIT II: Data Science: Introduction to Data science, The Data Science Process, Sources of Data science, Adoption of data science & Skills.

UNIT III: Case studies: Case studies on Big Data Exploration, The Enhanced 360 View of a Customer, Security and Intelligence Operations and Analysis.

UNIT IV: Querying big data with Hive: Introduction to the SQL Language, Overview, Useful Functions, Advanced SQL, Useful Resources, Migration to HiveQL.

UNIT V: Applications of Big Data: Applications of Big Data in academics, Healthcare, Media and Entertainment, Weather, Transportation and Banking Sector.

COURSE OUTCOMES:

Students will be able to

CO 1: Have sound background in Big data

CO 2: Have sound background in Data science

CO3: Familiarize with the use of the Big Data-case studies

CO4: Execute the Queries, and

CO5: Comprehend Big data applications

TEXT BOOKS:

1. An Introduction to Statistical Learning, by James, Witten, Hastie, and Tibshrani.

REFERENCE BOOKS:

1. Elements of Statistical Learning by Hastie, Tibshrani, and Friedman

PROGRAMME ELECTIVE-I /SIT -03

TERRAIN MODELLING

OBJECTIVES:

1. To introduce the concepts of terrain modelling.
2. To familiarize with the data acquisition methodology.
3. To comprehend the concept of terrain surface modelling.
4. To have exposure to data quality control.
5. To familiarize with multi scale representation of DEM.

UNIT-I: Terrain Model Concepts: Digital terrain representation, Digital terrain models, Digital elevation models, Topographic Contours, Geometric characteristics of terrain surface, Complexity of terrain surface, Terrain classification.

UNIT-II: Data Acquisition Methodology
Data sources, Interferometric, Synthetic Aperture Radar Interferometry (InSAR), GNSS and other ground-based measurement.

UNIT-III: Terrain Surface Modelling
Basic concepts, Approaches to surface modelling, Grid network: concepts and formation approaches, Comparison between TIN-based and grid-based modelling, **Interpolation Methods-**Classification of interpolation methods, Global interpolation, Kriging ,Patch-wise interpolation methods, Point-based interpolation methods, Discussion on interpolation methods.

UNIT-IV: Data Quality Control
DTM quality control: concepts and strategy, On-line quality control in photogrammetric data acquisition, **Mathematical Models for DTM Accuracy,** Problems and strategy, Accuracy of sources data, Relationship between DTM accuracy and contour interval.

UNIT-V: Multi-Scale Representation of Digital Elevation Models
The concepts of scale and resolution, Multi-scale representation: pyramid structure versus quad tree, Multi-scale representation: surface generalisation, Multi-scale DTM at a national level, **DTM Data Management,** Concepts of data structure and databases, DTM data structure: TIN and Grid, Database organisation of DTM, Databases for DTM management, Extraction of characteristic line, Extraction of hydrological information.

COURSE OUTCOMES:

The students will have exposure to

CO1: Basic concepts of terrain modelling.
CO2: Methods of acquisition.
CO3: Terrain surface modelling.
CO4: Data quality control
CO5: Multi Scale representation of DEM.

TEXT BOOKS:

1. Terrain Modelling (2007) by Richard Windrow, Compendium Publishing.
2. Digital Terrain Modeling: Principles and Methodology (2004) by Zhilin Li, Christopher Zhu, Chris Gold, CRC Press.

REFERENCE BOOKS:

- Annoni, A. (2005). *European Reference Grids*, volume EUR 21494 EN. European Commission, Joint Research Centre. URL http://sdi.jrc.it/publist/annoni2005eurgrids.pdf
- Annoni, A., Luzet, C., Gubler, E., and Ihde, J., editors (2003). *Map Projections for*
- *Europe*, volume EUR 20120 EN. European Commission, Joint Research Centre.
- Arrighi, P. and Soille, P. (1999). From scanned topographic maps to digital elevation.

PROGRAMME ELECTIVE –II/ SIT-04

GEODESY

OBJECTIVES:

1. To introduce the fundamental concepts of reference co-ordinate systems, time and signal propagation.
2. To familiarize with the satellite orbital motion.
3. To comprehend GPS fundamentals and receivers.
4. To acquire working knowledge of processing navigational data ,and the assessment error budget.
5. To have an exposure to the role of permanent reference points in the context of satellite navigation, networks and its applications.

UNIT– I: Fundamentals: Introduction to geodesy, historical perspective, Reference coordinates systems, Time system, Signal Propagation.

UNIT–II: Satellite Orbital Motion: Fundamentals of Celestial Mechanics, Orbit determination, Satellite Orbits and Constellations.

UNIT–III: GNSS Fundamentals: Space segment, Control segment, Observation principle and signal structure; Receivers, Future developments.

UNIT–IV: Data Pre Processing: Ambiguity Resolutions; adjustments, filtering and smoothing; Dilution of precision

Unit – V: GNSS errors sources & improving positional accuracy: Satellites clocks, orbit errors, Atmospheric delays ,receivers noise, multipath; multi frequency multi constellation, DGNSS, Argumentation systems.

COURSE OUTCOMES:

The students will be able

CO1: Introduce the fundamental concepts of reference co-ordinate systems, time and signal propagation.
CO2: Fundamentals of satellite orbital motion.
CO3: Working principles of satellite orbital motions and GPS receivers.
CO4: Processing navigational data and assessment of error budget, and
CO5: Knowledge of the role of permanent reference points in the context of satellite navigation, networks and its applications.

TEXTBOOKS:

1. Satellite Geodesy by GUNTER SEEBER, Copy Right 2003 by WALTER DE GRUYTER 1993, ISBN: 3-11-017549-5.
2. Global Positioning System – Theory and Practice – Hofmann W.B, Lichtenegger. H, Collins. J – Springer Verlag Wein, New York.-2008
3. "GPS Satellite Surveying", Alfred Leick 3rd Edition, John Wiley and Sons 2004.

PROGRAMME ELECTIVE –II/ SIT-04

WEB-GIS

OBJECTIVES:

1. To know Fundamentals of Web.
2. To know about Java Script.
3. To know about Programming in Web GIS
4. To have exposure to handling Geographical Data in Internet Environment
5. To understand about Publishing the Geo-spatial data

UNIT I: Fundamentals of Web: Introduction to web & Mark up languages, Different tags of HTML, Marquee List, frames ,I-frames and creation of form document, CSS: Block level and Inline elements, Types of style sheets, Box model, Different fonts, Animation, Static layout.

UNIY II: Java Script for Form validation: Introduction to java script: Syntax, Statements, Comments, Popup Boxes: Alert, Confirm, Prompt, Variables, Operators, Conditional Statements, Loops, Events, Cookies. Page Printing, Page redirection, Built-in Objects, Debugging, HTML DOM.

UNIT III: Programming in Web GIS: Introduction to different 2D and 3D view, working with Map views, Constructors, Map view properties and methods.

UNIT IV: Display Geographical Data in Internet Environment: Base maps, Rendering ,Query task, Point graphics, Working with base map tools, Feature Layer Query, Geometric engine, Demonstration of use cases

UNIT V: Publishing the Geo-spatial data: Search widget, Publishing of Geospatial data in Local server and Global server, Geo-coding, Validating and Analyzing the results.

COURSE OUTCOMES:

The student will be able to

CO1: Comprehend basic programming including HTML & CSS to implement high quality web mapping applications.
CO2: Familiarize with the usage of Java Script for form validation of web page
CO3: Gain an understanding of the basic concepts of programming using web GIS
CO4: Have the basic knowledge of techniques to distribute, process and display geographical data in the Internet environment, and
CO5: Develop the skill for publishing the geospatial data

TEXT BOOKS:

1. An Introduction to Web design and programming, McGraw Hill, Wang, Thomson.
2. Ajax: The Complete Reference – Thomas A. Powel, McGraw Hill, 2008.
3. JavaScript 2.0 Complete Reference, 2nd Edition by Thomas A. Powel, McGraw Hill.

PROGRAMME ELECTIVE –II/ SIT-04

WEB TECHNOLOGIES

OBJECTIVES:

1. To familiarize with concepts of scripting languages.
2. To comprehend the concepts of style sheets.
3. To have and exposure to DotNET frame work.
4. To familiarize with concepts of web services
5. To introduce the concepts of servers.

UNIT - I: Introduction to Web Technologies and Web 2.0: Introduction to client server systems, HTTP protocols, Common tags in HTML: List, Tables, Forms, Frames, Images, Links and Addressing, Cascading Style Sheet (CSS), XML: Comparative study of XML and HTML, Document Type Definition, Schema, Parsers (Dom and SAX), Introduction to JavaScript, JavaScript objects, programming using java script if-else, switch, popup box, while loop, for loop, event handling, Introduction to Web 2.0, Data and Web 2.0, Convergence, Web Services: SOAP, JSON, Building Rich Internet Applications with AJAX, Servlets.

UNIT - II: HTML5&CSS3: HTML5 Document Structure Changes, Forms, Form elements, Video and Audio, Semantic elements, Structural elements, Introduction to CSS3, Style inclusion methods, selectors, properties, fonts, colors.

UNIT - III: Introduction to Microsoft .NET framework: Introduction to Microsoft .NET framework: arrays, operators, flow control statements, functions and properties, collection and generics, Getting started with ASP.NET – web forms, controls-web form validation, website navigation, enhancing websites using master pages.

UNIT - IV: .NET framework and web services: Web services and .NET framework(exposing web services, consuming web services, .NET remoting, namespace, web service architecture), ADO.NET programming objects and architecture, connected model (command objects), disconnected model (data sets), introduction to LINQ.

UNIT - V: Working with Geo Server and Open Layers: Introduction to map server and web server, map file concept and format, geographic data formats, Open Layers- Understanding Open Layers Syntax, Layers, Controls, Formats, Overlays, Styling, Geoserver- Publishing data in GeoServer, Different types of Services: WMS, WFS,WCS.

COURSE OUTCOMES:

The student will have exposure to

CO1: Concepts of scripting languages.
CO2: HTML 5 and CSS3.
CO3: DotNET frame work.
CO4: Customized wed services.
CO5: GeoServer and Open layers.

TEXT BOOKS:

1. The Complete Reference: HTML and CSS, 2nd & 5th Editions by Thomas A. Powel, McGraw Hill.
2. JavaScript 2.0 Complete Reference, 2nd Edition by Thomas A. Powel, McGraw Hill.
3. Ajax: The Complete Reference – Thomas A. Powel, McGraw Hill, 2008.

REFERENCE BOOKS:

1. Professional AJAX – Nicholas C Zakas et al, Wrox publications, 2006.
2. Pro ASP.Net 4 in C# 2010 by Mathew MacDonald, Adan Freeman (paperback).
3. Beginning ASP.net 4: in C# & VB (Wrox programer to programmes by Ima Spanjaars
4. An Introduction to Web design and programming, Wang, Thomson.
5. Beginning MapServer, Opensource GIS Development, by Bill Kropla.

LAB 1/ SIT -05

GIS LABORATORY

OBJECTIVES:

1. To provide hands-on experience in preparation of remote sensing data for analysis/ interpretation, and to familiarize with the topographic maps and thematic maps.
2. To provide an and exposure to various aspects of base map preparation.
3. To make the scholars develop different thematic maps like drainage map, slope map, watershed map and land use / land cover map.
4. To have an exposure to digital change detection process and map updation.
5. To collect and process the navigational data both in stand- alone mode and DGPS mode- the steps towards surveying.

List of the Practicals

1. Study of satellite imageries and Topo maps .
2. Map Scanning
3. Geo-referencing and Map composition
4. Image Interpretation for base map preparation
5. Drainage Maps
6. Watershed Maps
7. Surface Analysis .
8. Preparation of Urban road and rail network Map
9. Land Use/Land Cover Maps
10. Preparation of DEM/DTM/DSM

COURSE OUTCOMES:

The students will be able to

CO1: Prepare remote sensing data for analysis/ interpretation, and will be familiar with the topographic maps and thematic maps.

CO2: Prepare base maps.

CO3: Develop different thematic maps like drainage map, slope map, watershed map and landuse / landcover map.

CO4: To analyze the change in terrain features/ land use/ land cover from multi-temporal and multispectral data, and map updation.

CO5: Carry out GPS survey.

LAB 2/ SIT -06

SOFTWARE DEVELOPMENT LABORATORY

OBJECTIVES:

1. To discuss different data types, conditional statements in programming language.
2. To understand the concepts of OOPS.
3. To discuss about method overloading and overriding.
4. To learn about various windows services.
5. To understand the integration of DotNet with ArcGIS environment..

LIST OF THE PRACTICALS

1) Introduction to the .NET platform.
2) Working with Data Types in C#.NET.
3) Implementation of Type Conversion.
4) Execution of Boxing & Unboxing in C#.NET.
5) Working with Conditional Statements, operators, Looping Arrays.
6) Implementation of OOPS Concepts in Dot NET.
7) Working with Constructors & Destructors in Dot NET.
8) Working with Static method and Static classes.
9) Implementation of Method overloading and overriding.
10) Working with sealed classes, Partial Classes in C#.NET.
11) Interaction with Windows forms and Event Controls.
12) Handling various File Systems with various File Streams.
13) Development of sample customized tools in Arc-GIS.
14) Working with Insert cursors of Arc-GIS environment.

COURSE OUTCOMES:

The student will be able to

CO1: Handle the implementation of programming concepts of Dot Net.
CO2: Learn the usage of Type conversion techniques.
CO3: Gain an understanding of the basic concepts of OOPS.
CO4: Have the basic knowledge of different windows services.
CO5: Gain hands-on experience in Handling of Assemblies in DotNet.

CORE/ SIT-07

RESEARCH METHODOLOGY AND IPR

UNIT - 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.
Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT- 2: Effective literature studies approaches, analysis Plagiarism, Research ethics.

UNIT- 3: Effective technical writing, how to write report, Paper

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT-6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

COURSE OUTCOMES:

Students will be able to

CO1: Understand research problem formulation.
CO2: Analyze research related information
CO3: Follow research ethics
CO4: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO5: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO6: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students
2. Wayne Goddar and Stuart Melville, "Research Methodology:An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"

REFERENCE BOOKS:

1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
2. Mayall, "Industrial Design", McGraw Hill, 1992.
3. Niebel, "Product Design", McGraw Hill, 1974.
4. Asimov, "Introduction to Design", Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
6. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2000

AUDIT COURSE -1/ SIT -08

ENGLISH FOR RESEARCH PAPER WRITING

UNIT –I: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT-II: Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

UNIT-III: Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

UNIT-IV: Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT-V: Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT-VI: Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

COURSE OUTCOMES:

Students will be able to:

CO1: Understand that how to improve your writing skills and level of readability
CO2: Learn about what to write in each section
CO3: Understand the skills needed when writing a Title
CO4: Ensure the good quality of paper at very first-time submission

SUGGESTED STUDIES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

AUDIT COURSE -1/ SIT -08

DISASTER MANAGEMENT

UNIT-1: Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT-II: Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.
Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III: Disaster Prone Areas in India: Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

UNIT-IV: Disaster Preparedness And Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT-V: Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival.

UNIT-VI: Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation, Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

COURSE OUTCOMES:

Students will be able to:

CO1: Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO2: Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO3: Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO4: Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi

AUDIT COURSE -1/ SIT -08

SANSKRIT FOR TECHNICAL KNOWLEDGE

OBJECTIVES:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. Learning of Sanskrit to improve brain functioning.
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

UNIT-I:

- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

UNIT-II:

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

UNIT-III:

- Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

COURSE OUTCOMES:

Students will be able to

CO1: Understand basic Sanskrit language.
CO2: Understand Ancient Sanskrit literature about science & technology.
CO3: Develop logic in students being a logical language.

SUGGESTED READING

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

AUDIT COURSE -1/ SIT -08

VALUE EDUCATION

OBJECTIVES:

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

UNIT-I:

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgments.

UNIT-II:

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism, Love for nature, Discipline.

UNIT-III:

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

UNIT-IV:

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence, Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

COURSE OUTCOMES:

Students will be able to

CO1: Gain knowledge of self-development
CO2: Learn the importance of Human values
CO3: Develope the overall personality

PROGRAMME CORE-III/ SIT -09

ADVANCED DIGITAL IMAGE PROCESSING

OBJECTIVES:

1. Familiarize with different types of distortions.
2. To learn different Image Enhancement.
3. To understand the different types of Image Interpretation/Analysis are enumerated in this unit.
4. Familiarize with Hyper Spectral Image Analysis.
5. To understand the concepts of Change Detection and Accuracy Assessment.

UNIT-I: Introduction: Sources of radiometric distortions- atmospheric effect, instrumentation errors; Correction of radiometric distortions, Sources of geometric distortions: earth rotation effects, panoramic distortions, earth curvature, scan line skew, etc. Geometric Correction: use of polynomials for image corrections, image registration, ortho-rectification.

UNIT-II: Image Enhancements: Data formats. Image processing softwares - IDRISI, ILWIS, ERDAS Imagine, ENVI, e-Cognition, etc., Radiometric enhancement techniques: Contrast modification, Histogram equalization, Histogram matching, density slicing, Geometric enhancement techniques: Neighbourhood operations, image smoothing, spatial filtering, edge detection and enhancement, Data fusion methods-IHS transformation, Brovey, Wavelet transform, principal component transformation, multiplicative.

UNIT-III: Image Interpretation/Analysis: Image interpretation, Digital image analysis-unsupervised classification, supervised classification including advanced classification approaches, - machine learning, deep learning, AI.

UNIT-IV: Change Detection and Accuracy Assessment: Change Detection: Scope and Methods-Spectral Differencing, NDVI-based Analysis, Post-classification change detection, Principal Component Analysis, Precision versus Accuracy, types of accuracies: positional, thematic- sources of errors in thematic maps, Error matrix analysis, report of accuracy, textural classifiers, object oriented classifier.

UNIT-V: Hyper Spectral Image Analysis: Image cube**,** Data Visualization, Dimensionality Reduction, Feature Extraction - Pixel Purity Index, Hyper Spectral Data Analysis Methods: - SAM, Spectral Feature Filtering, Spectral Unmixing

COURSE OUTCOMES:

The students will have

CO1: Exposure to various image restoration techniques.
CO2: Comprehend various image enhancement techniques.
CO3: Thorough understanding of the procedures for image interpretation.
CO4: Familiarity with hyperspectral data and its analysis, and
CO5: Exposure to change detection and accuracy assessment.

TEXT BOOKS:

1. John R.Jensen, 1996.Introductory Digital Image Processing., Prentice Hall Series,.
2. John A. Richards and X. Jia, 2013.Remote Sensing Digital Image Analysis. Springer-Verlag,.
3. Lillisand T.M , R.W.Kiefer and Chipman,J.W.,2008. Remote sensing and image interpretation, John Wiley & Sons, New York.
4. Campbell J.B. and Wynnne,R.H., 2012. Introduction to Remote Sensing. Fifth edition. The Guilford Press, New York.

REFERENCE BOOKS:

1. David L. Verbyla .Satellite Remote sensing of Natural Resource Management., Lewis publishers, Florida
2. Anil K. Jain .Fundamentals of Digital Image Processing. Prentice Hall Publications, USA.

PROGRAMME CORE-IV/ SIT-10

REMOTE SENSING APPLICATIONS

OBJECTIVES:

1. In this unit concepts concerned to Land Resources are studied.
2. Types of different Resources are dealt in this unit.
3. To understand the concepts of water resources are enumerated in this unit.
4. Concepts of Environmental Studies are discussed here.
5. To understand the concepts of Natural disasters

UNIT- I: Land Resources: Land use land cover- mapping and monitoring of land use including wastelands and urban land use

Soil resources- soil resources mapping, soil resources database, generation of derivative maps (land capability, land irritability and crop suitability maps); land degradation mapping and monitoring; and soil moisture estimation using microwave .

Minerals and ground water- Geological and geomorphologic mapping, hyperspectral data for mineral targeting, ground water prospecting and exploration and Identification of sites for ground water recharge.

UNIT – II: Vegetal Resources: Agriculture-Crop inventory and acreage and production estimation, (Forecasting Agricultural output using Space Agrometeorology and Land based observations (FASAL); Crop condition assessment, crop intensification, precision farming, and crop insurance.

Forests-Forest cover and density mapping, forest change detection, forest fire monitoring; Biodiversity characterization.

UNIT – III: Water Resources: Water resources inventory; snow cover mapping; Flood inundation mapping; water quality monitoring; high resolution data applications- irrigation infrastructure mapping and monitoring.

UNIT - IV: Environmental Studies: Role of remote sensing in environmental studies- water and air pollution; Environmental Policy - Environmental Impact Assessment.

UNIT- V: Natural disasters: Natural disasters – floods, agricultural drought, earthquakes and tsunamis – volcanoes – landslides, Familiarization with Decision Support System and National Database for Disaster Management.

COURSE OUTCOMES:

The students will be able to know

CO1: Role of remote sensing in the management of land resources

CO2: Role of remote sensing in the management of Vegetatal Resources

CO3: Water resource management by Remote sensing techniques

CO4: Remote sensing of environment, and

CO5: Basic concept and types of natural disasters, and the role remote sensing plays in natural disaster management.

TEXT BOOKS:

1. Lillisand T.M and R.W.Kiefer (2004) 4th edition. Remote sensing and image interpretation, John Wiley & Sons, New York.
2. JOHN R.JENSEN "Remote sensing for Environment"Pearson edition Pvt Ltd, New Delhi.
3. Anji Reddy, M., (2001) Remote Sensing and Geographical Information Systems, 2nd edition, BS Publications, Hyderabad.

PROGRAMME ELECTIVE-III/ SIT -11

GLOBAL NAVIGATION SATELLITE SYSTEM

OBJECTIVES:

1. Introduction to Geodesy specially satellite geodesy.
2. To have an overview of positioning and basic physical concept.
3. To have an in depth knowledge of Navigational satellite system.
4. To have an exposure various navigational satellite **Data** Processing.
5. To familiarize with Applications of Satellite Geodesy.

UNIT-I: Basics: Definition - Fundamental goals of Geodesy - Definitions - basic concepts - Historical perspective – development, applications in Satellite Geodesy - Geoid and Ellipsoid, Earth Geoid models(EGM), satellite orbital motion - Keplerian motion - Kepler‟s Laws - Perturbing forces - Geodetic satellite

UNIT –II: Different Techniques: Determination of direction by photography - SECOR - Electronic observation techniques - Doppler effect - Positioning concept - Development of TRANSIT satellites

UNIT- III: Satellite System: GPS - Different segments – space, basic constellation of satellite geometry & accuracy measures,control and user segments - satellite configuration - GPS signal structure - Orbit determination and Orbit representation, Anti Spoofing and Selective Availability - Task of control segment - GPS receivers - main receiver components - Example of GNSS receivers,NAVIC,GAGAN,GLONASS, GALILEO, COMPASS,Beidou and IRNSS satellite configuration and comparisons

UNIT- IV: GPS Data Processing: GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation - data processing - software modules – ambiguity resolution and cycle slips, RINEX format, Concepts of rapid static methods with GPS, semi kinematic and pure kinematic methods .

UNIT-V: Applications of Satellite Geodesy: Geodetic control surveys, Cadastral surveying, close range photogrammetry, Engineering applications and Monitoring - Satellite Laser Ranging & Applications - Concepts of satellite altimetry.

COURSE OUTCOMES:

The students will have exposure to

CO1: Satellite geodesy.

CO2: Overview of positioning and basic physical concept.

CO3: In depth knowledge of navigational satellite system.

CO4: Navigational satellite data processing and techniques.

CO5: Applications of Satellite Geodesy

TEXT BOOKS:

1. Satellite Geodesy by GUNTER SEEBER, Copy Right 2003 by WALTER DE GRUYTER 1993, ISBN: 3-11-017549-5.
2. Global Positioning System – Theory and Practice – Hofmann W.B, Lichtenegger. H, Collins. J – Springer Verlag Wein, New York.-2008
3. “GPS Satellite Surveying”, Alfred Leick 3rd Edition, John Wiley and Sons 2004.

REFERENCE BOOKS:

1. Global Navigation Satellite Systems by G. S. Rao 2010 Tata McGraw Hill Education Pvt Ltd.
2. “GPS Theory, Algorithms and Applications .Guocheng Xu,” Springer-Verlag, 2003.

PROGRAMME ELECTIVE-III/ SIT -11

EARTH OBSERVATION SYSTEMS

OBJECTIVES:

1. To review the emerging and federated observation system concepts
2. To identify potential benefits to be obtained in light of observation needs in different Earth Observation domains
3. To identify key required technology challenges entailed by the emerging fractionated and federated by Indian satellite system concepts.
4. To validate observation needs with the respective user communities to be fit for purpose in terms of scientific and commercial applications
5. To propose an high resolution satellite data for GEOS

UNIT-1: Introduction to Earth Observation system: Introduction Of Earth Observation System, Sensing Platforms, Airborne Platforms, Spaceborne Platforms, Near-Polar Orbits, Geosynchronous Orbits, Sensors, Optical Sensors, Photographic Cameras Digital Aerial Cameras, Video Cameras, Radiometers, Electro-Optical Scanners, Microwave Sensors, Passive Microwave Sensors, Active Microwave Sensors, LiDAR ,The Ground Segment ,Earth-Observing Systems .

UNIT-2: International Satellite Programmes: The Landsat System, Satellite Pour l' observation De La Terre (SPOT), Pleiades Systems, The Earth Observing System Mission, Terra (Eos-Am), Aqua (Eos Pm), 8 Earth Observing-1 (Eo-1) Mission, Rapideye.

UNIT-3: Indian Remote Sensing Satellites Mission: IRS IA/IB, IRS IC/ID, Resourcesat series, Cartosat series, OCM series, RISAT series, HySi.

UNIT-4: High Resolution Data: High Spatial Resolution Remote Sensing Systems, Early bird & Quick bird, Ikonos, Orbview-3, Geoeye-1, Worldview Mission.

UNIT-5 : Microwave Mission: Spaceborne Imaging Microwave Systems , Seasat , European Remote Sensing Satellite (Ers-1 And -2) , Sentinel-1 Japanese Earth Resources Satellite (Jers-1), Advanced Land Observation Satellite (Alos-1), Radarsat Missions, Radarsat-1 , Radarsat-2 , Radarsat Constellation Mission (Rcm) , Envisat , Radar Imaging Satellite (Risat) Missions, Radar Imaging Satellite (Risat-2), Radar Imaging Satellite (Risat-1), Soil Moisture And Ocean Salinity Mission (Smos)., Measurement Principle , Soil Moisture Active Passive Mission (Smap).

COURSE OUTCOMES:

The students will have exposure to

CO1: Existing and emerging earth observation system.
CO2: Various satellite platforms
CO3: IRNNS program and its data processing
CO4: Satellite data structures
CO5: Currently operating and future GEOS

TEXT BOOKS:

1. Aoki, S., 2006. Nihon no Uchu Senryaku (Japanese Space Strategy), Keio University Press, Tokyo, p. 309.
2. Richards and jia "Global Earth Observation Systems".
3. Gaos Book " Global Earth Monitoring Systems".

PROGRAMME ELECTIVE-III/ SIT -11

OBJECT ORIENTED PROGRAMMING CONCEPTS

OBJECTIVES:

1. To familiarize with the concepts of basics of object-oriented programming and working with files.
2. To provide an overview of advanced concepts of object-oriented programming concepts.
3. In a logical sequence to familiarize the student with concepts of Java.
4. To introduce the advanced concepts of Java
5. To comprehend with the concept of Java script.

UNIT-I: Getting started with OOPs Concepts: Principles of object oriented programming, operators, Datatypes, Beginning with C++, Tokens, Expressions and control structures, Functions in C++, Classes and objects, Access Specifiers, Keywords, Constructors and Destructors, Operator Overloading, Type Conversions, Inheritance, Pointers, Virtual functions and Polymorphism.

UNIT-II: Advanced Concepts in OOPS: Managing console I/O operations, working with files, Templates, exception handling, manipulating strings.

UNIT-III: Introduction of JAVA: Principles of object oriented programming, The Genesis of Java, an overview of Java, Comparative study of C++ and JAVA: Data types variables and arrays, operators, control statements, methods and classes, inheritance, Packages and interfaces, exception handling.

UNIT-IV: Advanced Concepts of JAVA: Java Library, Multithreaded programming, I/O, Applets, string handling, input/outputs, Applet class, event handling, AWT, AWT controls, Layout managers and menus, working with images.

UNIT–V: Working with Java Script: Introduction to javascript- Syntax, Statements, Comments, Popup Boxes, Alert, Confirm, Prompt, Variables, Operators, Conditional Statements, Loops, Events, Cookies, Page Printing, Page redirection, Built-in Objects, Debugging, HTML DOM.

COURSE OUTCOMES:

The students will have exposure to

1. Concept of classes, objects and files.
2. Working with files and strings.
3. To provide an overview of Java and its packages
4. Concept of Java AWT controls, Layouts.
5. To familiarize the students working with Javascript.

TEXT BOOKS:

1. Programming in C++ by Balaguruswamy, 4th edition, Tata McGraw Hill Education Pvt. Ltd.
2. Java: The Complete Reference by Herbert Scheldt McGraw-Hill, 2011.

REFERENCE BOOKS:

1. C++ Primer plus by Stephen Prata, 6th edition, Person education.
2. Problem Solving in C++, The OOP by W.Savitch 4th edition, Pearson education.
3. Object Oriented Analysis and Design with Applications by Grady Booch, 2nd edition, Pearson education.
4. Schaum's Outline of Programming with C++ by John R. Hubbard, 2nd edition, McGraw Hill.

PROGRAMME ELECTIVE-IV/ SIT -12

SPATIAL DATABASE CREATION

OBJECTIVES:

1. To introduce the fundamental concepts of thematic maps.
2. To familiarize with Map Production techniques.
3. To comprehend Concept of Database.
4. To acquire knowledge of Database System Architecture, and
5. To have an exposure to Database Creation and management.

UNIT I: Thematic maps: Introduction to different types of maps-chloropleth maps, Heat maps, proportional symbol maps, dot density maps, animated time-series maps.

UNIT II: Technology of Map Production: Standard procedure- data preparation-data model creation, cartographic design, map layout, quality control.

UNIT-III: The Concept of Database: Introduction to Database, characteristics of database, Database design, Entities and attributes, database models, Relationships, Designing for data integrity, Database normalization and Denormalization.

UNIT IV: Database System Architecture:
Database system- Architecture, Centralized and Client–Server Architectures, Server System Architectures, Parallel Systems, Distributed Systems, Network Types.

UNIT V: Database Creation and management: Conceptual Modeling and Database Design methodology, Data storage and querying- storage and file structure, indexing and hashing, query processing; transaction management- transactions, concurrency control, recovery system; Database security.

COURSE OUTCOMES:
The students will have exposure to

CO1: Various types of thematic maps
CO2: Production of map's
CO3: Database creation & Redundancy
CO4: Various types of database systems
CO5: Creation and management of database

TEXT BOOKS:

1. Cauvin,Colette; Francisco Escobar and Aziz Serradj, Thematic Mapping and Transformations.ISTE Ltd.,Willey.
2. Denegre,J.1994. Thematic Mapping From Satellite Imagery:A Guide Book. Elsevier Science Ltd.
3. Elmasri, Ramez and Navathe, Shamkant B., 2011. Fundamentals of Database Systems. Addison-Wesley.
4. Silberschatz, Abraham;Henry F. Korth and S. Sudarshan, 2006 Database Systems Concepts. McGraw Hill.

PROGRAMME ELECTIVE-IV/ SIT -12

PYTHON SCRIPT PROGRAMMING

OBJECTIVES:

1. To introduce the fundamental concepts of scripting language.
2. To familiarize with the OOPS concepts
3. To comprehend Modules and regular expressions in scripting environment.
4. To acquire working knowledge of File and Database Connections , and
5. To have an exposure to UI programming.

UNIT 1: Fundamentals of Python: Introduction to Python; Installation of python; Code execution ways; Data types Control statements (if, if else); Iterators and generators (For , While, yield), Operators; Functions in python.

UNIT 2: Introduction to OOPS: Features of OOPS; Classes and Objects; Types of class methods; Inheritance; Encapsulation, Abstraction; Polymorphism; Exception handling.

UNIT 3: Introduction to Modules and regular expressions: Introduction to regular expression; Working strings using RE; Working with files using RE; Introduction to modules; Creating own modules; In-built modules and GIS modules; Common usage models for Excel, Database.

UNIT 4: File and Database Connections: Reading and writing data from notepad and Excel; Installation of database (MySQL for python); Database Connections (MySQL); Working with queries (Update, delete, Insert, Retrieving).

UNIT 5: Introduction to UI programming: Introduction to TKINTER module; Root window; Containers; Canvas; Frames; UI Elements (Button, Message, Text, Menu etc…).

COURSE OUTCOMES:

The student will have exposure to

CO1: Fundamentals of PYTHON
CO2: Familiar with various elements of Python script programming, namely OOPS
CO3: Integration of Modules and regular expression in PYTHON.
CO4: Data base programming
CO5: With abovementioned background they will be able to develop small application

TEXT BOOKS:

1. Core python Programming by Dr Nageswrara rao.
2. Python Cookbook by Brian Jones
3. Dive into Python 3 Mark Piligrim

PROGRAMME ELECTIVE-IV/ SIT -12

ADVANCED GEOSPATIAL TECHNOLOGIES

OBJECTIVES:

1. To provide exposure to Web and Internet GIS.
2. To familiarize with centralized and distributed Web GIS.
3. To comprehend the web services in GIS domain.
4. To introduce the web mapping applications.
5. To provide overview of working principles of web mapping services and open source GIS.

Unit - I: Introduction to Web and Internet GIS: Distributed Geospatial Services, Server side Internet GIS, Client side Internet GIS and different web GIS architectures, evolution of web mapping.

Unit - II: Centralized and Distributed Web GIS Application Framework: Introduction to centralized, distributed, enterprise and mobile GIS applications, database servers in enterprise environment, web service framework, XML, SOAP and other web service standards .

UNIT-III: Web Services in GIS Domain: Interoperability in GIS, OGC and its specifications, OGC specifications for GIS web services (WMS, WFS, WCS, WPS, SLD etc), GIS Servers –commercial (Arc GIS Server) and open source (UMN Map Server, Geo-server), OGC GML and metadata standards, Quality of web GIS Service and Security issues in Distributed GIS.

UNIT - IV: Web mapping application development tools: Introduction to HTML, JavaScript, PHP, .Net framework for web applications, web GIS API (Open Layer or Arc GIS), EPSG and Proj4 libraries, XML and GML schema creation, OGC web service publishing and consuming (WMS, WFS and WCS), SLD creation, Data querying, processing and analysis in multi-user environment, introduction to AJAX, Web 2.0, 3D web geo-visualizations and Semantic web service, Data security, performance tuning for web mapping application.

UNIT-V: Web Mapping Services & Open Source GIS Software: Spatial data infrastructure- NSDI, Distributed geo-processing, spatial decision analysis in web GIS environment, OGC WPS, Symantec web Architectures and Database connections, GRASS, POST GRE SQL, JUMP, etc

COURSE OUTCOMES:

The students will have

CO1: Exposure to Web and internet GIS.
CO2: Familiarization with centralized and distributed web GIS applications frame work.
CO3: Grasp of web services in GIS domain.
CO4: Working knowledge of web mapping application development tools.
CO5: An idea about web mapping services and open source GIS software.

TEXT BOOKS:

1. Network GIS- Yang, Chaowei, Wong, David W.S., Kafatos, Menas.
2. Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks- Zhong-Ren Peng and Ming-Hsiang Tsou John Wiley and Son Inc.
3. Distributed GIS- Frederic P. Miller, Agnes F. Vandome and John McBrewster.

LAB 3/ SIT-13

DIGITAL IMAGE PROCESSING LABORATORY

OBJECTIVES:

1. To introduce the fundamental concepts of Image formats.
2. To familiarize with Image processing techniques.
3. To comprehend Image fussion techniques.
4. To acquire knowledge of classifications, and
5. To have an exposure to spatial model maker.

LIST OF PRACTICALS

1. Displaying digital image data with various formats, namely BIL, BSQ and BIP, tiff, jpeg, png & Generation of Color Composite.
2. Geometric correction of satellite images.
3. Mosaic Preparation of digital images
4. Image enhancement techniques, namely
   - Contrast enhancement
   - Edge enhancement
   - Different Filtering techniques
   - Principal Component Analysis (PCA),
   - Fourier Transform Analysis
5. Image fusion techniques.
6. Digital image analysis
   - Unsupervised Classification
   - Supervised Classification
   - Accuracy assessments
7. Change detection
8. Spatial model maker
9. Contour mapping
10. DEM Generation

COURSE OUTCOMES:

The students will have hands –on experience in

CO1: Data preparation for image analysis
CO2: Various types of digital image enhancements.
CO3: Different digital image fusion techniques.
CO4: Digital image analysis- unsupervised and supervised approaches.
CO5: Change detection techniques and spatial model maker.

LAB 4/ SIT- 14

GNSS & IN-SITU DATA COLLECTION

OBJECTIVES:

1. To introduce the fundamental concepts of GNSS
2. To familiarize with concepts of DGNSS.
3. To comprehend file formats of GNSS.
4. To acquire knowledge of Integrating GNSS, GPS and RS data.
5. To comprehend different protocols.

LIST OF PRACTICALS:

1. Exploring GNSS Constellation
2. To learn the concept of navigation and positioning.
3. Familiarization with the concepts of DGNSS.
   i. DGPS
   ii. RTKP(Real time kinematics Positioning)
4. Precise Point Positioning Concepts
5. Familiarization with different file formats of GNSS.
6. DGNSS through NTRIP Protocol
7. Field Exercises to map a field/group of fields of campus with different positioning methods
8. Navigational Data processing from different GNSS systems.
9. Integrating GNSS and RS data
10. Institute data collection using smart phones

COURSE OUTCOMES:

Students will be able to

CO1: Familiarize various contents of GNSS
CO2: Handling of the DGPS & RTK'S
CO3: Handling of RTKP
CO4: Able to Handle different file formats
CO5: Integrate Remote sensing data with GNSS

CORE/SIT-15

MINI PROJECT

The mini project will be based on the work done during the industrial training/internship of two months provided during semester break.

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done

(a) Along with the report on identification of topic for the work and

(b) The methodology adopted involving scientific research, collection and analysis of data,

(c) Determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Semester and End Semester will be monitored by the departmental committee.

COURSE OUTCOMES:

CO1: Students will get an opportunity to work in actual industrial environment if they opt for internship.

CO2: In case of mini project, they will solve a live problem using software/analytical/computational tools.

CO3: Study different techniques used to analyze complex systems

CO4: Students will learn to write technical reports.

CO5: Students will develop skills to present and defend their work in front of technically qualified audience.

AUDIT COURSE-2/SIT-16

CONSTITUTION OF INDIA

OBJECTIVES:

1. To understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT-I: History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working).

UNIT-II: Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-III: Contours of Constitutional Rights & Duties:

- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

UNIT-IV: Organs of Governance:

- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

UNIT-V: Local Administration:

- District's Administration head: Role and Importance,
- Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Panchayati raj: Introduction, PRI: Zilla Panchayat.
- Elected officials and their roles, CEO Zilla Panchayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

UNIT-VI: Election Commission:

- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

COURSE OUTCOMES:

Students will be able to:

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

CO4: Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

AUDIT COURSE-2/SIT-16

PEDAGOGY STUDIES

OBJECTIVES:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

UNIT-I: Introduction and Methodology:

- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions**.**
- Overview of methodology and Searching.

UNIT-II: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.

- Curriculum, Teacher education.

UNIT-III: Evidence on the effectiveness of pedagogical practices

- Methodology for the in depth stage: quality assessment of includedstudies.
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV: Professional development: alignment with classroom practices and follow- up support

- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

UNIT-V: **Research gaps and future directions**

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

COURSE OUTCOMES:

Students will be able to understand:

CO1: What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

CO2: What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

CO3: How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

AUDIT COURSE-2/SIT-16

STRESS MANAGEMENT BY YOGA

OBJECTIVES:

1. To achieve overall health of body and mind.
2. To overcome stress.

UNIT-I: Definitions of Eight parts of yog. (Ashtanga)

UNIT-II: Yam and Niyam.
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

UNIT-III: Asan and Pranayam
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

COURSE OUTCOMES:

Students will be able to:
CO1: Develop healthy mind in a healthy body thus improving social health also
CO2: Improve efficiency

SUGGESTED READING

1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

AUDIT COURSE-2/SIT-16

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

OBJECTIVES:

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom in students.

UNIT-I: Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-II: Approach to day to day work and duties.

- Shrimad BhagwadGeeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-III: Statements of basic knowledge.

- Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad BhagwadGeeta:
- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

COURSE OUTCOMES:

Students will be able to

CO1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

CO2:The person who has studied Geeta will lead the nation and mankind to peace and prosperity

CO3:Study of Neetishatakam will help in developing versatile personality of students.

SUGGESTED READING

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

PROGRAMME ELECTIVE-IV/ SIT -17

DRONE-FLYING AND DATA ANALYSIS

OBJECTIVES:

1. To introduce the fundamental concepts of Multirotor UAV Pilot.
2. To familiarize with Surveying with Drone
3. To comprehend Image processing and Photogrammetry.
4. To acquire knowledge of Modeling, and
5. To have an exposure to Applications of drones.

UNIT I:Introduction: Introduction to Drones, History of Drone/UAS/UAVs, payload, battery life, Specs for good results, Regulations of DGCA and Drone license, Pre, Post Flight planning- Flight execution and photography, data collection. Uavs collected, processed, analysed and interpreted.

UNIT 2: Surveying with Drone

Consideration for hardware selections, comparison on surveying drone and its accuracy, Techniques of controlling errors, Consideration of GCP in vertical and horizontal accuracies, Planning and estimation of drone surveying jobs, Autonomous flight vs. manual and hybrid flight profiles

UNIT 3: Image processing and Photogrammetry

Aerial Triangulation, post possessing software's, Analyzing Data, Contouring, DEM, DSM, Cut, Fill, and Volumetric Measurement Calculation and orthophoto generation.

UNIT 4: Modeling

Introduction to mapping and modeling concepts, Understanding RTK, PPK and GCP's,Overview of popular data processing software platforms and functions.

UNIT5: Applications

Application of drone for Surveying & Mapping like Construction, Agricultural, Engineering Land Survey and Architecture.

COURSE OUTCOMES:

The students will have exposure to various components of Drones including

CO1: Data collection by UAV'S.
CO2: Surveying with drones.
CO3: Concepts of Image processing techniques.
CO4: Modelling and mapping by drone data.
CO5: Applications of drones.

TEXT BOOKS:

1. One Nation Under Drones: Legality, Morality, and Utility of Unmanned Combat Systems by John E. Jackson
2. Drones and Support for the Use of Force by James Igoe Walsh.

PROGRAMME ELECTIVE –V/ SIT -17

STATISTICS AND COMPUTATION

OBJECTIVES:

1. To have an introduction to Measurements and Their Analysis
2. To comprehend Random Error Theory and Hypothesis Testing.
3. To have an exposure to Error Propagation in Traverse Surveys.
4. To comprehend with Neural Network and Fuzzy Logic.

UNIT I: Measurements and Their Analysis: Introduction, Direct and Indirect Measurement, Measurement Error Sources, Sample versus Population, Range and Median, Graphical Representation of Data.

Unit II: Random Error Theory: Introduction, Theory of Probability, Properties of the Normal Distribution Function, Probability of the Standard Error, Uses of Percent Errors.

Unit III: Hypothesis Testing: Hypothesis Testing: Test of Hypothesis for the Population Mean, Test of Hypothesis for the Population Variance: Test of Hypothesis for the Ratio of Two Population Variances.

Unit IV: Error Propagation in Traverse Surveys: Introduction, Derivation of Estimated Error in Latitude and Departure, Derivation of Estimated Standard Errors in Course Azimuth, Computing and Analyzing Polygon Traverse Misclosure Errors, Computing and Analyzing Link Traverse Misclosure Errors.

Unit V: Neural Network and Fuzzy Logic: Introduction: Basic Concepts of Neural Networks and Fuzzy Logic, Differences Between Conventional Computing and Neuro-Fuzzy Computing, Characteristics of Neuro-Fuzzy Computing. Fuzzy Set Theory: Basic Definitions and Terminology and Membership Functions – Formulation and Parameters, Neural Networks, Fuzzy Logic and Genetic Algorithm.

COURSE OUTCOMES:

The students will have exposure to

CO1: A thorough understanding of measurements and their analysis.

CO2: Comprehension of Random Error Theory

CO3: Hypothesis Testing.

CO4: To Error Propagation in Traverse Surveys.

CO5: Comprehension of Neural Network and Fuzzy Logic.

TEXT BOOKS:

1. Adjustment Computations (Statistics and Least Squares in Surveying and GIS) - Paul R.Wolf & Charles D. Ghilani
2. Finite Element by Buchnan, TataMcgraw Hill, 2006

REFERENCE BOOKS:

1. Neural Networks by Satish Kumar,Tata Mcgraw Hill,2004.

PROGRAMME ELECTIVE –V/ SIT -17

WEB DEVELOPMENT

OBJECTIVES:

1. To provide an exposure to concepts of HTML5
2. To provide hands on experience on working with HTML5 concepts
3. To provide an exposure to applying styles with CSS3
4. To study concepts of DotNet basics.
5. To provide a glimpse of working with windows services

UNIT-I: HTML5: HTML 5, Overview of HTML 5, HTML5 Syntax, Forms, Form Elements, New attributes for <form>, New attributes for <input>, Video and Audio, Types of Elements, HTML5 NEW ELEMENTS, Migration from HTML4 to HTML5, HTML5 DEPRECATED TAGS, HTML5 DEPRECATED ATTRIBUTES.

UNIT-II: Advanced concepts of HTML5: App Cache or Offline Applications, Web Storage, Web Workers, Server Sent Events - One Way Messaging, MathML, Geolocation, Drag and Drop API, File API, WEB SQL, Canvas Overview, SVG.

UNIT-III: CSS3: CSS 2.0 vs CSS 3.0,Introduction to css3,whats new in css3.0,border, background, Gradients, Linear Gradients, Radial Gradients, text effects, FONT Face, Google fonts, 2D Transforms, 3D Transforms, Box Resize, Box Sizing, Outline, Animations, Selectors, Multiple Columns, Converting Layout to HTML 5 & CSS 3.

UNIT-IV: WORKING With DOTNET: Introduction to Microsoft .NET framework: arrays, operators, flow control statements, functions and properties, C#.NET Language Basics-Working with Data Types -Type Conversion, Boxing & Unboxing, Conditional Statements (if, switch condition), operators, Looping Arrays, Enumerations.

UNIT-V: Creating Web Services: Windows forms and Event Controls., Understanding the services, Windows service Architecture, Windows Services- Service base class, Service Process installer, Service Installer, Creating a Windows Service, Installing and uninstalling windows services, Google Earth, KML Virtual Earth & Bhuvan.

COURSE OUTCOMES:

The students will have exposure to

CO1: Fundamentals of HTML5.

CO2: Various types of tags in HTML5.

CO3: Familiarization with CSS3.

CO4: Concepts and working knowledge in DotNet

CO5: Concepts and creation of web services.

TEXT BOOKS:

1. The Complete Reference: HTML and CSS, 2nd & 5th Editions by Thomas A. Powel, McGraw Hill.
2. Ajax: The Complete Reference – Thomas A. Powel, McGraw Hill, 2008.
3. Web Technologies by Puntem bekhar Edition-2

REFERENCE BOOKS:

1. Professional AJAX – Nicholas C Zakas et al, Wrox publications, 2006.
2. An Introduction to Web design and programming, Wang, Thomson.
3. Visual C# .NET Programming

OPEN ELECTIVE/ SIT -18

BUSINESS ANALYTICS

OBJECTIVES:

1. Understand the role of business analytics within an organization.
2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. Use decision-making tools/Operations research techniques.
6. Mange business process using analytical and management tools.
7. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

UNIT I: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression.

Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

UNIT-VI: Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

COURSE OUTCOMES:

Students will be able to

CO1: Demonstrate knowledge of data analytics.

CO2: Think critically in making decisions based on data and deep analytics.

CO3: Use technical skills in predicative and prescriptive modeling to support business decision-making.

CO4: Translate data into clear, actionable insights.

REFERENCE BOOKS:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

OPEN ELECTIVE/ SIT -18

INDUSTRIAL SAFETY

UNIT-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT-III: Wear and Corrosion and Their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT-IV: Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

REFERENCE BOOKS:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPEN ELECTIVE/ SIT -18

OPERATIONS RESEARCH

UNIT I: Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

UNIT II: Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III: Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT.

UNIT IV: Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V: Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

COURSE OUTCOMES:

The student should be able to

CO1: Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
CO2: Students should able to apply the concept of non-linear programming
CO3: Students should able to carry out sensitivity analysis
CO4: Student should able to model the real world problem and simulate it.

REFERENCES BOOKS:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

OPEN ELECTIVE/ SIT -18

COST MANAGEMENT OF ENGINEERING PROJECTS

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

REFERENCE BOOKS:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi
2. Charles T. Horngren and George Foster, Advanced ManagementAccounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheelerpublisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

OPEN ELECTIVE/ SIT -18

COMPOSITE MATERIALS

UNIT–I: **Introduction:** Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: **Reinforcements:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding, Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

REFERENCE BOOKS:

1. Hand Book of Composite Materials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L. Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

OPEN ELECTIVE/ SIT -18

WASTE TO ENERGY

UNIT-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

UNIT-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

REFERENCES BOOKS:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

OPEN ELECTIVES (OE) SIT-18
GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS)

Course Objectives:
The course is designed to fulfill the following objectives:

1. To review the emerging and federated observation systems.
2. To familiarize with various EOS operating in optical domain.
3. To familiarize with various EOS microwave missions.
4. To provide an overview of high resolution satellite data, and
5. To comprehend the satellite data products and their availability.

Unit-1 Introduction to EOS
Introduction to EOS, Sensing Platforms-Airborne Platforms, Spaceborne Platforms-Near-Polar Orbits, Geosynchronous Orbits; Sensors-Optical Sensors- Photographic Cameras (Digital Aerial Cameras & Video Cameras); Radiometers-Electro-Optical Scanners, Lidar; Microwave Sensors- Passive and Active; Detectors.

Unit-2 EOS-Optical (Medium to coarse Resolution)
The Landsat Systems, Multi-Sensor Formation Concept, The Earth Observing System mission- Terra (EOS-AM) , Aqua (EOS PM), Earth Observing-1 (Eo-1) mission. The Satellite Pour L'observation de la Terre (SPOT) missions, The Sentinel optical missions, China–Brazil Earth Resources Satellite (CBERS) Programme, Formosat-1mission Satellite missions, The Indian Remote Sensing Satellites (IRS) missions.

Unit-3 EOS: Optical (High Resolution)
High Spatial Resolution Remote Sensing Systems- Early Bird & Quick Bird, Ikonos, Orbview-3 , Cartosat missions, Geoeye-1 , Worldview missions, Formosat (-2 onwards) missions.

Unit-4 EOS in Microwave Region
Spaceborne Imaging Microwave systems , Seasat , European Remote Sensing Satellite (ERS-1 &-2) , Sentinel-1 , Japanese Earth Resources Satellite (JERS-1), Advanced Land Observation Satellite (ALOS-1&-2), Radarsat missions- Radarsat-1&-2), Radarsat Constellation Mission (RCM); Envisat , Radar Imaging Satellite (RISAT-1&-2), Soil Moisture And Ocean Salinity Mission (SMOS), Soil Moisture Active Passive Mission (SMAP).

Unit-5 Data Products & Availability
Dta storage formats, Data processing levels; Science products from Terra/Aqua (MODIS&ASTER; Landsat-ETM+/OLI; Shuttle Radar Topography Mission(SRTM)-DEM, Cartosat-DEM; Sources of EOS data.

Course Outcomes:
At the end of semester the students will have exposure to various components of GEOS including

CO 1.Platforms and Instrumentations.
CO 2.Current and future earth observation missions operating in optical domain..
CO 3. Earth observation missions operating in microwave domains
CO 4.Th concept of satellite data structure and processing levels.
CO 5. Science products and sources of EOS data.

References Books: Text book by Kramer-

- Aoki, S., 2006. Nihon no Uchu Senryaku (Japanese Space Strategy), Keio University Press, Tokyo, p. 309.
- Richards and Jia "Global Earth Observation Systems
  - Gao,J. Global Earth Monitoring Systems.
  - Jensen, J.R, Remote Sensing of the Environment –An Earth Resources Perspective..Prentice Hall Inc.
  - Gao,J.2009. Digital Analysis of Remotely Sensed ImageryMacGraw Hill.

OPEN ELECTIVES (OE) SIT-18

Basics of Artificial Intelligence and Machine Learning for Geomatics

Course Objectives:

The course is designed to fulfill the following objectives:

1. To review the Artificial Intelligence basic concepts.
2. To familiarize with various **Problem solving techniques**.
3. To familiarize with various **Machine Learning** Techniques.
4. To provide an overview of **Decision Tree Learning**, and
5. To comprehend the **Artificial Neural Networks** and their applications in Geospatial fields.

Unit 1:

Introduction AI, history, intelligent systems, foundations of AI, applications, tic-tac-toe game playing, development of AI languages, current trends.

Unit 2:

Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening A*, constraint satisfaction.

Problem reduction and game playing: Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games.

Unit 3:

Introduction: Well posed learning problems, designing a Learning system, Perspective and Issues in Machine Learning.

Concept Learning: Concept learning task, Concept learning as search, Find-Salgorithm, Version space, Candidate Elimination algorithm, Inductive Bias.

Unit 4:

Decision Tree Learning: Decision tree representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, hypothesis space searchin decision tree learning, Inductive bias in decision tree learning, Issues in decisiontree learning.

Unit 5:

Artificial Neural Networks: Introduction, Neural Network representation, appropriate problems, Perceptrons, Backpropagation algorithm.

Role of AI in Image processing, Feature Extraction using AI, Applications of AI in Image Processing, Industrial Applications of AI, Machine Learning tools in AI.

Course Outcomes:

At the end of semester the students will have exposure to various components of AI & ML with respect to Geomatics including

CO 1. Concepts of Artificial Intelligence basics.
CO 2. Integration of Problem solving techniques with real world**. ..**
CO 3. Various Machine Learning Techniques **and** its usage
CO 4. Decision Tree Learning techniques**,.**
CO 5. Artificial Neural Networks with respect to Geospatial fields**.**

TEXT BOOKS:

1. Artificial Intelligence- Saroj Kaushik, CENGAGE Learning,
2. Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA
3. Machine Learning, Tom M. Mitchell, MGH.
4. Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.

DISSERTATION PHASE-1

The Project Work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

Seminar should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech.

The examination shall consist of the preparation of report consisting of a detailed problem statement and a literature review.

The preliminary results (if available) of the problem may also be discussed in the report.

The work has to be presented in front of the examiners panel set by Head DRC.

The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

COURSE OUTCOMES:

CO1: Students will be exposed to self-learning various topics.
CO2: Students will learn to survey the literature such as books, national/international refereed journals and contact resource persons for the selected topic of research.
CO3: Students will learn to write technical reports.
CO4: Students will develop oral and written communication skills to present and defend their work in front of technically qualified audience.

DISSERTATION PHASE- II

It is a continuation of Project work started in semester III.

He has to submit the report in prescribed format and also present a seminar.

The dissertation should be presented in standard format as provided by the department.

The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.

The report must bring out the conclusions of the work and future scope for the study.

The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner and a guide, co-guide etc. as decided by the Head and PG coordinator.

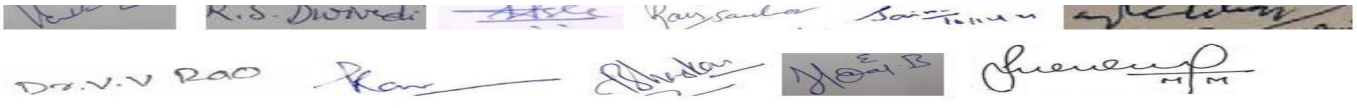
The candidate has to be in regular contact with his guide.

COURSE OUTCOMES:

CO1: Students will be able to use different experimental techniques.
CO2: Students will be able to use different software/ computational/analytical tools.
CO3: Students will be able to design and develop an experimental set up/ equipment/test rig.
CO4: Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
CO5: Students will be able to either work in a research environment or in an industrial environment.
CO6: Students will be conversant with technical report writing.
CO7: Students will be able to present and convince their topic of study to the engineering community.

Eligibility Criteria:

M.Tech (Spatial Information Technology)	**B.E/B.Tech:** Civil/Environmental, Computer Science, Remote Sensing, IT, ECE, Marine, Bio-informatics, Agriculture, Geomatics, courses in planning and Architecture, and other related courses. M.Sc: Geoinformatics/Geomatics/Geospatial Science, Geophysics, Geology, Geography, Remote Sensing, Oceanography, Physics, Agriculture, Forestry, Horticulture, Environmental Management


R.S. Dhanvedi
Dr. V.V Rao