

ACADEMIC REGULATIONS (UNDER-GRADUATE COURSES)

The students admitted in 2010-11 shall be governed by the relevant rules as indicated below:

1.0 DEFINITIONS

- 1.1 'Academic Year' or 'Academic Session' of the University shall ordinarily be between July to June and shall consist of two semesters.
- 1.2 'Semester' is an academic term of normally 18-20 weeks including examinations.
- 1.3 'Course' means a unit of instruction or a segment of a subject matter to be covered in a semester. Each course is assigned a specific number, title and credits.
- 1.4 'Credit Hour' also written as 'Credit' means the numerical weight allotted to the course, including its theory and practical parts. One credit will represent one hour of lecture and two to three hours of laboratory/field practical in each week.
- 1.5 'Grade point' is a numerical number which denotes students' performance in a course. It is obtained by dividing the percentage marks obtained by ten.
- 1.6 'Credit point' is the product of credit and grade point obtained by the student in a course.
- 1.7 'SGPA' (Semester Grade Point Average) is the average of the credit points of a semester.
- 1.8 'OGPA' is the overall cumulative grade point average obtained by the student in the courses taken in all the semesters completed by him/her.
- 1.9 'Year' means an academic session consisting of two semesters. Say, first year means the first academic session of the prescribed course of a degree programme. Similarly, second year, third year, and fourth year mean second, third and fourth academic sessions, respectively.
- 1.10 'Equivalent percentage' is the percentage obtained by multiplying grade point, SGPA, and OGPA respectively by ten.

2.0 THE PROGRAMME AND GRADUATION REQUIREMENTS

- 2.1 Minimum residential requirement and maximum period for all the programmes:

Minimum residential requirement	8 semesters
Maximum period for which a student can remain on the college roll	12 semesters

Note: In case a student does not complete his/her course work satisfactorily (5.0 OGPA out of 10) within the maximum prescribed period he/she shall no longer be a student of the university and the respective Dean of the college shall drop him from the college roll.

3.0 EXAMINATION

There shall be a main theory and/or practical examination conducted by the university at the end of each semester. The theory and practical examinations shall be of three hours duration except otherwise specified. Besides this, there will be a mid-term examination.

3.1 Mid-Term Examination:

A mid-term examination of 20 maximum marks shall be held after completion of about 50% syllabus in each course. The mid-term examination shall be of one hour duration.

"If a student misses the mid term examination due to any legitimate reason including deputation by the university, then he/she will be permitted to appear in a special mid term examination before the final examination". Only one special mid-term examination per course shall be conducted for all eligible students under this rule.

Students who are deputed by the university will have to submit the information in advance to the concerned department for awarding attendance.

- 3.2 The distribution of marks for the mid-term examination, final theory examination and practical examination shall be as follows:

Credit (Marks T/P)	Mid-Term Examination	Final (University) Examination		Total
		Theory	Practical	
1/2/3/4+1	20(T)	50	30	100
0+1/2/3/4	20(P)	-	80	100
1/2/3/4+0	20(T)	80	-	100
1+2/3/4	20(P)	30	50	100

3.3 The distribution of marks for the final practical examination shall be as under

	Practical with Maximum Marks	30	50	80
(a)	Practical record and day-to-day assessment (Sessional work)	5	10	15
(b)	Practical exercises (may include any exercises as decided by the external examiner)	20	30	50
(c)	Viva-voce	5	10	15

3.4 Grading System

(i) A numerical grading system is followed for evaluation. Each course has a numerical weightage known as credit. The total marks obtained in each course (including its mid-term, theory and practical parts) are converted into percentage and divided by 10 to obtain the grade point for that course. The grade point when multiplied by the total course credit, gives credit points for the course.

(ii) Semester Grade Point Average (SGPA) is simply average of the credit points for a semester. The Overall Grade Point Average (OGPA) is the average for all courses upto the current semester.

If C_i and G_i are the credit and grade points for a course, then OGPA and SGPA are given by the following formulae:

$$SGPA = \frac{\sum C_i G_i}{\sum C_i} \text{ where the summation is for all courses in the semester}$$

$$OGPA = \frac{\sum C_i G_i}{\sum C_i} \text{ where the summation is for all courses of preceding semester including the current one}$$

(iii) The percentage equivalent of OGPA shall be determined by multiplying OGPA by ten.

(iv) The division of the under graduate student shall be determined by the OGPA at the end of successful completion of program as follows:

Division	OGPA
First	6.00 and above
Second	5.00 and above

3.5 Pass Requirements:

- (i) Candidates are required to pass separately in final theory and/or practical examinations in each course
- (ii) For a pass, a candidate is required to obtain at least 40% marks in each theory final examination as well as in each practical final examination and 4.00 grade point in the course.
- (iii) The minimum OGPA required for degree is 5.00.

3.6 Promotion to Higher Classes:

- (i) The promotion to next class shall be decided only at the end of an academic year.
- (ii) A student will not be eligible for promotion to fourth year unless and until he/she clears all courses of 1st year.
- (iii) A student will be promoted to higher class if he/she secures an OGPA as mentioned in the table below.

Year to which promotion is being Considered	Minimum OGPA required for Promotion
Second	4.00
Third	4.50
Fourth	4.75 (with no Backlog of 1 st Year)

- (iv) A student who has been promoted to the first Semester of a class as a result of above rule, shall be automatically promoted to the second semester of that class regardless of the result of the year's first semester examination.
- (v) If a student is not promoted to a higher class, he/shall become an ex-student of the failed class and has to clear the backlog and/ or improve his/her OGPA to be eligible for promotion.
- (vi) Provisional Promotion :
 - (a) The Promotion will be provisional with the permission of Concerned Dean to higher class till the result of the previous semester is declared.
 - (b) Student has to register as per academic calendar, i e. Date of registration without late fee and date of registration with late fees would be applicable.
 - (c) Student has to give an undertaking that on declaration of result, if he/ she is not eligible, the registration would stand cancelled automatically.

- (d) Student should have a minimum OGPA as per existing UG rules.
- (e) Per-requisite courses, if any, have to be cleared prior to the regular courses.

3.7 Clearing of Backlogs and Repeating of Courses for Improvement of OGPA:

A. Clearing of Backlog:

- (a) All the students with backlog (whether promoted or ex-students) shall have to appear in the examination of backlog courses in the main examination of the semester in which such courses are regularly offered. The student will be permitted to appear in backlog examination in failed part only whether it is theory or practical or both. He/she shall not be required to attend regular classes for such courses.
- (b) Mid term marks obtained by a student will not be carried over for backlog examination and proportionate marks shall be awarded.
- (c) The university shall conduct final examination as per current scheme of examinations. Students offered backlog courses would be required to appear in the equivalent course in the new programme. In case of variation in the course content, student has to do self preparation.
- (d) If the backlog course is the result of being detained on account of shortage of attendance, the student has to appear in both theory and practical examinations by regularly offered courses or as a contact course, if time table adjustment is not possible

B. Improvement of OGPA

- (a) Student should apply to improve the OGPA within 11 days from the date of issue of mark sheet of last semester. They should surrender the original mark sheet issued to them and submit the same along with application form.
- (b) A student would be given only one chance for improvement of OGPA.
- (c) Student will be allowed to repeat two courses of his/her choice irrespective of grade obtained in the course (s) or semester, provided that the course is being offered as regular course in current semester.
- (d) There will be a common examination for regular students and for those who have been offered courses for improvement.

- (e) Students will not be issued PDC till the result of the courses offered for improvement is declared.
- (f) The repeated course shall be marked as "Repeat" in the revised mark-sheet.
- (g) In case PDC has been issued to the student he/she will not be eligible for improvement.
- (h) The student would be required to pay regular semester fees if he/she wishes to attend the classes. Otherwise he/she shall be treated as Ex-student.
- (i) The examination fee for courses offered for improvement will be Rs. 1000.00 (Rupees one thousand only) per paper irrespective whether it is a regular course or a special paper.
- (j) The student has to submit an undertaking that the marks obtained in the examinations taken for improvement will replace the marks obtained in the original examination of the paper(s), if he/she gets more than previous result.
- (k) In case a student fails in the improvement course, he/she will be awarded minimum pass marks in that paper.
- (l) Mid term marks in improvement courses: In such cases, the student will be awarded proportionate marks based on marks obtained in final examination.

3.8 Special Backlog Examination:

A. In case student has completed 8th Semester and has backlog in only one course which is not of 1st year :

- (i) Special examination will be conducted earliest possible after the declaration of semester result i.e. September/ October of 1st semester of the academic year for only that course.
- (ii) Student will be charged fee as prescribed by the university, irrespective of whether it is a regular course or a special paper.
- (iii) Student has to apply for special examination within 11 (eleven) days of declaration of result of 8th semester, failing which his/her application will not be considered.
- (iv) In case if a student chooses for re-evaluation and fails, examination for such a paper will be conducted along with regular papers of that semester only.
- (v) If a student fails in a special paper examination, he/she would be allowed to reappear with regular examination of next semester only i.e. once in a semester.

B. In case a student has completed 8th semester and has got backlog of up to 6 courses irrespective of semester:

- (i) Backlog examination will be conducted along with regular examination of the semester.
- (ii) If regular examination is being conducted for a particular paper, he/she would have to pay normal fee for that paper and special fee of Rs. 1000/- per paper will be charged for the course which are not listed for conducting the examinations in that semester.
- (iii) If a student does not clear one or more backlog course, he/she will have to appear as Ex-student along with regular examination in the next semester and fee will be charged at regular rate, if the courses are listed for conducting the examination in that semester, otherwise, special fee of Rs. 1000/- will be charged

C. Other rules like maximum number of semesters, minimum passing marks, etc will be applicable as per rules.

3.9 Re-evaluation for answer book:

- (i) (a) Re-evaluation is permissible only in Theory paper of semester's final examination.
(b) Re-evaluation is not permissible in the Answer book of unfair means case (s)
- (ii) The candidate may apply for re-evaluation within 11 days of the issue of the mark sheet on the prescribed form through Head of the institution depositing required fee and original mark-sheet. Incomplete and late submitted application shall not be considered.
- (iii) The re-evaluation fee per paper shall be as prescribed and will not be refundable on any pretext.
- (iv) Re-evaluation shall be done by an examiner of the subject to be appointed by the Vice Chancellor.
- (v) If the marks obtained after re-evaluation increase / decrease within 20% of the maximum marks prescribed for the paper, the same will be taken as marks obtained after re-evaluation. However, if the marks awarded by the re-evaluation increase /decrease by more than 20% of maximum marks prescribed for the paper then the answer book will be referred to the second re-evaluation and the average of two closest awarded marks (the middle award in case the three awards if uniformly spread) shall be taken as the marks obtained after re-evaluation and shall be awarded. However, a student who was declared Pass prior to re-evaluation and fails after re-evaluation, shall be awarded minimum pass marks.

- (vi) Marks awarded after re-evaluation of the paper will be considered for award of merit.
- (vii) (a) No one shall be admitted in the next higher class and considered for any beneficial claim only on account of submission of application of the re-evaluation of Answer Book(s) in the office.
(b) A student becoming eligible for admission on account of result of re-evaluation may be admitted in next higher class without late fee. He will be required to pay full fees for the year within 7 days of declaration of the result. Attendance in such case shall be counted from the date of admission.

3.10 Moderation of Results:

The result committee shall also act as Moderation Committee to review the results for the normal distribution of marks, the percentage of pass and failure. Any moderation suggested in a paper shall be uniformly applied to all the students registered in that paper, with the approval of the Vice Chancellor. Any moderation effected should not be more than 10 % of maximum marks in a paper. However, if after moderation or otherwise, if a student is failing only by one mark in a paper, Controller of Examinations may award one grace mark to pass the student in that paper.

4.0 GENERAL RULES PERTAINING TO EXAMINATIONS

- 4.1 A student who has been deputed by College/University authorities to represent at a national/international meet/championship/tournament/extra curricular activities, does not appear in the final examination due to such participation, may be permitted to take missing paper(s) at next main examination, when such course(s) are regularly offered as a special case. He/she, however, will be required to seek prior permission from the Vice-Chancellor.
- 4.2 No special examination shall be held for students who miss the examination on account of police custody, court attendance or fail to attend for other reason, whatsoever.
- 4.3 Examinations will not be postponed due to failure of electricity.
- 4.4 The boycotted and walked out papers shall not be recounted. This authority rests only with the Chancellor of the university.

5.0 PRACTICAL WORK EXPERIENCE REQUIREMENTS

After successful completion of all the courses including practical trainings with minimum OGPA of 5.0, a student will become eligible for the degree.

Details of practical training (Training in factory, workshop, mine, engineering works/design, office etc.) which students are to undertake in different degree programmes are given below:

Branch of Engineering	Duration	Year
(a) Agriculture*	30 + 30 = 60 days	At the end of II & III year
(b) Mechanical	30 + 30 = 60 days	- do -
(c) Mining**	30 + 30 = 60 days	- do -
(d) Electrical	30 + 30 = 60 days	- do -
(e) Computer Science & Engg.	30 + 30 = 60 days	- do -
(f) Electronics & Communication	30 + 30 = 60 days	- do -
(g) Information Technology	30 + 30 = 60 days	- do -
(h) Civil Engineering	30 + 30 = 60 days	- do -

* In addition to the above 2 months training programme, the agricultural engineering graduates have to undergo experiential learning or Hands-on training (4 month) in the second semester of final year BE.(Ag.).

In order to take policy decision and to solve the operational and administrative bottleneck, if any, there shall be a college level committee consisting of the followings. The committee will guide in selection of cafeteria courses and experiential learning/project.

Senior most Head of the Department	-	Convenor
Heads of concerned Department	-	Member
Training Officer	-	Member
Class Advisor of IV year	-	Member

Procedure for evaluating the students on all the above practical trainings will be followed as prescribed.

** The Mining Engineering students shall have to undergo 12 days mining camp at the end of I semester of II year and 12 days survey camp at the end of I semester of III year, in addition to 60 days practical training.

6.0 ATTENDANCE REQUIREMENTS

6.1 The student shall be permitted to appear in the university main examination only if a minimum attendance of 75% is maintained separately in theory and practical in each course from the date of registration in that course. However, in NCC/NSS/NSO the minimum attendance requirement would be 65%. In case of sickness or any other valid reasons, the vice-chancellor may condone the attendance to an extent of 10%.

6.2 A student who is short of attendance in one or more courses will be detained from appearing in the final semester examination of all such course(s) and will be awarded zero grade point. Such courses shall be denoted by letter "DE" in the mark sheet.

6.3 En-mass absence shall be treated as absent in the attendance record of the students and will be charged a fine of Rs. 2000/- on en-mass cutting of the classes for more than 3 days.

6.4 If a student absents continuously for 7 working days in a semester in any subject, his/her registration in the semester will be cancelled and parents informed accordingly. Such students will be provided an option for re-admission in the course/programme within 7 days of the cancellation of their registration by paying a fee of Rs. 500/-.

6.5 If a student who has been admitted to the 1st semester of a programme and fails to attend the classes continuously for a period of 30 days without the permission of the Dean of the college, the name of such a student will be removed from the college roll. No petition is permitted in this case. He/she may have to seek re-admission as a fresh candidate.

6.6 If a regular student of the college in subsequent semester fails to register on schedule time or fails to attend the class after registration continuously for 30 days without the permission of the Dean of the college, the student will be removed from the college roll and parents informed accordingly. A student so removed may apply to the Dean within 15 days of his/her removal for reconsideration for re-registration in the next academic session, giving valid and strong reasons for failing to take permission. His removal may be revoked, provided that, his/her advisor is satisfied with the performance of the student and the same is approved by the Dean. The period of removal shall be counted towards the number of semester, though no grade/marks would be awarded for this semester.

7.0 ADVISORY SYSTEM

Student will be required to report to the respective class advisors for getting registration form and examination form for the purpose of registration. Class advisors will also be responsible for distribution of marksheet obtained from the university.

8.0 SYMBOLS AND THEIR MEANING

Following symbols would be used to designate the status of the student:

Symbol	Significance
F	Fail
DE	Detained
UM	Unfairmeans
R	Repeat

Note - All such courses which are cleared by repeating the same or repeated for improvement of OGPA to bring it to the minimum required level shall be marked by letter 'R' in the transcript.

9.0 WITHDRAWAL FROM SEMESTER

- A student shall be permitted to withdraw from a semester only two times in the degree programme, on the grounds of ill-health and personal exigencies subject to the condition that the reasons for withdrawal are convincing. For this the student has to submit a written request at least one week prior to the commencement of the main examination of the semester from which the student wants to withdraw.
- A student who has withdrawn from a semester has to join the same semester during next year.
- The period lost due to withdrawal (one year for one withdrawal) shall not be counted towards maximum permissible period for which a student can remain on the college roll.

10.0 EXAMINATION OF PRACTICAL TRAINING, PROJECT AND SEMINAR

- For the examination of practical training (including industry visit, mining camp, survey camp, etc.) there will be an internal board appointed by the Dean. The board will comprise of concerned Head of the Department as chairman and one or two teachers of the concerned department(s) as members. The marks will be awarded on the basis of work report, practical record, quiz, viva-voce, etc. and added to the marks list in the Final year's examination.
- For project viva-voce examination there shall be a Board of examiners consisting of project committee and one/two external examiners. The concerned Head of the Department will be the Chairman of the committee. However, in Agriculture Engineering discipline, the Chairman will be the Project Chairman. The Chairman will then nominate two teachers as members. The Board may meet in one or two meetings according to the availability of external examiner(s). A candidate will be assessed for the work done during semester by the Project Advisor and the Project Committee.

As the project is assigned in the first semester of the final year and the student works on it during both the semesters the assessment of the project shall be done in both the semesters. The internal viva-voce of first semester and both the seminars shall be assessed by the Project Committee. However the marks shall be counted in the second semester only. The distribution of marks shall be as follows :

Particulars	I Semester	II Semester	Total
Day-to-day assessment by the major advisor	15	20	35
Seminar	10	15	25
Viva-voce	10 (Internal)	30 (External)	40
TOTAL	35	65	100

- For seminar, wherever prescribed as a course of study, there shall be a board of examiners consisting of the Head of the Department as chairman and two teachers of the department.

11.0 CHANGE OF BRANCH OF STUDY IN SECOND YEAR B.TECH.

The students, in the second year, can avail one opportunity to change their branch of study on merit basis in accordance with rules framed by the university from time to time.

12.0 ADMISSION OF DIPLOMA STUDENTS IN SECOND YEAR B.TECH.

The diploma holders from the Board of Technical Education, Rajasthan with 10+2 qualification can seek direct admission in second year B.Tech. The number of seats, admission procedure, educational and other requirement would be as specified by the Government and/or approved by the university from time to time.

13.0 GRADUATION REQUIREMENT AND AWARD OF DIVISION

- A student shall be awarded degree only if he has passed all the courses and completed other requirements prescribed for the programme and secured an OGPA of 5.00 or above.
- The division of the student shall be determined by the OGPA at the end of successful completion of the program as follows :

Division	OGPA
First	6.00 and above
Second	5.00 and above

SCHEME OF TEACHING AND EXAMINATION
(Mining Engineering)

First Year B.Tech. (Common for All Branches)

I-SEMESTER

remain in the same group in II semester as well. However, they have to offer all the eight courses in first year.

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 111	Mathematics - I	3	0	3	0	0	80	-	20
ME 113	Mechanical Engg. - I	3	0	3	0	0	80	-	20
ME 114	Workshop Practice	0	1	0	0	3	0	80	20
CE 115	Engineering Drawing	0	1	0	0	3	0	80	20
	NCC/NSS/NSO ¹	-	-	0	0	2	-	-	-
GROUP I									
BS 100P	Engineering Physics	2	1	2	0	2	50	30	20
CE 100	Engineering Mechanics	2	1	2	0	2	50	30	20
EE 100	Electrical Engg. - I	3	1	3	0	2	50	30	20
ENVS 100	Environmental Studies	2	1	2	0	2	50	30	20
GROUP II									
BS 100C	Engineering Chemistry	2	1	2	0	2	50	30	20
EC 100	Electronics and Instrumentation	3	1	3	0	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure	3	1	3	0	2	50	30	20
BS 100E	English and Communication Skill ²	1	1	1	0	2	50	30	20
	Total	15	6	15	0	16	-	-	-
Total Credits/Hours/Marks		21		31			800		

¹ NCC/NSS/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

² The examination (Theory and Lab) shall be conducted internally by the college.

Note: The courses BS 100P, CE 100, EE 100, ENVS 100, BS100C, EC 100, CS 100 and BS 100E shall be offered in both the semesters. The students will be divided in two groups in I semester itself and shall

II-SEMESTER

Course No.	Title	Credit		Hours/Week			Marks		
		Th.	P	L	T	P	Th.	P	MT
BS 121	Mathematics - II	3	0	3	0	0	80	-	20
CE 122	Civil Engineering	1	1	1	0	2	50	30	20
ME 123	Machine Drawing - I	0	1	0	0	3	0	80	20
ME 124	Workshop Technology	2	1	2	0	3	50	30	20
	NCC/NSS/NSO ¹	-	-	0	0	2	-	-	-
GROUP I									
BS 100C	Engineering Chemistry	2	1	2	0	2	50	30	20
EC 100	Electronics and Instrumentation	3	1	3	0	2	50	30	20
CS 100	Introduction to Computer Programming and Data Structure	3	1	3	0	2	50	30	20
BS 100E	English and Communication Skill ²	1	1	1	0	2	50	30	20
GROUP II									
BS100P	Engineering Physics	2	1	2	0	2	50	30	20
CE 100	Engineering Mechanics	2	1	2	0	2	50	30	20
EE 100	Electrical Engineering - I	3	1	3	0	2	50	30	20
ENVS 100	Environmental Studies	2	1	2	0	2	50	30	20
	Total	15	7	15	0	18	-	-	-
Total Credits/Hours/Marks		22		33			800		

¹ NCC/NSS/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

² The examination (Theory and Lab) shall be conducted internally by the college.

SECOND YEAR B.Tech.

III-SEMESTER

Course No.	Title of course	Credit Hours		Hours per week			Marks allotted		
		Th.	P	L	T	P	Th.	P	MT
BS 211 (All branches)	Mathematics III	3	0	3	0	0	80	-	20
CE 211 (AE, EE, MI)	Strength of Material	2	1	2	1	2	50	30	20
EE 213 (AE, ME, MI)	Electrical Engineering II	2	1	2	-	2	50	30	20
MI 214	Mining Geology I	3	1	3	-	2	50	30	20
MI 215	Elements of Mining	3	1	3	-	2	50	30	20
MI 216	Mine Machinery I	3	1	3	-	2	50	30	20
	NCC/ NSS/NSO ¹	-	-	0	0	2	-	-	-
	Total	16	5	16	1	12	-	-	-
Total Credits/Hours/Marks		21		29			600		

Note: There will be a Mining Camp / Visits of duration of 12 effective days during/ after the III semester.

IV-SEMESTER

Course No.	Title of course	Credit Hours		Hours per week			Marks allotted		
		Th.	P	L	T	P	Th.	P	MT
BS 221 (EC, EE, ME, MI)	Mathematics IV	3	0	3	-	0	80	-	20
CE 221 (AE, MI,)	Fluid Mechanics	2	1	2	-	2	50	30	20
ME 223 (EE, MI)	Mechanical Engineering II	2	1	2	-	2	50	30	20
MI 224	Mining Geology II	3	1	3	-	2	50	30	20
MI 225	Mine Development	3	1	3	-	2	50	30	20
MI 226	Mine Surveying I	3	1	3	-	3	50	30	20
MI 227	Mine Computing Lab I	0	1	0	-	2	-	80	20
	NCC/NSS/NSO ¹	0	0	0	-	2	-	80	20
	Total	16	06	16		15	-	-	-
Total Credits/Hours/Marks		22		31			700		

¹ NSS/NCC/NSO is compulsory and the student will be assessed as satisfactory/ unsatisfactory at the end of IV semester.

Note: Students have to undergo a practical training of 30 days at the end of IV semester for which assessment will be made at the beginning of the next semester.

THIRD YEAR B.Tech.

V-SEMESTER

Course No.	Title of course	Credit Hours		Hours per week			Marks allotted		
		Th.	P	L	T	P	Th.	P	MT
MI 311	Mine Ventilation	3	1	3	-	2	50	30	20
MI 312	Surface Mining	3	1	3	-	2	50	30	20
MI 313	Underground Coal Mining	3	1	3	-	2	50	30	20
MI 314	Computer Application in Mining	2	1	2	-	2	50	30	20
MI 315	Mine Surveying II	3	1	3	-	2	50	30	20
MI 316	Rock Mechanics I	3	1	3	-	2	50	30	20
	Total	17	6	17	-	12	-	-	-
Total Credits/Hours/Marks		23		29			600		

T - Tutorials do not carry any credit

Note: There will be a Survey Camp of duration of 12 effective days after V semester.

VI- SEMESTER

Course No.	Title of course	Credit Hours		Hours per week			Marks allotted		
		Th.	P	L	T	P	Th.	P	M T
MI 321	Underground Mine Environment	3	1	3	-	2	50	30	20
MI 322	Dimensional Stone Technology	3	1	3	-	2	50	30	20
MI 323	Underground Metalliferrous Mining	3	1	3	-	2	50	30	20
MI 324	Mine Machinery II	3	1	3	-	2	50	30	20
MI 325	Mining Geology III	3	1	3	-	2	50	30	20
MI 326	Rock Mechanics II	3	1	2	-	2	50	30	20
MI 327	Survey Camp	0	1	0	-	0	-	100	-
	Total	18	07	17		12	-	-	-
Total Credits/Hours/Marks		25		29			700		

Note: Students have to undergo a practical training of 30 days at the end of VI semester for which assessment will be made at the beginning of the next semester.

FOURTH YEAR B.Tech.

VII-SEMESTER

Course No.	Title of course	Credit Hours		Hours per week			Marks allotted		
		Th.	P	L	T	P	Th.	P	MT
MI 411	Mine Legislation & Safety	3	0	3	-	0	80	-	20
MI 412	Mine Management	3	0	3	-	0	80	-	20
MI 413	Mine Machinery III	3	1	3	-	2	50	30	20
MI 414	Mineral Processing	3	1	3	-	2	50	30	20
MI 415	Environmental Management in Surface Mines	3	1	3	-	2	50	30	20
MI 416	Mine Computing Lab II	0	1	0	-	2	-	80	20
MI 425	Project ¹	0	-	0	-	4	-	-	-
	Total	15	04	15	-	12	-	-	-
Total Credits/Hours/Marks		19		27			600		

¹ The topic for the project (MI425) will be allotted in the VII semester but assessed in both the semesters. The total credits will however be counted in the VIII semester.

VIII-SEMESTER

MI 423 (e) Maintenance Management

Note: The students have to take one elective each out of the lists (Electives I & II) given. However, the elective may not be offered if faculty expertise is not available or a minimum of 7 students do not opt for a particular elective.

Course No.	Title of course	Credit Hours		Hours per week			Marks allotted		
		Th .	P	L	T	P	Th .	P	MT
MI 421	Mine Economics & Financial Management	3	0	3	-	0	80	-	20
MI 422	Mine Planning & Design	3	1	3	-	2	50	30	20
MI 423	Elective I	3	0	3	-	0	80	-	20
MI 424	Elective II	3	0	3	-	0	80	-	20
MI 425	Project	0	8	0	-	12	-	100	-
MI 426	Practical Training, Industrial Visit & Mining Camp	0	4	-	-	-	-	100	-
MI 427	Seminar	0	2	0	-	2	-	100	-
	Total	12	15	12	-	16	-	-	-
Total Credits/Hours/Marks		27		26			700		

Note:

1. The student will undergo supervised practical training at mines for a total period of 60 days during the course.
2. The allocation of marks for practical training, industrial visit, mining camp tentative will be as follows:

Training-I after IV semester (II B.Tech.), 30 days duration	- 35
Training-II after VI semester (III B.Tech. 30 days duration)	- 35
Mining camp (12 days)	- 20
Industrial Visit	- 10

100

List of Electives:

ELECTIVE – I		ELECTIVE - II	
MI 423 (a)	Rock Fragmentation	MI 424 (a)	Experimental Stress Analysis
MI 423 (b)	Rock Engineering	MI 424 (b)	Numerical Methods
MI 423 (c)	Computer Aided Mine Design	MI 424 (c)	Advanced Mineral Exploration
MI 423 (d)	Advances in Mine Ventilation	MI 424 (d)	Advanced Mineral Processing

COURSE CONTENT

FIRST YEAR B.Tech. (I SEMESTER)

BS 111 MATHEMATICS – I

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Taylor's and Maclaurin's expansions; Asymptotes, Curvatures, Simple curve tracing.

Unit-II

Partial differentiation; Homogeneous functions and Euler's theorem; Composite functions and total differential coefficient; Jacobians; Error and Approximations.

Unit-III

Double and Triple integrals; Change of order of integration; Rectification of standard curves; Volumes and surfaces of revolution of curves.

Unit-IV

Differential equations of higher order with constant coefficients: Methods of finding complementary functions and particular integrals; Homogeneous equations with constant and variable coefficient.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.
2. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

ME 113 MECHANICAL ENGINEERING – I

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Thermodynamics: Thermodynamic properties, closed and open systems, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of First Law in heating and expansion of gases in non-flow processes. First Law applied to steady flow processes.

Second law of thermodynamics: Kelvin-Planck and Clausius statements. Reversible processes, Carnot cycle, Carnot theorem. Entropy, physical concept of entropy, change of entropy of gases in thermodynamic processes.

Unit-II

Properties of Steam: Difference between gas and vapour, change of phase during constant pressure process. Generation of Steam, triple point and critical point. Internal energy and entropy of steam. Use of steam tables and Mollier chart, heating and expansion of vapour in non-flow processes, measurement of dryness fraction.

Unit-III

Vapour Power Cycles: Introduction, Carnot Cycle. Desirable properties of working fluid used for power plants. Rankine cycle. Expansive and non expansive working.

Steam Generators : Classification of steam boilers. Cochran, Lancashire, locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories.

Steam Engines: Introduction to simple and compound steam engines, saturation curve and missing quantity, governing.

Unit-IV

Gas Power Cycles: Introduction. Air Standard efficiency, other engine efficiencies and terms. Otto, diesel and dual cycles. Calculation of efficiency, mean effective pressure and their comparison.

Internal Combustion Engines: Introduction. Classification, terminology and description of IC Engines. Four stroke and two stroke petrol, gas and diesel engines. Valve timing diagrams. Comparison of petrol and diesel engines. Simple carburettor. Ignition system of SI engine, diesel fuel pump and injectors.

Text Books/References

1. M. L. Mathur and F. S. Mehta. Thermal Engineering, (Vol. I, SI Edition), Jain Brothers, New Delhi.
2. R. K. Purohit. Thermal Engineering. 2nd Ed., Scientific Publishers, Jodhpur.

ME 114 WORKSHOP PRACTICE

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	0	0	1
Hours	0	0	3

Carpentry Shop: Acquaintance with types of wood, tools and their uses. Simple exercises involving basic operations like sawing, planning, chiselling, etc. Preparation of simple joints, cross half lap joint, dovetail joint, bridle joint, tennon and mortise joint.

Smithy Shop: Acquaintance with types of tools and their uses. Simple exercises involving basic operations like bending, drawing, punching, shaping, upsetting, and riveting.

Fitting Shop: Acquaintance with tools, measuring and marking tools, precision measuring tools and their uses. Simple exercises involving basic operations like sawing, chipping, filling, drilling, reaming, threading with taps and dies.

Sheet Metal and Plumbing Shop: Demonstration of basic tools, pipe fittings and operations.

Texts/References

1. S. K. Hajra Choudhury and AK Hajra Choudhury. Elements of Workshop Technology (Vol. I), Media Promoters & Publishers Pvt. Ltd., Bombay.

CE 115 ENGINEERING DRAWING

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	0	0	1
Hours	0	0	3

Introduction and letter writing. Construction and use of plain, diagonal and vernier scale. Methods of drawing ellipse, parabola and hyperbola. Methods of drawing cycloids, spirals. Orthographic projection and projection of points.

Projection of lines, projection of planes, projection of solids. Introduction of prism, pyramid, cylinder and cone.

Section of solids, introduction of intersection of surfaces. Development of plane and curved surface. Isometric projection.

Text/Reference

1. N.D. Bhatt. Elementary Engineering Drawing, Rupalee publication, Anand.
2. Lakshmi Narayan and Vaishwanar. A Text Book of Practical Geometry, Jain Brother, New Delhi.
3. R.B. Gupta. A Text Book of Engineering Drawing, Satry Prakashan, New Delhi.
4. Fundamentals of Technical Drawing, Parkinson.

BS 100P ENGINEERING PHYSICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Unit-I

Electric Field: Line integral of electric field, Potential difference, Field as gradient of potential, Divergence of a vector function, Differential form of Gauss's law, Laplacian, Laplace equations, Curl of a vector function. Gauss's divergence theorem.

Magnetic Field: Curl and Divergence of a magnetic field, Magnetic scalar and vector potential.

Unit-II

Varying Field: Faraday's law-integral and differential form, Self and mutual inductance, Neumann's equation, Charge and discharge of a capacitor through register, Growth and decay of current in LR circuit, Energy stored in electric and magnetic field, Displacement current, Maxwell's equations.

Unit-III

Laser: Coherence, Einstein's coefficient, Spontaneous and stimulated emission, Population inversion, Laser gain (pumping), Spectral narrowing in laser, Coherence length, Ruby and He-Ne laser.

Interference: Division of amplitude, colour of thin films, Newton's ring, Febry-Perot interferometer-principle, operation, determination of wave length and difference in wave length.

Unit-IV

Diffraction: Double slit Fraunhofer diffraction pattern, Fraunhofer diffraction by a plane transmission grating, Formation of spectra.

Polarization: Analysis of linearly, circularly and elliptically polarized light (Half wave and quarter wave plates), Optical activity, specific rotations, Laurent's half shade and its use for determination of specific rotation of sugar solution.

Practicals

1. To find refractive index and dispersive power of material of prism by spectrometer.
2. To find wave length of light by Newton's ring.
3. To find wave length of light by diffraction grating.
4. To find specific rotation of sugar solution by polarimeter.
5. To find wave length of light by Fresnel Biprism.
6. To find frequency of A.C. mains.
7. To determine dielectric constant of liquid using series resonance method.
8. To study charge and discharge of condenser through a resistor (C.R. Circuit).
9. To study LCR resonant circuit, resonance, quality factor and sharpness in (i) series circuit (ii) parallel circuit.

Text Books/References

1. K.K. Tiwari. (1995). Electricity and Magnetism, S. Chand and Company, New Delhi.
2. N. Subrahmanyam and Brijlal. (1993). A Text Book of Optics, S. Chand and Company, New Delhi.
3. Ahmed and Lal. (1966). Electricity, Magnetism and Electronics, Unitech House, Lucknow.
4. D.S. Mathur. (1993). Mechanics, S. Chand and Company, New Delhi.
5. Gupta and Kumar. (1995). Practical Physics, Pragati Prakashan, Meerut.

CE 100 ENGINEERING MECHANICS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

(A) STATICS

Unit-I

Introduction of condition of equilibrium: Force, system of force, coplanar forces.

Moment and couples: Moment and parallel forces, Couples, General conditions of equilibrium

Practical Applications: Levers, Cracked levers, Steel yards. Sagging chains and toggle joints.

Centre of Gravity: Centre of parallel forces, C.G. in some simple cases, C.G. of Solids.

Moment of Inertia: Moment of inertia, Radius of gyration and perpendicular axis. Determination of moment of inertia of simple sections. Mass of moment of inertia.

Unit-II

Friction: Introduction, Critical angle of friction, Friction on horizontal planes, Friction on inclined planes, Wedge and block, Screw jacks, Rolling friction.

Machines: Introduction, Effects of friction, Loss of work, Reversible and irreversible machine, Law of machine, Wheel and axle, Differential wheel and axle, Pulley block, Screw jack, Single and double purchase crab, Worm and Worm wheel, System of pulleys.

Frames: Statically determinate plane frames, Method of joints, Method of sections, Graphical method.

(B) DYNAMICS

Unit-III

Rectilinear Motion, Motion under gravity, Projectiles equation of the path, Maximum height attained, Time of flight, Horizontal range. Angle of projection, Projectile from a given height, Projectile on an inclined plane, Problems.

Work, Power and Energy: Work, Power, Work done by torque, Energy, Law of conservation.

Unit-IV

Centripetal and centrifugal forces, Laws of motion: Newton's Law of motion and their explanation, Collision of elastic bodies; Impulse and impulsive force, Principle of conservation of momentum, Loss of kinetic energy during impact.

Practicals

1. Verification of law of polygon of forces.
2. Verification of principle of moment in case of compound level.
3. Verification of principle of moment in case of bell crank level.
4. Determination of reaction in case simply supported beam with or without overhang.
5. To determine coefficient of friction between different surfaces on horizontal plane.
6. To determine coefficient of friction between different surfaces in inclined plane.
7. Study of different wheel and Axle.
8. Study of single purchase crab.
9. Study of worm and worm wheel.
10. Study of Weston's pulley block.
11. Determination of mechanical advantage, velocity ratio and efficiency of single purchase crab.
12. Determination of mechanical advantage, velocity ratio and efficiency of double purchase crab.
13. Determination of mechanical advantage, velocity ratio and efficiency of first system of pulley.
14. Determination of mechanical advantage, velocity ratio and efficiency of second system of pulleys.
15. Determination of mechanical advantage, velocity ratio and efficiency of third system of pulleys Flywheel.

Text Books/References

1. I.B. Prasad. Engineering Mechanics, Khanna Publisher, New Delhi.
2. R.S. Khurmi. Applied Mechanics, S. Chand & Company Ltd., New Delhi
3. S.B. Junnarkar. Applied Mechanics, Charotar Publishing House, New Delhi.
4. Saluja. Applied Mechanics, Satya Prakashan, New Delhi.

EE 100 ELECTRICAL ENGINEERING – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit-I

D.C. Networks: Kirchoff's law, node voltage and mesh current methods, delta-star and star delta transformation, source conversion; solution of DC circuits by network theorems: Thevenin's, Norton's, superposition, Reciprocity and Maximum Power Transfer theorem.

Unit-II

Single Phase A.C.Circuits : Single Phase EMF generation, average and effective values of sinusoidal and linear periodic wave forms, instantaneous and average power, power factor, reactive & apparent power, solution of R-L-C, series, parallel, series-parallel circuits, complex representation of impedances, phasor diagram, series and parallel resonance.

Unit-III

Three Phase A.C., Circuits : Three phase EMF generation, delta and star-connection, line and phase quantities, solution of the 3- phase balanced circuits, Phasor diagram, measurement of power in three phase balanced circuits.

Transformer: Faraday's laws of Electromagnetic induction, construction and principle operation of single phase transformer, EMF equation, voltage and current relationship and Phasor diagram for ideal transformer.

Unit-IV

Electrical Measuring Instruments : Introduction; type of measuring Instruments, Deflecting controlling & Damping Torque, D.C. PMMC instruments, shunts and multipliers, Moving iron ammeters and voltmeter, Dynamometers wattmeter, Induction type energy meter.

Practicals : Based on theory

Text Books/References

1. B. L. Therja. Electrical Technology, S. Chand.
2. M.E.Van Valkenberg. Network analysis, PHI.
3. Soni and Gupta. Introduction to Electrical Network Theory, Dhanpat Rai Publisher.
4. R.A. Gupta and Nikhal Gupta. (2002). Fundamentals of electrical & Electronics Engineering, JPH, 1st Edition.
5. H.P. Tiwari. (2002). Electrical & Electronics Engineering, College Book Centre, Jaipur.
6. J.B. Gupta. (2002). Fundamentals of Electrical & Electronics. S.K. Kataria and Sons. Dehli.

ENVS 100 ENVIRONMENTAL STUDIES

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Unit-I

The Multidisciplinary nature of environmental studies:

Definition, scope and need for public awareness. Environmental problems and their consequences

Natural Resources:

Renewable and non-renewable resources

Natural resources and associated problems

- Forest resources: Use over-exploitation, deforestation, and case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams, benefits and problems.
- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity, case studies.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- Land resources: Land and a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources, Equitable use resources for sustainable lifestyles.

Unit-II

Ecosystems

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the following ecosystem.

- Forest ecosystem
- Grassland ecosystem
- Desert ecosystem
- Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its conservation

Introduction – Definition: genetic, species and ecosystem diversity, Biogeographically classification of India, Value of biodiversity: Consumptive use, productive use, social, ethical, and aesthetic and option values, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-III

Environmental Pollution

Definition, Causes, effects and control measures of :-

Air pollution

Water pollution

Soil pollution

Marine pollution

Noise pollution

Thermal pollution

Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies, Disaster management: floods, earthquake, cyclone and landslides

Unit-IV

Social Issues and the Environment - From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people: its problems and concerns, Case studies, Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness.

Human Population and the Environment

Population growth, variation among nations, Population explosion-Family Welfare Programme, Environment and human health, Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies.

Practicals

Visit to river, forest, hill, mountain, local polluted plant, pond ecosystem

Text Books/References

1. K. C. Agarwal. (2001). Environmental Biology, Nidi Publications, Bikaner.
2. B. L. Chaudhary and Jitendra Pandey. (2005). Environmental Studies, Apex Publishing House, Udaipur.
3. H Jhadav & V. M. Bhosale. Environmental Protection & Laws, Himalaya Pub. House, Delhi.
4. M. N. Rao and A. K. Datta. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd.
5. B. K. Sharma. Environmental Chemistry. Goel Publishing House, Meerut.
6. Pratap Singh, N. S. Rathore and A. N. Mathur. (2004). Environmental Studies, Himanshu Publications, Udaipur.
7. R. K. Trivedi and P. K. Goel. Introduction to Air Pollution, Techno Science Publications.

BS 100C ENGINEERING CHEMISTRY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Unit-I

Sources of water, common impurities, requisites of drinking water in municipal water supply. Purification of water, sedimentation, sterilization, break point chlorination. Hardness, determination of hardness by Complexometric (EDTA) method, degree of hardness, chloride, dissolved oxygen, carbon dioxide and sulphate, control of pH of water used in industry, Boiler troubles, carry over corrosion, Sludge and scale formation. Caustic embrittlement, cause of boiler troubles and their prevention.

Unit-II

Classification of fuels, solid fuels, coal origin and its classification, Proximate and ultimate analysis of coal, significance of constituents, Gross and net calorific values. Liquid fuels- advantages, Petroleum origin, classification, Refining of Petroleum, Gasoline, knocking, octane number, anti knock agents . Flue gas analysis by Orsat Apparatus, Calculations based on combustion.

Unit-III

Corrosion: Definition and its significance, theories of corrosion, protection of corrosion use of inhibitors and passivation, Alloying protective coatings -Metallic, inorganic and Organic.

Refractories: Definition, Properties, Classification. Properties of Silica and Fireclay refractories.

Unit-IV

Chemical Kinetics- Order and Molecularity of reaction, first and second order reaction, Derivation of equations for first and second order reaction, determination of order of reaction, Energy of activation and Arrhenius equations, Numericals of first and second order reactions.

Practicals

1. Determination of viscosity of a liquid.
2. Determination Surface Tension of a liquid by Stalagmometer method.

3. Determination of carbonate and non carbonate hardness by soda reagent method.
4. Determination of temporary and permanent hardness by EDTA method.
5. Estimation of free chlorine in a water sample.
6. Determination of copper sulphate iodometrically.
7. Estimation of potassium dichromate iodometrically
8. Determination of purity of Ferrous Ammonium Sulphate (Mohr's Salt) using Potassium Permanganate.
9. Determination of Potassium Dichromate using Potassium Ferricyanide as an external indicator.
10. Estimation of available chlorine in bleaching powder sample
11. Analysis of Brass
12. Analysis of Iron ore
13. Analysis of Pyrolusite
14. Analysis of common salt.

Text Books/References

1. Jain and Jain. Engineering Chemistry, Dhanpat Rai & Sons, Nai Sarak, Delhi.
2. Jain and Gupta. A Text Book of Engineering Chemistry, Jaipur Publishing House.
3. B.K. Sharma. Engg. Chemistry, Krishna Prakashan Media (P) Ltd., Merrut.
4. S.S. Dara. A Text Book of Engineering Chemistry, S.Chand & Co., New Delhi.
5. M.A. Uppal. A Text Book of Engineering Chemistry, Khanna Publishers, Delhi.
6. S.S. Dara. A Text Book on Experiments and Calculations Engg. Chem. Ram Nagar, Delhi.
7. S.K. Banerji and S.K. Jain. Hand Book of Technical Analysis, Jain Brothers, New Delhi.

Unit-I

Passive Components: Construction and characteristics of carbon composition , wire wound and film resistors. Potentiometer, color codes and rating of resistors. Characteristics and rating of capacitors for electronics circuits.

Semi conductor: Basic electrical characteristics of semi conductors. Theory of p-n junction. Characteristics and ratings of junction diodes. basics of zener diode, photo diode and LED.

Unit-II

Bipolar Junction Transistor: npn and pnp transistors,, Various configurations (CB, CC,CE) of BJT. Transistor biasing (Fixed, self, potential dividers) Basic classification of amplifier (Voltage and power amplifier). Basic concept of Class A, B , AB and C amplifiers.

Unit-III

Generation of waveforms: Concept of positive and negative feed back. Introduction of oscillators like R-C , L-C and Crystal oscillators.

Power supply: Circuit configuration and analysis of Half wave , Full wave and Bridge rectifier .Basic concept of regulation, Zener diode voltage regulator., Transistor serier regulator.

Unit-IV

Transducers: Definition, classification : Active and passive transducer, primary and secondary transducers, Analog and digital transducers. Measurement of displacement, temperature, velocity, force and pressure using potentiometer, resistance thermometer, thermocouples , bourden tube, LVDT, strain gauge and techogenerator.

Practicals : Based on theory

Text Books/References

1. Millman and Halkias. Integrated electronics: Mc Graw Hill
2. W.D Cooper. Electronics Instrumentation and Measurement : PHI
3. M.L.Gupta. Electrical Engineering Materials
4. Malvino. Principles of Electronics
5. Jhon D. Ryder. Electronics Fundamentals

**CS 100 INTRODUCTION TO COMPUTER PROGRAMMING
AND DATA STRUCTURE**

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 0 2

Unit-I

Computer Fundamentals: History of Computers; Organization of Computers: input unit, output unit, Storage Unit, Arithmetic Logic Unit, Central Processing Unit; CPU Operation; Memory Subsystem: RAM, ROM, Cache Memory & memory Hierarchy; Instruction Format and Instruction Execution Cycle; Number System & Codes: Binary, Decimal, Octal & Hexadecimal Number System, Conversion from one number system to another, sign magnitude, 1's Complement & 2's Complement representation of numbers; Numerical & Character codes: BCD, Excess - 3, Gray, ASCII & EBCDIC Codes.

Unit-II

Basics of Programming in C: Constants, Variables and Data Types, Operators and Expressions, Input and Output operations, Decision making & Branching: if-else, switch statement; Decision making and looping; Arrays.

Unit-III

Character Arrays & strings, User defined function, Structures & Unions, Pointer Management, Dynamic Memory allocation & linked lists.

Unit-IV

Introduction to Data Structures : Introduction to Linear Arrays & Representation of Linear Array in Memory, Traversing, Insertion & Deletion in Linear arrays, Bubble Sort, Linear & Binary search; Introduction to linked list – Representation of linked list in memory, Traversing, Searching, Insertion & Deletion in a linked list.

Practicals : Based on Theory

Text Books/References

1. E. Balagurusamy. "Programming in ANSI C", Tata McGraw Hill.
2. Kernighan and Ritchie. "The C Programming language", Printice Hall
3. P.M. Jat. "Programming with C", Apex Publishing House, Jaipur.
4. Dharm Singh. "Fundamentals of Compute Organization", Paragon International Publishers, New Delhi.
5. P.K. Sinha & P. Sinha. "Computer Fundamentals", BPB Publication.
6. Seymour Lipschutz. "Data Structure", Schaum's outline series, McGraw Hill.

BS 100E ENGLISH AND COMMUNICATION SKILL

Cr. Hrs. 2 (2 + 0)

L T P

Credit 2 0 0

Hours 2 0 0

(A) ENGLISH

Grammar and Usage – Tenses, Agreement of Subject and verb, Passive Voice, Basic Sentence Patterns, Prepositions, Phrasal verbs, Common Grammatical Errors, Use of articles, Punctuations, Modals, Gerund, Participle, Infinitive, Word Formation (affixes, prefixes, suffixes, synonyms and antonyms), Idioms, Synthesis & Transformation of sentences, Sentence Linkers.

Comprehension – Unseen Passage

Composition – Precise writing, Personal Letters, Business letters, Job Applications, Writing of technical Report, Essay writing

Introduction to sounds – Vowels, Diphthong, Consonants Phonetics Transcriptions. Word stress and exercises on pronunciation, Group discussion on current topics and Presentation of Technical report. Practice in Language Laboratory

(B) COMMUNICATION SKILL

Communication Skills: Meaning and process of communication, Verbal and non-verbal communication; Quality of good communicator; Writing skills, Group discussion; Organizing seminars and conferences.

Text Books/ References

1. Thomson and Martinet. (1997). A Practical English Grammar Exercise Book, Vol. I and II, O.U.P. Publication.
2. Michal Swan. (1995). Practical English Grammar, O.U.P. Publication.
3. David Green. (1990). Contemporary English Grammar Structure Composition, Macmillan Publication.
4. S. Allen. (1997). Living English Structures, Orient Longmans.
5. Daniel Jones, Drills and Tests in English Sound, ELBS.
6. Hornby. (1990). Advanced Learners Dictionary, O.U.P. Publication.
7. Kirshan Mohan. Speaking English Effectively; Macmillan Publication.
8. Audio-Video Tapes prepared by the British Council, New Delhi and Central Institute of English and Foreign Language, Hyderabad to be used in a Language Laboratory.
9. A. Adivi Reddy. Extension Education, Sree Lakshmi Press, Bapatla (A.P.)
10. G.L. Ray. (2005). Extension Communication and Management, Kalyani Publishers.

BS 121 MATHEMATICS – II

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Differentiation of Vectors: scalar and vector point functions, vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of vector point functions; Directional derivatives; Line, Surface and Volume integrals; Gauss, Stoke's and Green theorems (Statement only) and their applications.

Unit-II

Ordinary Differential Equations: Second order differential equations with variable coefficients; Exact form; Part of complimentary function is known; Change of dependent and independent variables; Method of variation of parameters.

Unit-III

Partial Differential Equations: Formation of partial differential equations; Lagrange's linear equations; Higher order linear partial differential equations with constant coefficients. Standard forms of partial differential equations.

Unit-IV

Matrices: Elementary transformations; Rank of a matrix; Reduction to normal form; Gauss Jordan method to find inverse of a matrix; Consistency and solutions of linear equations; Eigen values and Eigen vectors; Cayley-Hamilton theorem.

Text Books/References

1. Y.N. Guar and C.L. Koul. (2005). Engineering Mathematics, (Vols.-I, II), Jaipur Publishing House, Jaipur.
2. J.L. Bansal and H.S. Dhama. (2005). Differential Equation, (Vols.-I), Jaipur Publishing House, Jaipur.
3. N.P. Bali and N.Ch.S.N. Iyengar. (2003). A text book of Engineering Mathematics, Laxmi Publications (P) Ltd, New Delhi.

	L	T	P
Credit	1	0	1
Hours	1	0	2

(A) SURVEYING AND LEVELING

Unit-I

Principle and purpose of plane surveying.

Chain Surveying : Instrument for chaining, Direct & indirect ranging. Methods of chain along plane & sloping ground, Base line, check line, Tie line, Offset, Chain angle & recording in field book.

Compass Surveying : True & Magnetic meridian, whole circle bearing & quadrantal bearing system, construction & use of Prismatic & Surveyor Compass, Local attraction.

Unit-II

Level and leveling : Definition of various terms used in leveling. Types of Bench mark and their uses. Construction and use of Dumpy and Tilting levels, Leveling staves. Temporary adjustment of Dumpy level. Simple, differential leveling, fly leveling, longitudinal and cross sectioning, plotting of profile leveling. Determination of level by line of collimation and rise and fall method, Arithmetical checks. Level book and record keeping, leveling difficulties and errors in leveling.

(B) BUILDING MATERIAL

Unit-III

Stones: Different types, properties of good building stones, common testing of stones, Dressing of stones and use of stones in construction.

Bricks: Types, raw materials, identification, composition. Properties and uses of ordinary bricks, fire resistant and chemical resistant bricks.

Limes: Definition, sources of lime, slaking of lime, ISI classification of lime.

Unit-IV

Cement: Chemical composition, types of cement, properties, uses and tests on cement.

Mortars: Proportioning, properties of ingredients and use of lime, cement and gauge mortars.

Cement Concrete: Ingredients, common proportions, properties of fresh hardened concrete, Water cement ratio, curing and consolidation of concrete.

Practicals

1. Study of accessories used in measurement of distances.
2. Ranging Direct and indirect and use of chain and tape.
3. Chining along sloping ground.
4. Chain surveying, field book recording and taking offsets for location details
5. Study of prismatic and surveying compass and taking bearings..
6. Study of Dumpy level, temporary adjustment and R.L. calculations.
7. Study of Tilting level, temporary adjustment and R.L. calculations
8. Simply and differential leveling operation, record in level book, practice for staff reading line of collimation and Rise and fall method calculations.
9. L-section and cross sectioning, fly leveling operation.
10. Plotting of working profile.

Text Books/References

1. S.C. Rangwala. Engineering Materials, Charotar Book Stall, Anand.
2. B.C. Punmiya. Surveying & Field Work (Vol. I), Laxmi Publications, New Delhi.

ME 123 MACHINE DRAWING – I

Cr. Hrs. 1 (0 + 1)

	L	T	P
Credit	0	0	1
Hours	0	0	3

Introduction, conventional representation of different materials used in machine drawing, Introduction to BIS codes.

Orthographic Projection: First and third angle methods of projection. Preparation of working drawing from models and isometric views. Drawing of missing views.

Dimensioning: Different methods of dimensioning.

Sectional Views: Concept of sectioning. Revolved and oblique section. Sectional drawing of simple machine parts

Riveted and Welded Joints: Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints.

Screw Fastenings: Nomenclature, thread profiles, multistart threads, left and right hand threads. Square headed and hexagonal nuts and bolts. Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts.

Different types of joints: Knuckle joint, cotter joint and universal joint.

Text Books/References

1. N. D. Bhatt. Machine Drawing, Charotar Book Stall, Anand.
2. V. Laxminarayan and ML Mathur. A Text Book of Machine Drawing, Jain Brothers, New Delhi.
3. P. S. Gill. Machine Drawing: S. K. Kataria & Sons, New Delhi.

ME 124 WORKSHOP TECHNOLOGY

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	3

Unit-I

Welding: Introduction to welding, types of welding. Oxyacetylene gas welding, types of flames, welding techniques and equipment. Principle of arc welding, equipment and tools. Soldering and Brazing.

Unit-II

Lathes: Classification, constructional details of centre lathe. Main operations and tools used on centre lathes.

Shaper: Types of shapers. Constructional details of standard shaper, shaper tools and main operations.

Unit-III

Drilling Machines: Types of drilling machines. Constructional details of pillar type, and radial drilling machines. Main operations. Twist drills, drill angles and sizes.

Measurement and Inspection: Classification of measuring instruments, linear and angular measurement, comparators.

Unit-IV

Forming: Basic descriptions and applications of hot and cold working processes, forging, bending, shearing, drawing and forming operations.

Foundry: Moulding tools and equipments. Moulding sands, properties of moulding sand, sand mould making process.

Practicals

Practical exercises on welding, pattern making, foundry and machining operations.

Text Books/References

1. S.K. Hajra Choudhury and A.K. Hajra Choudhury. Elements of Workshop Technology (Vol. I and II), Media promoters & Publishers Pvt. Ltd., Bombay.

SECOND YEAR B.TECH. (III SEMESTER)

BS 211 (All Branches) MATHEMATICS – III

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Interpolation: Finite differences, various difference operators and their relationships, factorial notation. Interpolation with equal intervals; Newton's forward and backward interpolation formulae, Lagrange's interpolation formula for unequal intervals.

Unit-II

Gauss forward and backward interpolation formulae, Stirling's and Bessel's central difference interpolation formulae.

Numerical Differentiation: Numerical differentiation based on Newton's forward and backward, Gauss forward and backward interpolation formulae.

Unit-III

Numerical Integration: Numerical integration by Trapezoidal, Simpson's rule. *Numerical Solutions of Ordinary Differential Equations:* Picard's method, Taylor's series method, Euler's method, modified Euler's method, Runge-Kutta methods.

Unit-IV

Laplace Transform: Laplace transforms of elementary functions; Basic properties of Laplace transform; Initial value theorem, final value theorem and convolution property of Laplace transform; Inverse Laplace transforms. Applications of Laplace transform to solve ordinary differential equations.

Text Books/References

1. H.C. Saxena. Text Book of Finite Differences and Numerical Analysis, S. Chand and Co.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain. Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd.
3. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics, Laxmi Publication Pvt. Ltd., New Delhi (VII Edition).
4. S.P. Goyal and A.K. Goyal. Integral Transforms, Jaipur Publishing House, Jaipur.

CE 211 (AE, EE, MI) STRENGTH OF MATERIALS

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	1	2

Unit-I

Fundamentals : Stress and strain, engineering properties, Saint-Venant's Principle. Stress strain diagram's, mechanical properties of materials, elasticity and plasticity. Shear stress. and strain, pure shear. Complementary shear. Linear elasticity and Hooke's law. Poisson's ratio, volumetric strain, bulk modulus of elasticity. Elastic constants and relation between elastic modulus. Stress and strain in axially loaded members. Temperature stresses and effects.

Unit-II

Analysis of stress and strain : Stress at a point, stress components. Stresses on inclined planes. Plane stress and strain. Mohr's circle representation of plain stress and strain. Principle stresses and strains, maximum shear stresses. Hooke's law for plain stress.

Stresses in thin cylinder and special shells subjected to internal & external pressures.

Unit-III

Beam under Flexural Loads : Bending moment and shear force, relation between load, Shear force and bending moment. Bending moment and shear force diagrams for simply supported, Cantilever and overhang beams under static loading of different types viz. point loads, Uniformly distributed loads, linearly varying loads, Pure bending. Theory of simple bending of initially straight beams. Flexural stresses in beams. Built up and composite beams. Shear stresses in beams of rectangular, Circular and I-section. Shear formula, effect of shear strain.

Unit-IV

Torsion : Torsion of solid and hollow circular shafts. Non-uniform torsion.
Columns : Buckling and stability, critical load. Euler's theory for initially straight column with different end conditions, equivalent length, Limitation of Euler's formula. Rankine's formula. column under concentric loading. Secant, Perry's and Indian standard Formulas.

Practicals

1. Study of Universal Testing Machine, its part and functions.
2. Operation of U.T.M, fixing of specimen for different testing.
3. Tensile test on mild steel specimen to failure and computing, Stresses, % elongation, Contraction etc.

4. Compression test on timber.
5. Compression test on mild steel.
6. Compression test on concrete cube.
7. Determination of toughness test of mild steel, Brass and Aluminum by Charpy test.
8. Determination of toughness by Izod test for wood, Aluminum & Brass.
9. Study of torsion testing machine.
10. Performance of torsion test on circular shaft specimen.
11. Bending test on wooden beam and determination of modulus of rupture.
12. Deflection test on wooden beam.
13. Revision.
14. Revision.
15. Revision.

Text Books/References

1. S.B. Junarkar and H.J. Shah. Mechanics of Structures Vol.-I Charoter Publishing, Opp.- Amul Dairy, Court Road, Anand (1997).
2. B.C. Punima. Strength of Materials and Mechanics of Structures, Vol-I (1990) edition, Standard publisher distributors, Nai Sarak, New Delhi – 19.

EE 213 (AE, ME, MI) ELECTRICAL ENGINEERING – II

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Unit-I

D.C. Machines : Characteristics curves of d. c. generators and motors. Application of motors for different uses, starting and speed control of motors.

Unit-II

Transformers: Phasor diagram and equivalent circuits, regulation efficiency and their determination, open circuit, short circuit and sumpner's test.

Unit-III

Induction Motors: Poly phase induction motors- Starters, equivalent circuit, effect of rotor resistance, torque slip curves, speed control by rotor resistance, pole changing and cascading, use in industry; Single – phase induction motor- starting methods.

Unit-IV

Alternators: Elementary idea of armature winding- calculation of induced e. m. f. factors affecting generating e.m.f. open circuit, short circuit and load characteristics. Voltage regulation and its determinations by synchronous impedance methods, synchronizing.

Synchronous Motors: Methods of starting, power angle characteristics of cylindrical rotor machine, operation of synchronizing motor as a condenser and as a reactor, Application in Industries.

Practicals : The practical will be as per the theory syllabus.

Text Books/References

1. Nagrath and Kothari. Electrical Machines
2. Ashfaq Hussain. Fundamentals of Electrical Engineering

MI 214 MINING GEOLOGY – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Introduction and importance of geology in Mining: Evolution, age, origin and interior of the earth; Physio-graphic features of India ; Geological Time Scale; Exogeneous and endogeneous processes; Metallogenesis.

Physical geology: Geological processes- weathering, erosion, transportation and deposition; Geological work done by wind, river, lake, glacier, underground water and sea;

Unit – II

Mineralogy: Definition of mineral, identification by physical, chemical and optical properties; Polymorphism and isomorphism; Crystallography and its definition; Crystal systems in brief; Classification of rock forming minerals; Description of mineral families. i.e. feldspar group, mica group, pyroxene group, amphibole group.

Unit - III

Petrology: Definition of rock, formation, crystallization, texture, structure and classification of igneous rocks; Definition of sedimentary rocks,

formation, texture, structure and classification; Definition of metamorphic rock, metamorphism, agents responsible for metamorphism, texture, structure and classification.

Unit- IV

Diastrophism ; Slow and rapid earth movements; Earthquakes causes and effects; Seismic belts, Interior of earth; Volcanoes: products and distribution; Mountains: types, mountain building, and plate tectonics.

Practicals

1. Minerals under handspecimen.
2. Rocks under handspecimen.
3. Geomorphic models.
4. Crystal models under handspecimen.
5. Geological Time-Scale.
6. Geological succession of India and available minerals.
7. Geological succession of Rajasthan and available minerals.
8. Geologic maps and sections.
9. Plotting Indian geological formations & mineral deposits.
10. Plotting of earthquake/ seismic belts of world.
11. Plotting of earthquake/ seismic belts of India
12. Plotting of volcanic belts of Worlds
13. Plotting of volcanic belts of India
14. Plotting of Physiographic maps of India
15. Plotting of structure/ tectonic map of India

Text Books/References

1. P.K. Mukerjee. A Textbook of Geology, The World Press Pvt.LtD Calcutta.
2. G.W. Tyrell. The Principles of Petrology, B.I.Publications Pvt. Ltd
3. H.H.Read .Textbook of Minerology Oxford University Press.Delhi
4. G.N. Haung . Petrology
5. F.J., Pettijohn. Sedimentary Rocks, C.B.S.Publishers & Distributors
6. Turner & Verhoogen, Igneous Petrology, McGraw Hill Inc.
7. Miyashiro. Metamorphic Petrology
8. Winkler. Metamorphic Petrology, Mcgraw Hill Inc.
9. Holmes. Principles of Physical Geology, E.L.B.S.

MI 215 ELEMENTS OF MINING

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Mineral resources of Rajasthan, India and World; Mining of important economic minerals in India; Various terms used in mining; Introduction and comparison of underground and surface mining. Introduction to unit operations.

Unit – II

Prospecting and Exploration : Reconnaissance; principles and methods of prospecting - pit, shaft, trench and boreholes; Methods of Exploration, Selection of sites for boreholes; Surface layout of boring; Details of equipment, Borehole logging; Maintenance of records; Deflection of boreholes; Difficulties in boring; Fishing tools and their uses; Methods of exploratory drilling for oil; Interpretation of borehole data.

Unit – III

Supports and Reinforcement : Examination of roof; Materials for support: Timber, masonry, concrete and steel supports; Storage, preservation and fire proofing of timber; Objectives and limitations of supports under different conditions; Rigid and yielding types of supports, Strata bolting; Roof stitching; Recovery of falls; Shotcreting, cable bolting.

Unit – IV

Explosives: Classification and comparative properties of explosive; Blasting devices; General application and uses; Blasting theory; Safety considerations.

Blasting system: Electric and non -electric methods; Delay blasting techniques; Priming; Charge distribution; Mechanisms of rock blasting; Blasting with cut and solid blasting, Introduction to SMS, PMS, Emulsion and Heavy ANFO

Practical

1. Mapping of different mineral resources of (i) Rajasthan (ii) India and (iii) world.

2. Illustration of Mining Terminology.
3. Various types of fishing tools used in exploratory boring for mineral and oil.
4. Bore-hole logging and interpretation of bore hole data and numerical problems related to it.
5. Working of the Sylvester prop withdrawal system.
6. Design and use of the friction props.
7. Design and use of the hydraulic props
8. Various types of roof bolts, roof stitching and different wooden supports & their application in mines.
9. To feed the bore hole data in computer software and to take results related with the formation and quantum of mineral resources.
10. Selection of various types of blasting accessories used in mines and designing of explosive magazines
11. PMS Plants with various capacities for surface mines.
12. SMS Plants with various capacities for surface mines
13. Charging problem
14. Study of portable magazine
15. Study of exploder

Suggested Readings

1. C.P. Chugh, High Technology in Drilling and Exploration. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
2. C.P. Chugh, Diamond Drilling. Pub: Oxford & IBH Publisher.
3. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
1. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, TO5036, USA.
2. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:- New Age International Pvt.Ltd. New Delhi
3. Dr. Calvin Konya; "Rock Blasting and Overbreak Control" Precision Blasting Services, Montville, Ohio

MI 216 MINE MACHINERY – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Compressed Air: Air Compressors; types, construction, installation & maintenance; Transmission and distribution of compressed air; Calculations of main parameters; Comparison of compressed air with other forms of power.

Wire ropes: Wire ropes used in mines- types and their construction, installation, maintenance and tests; Rope splicing and change of ropes; rope caps and process of capping.

Unit – II

Drills for blasting: Introduction to drilling systems; Mechanics of percussive, rotary and rotary-percussive drilling; Different types of drills: compressed & hydraulic, diesel and electric drills; Selection of drills; Jack hammers, sinkers, stoppers, drill jumbos, wagon drills and other blast hole drills; Drill accessories and their working; Types of drill steels, bits and their uses.

Unit – III

Machinery for underground mining: Coal cutting machine, Loaders: SDL, LHD, LPDT; Cutter loaders: SERDS, DERDS, Coal Plough, Continuous miner, Road headers.

Unit – IV

Open pit Machinery: Dozers; Front end loaders; Power shovels: Rope and hydraulic, Back hoes, Draglines; Dumpers, Coal haulers; Motor graders; Scrappers; Rippers; Bucket wheel excavators; Spreaders; Reclaimers; Continuous surface miner.

Practical

1. Transmission and distribution of compressed air for surface and underground mines with pressure losses and remedial measures.
2. Anderton drum shearer used in coalmines.
3. DERDS used in coal mines.
4. Hydraulic, rope and back hoe types of loading machines and their selection criteria.
5. Dragline application in various deposits.

6. Application of bucket wheel excavators in coal mines.
7. Detailed design problem for complete calculation for various machines for shovel-dumper combination.
8. Detailed design problem for complete calculation for various machines for dragline..
9. Detailed design problem for complete calculation for various machines for bucket wheel excavator.
10. Design and application of rope cattles.
11. Detailed design problem for L.H.D. & S.D.L.
12. Hydraulic drills
13. Constructional aspect of Jackhammer and its maintenance.
14. Various drill performance parameters and measurement of rate of penetration in various types of rocks.
15. Different types of drill bits used in drilling and their selection criteria.

Suggested Readings

1. Dr. G.B. Mishra, Surface Mining Pub:Dhanbad Publisher, Dhanbad.
2. Amitosh Dey, Heavy Earth Moving Machinery. Available at Geeta book store, Dhanbad.
3. M.A. Ramlu, Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
4. Karelin, Mine Transport. Pub:- Orient Longmans Ltd. New Delhi.
5. M. A. Ramlu; "Mine Hoisting" Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. C. P. Chug; "High Technology in Drilling and Exploration" Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
7. Cummins & Givens; "SME Mining Engineering Handbook, Vol. I & II" A.I.M.M.New-York
8. R..D. Singh, Principles & Practices of Modern Coal Mining Pub:-New Age International Pvt.Ltd. New Delhi

SECOND YEAR B.TECH. (IV SEMESTER)**CE 221 (AE, MI) FLUID MECHANICS****BS 221 (EC, EE, ME, MI) MATHEMATICS – IV****Cr. Hrs. 3 (3 + 0)**

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Fourier Series: Fourier series, even and odd functions; Half range series; Change of interval; Exponential form of Fourier series; Harmonic analysis.

Unit-II

Roots of Nonlinear (Algebraic and Transcendental) Equations: Bisection method, False position method, Newton Raphson method; Convergence of False position and Newton Raphson method. Complex roots of polynomials by Bairstow's method.

Unit-III

Partial Differential Equations: Classifications of partial differential equations; Method of separation of variables to solve Heat equation, Wave equation and Laplace's equations.

Unit-IV

Statistics: Correlation and regression; Principle of least square method and curve fitting.

Probability Distribution Functions: Random variable; Mathematical expectations; Moment generating functions; Discrete and continuous distribution functions; Binomial, Poisson and Normal distributions.

Text Books/References

1. J.L. Bansal and H.S. Dhama. Differential Equations (Vols.-II), Jaipur Publishing House, Jaipur (2005).
2. N.P. Bali and Manish Goyal. A Text book of Engineering Mathematics (VII Edition), Laxmi Publication Pvt. Ltd., New Delhi.
3. S.C. Gupta and V.K. Kapoor. Mathematical Statistics, Sultan Chand & Sons, New Delhi.

Cr. Hrs. 3 (2 + 1)**L T P****Credit 2 0 1****Hours 2 0 2****Unit-I**

Hydrostatics : Fluid Properties, Measurement of liquid pressure. Pascal's law fluid pressure on plane and curved stationery surface, Centre of pressure, Principal applications (preliminary) in simple gales and tanks.

Unit-II

Fluid motion: Type and patterns, velocity and acceleration of fluid, continuity equation, elementary concept of velocity potential. Stream function and flow nets. Euler's equation of motion, integration of Euler's equation to give Bernoulli's equation for compressible and incompressible fluids. Euler's equation of motion. Integration of Euler's equation to give Bernoulli's equation for compressible and incompressible fluids, applications of Bernoulli's equation.

Unit-III

Impulse momentum equation: Introduction, Force on pipe bends. Flow through sharp edged orifices, flow through mouth pieces (steady flow condition).

Discharge measurement in pipes and open channels: Venturimeter, orificemeter. Nozzle and pitot tube (steady flow condition). Flow over weirs, and notches (steady flow condition).

Unit-IV

Flow through pipes: Various types. Velocity distribution. Loss of head due to friction. Minor losses, hydraulic gradient, pipes in series and parallel.

Open Channel Flow: Various types, flow equations, geometrical properties of sections, Most economical section.

Practicals

1. Study and use of pressure gauge.
2. Study & use of manometer.
3. Determination of C_C for orifices.
4. Determination of C_V for orifices.
5. Determination of C_d for orifices.
6. Calibration of a Venturimeter.
7. Calibration of V notch.
8. Calibration of Rectangular notch.
9. Determination of friction for pipe.
10. Velocity distribution in channel cross section.
11. Field visit.
12. Field visit.
13. Revision.
14. Revision.

Text Books/References

1. Jadish Lal. Hydraulics, Metropolitan Book Co. Pvt. Ltd., Delhi-(1986)
2. P.N. Modi and S.M. Seth. Hydraulic and Fluid Mechanics, Standard Book House, Delhi-6 (1995)
3. R.K. Bansal. Fluid Mechanics & Machine.

ME 223 (EE, MI) MECHANICAL ENGINEERING – II

Cr. Hrs.	3	(2 + 1)	
	L	T	P
Credit	2	0	1
Hours	2	0	2

Unit-I

Transmission of Power: Belts, ropes and chains, length of belt, tension in belt, centrifugal tension and maximum power transmitted by belts, Spur gear nomenclature, involute and cycloidal profiles, helical, bevel and worm gears. Gear trains.

Brakes and Dynamometers : Band brake, block, band and block brake. Single and multiple disc clutches. Transmission and absorption type dynamometers.

Unit-II

Balancing : Balancing of rotating mass in single multiple and planes. partial primary and secondary balancing of reciprocating masses.

Vibrations : Free, longitudinal, transverse and torsional, Critical speed.

Bearing and Couplings : Main types of bearing and coupling. Antifriction bearings.

Lubrication: Laws of friction for dry and lubricated surfaces, Methods of lubrication of bearings.

Unit-III

Steam Boilers : High pressure boilers of natural and forced circulation type, LaMont, Benson, Loeffler, Velox Boilers;

Steam Turbine : Expansion of steam through nozzles with and without friction. Throat pressure for maximum discharge. Working of impulse and reaction turbine. Compounding. Velocity diagrams. Governing of turbines. Emergency governing;

Condensers : Types, classifications and details. Vacuum efficiency. Cooling towers and spray ponds.

Unit-IV

Gas Turbines : Basic principles, simple gas turbine cycle, application of gas turbines.

Refrigeration and Air Conditioning : Bell-Colleman refrigerator, vapour compression and absorption refrigerators. Psychrometric chart. Introduction to comfort air-conditioning.

Water Turbine: classification & characteristics of various water turbines, governing of turbine, problems of cavitations, selection of turbine for hydropower schemes.

Centrifugal Pumps: Classification, characteristics & selection of various centrifugal pumps.

Practicals

Study of gears, brakes and dynamometers. Study of various types of clutches and antifriction bearings. Study of critical speed of shaft. Study of air compressors. Study of high pressure boilers and condensers. Study of steam and gas turbines. Study and experiments on refrigeration systems. Study of air conditioner.

Text Books/References

1. M.L. Mathur and F.S. Mehta. Thermal Engineering, (Vol.I& II, SI Edition), Jain Brothers. New Delhi.
2. R.K. Purohit. Thermal Engineering.
3. R.S. Khurmi and J.K.Gupta. Theory of Machines, Eurasia publishing House (Pvt.) Ltd. New Delhi.
4. P.L. Ballaney. Theory of Machines, Khanna Publishers, Delhi.

MI 224 MINING GEOLOGY – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Structural Geology: Structural features of rocks, attitude of rocks; Folds and faults- definition, mechanism, classification, recognition and impact in mining; Joints, definition, classification and impact in mining; Unconformities, outlier and inlier. Stereographic plotting of geological features.

Unit – II

Stratigraphy: Introduction, standard stratigraphic scale, principle of stratigraphic correlation; Geology of India in brief; Review of major geological formations of minerals of India. Geology of Rajasthan with emphasis on economic importance; Precambrian stratigraphy of

Rajasthan, Central India, Bihar, Orrisa, Eastern and Western Ghats, and South India; Middle and late Proterozoics i.e Cuddapah, Vindhyan and its equivalents; Gondwana system.

Unit – III

Economic Geology: Definition of ore, gangue, tenore and grade and classification of mineral deposits; Study of occurrence, shape, form, size, mineral composition and texture of various process generated mineral deposits; Controls of localization of mineral deposits.

Unit – IV

Engineering Geology and Hydrogeology: Criteria of site selection for shaft, incline, tunnels, dams and wells; Introduction to hydrogeology and its impact on mining

Practical:

1. Structural models under hand specimen.
2. Metallic minerals under hand specimen.
3. Non-metallic economic minerals under hands pecimen.
4. Plotting of geological section along given section line in the given geologic map.
5. Stereo-net plotting of ore body planes with the help of dip and strike data obtained by borehole drilling.
6. Find the apparent dip in given direction with the help of stereo-net.
7. Find the amount and direction of plunge of the ore body by given strike-dip data with the help of stereo-net.
8. Construction of Clinometers and Brunton compass.
9. Determination of volumetric joint count.
10. T.V.I calculation with the help of given data.
11. Calculation of specific yield of a well.
12. Calculation of a cone of depression.
13. Plotting of dip isogons.
14. Calculation of T/W ratio for dams (T= pressure of reservoir water tends to displace the dam horizontally & W = the weight of the dam which acts downwards and tends to key the dam in position, R= resultant forces)
15. Exercise related to problems associated with dams.

Suggested Readings

1. Billings M.P, Structural Geology, Prentice Hall of India Pvt. Ltd New Delhi
2. Krishnan M.S, Geology of India & Burma, C.B.S. Publishers & Distributors Delhi.

3. Ravindra Kumar, Fundamentals of Historical Geology & Stratigraphy of India, Wiley Eastern Pvt Ltd New Delhi.
4. Rogers J.J.W, Precambrian Geology of India, Oxford University Press
5. Lemon R.R, Principles of stratigraphy, Meril publishing Co. London.
6. Weller J.M, Stratigraphic principles and Practice, Universal Bookstall Delhi
7. John G. Ramsay, Folding and fracturing of rocks, McGraw Hill Book Co.
8. Ragan, Structural geology: An Introduction to the Geometrical Techniques, John Wiley & Son's.

MI 225 MINE DEVELOPMENT

Cr. Hrs. 4 (3 + 1)

L	T	P
Credit	3	0 1
Hours	3	0 2

Unit-I

Introduction to primary and secondary mine development.

Mine Entries: Choice, location and size of mine entries- shafts, inclines, declines and adits; their merits and applicability.

Mine Structures: Construction and layouts of structures - *Shaft insets, ore and waste bins, skip-pockets, engine chambers, ore passes, chutes, garages, grizzlies and sumps.*

Unit-II

Shaft Sinking: Conventional methods; Preparatory arrangement; Drilling, blasting, loading and hoisting of muck; Lining, ventilation, drainage and lighting; Sinking through loose, fractured, flowing and water bearing ground; Widening and deepening of shafts; Shaft boring; staple shaft.

Unit-III

Drifting: Conventional methods, different types of drilling patterns, blasting, loading, transport of muck, support, ventilation, drainage and lighting; Drifting through loose, fractured, flowing and water bearing ground; Drifting by road headers and tunnel boring machines. Cross-measure drifts and laterals.

Unit-IV

Stope Development: Conventional methods of raising and winzing; Modern methods of Raising - *Raise climbers, Long hole raising and Raise borers; Slot preparation.*

Practicals

1. Design a drift taking into consideration different options available for given set of conditions.
2. Tunnel boring machine used in India and Abroad & various application parameters.
3. Ordinary method of shaft sinking.
4. Piling methods of shaft sinking and their applicability
5. Drop shaft methods of shaft sinking and their applicability
6. Designing the Cementation method of shaft sinking.
7. Designing the Freezing method of shaft sinking for watery conditions.
8. Alimak raise climber and procedure of driving a raise by it.
9. VCR method (drop shaft) of raising in hard rock and fracture zone.
10. Procedure of shaft deepening in a working mine upto 300mts depth.
11. Shaft widening for raising the daily production from 1500 tonnes to 5000 tonnes in metal mines.
12. Modern tunneling techniques.
13. Raise borers
14. Cast iron tubbing - English & German tubbing
15. Various types of mine structures

Text Books/References

1. L. Howard, Hartman. Introductory Mining Engineering, Pub: John Willey & Sons
2. Cummins & Givens. SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York
3. Lowrie Ray. "SME Mining Reference Handbook" SME Publication 2002
4. A. William Hustrulid, Bullock Rechard. "Underground Mining Methods" SME Publication.

MI 226 MINE-SURVEYING – I

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 0 3

Unit-I

Theodolite: Various types; Principles of construction; Temporary and permanent adjustments; Measurement of horizontal angles; Tubular and trough compass.

Traversing: Theodolite traversing; Closing error and its adjustment; Calculation of coordinates; Problems in traverse surveying; Area of closed traverse; Omitted measurements and their calculations.

Unit-II

Tacheometric Surveying: Principles; Types of tacheometer; Additive and multiplying constants; Tangential tacheometry; Anallactic lens; General procedure for field work; Degree of accuracy.

Unit-III

Curve Ranging: Definition; Elements of curves; Degree of curvature; Different methods of setting out curves (apex accessible and apex inaccessible); Underground curve laying;

Unit-IV

Levelling: Shaft plumbing and measurement of depth of shaft; Subsidence survey; Underground levelling and grading, Giving and maintaining direction & gradient for inclined shaft, slopes, levels and tunnels; Maintaining alignment.

Contouring: Definitions; Characteristics of contours; Tacheometric Contouring - Fieldwork, Interpolation of contours; Plotting and interpretation of contours.

Practicals

1. Constructional details of vernier theodolites & its temporary adjustments.
2. Measurement of horizontal angle with the help of vernier theodolite
3. Traversing of given area with the help of vernier theodolite and its plotting with co-ordinate method.
4. Constructional details of microptic theodolites & its temporary adjustments
5. Measurement of horizontal angle with the help of microptic theodolite
6. Traversing of given area with the help of microptic theodolite and its plotting with co-ordinate method
7. Determination of tacheometric constants.
8. Determine the height of inaccessible points, distance between two inaccessible points with tacheometer.
9. Exercise on tacheometric contouring and plotting of contour map for flat area.
10. Exercise on tacheometric contouring and plotting of contour map for hilly area
11. To prepare topographic map by co-ordinate plotting of given area at a scale of 1:1000, 1:2000 as per mining regulation.
12. G.T. sheet and its application.
13. Elements of a curve and design a curve for underground roadways meeting at an angle of 90, 120, 150 degree etc.
14. Use of theodolite in maintaining the gradient of driveway, laying of drainage system
15. Transferring of T. I. points level to B. M.

Text Books/References

1. Dr.B.C.Punmia. Surveying Vol. I & II, Pub: Laxmi Publication New-Delhi
2. T.P. Kanetkar. Surveying & Levelling, Vol I & II, Geeta book store Dhanbad.
3. Mc Adam. "Colliery Surveying"
4. Holland. Surveying Vol. I & II

MI 227 MINE COMPUTING LAB- I

Cr. Hrs. 2 (0 + 2)

	L	T	P
Credit	0	0	1
Hours	0	0	2

Practical

1. Exercises related to Word processing: MS Word and Preparation of technical report.
 2. Exercises related to Word processing: MS Excel
 3. Exercises related to Word processing: Powerpoint
 4. Exercises related to Acrobat reader
 5. Introduction to software packages related to mining.
 6. Introduction to Datamine software
 7. Introduction to ore body modeling with Datamine software.
- Practical based on 'C' language:**
8. Programs related to calculate explosive quantity and powder factor
 9. Program to determine distances and reduced levels of various points in tacheometry.
 10. Program to determine co-ordinates of surface mine survey.
 11. Program related to calculation of area of closed traverse.
 12. Program to calculate bucket capacity of a excavator for given production parameters.
 13. Program based on drill parameters: rate of penetration, drilling rate etc.
 14. Program related to contouring.
 15. Program related to trigonometry.

THIRD YEAR B.TECH. (V SEMESTER)

MI 311 MINE VENTILATION

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit-I

Mine Gases: Occurrence, properties, detection, measurement and monitoring; Methane layering; Methane drainage.

Heat and Humidity: Sources; Effect and control of heat and humidity in mines; Conditions of comfort; Cooling power of mine air; Air conditioning.

Unit-II

Air Flow in Mine Workings: Standards of ventilation; Reynold's number; Laminar and turbulent flow; Pressure losses due to friction and shock resistances; Pressure across the mine; Equivalent orifice of the mine; Resistances in series and parallel; Air quantity requirements; Leakages; Homotropical and Antitropical ventilation; Central and boundary ventilation. Network analysis.

Unit-III

Natural Ventilation: Mechanism; Estimation and measurement of natural ventilation pressure; Characteristic curves.

Mechanical Ventilation: Centrifugal and axial flow fans- Construction, pressure developed, characteristic curves, series and parallel operations; Installation and testing; Forcing and exhaust ventilation; Fan drifts and evasees; Reversal of air flow.

Auxiliary Ventilation: Longitudinal air curtains and brattices; Forcing, exhausting and forcing cum exhausting ventilation systems; Dust extraction; Auxiliary fans- Types, construction, characteristics, location and installation; Air ducts; Risk of re-circulation.

Unit-IV

Ventilation Devices: Stopping, doors, air locks, air crossings and regulators; Regulators and boosters for the regulation of air flow- Construction, location and installation and their effect on the air flow in

the panel and the entire mine; Risk of re-circulation; Controlled re-circulation for ventilating extensive mine workings.

Ventilation Survey: Purpose, instruments, procedure, tabulation and calculation, Preparation and interpretation of ventilation plans.

Practicals

1. Different gases found in coalmines, metal mines and their permitted limits as per the mining regulations. Effect of these gases when found in excess.
2. Various types of Methanometers used in mines and their selection criteria.
3. Various types of CO-detectors used in mines and their selection criteria
4. Measurement of relative humidity with the help of various types of hygrometer.
5. To find the effect of heat, humidity and air velocity with the help of Kata-thermometer.
6. Various air circuits with resistance in series and parallel.
7. Calculation for the installation of main ventilation fan and its reversal arrangement.
8. Design the evasee of ventilation fan in different working conditions.
9. Designing auxiliary ventilation system and their comparative performance.
10. Measurement of air velocity with the help of anemometer, velometer etc, measurement of temperature, pressure etc.
11. To prepare complete ventilation plan and indicating air direction and other ventilation devices as per the regulation in various colour codes.
12. Air conditioning problem.
13. Ventilation survey problem.
14. Auxiliary fan problem.
15. Networking problems

Text Books/References

1. G.B. Mishra. Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. L.C. Kaku. Numerical Problems on Mine Ventilation. Pub: Punam Publisher
3. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons

4. Mutmansky & Weng. Mine ventilation & Air conditioning. Pub: John Willey & Sons
5. Prof. S. P. Banerjee. "Mine Ventilation" Lovely Prakashan, Dhanbad

MI 312 SURFACE MINING

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Applicability: Applicability and limitations of surface mining.

Basic Parameters: Size of mine area ; Pit depth; Annual production and life of mine; Bench height, width and slope, Pit slope; Cut-off grade; Stripping ratio;.

Opening of Benches: Opening of deposits-Trench, Ramp; Width and slope of entry trenches; Driving of entry and opening trenches; Formation of benches.

Unit – II

Overburden Removal: Systems of overburden removal and disposal; Overcasting, haulage and combination methods.

Layouts: Basic layouts for flat, horizontal, inclined and steep deposits; Strip mining layouts; Layout for hilly deposits. Management of layouts (Pushback operation for rearrangement of existing layouts)

Unit – III

Blast hole drilling: Drilling concepts - Operation and performance, Selection of Drills; Control of dust;.

Blasting: Choice of explosive; Blast round design - Hole diameter and length; Burden, spacing, sub-grade and stemming length; Column charge configuration, Mode and points of initiation; Sequence of blasting and delay interval; Blast hole deviation, Inclined hole blasting; Fragmentation monitoring; Blast design for casting; Secondary blasting; Blasting hazards - noise, ground vibration, fly rock, dust & air over pressure and their remedial measures

Unit – IV

Optimization of shovel- dumper combination; Computerized truck dispatch system; Stock piling and blending; Haul road design, construction and safety measures.

Special Mining Situations: Mining over old underground workings; Placer mining: hydraulic, dredging, dump leaching; Deep sea mining. Steep angle conveyor, high angle conveyor, in pit crushing and conveying, highwall mining,

Lighting: Various lighting arrangements.

Drainage: Assessment of water make; Drains, sumps and pumping systems; Pre-drainage through diversion channels and boreholes.

Practical

1. Designing an approach road/ramp to open a deposit by surface mining.
2. Various techniques used in over cast from cost benefit point of view.
3. Designing various layouts for hilly deposits of vein and bedded forms.
4. Designing various types of layouts for deposits below the general ground level.
5. Designing of various types of layouts for placer deposits.
6. Designing a deposit by opencast mining, which has been partially excavated by underground mining.
7. Performance and choice of drilling equipment in surface mine working.
8. Designing the blast hole charging, taking into consideration various parameters.
9. Measurement of blasting vibrations with Blastmate series III equipment and its analysis.
10. Prediction of nuisances due to blasting and their controlling measures.
11. Design problem for opencast mine-Coal
12. Design problem for opencast mine-Lime stone
13. Blending problem solution for rock phosphate
14. Optimization of shovel dumper combination.
15. Open cast drainage problems.

Suggested Readings

1. Dr. G.B. Mishra, Surface Mining Pub: Dhanbad Publisher, Dhanbad..
2. Howard, L.Hartman, Introductory Mining Engineering, Pub: John Willey & Sons
3. Surface Mining Handbook.
4. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, VTO5036, USA.

MI 313 UNDERGROUND COAL MINING

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Stratified deposits-their origin and distribution; Characteristic of roofs, floors and associated rocks.

Factors influencing choice of methods; Classification of mining systems-their relative merits and application.

Global and Indian Status: Global and Indian status of different underground coal mining methods. Trend of change in technology of mining coal vis-vis demand.

Filling Arrangements: Fill materials; Methods of filling- Gravity, pneumatic, mechanical and hydraulic; Procurement of fill material on surface; Transport to bunker; Transport to face area; Filling installations and operations in face area.

Unit – II

Division of mine area: District and level system, concept of uni and bi-lateral panels, order of extraction, size of panel.

Bord and Pillar Method: Development - different methods and layout, Cutting, drilling, blasting, loading and transportation; Support, ventilation, drainage and lighting, manpower; Depillaring - different methods and layout; Simultaneous development and depillaring; Mechanised B&P development and depillaring by continuous miner.

Unit – III

Long wall Method: Advancing and retreating methods - Length of face and daily advance, Size of panel, Development of panel with multi-heading and single heading gates; Extraction of panel.- by drilling, blasting & loading and by Continuous mining; Support; Ventilation, drainage, lighting and signaling in extraction.

Room & pillar, Shortwall, comparison amongst B&P, Longwall, R & P and Shortwall mining methods.

Unit – IV

Hydraulic Mining: The concept; Layout of workings on district and level systems; Winning of panels; Pillar methods (square pillars, rectangular pillars and long pillars); and sublevel stoping;

In-situ Gasification: The concept and chemistry; Methods- using underground excavations, and using vertical or directionally drilled boreholes from surface;

Mining of coal under difficult Situations: Steeply inclined seams; Thin seams, Thick seams, Contiguous seams, seams prone to outburst and bumps; Horizon Mining; Blasting gallery method, Sublevel and integral caving method.

Mining of seams prone to fire and spontaneous combustion, Mining of seams in the vicinity of water bodies and structures.

Practical

1. General out line of Indian coal sector, with location, organization, production, problem related details.
2. Bord and pillar method of mining with caving technique.
3. Bord and pillar method of mining with stowing technique.
4. Various layouts of longwall advancing method and its suitability in Indian conditions
5. Designing longwall retreating method for a coal seam of thickness 2.4m and dipping at 1 in 15.
6. Application of powered support in longwall mining.
7. Blasting gallery technique for excavation of coal deposits.
8. Various filling materials and their comparative properties and application.
9. Sand collection techniques at the river sides.
10. U/g Gasification of coal
11. Exercise on simultaneous development and depillaring.
12. Various depillaring techniques
13. Problems of Thick seam mining.
14. Problems of horizon mining.
15. Problems of hydraulic mining.

Suggested Readings

- 1.. R.D. Singh, Principles & Practices of Modern Coal Mining Pub:- New Age International Pvt.Ltd. New Delhi
2. T.N. Singh, Underground winning of coal. Pub: Oxford & IBH, New-Delhi
3. Singh & Dhar, Thick Seam Mining, Pub: : Oxford & IBH, New-Delhi
4. Samir Kumar Das, Modern coal mining. Geeta book store, Dhanbad.
5. Prof. J. G. Singh; "Underground Coal Mining Method" Braj-Kalp Publisher, Varansi
6. William A. Hustrulid, Rechar Bullock; "Underground Mining Methods" SME Publication
7. MSHA; "Underground Coal Mine Blasting" ISEE Publication Cleveland, Ohio

MI 314 COMPUTER APPLICATION IN MINING

Cr. Hrs. 3 (2 + 1)

	L	T	P
Credit	2	0	1
Hours	2	0	2

Unit - I

Importance of computer application in mining, Different areas of application. Introduction to Computers and hardware for application in mining industry. Programming with 'C' computer language for mining related problems.

Unit - II

Basic Introduction for application of Computers in areas of :

Exploration- Data generation, collection and analysis through computers for exploration and reserve estimation

Surface Mining- Bench geometry design, Haul road design, Drainage, Waste dump design and monitoring.

Mine Planning & Design- Introduction of mine planning concept through mining software. Introduction to numerical methods in Mining.

Unit - III

Basic Introduction for application of Computers in areas of :

Environmental Engineering Basic concept of data generation, collection and analysis through computers for environment management. Relevant software application

Mine Surveying : Introduction to mapping, Estimation of area and volume, Preparation of plans & sections, Tonnage/ Volume calculation for contractual billing and relevant software application.

Project Monitoring : Systems & tools of monitoring of different mining operations, data collection, analysis and online monitoring. Inventory control and management.

Unit - IV

Mining Software

Mine Planning Software : Basic introduction, salient features, planning by different mining software like DATAMINE, SURPAC

Software for various applications : Basic introduction, salient features and application of software like BLASTWARE, FRAGLYST, GALENA, VENTetc.

The detailed Syllaby of the subject will be announced at the beginning of the session every year, in light of the continuous changing nature of the subject and its application in the mining industry.

Practical

1. Computer programming for mining problem with C++.
2. Introduction to different hardware application related to mining.
3. Introduction to Mine planning by DATAMINE
4. Introduction to Mine planning SURPAC
5. Introduction to BLASTWARE software.
6. Calculation of production tonnage of an opencast mine for contractual billing with Total station & Datamine
7. Introduction of "VENT" software of simulation of ventilation network of a mine.
8. Introduction to "FRAGLYST 2.0" software.
9. Introduction to "SINET" software of design of U/g mine ventilation system.
10. Introduction to "PSYCHRO" software.
11. Introduction to "AWQEFA" software.
12. Introduction to "FLAC/ FLAC 3D software
13. Introduction to "N-Fold" software.
14. Introduction to "GALENA" software related to slope stability.
15. Introduction to "Solid works" software

Suggested Readings

1. Sukumar Bandopadhyay; "Application of the Computers and Operation Research in the Mineral Industry" Proceedings of the 30th international Symposium SME Publication 2002
2. Manuals of different softwares

MI 315 MINE SURVEYING – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit - I

Correlation: Methods of correlation of surface and underground surveys- Through mine openings; Correlation by magnetic needle; Precautions and accuracy.

Surveying for tunnels and open pits.

Unit - II

Triangulation Surveying: Definition; Reconnaissance; Selection of signals and stations; Triangulation system with primary, secondary and

tertiary orders;; Measurement of base line and angles; Booking of observations; Auxiliary stations; Satellite stations; Computation; Calculation of coordinates; Errors and their distribution and plotting.

Unit - III

Stope and face surveying: Theodolite in stope surveying; Tape triangulation; Traversing; Radiation and other methods.

Plans and Sections: Legal requirements as to mine plans in India and symbols used; Preparation and preservation of plans and section; Enlargement of plans; Use of ediograph, pantograph and planimeter.

Errors: Sources, classification, propagation and growth; Treatment of non-systematic errors by the method of least squares; Probable errors; Most probable value; Probable error and weight; Limits of errors in drift surveys.

Unit - IV

Photogrammetry and Aerial Surveying: Terrestrial photogrammetry; Photo-theodolite & its construction; Method of field work and plotting from horizontal photographs with determination of elevations; Elementary perspective as applied to aerial photographic surveying.

Field Astronomy: Important definitions; Determination of Azimuth by observation of star.

Application of laser in surveying; Electronic distance measuring equipment; Total station. GPS.

Practical

1. Various methods of correlation and its practical applicability assuming the underground mining conditions.
2. Gyroscope and its use in correlation.
3. Measurement of Base-line for triangulation survey in difficult ground conditions.
4. Triangulation of a hilly terrain.
5. Various stope surveying methods.
6. Planimeter and calculation of areas with its help.
7. Determination of elevation from aerial photographs.
8. Determination of azimuth by observation star at equal altitude.
9. Problems on dip-strike, bore-hole, faults & drifts.
10. Exercise with the help of EDM, Total station.
11. Exercise with the help of GPS, and other latest instruments
12. Exercise of triangulation in flat & large area.
13. Study and problem with Pentograph.
14. Preparation and preservation of plans
15. Problems related to errors.

Suggested Readings

1. Dr. B.C.Punmia, Surveying Vol. I,II & III, Pub: Laxmi Publication New-Delhi.
2. Kanetkar, Surveying & Levelling, Vol I & II, Geeta book store Dhanbad.
3. D.K. Jain, Mine Surveyors Competency Examination, Geeta book store, Dhanbad.
4. Winiberg, Metalliferous Mine Surveying.

MI 316 ROCK MECHANICS – I

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit - I

Status of Rock Mechanics: Role and status of rock mechanics in mining engineering; Definitions & terms used in Rock Mechanics.

Stresses and Strains: Stresses in two and three dimensions; Stress tensors; Principal stresses; Stress invariants; Displacements and strains; Stress- Strain relations; Equilibrium and compatibility equations.

Unit -II

Geological Investigation of Rock mass: Classification, identification and survey of joints; Basic geological description of rock mass; Graphical representation of joint systems; Geophysical investigation of rock mass; Rock mass classification- RQD, RSR, RMR, Q-system

Rock Indices: Specific gravity, hardness, porosity, moisture content, permeability, swell index, slake durability, thermal conductivity, point load strength index, protodyakonov strength index, impact strength index.

Unit – III

Mechanical Properties of Rocks: Compressive, tensile and shear strengths; Modulus of elasticity; Poisson's ratio and tri-axial strength; Field and laboratory determination.

Determination of in-situ strength and in situ stresses – methods and instrumentation.

Unit – IV

Theories of rock failure. Elastic and time dependent properties of rocks, Dynamic properties, Post-failure phenomenon;

Soil Mechanics: Classification of soils; Strength, consolidation and seepage of soils; Stability of waste dumps, factors affecting, monitoring and control measures.

Practical

1. Preparation of core samples as per ISRM standards.
2. Determination of compressive strength and point load index of given rock samples.
3. Measurement of Schmidt rebound hardness and its application.
4. Determination of slake durability index of given rock samples.
5. Determination of elastic properties of given rock samples.
6. Determination of tensile strength of given rock samples of by Brazilian test
7. Determination of shear strength and triaxial properties of rock
8. Measurement of core recovery and RQD from the various data collected.
9. Determination of RMR of given field data
10. Determination of Protodykonov index of given rocks
11. Determination of impact strength index
12. Determination of Schmidt hammer rebound number of various rocks.
13. Determination of moisture contents of various rocks.
14. Measurement of insitu stress with Flatjack
15. Determination of triaxial properties of various compositions of spoil dumps.

Suggested Readings

1. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company
3. B.S. Verma, Elements of Mechanics of Mining Ground. Pub. Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
4. Vutukuri & lama, Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany
5. Syd.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons
6. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics. Pub: Chapman & hall, Londaon
7. Charles Jaeger, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London
8. Manual on Rock Mechanics, Prepared by Central Soil & Materials Research Station, New Delhi, Add: Central Board of Irrigation and power Malcha Marg, Chanakyapuri, New-Delhi- 110021
9. Vail, CO; "Rock Mechanics for Industry"Proceeding of the 37th Symposium on Rock Mechanics Vol. 1-2, ISEE Publication Cleveland, Ohio

THIRD YEAR B.TECH. (VI SEMESTER)

MI 321 UNDERGROUND MINE ENVIRONMENT

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Fires: Classification of fires; Causes, detection, monitoring and control of surface and underground fires; Preventive measures; Fire fighting and inertization; Monitoring of atmosphere behind sealed- off areas; Reopening of sealed- off areas; Case histories.

Spontaneous Heating: Mechanism, causes, detection, monitoring and control of spontaneous heating in underground mines, on surface and in coal stacks and dumps; Incubation period; Preventive measures.

Unit – II

Explosions: Types, causes and mechanism of firedamp and coal dust explosions; Preventive measures; Water spraying- Stone dusting, stone-dust and water barriers; Investigations after an explosion; Case histories.

Unit – III

Mine Rescue and Recovery work: Different types of rescue equipment; Test on rescue apparatus; Rescue stations; Recovery and first-aid appliances; Training of personnel and organization of rescue station; Rescue and recovery work in connection with mine fire, explosions and other conditions. Safety chamber

Unit – IV

Mine Inundation: Causes; Precautionary measures; Precautions to be taken while approaching old workings; Burnside boring apparatus; Design and construction of water dams; Recovery of flooded mines; Dewatering of old working; Water blast: dangers and precautions.

Practical

1. Monitoring of sealed off areas and goaf fires.
2. Soda ash fire extinguishers and its application
3. CO₂ snow fire extinguishers and its application
4. Dry chemical fire extinguishers and its application
5. Reasons of spontaneous heating, its preventive measures etc in underground and at surface.

6. Designing of stone dust barrier & water barrier in underground mines
7. Study of flame safety lamp
8. Testing of methane with the flame safety lamp and estimation of the percentage.
9. Design of lamp room layout for a mine of 5000 tonnes production per day.
10. Maintenance of mine camp lamp in the laboratory.
11. Exercise with self contained breathing apparatus
12. Exercise with Filter type breathing apparatus
13. Designing of rescue stations for different conditions
14. Exercise on Illumination survey.
15. Exercise on rescuecitation.

Suggested Readings

1. G.B. Mishra, Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad
2. Donald Mitchell; "Mine Fires, Prevention, Detection fighting" ISEE Publication Cleveland, Ohio
3. Ramlu M. R.; "Mine Fires, Explosion, Recovery & Innundation", Dahnbad Publisher, Dhanbad
4. David Stone; "Minefill 2001" Proceedings of the International Symposium on Mining with Backfill" SME Publication 2001

MI 322 DIMENSIONAL STONE TECHNOLOGY

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Resources of Marble, Granite, Slate, Sandstone and Limestone as Dimensional stones in India vis a vis world, uses, marketing, export. Geological, mineralogical and physico-mechanical properties of dimensional stones; Criteria for selection of dimensional stone deposit. Procedure for obtaining mining lease and preparation of project proposal.

Unit – II

Mining: Conventional mining of Sandstone, Limestone, Marble and Granite; Recent developments- wire saw including blind cut technique, chainsaw, belt saw, hydraulic splitting, flame jet cutting, water

channeling etc; Blasting techniques in dimensional stone mines: various types of explosives used, controlled blasting for providing horizontal & vertical cut; Splitting by swelling matetrial.

Unit – III

Insitu splitting technique used in compact limestone (Kota stone) for utilization of waste as dimensional stone. Various types of loaders cranes and hydraulic excavator used in dimensional stone mines; Quarry layouts. Hole making technique using hole-finder and laser beam. Application and development of diamond tools, formation of stone block and their handling.

Unit – IV

Processing: Dressing- Mono block dresser; Sawing- gang saws, circular saws; Preparation and mounting of blades/discs and segments; slab repair by resin Polishing - Manual, Mechanical; Various types of polishing machines; Abrasives- type, use and selection, shaping; Tile preparation; Automatic tiling plant, slurry handling and treatment including water supply. Multiwire technology.

Environmental impacts of mining and processing of dimensional stones; Secondary use of quarried land and waste of the industry; Land reclamation.

Practical

1. Marble & Granite deposits, types and potentials: Indian and Global scenario
2. Flowsheet of marble processing plant.
3. Determination of physico-mechanical properties of various marbles and granites.
4. Wire saw, Chain saw & and Belt saw its operational observation at nearby mines.
5. Various methods of splitting of rock and its application.
6. Gang saw and its operations for determination of rate of cutting for various dimensional stone.
7. Various types of cranes used in dimensional stone mining and processing & their applicability
8. Various abrasives used in dimensional stone processing and their application.
9. Jet flame technique for granite mining & observation in nearby industry.
10. Blind cut and its comparison to other method.
11. Design a mechanised marble quarry in hilly terrain for 200m X 200m lease area.
12. Design a mechanized granite quarry for flat terrain deposit in a 9 hectares lease area.

13. Design a mechanized flaggy lime stone (Kota stone) quarry for flat deposit of 150m X 150m lease area.
14. Impact of various types of diamond beads in wire saw operation
15. Impact of various types of diamond segment in gang saw operation

Suggested Readings

1. Rathore S. S., Bhardwaj G. S., Jain S. C; "Dimensional Stone Technology" Himanshu Publication New Delhi
2. Rathore S. S., Laxminarayana V.; "Safety and Technology in Marble Mining and Processing in New Millennium" Proc. of National Workshop held march 10-11 200 Udaipur.
3. Rathore S. S., Gupta Y. C., Parmar R. L.; "Recent Development in Machinery and Equipment for Dimensional Stone Mining" held Dec. 13-14, 2003 at Udaipur.
4. India Stones, Business Magazine on Indian Stone Industry, Pub. ICONZ Communications, 203, Mahaveer Residency, 15 Main J. P. Nagar, 5th phase, Bangalore.

MI 323 UNDERGROUND METALLIFEROUS MINING

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit-I

Metalliferous Mining in India and World - Historical development; Trend of mining non-coal deposit in India during the last ten years; Geographical distribution of important economic non-coal mineral in India.

Overview of various stoping Methods: Factors influencing selection of stoping methods; Classification of different stoping methods. Stope layouts and stope preparation work for different stoping methods.

Unit-II

Open stoping methods: Stull mining; Breast stoping; Room and Pillar; Sub-level; Shrinkage; Blast hole; VCR stoping and their variations.

Unit-III

Supported stoping methods: Post pillar; Cut and fill and their variations; Square set; Different types of support used.

Unit-IV

Caving stoping methods: Top slicing; Sub-level caving; Block caving and their variations.

Stoping of superimposed veins and parallel ore bodies; Combined methods; Extraction of underground pillar.

Special method of mining for deep deposit and difficult mining conditions. Ore mining by Leaching.

Practicals

1. Various terms, factors influencing selection of method of work and classification of underground methods.
2. Designing sub-level stoping for a ore body width varying 10-15 mts.
3. Application of blast hole stoping and its comparison with sub-level open stoping.
4. Cut and fill methods used in different Indian deposits.
5. Application of Vertical crater retreat method of mining in moderate strength of wall rocks.
6. Sub-level caving and block caving methods for deeper deposits.
7. Square-set stoping for excavation of manganese ore deposit.
8. Application of leaching technique in ore mining.
9. Stoping techniques used in excavation of gold deposit at deeper depth.
10. Designing an under ground metalliferous mine on given geological physico-mechanical properties of rock.
11. Design of Post pillar method
12. Design of Shrinkage method.
13. Problem for mining for greater depth.
14. Design of block caving.
15. Design Sub level top slicing

Text Books/References

1. Howard, L.Hartman. Introductory Mining Engineering, Pub: John Willey & Sons.
2. Cummins & Givens. SME Mining Engineering Handbook, Vol. I & II, Pub: A.I.M.M. New-York.
3. Ramlu et al, Computer in mineral industry. Pub: Oxford & IBH, New-Delhi.
4. W.A. Hustrulid. Underground mining methods handbook, Pub: Society of mining engineers of the American Institute of Mining Metallurgical and Petroleum Engineers, Inc. New-York.

MI 324 MINE MACHINERY – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit-I

Winding: Winding system-Drum & friction winding; Mechanical and electrical braking; Ward Leonard control; Automatic winding; Winding drums- types, their construction and duty cycles; Detaching hooks, cages, skips, suspension gear, rigid and rope guides; Methods of counterbalancing loads; Multi rope winding, Winding from different horizons. Shaft fittings and head gear design;

Unit-II

Design calculation for different types of winding systems; Safety devices- depth indicators, over speed and overwind preventors, keps, slow banking and other safety devices.

Rope Haulage: Different types- their construction, operation, maintenance and design calculations. Slushers, scrapers etc.

Unit-III

Transport: Track and trackless; Mine cars; Haulage track-its laying and maintenance; Gauge selection; Mine tubs and cars-their constructional details and attachment. Low profile dumpers and shuttle cars, their construction, operation and maintenance

Mine Locomotives: Diesel, battery and electric trolley wire types- their construction, operation and application; Calculations for locomotive haulage; Man riding systems in underground mines; Mono rails; Underground loco shed layout.

Unit-IV

Conveyor Haulage: different types, their construction, installation, maintenance and design calculations; Steep angle belt conveyor, Armoured face conveyor

Aerial Ropeway - different types, their construction, installation, operation and maintenance, their layouts including rope tensioning arrangement; Loading, unloading and angle stations.

Practicals

1. Process of changing of winding rope and its requirement as per regulation.

2. Designing direct rope haulage system in moderately dipping coal seam.
3. Endless rope haulage and its designing aspects.
4. Application of Mono cable and Bi-cable rope way & its designing parameters.
5. Diesel locomotives and comparative application.
6. Battery locomotives and comparative application.
7. Trolley wire locomotives and comparative application.
8. Suspension gear arrangement of the shaft.
9. Different types of winding system and their comparative application.
10. Application of various types of detaching hooks.
11. Various types of guides in winding.
12. Belt conveyors with their design parameters used in mines.
13. Scraper chain conveyors with their design parameters used in mines.
14. Shaker conveyors with their design parameters used in mines.
15. Exhaust conditioner

Text Books/References

1. M.A. Ramlu. Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi.
2. Kerelin. Mine Transport. Pub:- Orient Longmans Ltd. New Delhi.

MI 325 MINING GEOLOGY – III

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit-I

Geological Mapping: Definition of map, scale of map, types, map symbols; Surface and underground geological mapping. Computer based geological data plotting and preparation of map.

Assaying: Wet and dry methods, spectro-photometry, flame photometry and atomic absorption spectro-photometry.

Unit-II

Sampling and reserves estimation: Definition of sampling, methods and importance in mining; Mine sample reduction; Quality control; Total Quality. Definition of reserve, classification and estimation by conventional and geo-statistical techniques.

Role of geological parameters for physical scale and mathematical modeling for maintaining the slope.

Unit-III

Prospecting and Exploration: Definition, kind and degree of exploration; Geological, geophysical, geo-chemical and remote sensing methods. Geological factors consider for excavation viz rock related factors, structures, seismicity, special effects of faults i.e fault act as a ground water barrier, ground water conduit, sub surface drains and influence of ground water flow systems on rock excavations.

Unit-IV

Study of important metallic, nonmetallic and fuel minerals of India. Their geographical distribution, mode of occurrence, economic importance giving emphasis on occurrences in Rajasthan. Metallic minerals i.e. Lead, Zinc, Copper, Iron, Nickel, Gold, Aluminum, Manganese, Tungsten, Uranium; Non-Metallic minerals i.e. Limestone, Talc, Rock-Phosphate, Gypsum, Kyanite, Marble, Granite, Sandstone, Garnet, Corundum, Diamond, Fluorite, Quartz, Feldspar, Calcite, Topaz, Kyanite, Olivine; Fuel minerals i.e. Coal, lignite and Petroleum. Definition, composition, properties, origin, theories of migration of petroleum, structural features of coal seams; Fuel mineral resources of Rajasthan.

Practicals

- Find the width of ore body with the help of outcrop observations in the following topographic conditions:
 - On horizontal ground
 - Slope of ground opposite to the dip of the ore body.
 - Ground slopping in the same direction as dip of the ore body.
- Find out inclination and slope of ore body with the help of three-point method.
- Determination of apparent dip of ore body from true-dip with the help of stereo-net.
- Ore body outcrop compilation in given geologic map.

- Minerals under microscope.
- Rocks under microscope.
- Exercises related to ore reserve estimation.
- Preparation of assay plan.
- Determination of resistivity of ground/ sub surface rocks with the help of resistivity meter.
- Determination of magnetism of ground/ sub surface rocks with the help of magnetometer.
- Interpretation of Ariel photographs with the help of stereoscope.
- Plotting of geologic sections with the help of surface geological plan of the area.
- Interpretation of the satellite imagery.
- Analysis of major oxide percentage with spectro-photometric.
- Plotting of symbols in geologic map.

Text Books/References

- T. Bolton. Geological Maps, their solution and Interpretations, Cambrige Uni.Press
- S. Sinha Roy. Geology of Rajasthan, Geological Society of India, Bangalore.
- Krishnaswamy. Indias mineral resources, Oxford Pub.
- Dobrin Geophysical exploration.
- Mckinstry. Mining geology, Prentice Hall.

MI 326 ROCK MECHANICS – II

Cr. Hrs. 4 (3 + 1)

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Stress State: Stress distribution around narrow and wide openings (single and multiple).

Rock reinforcement: Introduction to local and mass support system, Design of support systems in shafts, systematic supports in headings, junctions, depillaring areas, gates, long wall faces and stopes; bolting;

Shot-creting & guniting. Cable bolting, filling & pillar as mass support system, pressure on supports.

Unit – II

Deformation and related instrumentation: Measurement of rock movements and interpretation of data; Load cells, convergence recorders, bore hole extensometers and borehole cameras.

In situ and induced stresses and their measurement. Basics of numerical methods in geomechanics with applications.

Unit – III

Subsidence: Mechanics of surface subsidence; Factors affecting subsidence; Sub-critical, critical and super-critical widths of extraction; Discontinuous and continuous subsidence; monitoring, prediction, control and management of subsidence.

Rock Bursts: Rock bursts and bumps; Mechanism of occurrence, prediction and control.

Design of shaft pillar, Tunnels and Caverns.

Unit – IV

Caving: Mechanics of caving; Cavability of rocks; Caving height.

Slopes: Types of slope failure; Analysis of slope failure; Factors affecting slope stability; Drainage and reinforcement of slopes; Monitoring of slopes.

Practical

1. Bore hole extensometer and measurement of displacement with its help.
2. Measurement of strain by tape extensometer.
3. Load cell and measurement of convergence.
4. Flat jack method and measurement of in situ stress.
5. Determination of ground vibrations with Blastmate III instrument and its effect on designing slopes.
6. Factors influencing the stability of slope. Design for maintaining of slope in adverse conditions.
7. Mechanics of caving in metalliferous mine.
8. Mechanism of subsidence and factors influencing it.
9. Mechanism of rock burst and bumps and factors influencing it.
10. Design of shaft pillar in hard and soft strata conditions.
11. Shotcreting method of support - principle, application etc.
12. Design of support system.
13. Application of cable bolting.

14. Factors influencing the stability of waste dump.
15. Application of numerical methods in geomechanics.

Suggested Readings

1. Obert & Duall, Rock Mechanics and design of structures in rock. Pub: John Willey & Sons.
2. Railey & Dalley, Experimental stress analysis. Pub: McGraw Hill Book Company.
3. B.S. Verma, Elements of Mechanics of Mining Ground. Pub. Tuhin & Co., E-1898(MIG) Rajajipuram, Lucknow, U.P.
4. Vutukuri & lama, Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany.
5. S.S.Peng, Coal Mine Ground Control. Pub: John Willey & Sons.
6. J.C. Jeager & NGW Cook, Fundamentals of Rock Mechanics. Pub: Chapman & hall, London.
7. Charles Jaeger, Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London.
8. Manual on Rock Mechanics, Prepared by Central Soil & Materials Research Station, New Delhi, Add: Central Board of Irrigation and power Malcha Marg, Chanakyapuri, New-Delhi- 110021.
9. B. Singh, Mine Subsidence.
10. Z.T. Bieniawski, Rock Mechanics Design in Mining and Tunneling, Pub: A.A. Balkema, P.O. Box 1675, 3000 BR Rotterdam, Netherlands.
11. Hoek E. and Brown, E.T. Underground excavations in Rock, Institutions of Mining and Metallurgy, London.
12. Brown, E.T., Rock characterization, testing and monitoring – ISRM suggested method, Pergamon Press, Oxford.
13. William A. Hustrulid (Editor), Slope Stability in Surface Mining.
14. Hoek and Bray, Rock slope Engineering, Taylor & Francis.

FOURTH YEAR B.TECH. (VII SEMESTER)

MI 411 MINE LEGISLATION AND SAFETY

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

General Principles of Mining Laws. Post Independence trend of changes.

Principal provisions of Mines and Minerals (Development and Regulation) Act & Mineral Concession and Development Rules.

Unit-II

Mines Act 1952 with upto date amendments

Mines Rules 1955 with upto date amendments

Coal Mines Regulation 1957 with upto date amendments

Metalliferous Mines Regulations 1961 with upto date amendments

Unit-III

Principal provisions of rescue rules, pit head and bath rules, creche rules , mine vocational training rules, explosive rules(related to mines); Electricity rules applicable to mines and oil fields.

Principal provisions of industrial dispute act, workmen's compensation act, trade union act, payment of wages act and minimum wages act.

Important technical circulars issued by DGMS.

Unit-IV

Accident, Health and Safety: Classification of accidents- statistics causes and prevention of accidents; Costs of accidents; Major accidents enquiry reports; Health of workmen Comfort conditions; Occupational diseases-their causes,nature and prevention.

Rescue rules; Legal requirements.

Text Books/References

1. P. Seshagiri Rao. Law of Mines & Minerals. Pub: Asia Law House, Hyderabad.
2. Rakesh & Prasad. Legislation in Indian Mines Vol. I & II. Pub: Mrs. Asha Lata Varanasi
3. Classified Mine Circulars Issued by DGMS (Compiled)
4. Relevant Act. Rules and Regulations, Published by Govt. of India

MI 412 MINE MANAGEMENT**Cr. Hrs. 3 (3 + 0)**

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit – I

Management: Principles of Scientific Management; Organization, Planning and control. Forms of Business Organization: Private and public enterprises with special reference to mining of minerals. Basic Principles of Trade unionism, Trade union activities w.r.t. mining in India, Major trade union bodies

Disputes: Types of disputes between contractors and owners, between workers and owners; Methods of avoiding and resolving disputes.

Unit – II

Network Analysis: CPM, PERT and Work scheduling.

Work Study: Time and motion study; Methods of improving productivity; Improving productivity; Improving working environment, welfare measures, incentives and penalties.

Unit – III

Inventory: Systems of inventory control; Methods of minimizing inventory.

Purchasing and Tendering: Purchase procedures in public sector; Preparation of tender documents; Tender completion formalities; Consideration of bids and finalization of purchase order.

Project Monitoring: Monitoring techniques; Management Information Systems (MIS).

Unit – IV

Introduction to system concept: System design; System analysis; Planning sub systems; Production sub-systems; Decision making process; Mining system and sub system; Perspective planning for a mineral community; Salvaging and transfer of equipment; Reallocation of manpower.

Suggested Readings

1. Banga & Sharma: Engineering Economics and Industrial Organisation. Pub: Khana Publishers, New-Delhi
2. V.L. Mote, Samuel Paul and G.S. Gupta. Managerial Economics, Concepts and Cases,
3. Memoria & Agarwal, Industrial Organisation, Pub: M/S Jain Brothers, Delhi.
4. Khana, O.P., A text book of Work Study. Pub: M/S Dhanpatrai & Sons, Delhi.
5. Jain, S.P. Industrial & Labour laws. Pub: M/S M/S Dhanpatrai & Sons, Delhi

MI 413 MINE MACHINERY – III**Cr. Hrs. 4 (3 + 1)**

	L	T	P
Credit	3	0	1
Hours	3	0	2

Unit – I

Pumps and Pumping: Principal types, construction, operation and characteristics; Calculation of size and efficiency; Installation, operation care and maintenance; Frictional resistance; Installation in shafts and roadways; Damage due to corrosion and abrasion, and precaution; Cleaning and replacement of pipes; location and design of mine sumps.

Unit – II

Mineral Handling: Layouts of pit-top and pit-bottom; Details of banking; Mineral handling and screening equipment; Creepers; Tipplers; Layouts of railway siding of mines; Storage bunker. Pit bottom installations and circuit with cage and skip systems.

Unit – III

Maintenance: Preventative and predictive maintenance; Condition monitoring; Workshops.

Automation and remote control of mining equipment.

Signaling: Safety regulations and different signaling systems in mines.

Unit – IV

Mine Illumination system: Flame safety lamps and electric lamps; Construction, examination, testing and maintenance; Underground lighting from mains; Illumination survey; Conventional and photographic methods. Recent advances in Mining cap lamp

Practical

1. Turbine pump with constructional details and characteristic curves.
2. Design of mine pump with its installation, care and maintenance.
3. Design of water dams with their locations in mines.
4. Burnside boring apparatus and its application.
5. Types of signaling systems used in mines for modern system of hoisting.
6. Pit-top layout with shaft for handling 3000 tonnes production per day.
7. Pit-top layout with direct rope haulage.
8. Designing of various pit-bottom layouts.
9. Application of creeper and tippler in mineral handling.
10. Design of mine sumps and their selection of site in mines.

11. Planning and scheduling of maintenance of machinery used in mines.
12. Layout of muck movement through ore passes bunkers, u/g crusher and shaft.
13. Railway siding layout.
14. Problem for pit bottom arrangement for coal mining.
15. Automation in mineral handling.

Suggested Readings

1. Rakesh & Lele, Water problem in mines. Pub: Dhanbad Publisher.
2. Rakesh & Lele, Selection, Installation and Maintenance of mine pumps. Pub: Dhanbad Publisher
3. M.A. Ramlu, Mine Hoisting. Pub: Oxford & IBH Publishing Co. Pvt.Ltd. New Delhi

MI 414 MINERAL PROCESSING

Cr. Hrs. 4 (3 + 1)

L	T	P
Credit 3	0	1
Hours 3	0	2

Unit-I

Scope, object and limitations of Mineral Dressing; Role of microscopic study.

Communitation and Liberation: Theory and practice of crushing & grinding; Conventional units used-their fields of application and limitation.

Sizing and Classification: Laws of setting of solids in fluid; Laboratory methods of sizing and interpretation of sizing data; Industrial sizing by screens; Types of classifiers; Classification as means of sizing by screens.

Unit-II

Gravity concentration Methods- Jigging, Flowing film concentration like spirals and shaking table, Heavy Media separation; Theory, applications and limitations of each method; Introductory Froth Flotation, physico-chemical, principles underlying flotation-reagents, flotation machines; Flotation of sulphides, oxides and non-metals.

Unit-III

Electrical Methods of Concentration: Electrostatic and magnetic methods, their principles of operation, fields of application and limitations.

Dewatering and drying: Thickening, filtration and drying.

Coal washing: coal washability, crushing, sizing and cleaning of coal.

Unit-IV

Sampling: Importance and methods used in ore-dressing.

Simplified Flow Sheets: Beneficiation of coal and simple ores of copper, lead, zinc, Iron and manganese with reference to Indian deposits.

Practicals

1. Jaw crushers and their comparison.
2. Roll crushers and their comparison.
3. Gyratory crushers and their comparison.
4. The ball mill and its application.
5. Various types of classifiers.
6. Determination of various sized product with sieve shaker.
7. Concept and apparatus of froth flotation.
8. Process of thickening & filtration.
9. Wilfrey table
10. Filter press
11. Laboratory jig.
12. Flowsheet of lead-zinc ore (Zawar).
13. Flowsheet of copper ore (Khetri).
14. Flowsheet of Gold, Iron ore, Manganese ore,
15. Flowsheet of coal washing.

Text Books/References

1. M.A. Gaudin. Mineral Dressing.
2. H.G. Vijendra. Handbook on Mineral Dressing. Pub: Vikas Publishing house New-Delhi
3. S.K. Jain. Mineral Dressing.
4. Rao. Mineral Dressing.
5. H.G. Vijendra. Hand book on mineral dressing. Pub: Vikas Publishing House, 576, Masjid Road, Jangpura New-Delhi 110014

MI 415 ENVIRONMENTAL MANAGEMENT IN SURFACE MINES

Cr. Hrs. 4 (3 + 1)

L T P

Credit 3 0 1

Hours 3 0 2

Unit-I

Man and Mine Environment: Changes of social environment caused by mining; Socio-economic factors; Occupational health hazards due to mine dust, poor lighting and ventilation, noise and vibration, trace elements, radioactive emission, Impact of surface subsidence.

Unit-II

Air and Water pollution: Sources, ill effects, measurement and monitoring, standards; Preventive and mitigating measures.

Dust in mines: Dangers, formation, prevention and suppression; Dust sampling apparatus, their construction and applications.

Noise and Vibration: Sources, ill effect, measurement and monitoring, standards; Preventive and mitigating measures.

Unit-III

Acid Mine Drainage: Sources, mechanism of formation and ill effects; Preventive and mitigating measures.

Land Reclamation: Re-vegetation and restoration methodologies; Plant species selection; Case studies of coal and metalliferous mine dumps/spoils.

Unit-IV

Environmental Management: Factors to be considered, EIA, EMP preparation, Mine Closure Planning.

Environmental laws and acts; Main provisions of Environmental Protection Act 1986, Forest Conservation Act 1980 and Forest Conservation Rules 1981 related with the Mining.

Practicals

1. Occupational health hazards and their remedial measures.
2. Standards for water, air, noise, dust etc. and their impact when found in excess.
3. Measurement of dust contents with the help of dust sampler.
4. Measurement of dust by instruments used in mines.
5. Sound level meter and measurement of noise level produced by various mining machineries.
6. Measurement of vibration with the help of Blastmate series III seismograph.
7. Reclamation of dumps for mechanized opencast mines.
8. Preparation of EMP of mines, collection of various fields data and their evaluation.
9. Measurement of vibrations produced in mines by seismograph.

10. Measurement of pH value of water samples collected from mine discharge and analyzing its adverse effects.
11. Gravimetric dust sampler
12. Preparation of EIA
13. Sound level measurement
14. Problem for Acid mine drainage
15. Case study of reclamation and valley filling.

Text Books/References

1. Dr. B.B. Dhar. Environmental Management of Mining Operations. Pub
2. Proceeding of the National & International Seminars/Symposium organized in concern with mine environment
3. Rekha Ghosh, D. S. Chatterjee. "Environmental Geology" Capital Publishing Co. New Delhi
4. David Stone. "Minefill 2001" Proceedings of the International Symposium on Mining with Backfill" SME Publication 2001.

MI 416 MINE COMPUTING LAB – II

Cr. Hrs. 1 (0 + 1)

L T P

Credit 0 0 1

Hours 0 0 2

1. Programs related with strain and stress analysis of rocks.
2. Slope stability analysis and simulation.
3. Pillar design problem for underground mines.
4. Design of mine opening.
5. Subsidence prediction of underground coal mines.
6. Detailed planning by Datamine/ Surpac software of massive deposit
7. Detailed planning by Datamine/ Surpac software of vein type deposit
8. Computer analysis of data collected during survey camp.
9. Design a optimum blast for lime stone quarry.
10. Design of a pumping system for a u/g mine.
11. Design of support system in U/G mining.
12. Design of stope with various field condition.
13. To prepare a program for designing a drift for metalliferous mining.
14. Optimization of Shovel-Dumper operation.
15. Design of mine ventilation system
 - (a) Calculation of air quantity
 - (b) Equivalent resistance of mines.

(c) Calculation of relative humidity etc

FOURTH YEAR B.TECH. (VIII SEMESTER)

MI 421 MINE ECONOMICS AND FINANCIAL MANAGEMENT

Cr. Hrs. 3 (3 + 0)
L T P
Credit 3 0 0
Hours 3 0 0

Unit – I

Introduction: Economic importance of the mining industry; mining economy; risky nature of the mining industry; the state and the mining industry; Marketing and export of minerals; National mineral policy;

Loss of mineral in Mining: Classification and incorporation of losses, coefficient of recovery of mineral extraction; Dilution and recovery.

Unit – II

Mine examination and Valuation: Examination and report on mines/mineral properties; valuation of mines/mineral properties; present value and its computation; ore value and profitability of mining; recoverable value.

Cost of Mining: Capital and operating cost, factor affecting operating cost, method of estimating future costs; computation of cost of development and stoping operation.

Unit – III

Financial Management: Finance function and objectives of a firm. Generally accepted accounting principles (GAAP); Scope of financial management.

Financial Statements: Nature and limitations of financial statements. Interpretation of financial statements. Uni-variate and multivariate ratio analysis. Limitation of ratio analysis.

Cost analysis: Various cost concept; Cost-Volume-Profit analysis; Break-even analysis; Cost indifference point. Decision making with the cost data. Cost and budgetary control.

Unit – IV

Financial Analysis: Revenue and mining costs; Taxes and royalties; Net Present Value (NPV); Internal Rate of Return (IRR); Effect of inflation on NPV of a project; Sensitivity analysis.

Capital-its importance, various forms, formation and processes of formation; Raising capital.

Mine accountancy and book keeping

International investment and trade in mineral materials and products.

Suggested Readings

1. Park , A text book of Mine Valuation..
2. W.A. Hustrulid, Underground Mining Methods Handbook.
3. Rendu, An Introduction to Geostatistical Methods of Mineral Evaluation.
4. R.T. Deshmukh, Mine Economics.

MI 422 MINE PLANNING AND DESIGN

Cr. Hrs. 4 (3 + 1)

L T P
Credit 3 0 1
Hours 3 0 2

Unit – I

Feasibility study: Its function and preparation of feasibility report for metallic and non-metallic minerals.

Minerals inventory and ore reserves;

Unit – II

Different types of underground mining methods as per the organizational and technical parameters;
Determination of size of mine, life of mine and production rates .

Design for mining the mineral deposits by open-pit mining, under ground mining and the combination of both; The ultimate open pit profile based on physical and economical parameters; Optimum pit design.

Unit – III

Division of underground mine into parts, levels and panels;
Determination of level interval; Size of long wall faces.
Stope design-the basic concepts,

Different planning stages- micro and macro planning, Project scheduling.

Unit – IV

Computer applications; Information systems; Information technology

Design for mining mineral deposits by underground mining.

Production planning: Selection of machines; Haul road design; Optimum load haul system; Optimum blast design.

Practical

Each practical is computer based.

1. Estimation of ore reserve based on bore hole data of lime stone deposit.
2. Estimation of ore reserve based on bore hole data of Iron ore deposit
3. Estimation of ore reserve based on bore hole data of Bauxite deposit
4. Estimation of ore reserve based on bore hole data of Lead zinc deposit
5. Design of drive in a lead zinc mine.
6. Design of Raise/ winge in a lead zinc mine.
7. Design of shaft in a lead zinc mine.
8. Design of box cut in an o/c mine.
9. Design of haul road.
10. Problem related to ultimate slope in o/c mine.
11. Problem for shovel dumper combination.
12. Design of length of long wall face.
13. Problem related to scheduling
14. Optimum blast design. For o/c mine.
15. Optimum blast design. For u/g mine.

Suggested Readings

1. W.Hustrulid & Kuchta, Open Pit Mine Planning and Design
Vol & I. Pub: A.A. Balkema
2. W.A. Hustrulid, Underground Mining Methods Handbook

3. Cummins and Gievens; SME Handbook.Pub: Society of Mining Engineers of the American Institute of Mining , Metallurgical, and Petroleum Engineers, Inc New York

ELECTIVE - I

MI 423 (a) ROCK FRAGMENTATION

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit – I

Present status of drilling and blasting practices in India and abroad: Methods of drilling; Different types of machines; Hydraulic drills; Long hole drilling; Novel methods of drilling; Choice of drills.

Unit – II

Variables in drilling; Machines of drilling; Drillability of rocks; Boring in rocks.

Study of bit life, cost of drilling, hole diameter, pull down weight, joints etc. in relation to BHD and rock characteristic; Trouble shooting; Diagnosis of problems in drilling.

Unit – III

Emerging trends in explosives, initiating system and blasting techniques; Mechanics of blasting, Blast round design & influence of controllable and non controllable parameters on blasting, Fragmentation assessment and monitoring, Instrumentation and software application for design of blast round, monitoring and assessment of rock fragmentation. Hot hole blasting, Stemming plug.

Unit – IV

Blasting damages – Micro and macro level damages due to blasting; Ground vibrations, flyrock and air over pressure; Wall control, Blast casting; Demolition blasting, Nuclear blasting; Destress blasting; Safety during blasting,

Suggested Readings

1. Dr.Sushil Bhandari, Engineering Rock Blasting Operations. Pub: A.A.Balkema Publisher Old post Road, Brook field, VTO5036, USA.
2. C.P. Chugh, High Technology in Drilling and Exploration, Pub: Oxford & IBH, New Delhi.

MI 423 (b) ROCK ENGINEERING

Cr. Hrs. 3 (3 + 0)

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Slope design: Basics mechanics of rock and spoil slope failures; Parameters for stability analysis; Design of slopes; Reinforcement of rock slopes and monitoring of slopes.

Unit-II

Design of mine excavations like drifts, shafts and stopes; Pillar design; Theories of roof failures of small and large excavations; Cavability of ore and stratified deposit.

Mining subsidence, bumps and rock burst, destressing to control rock bursts.

Unit-III

Drillability of rocks; Mechanics of rotary and percussive drilling; Design of drills; Drill bits for optimum penetration; Parameters affecting rate of penetration; Effect of flushing medium on drill performance.

Unit-IV

Rock reinforcement; Estimation of support requirements of underground excavation.

Mechanics of rock breakage in blasting; Influence of rock properties; Controlling damage.

Text Books/References

1. Dr. Sushil Bhandari. Engineering Rock Blasting Operations. Pub: A.A. Balkema Publisher Old post Road, Brook field, VTO5036, USA.
2. Obert & Duall. Rock Mechanics and design of structures in rock. Pub: John Willey & Sons.
3. Railey & Dalley. Experimental stress analysis. Pub: McGraw Hill Book Company.

MI 423 (c) COMPUTER AIDED MINE DESIGN**Cr. Hrs. 3 (3 + 0)**

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Computer Graphics: Display devices- Refresh Cathode- Ray tubes, Random-Scan and Raster scan monitors, color CRT monitors, three dimensional monitors; hard copy devices; interactive input devices; display processors; graphic software.

Unit-II

Output primitives: Points and lines; DDA and Bresenham's line algorithms; Antialiasing lines; Line command; Fill areas; Bresenham's algorithm for drawing circle and ellipse; other curves; Different attributes to output primitives; Interactive picture-construction techniques.

Unit-III

Two dimensional transformation: Translation, scaling and rotation; Matrix representation; Composite transformation; Concatenation properties; Mirroring, reflection, windowing and clipping; viewport.

Unit-IV

Optimization of location of Mining facilities. Application of O & M. techniques in mining: Mathematical programming: Queing theory, Replacement theory, Optimal production planning and scheduling, Optimization of mine field, mine capacity and other mining parameters.

Text Books/References

1. W. Hustrulid & Kuchta. Open pit Mine Planning and Design Vol. I & II, Pub. : A.A. Balkema.
2. Banga and Sharma. Engineering Economics and Industrial Organisation. Pub. : Khanna Publisher, New Delhi.
3. Sukumar Bandopadhyay. Application of computers and operation Research in Mineral Industry. Proceeding of 30th International Symposium, 2002.

MI 423 (d) ADVANCES IN MINE VENTILATION**Cr. Hrs. 3 (3 + 0)**

	L	T	P
Credit	3	0	0
Hours	3	0	0

Unit-I

Advanced treatment of Air flow in Mines; Thermodynamics considerations; Instrumentation and monitoring in mine ventilation and air conditioning.

Unit-II

Planning and design of mine ventilation systems, network theory and analysis by digital computer, heat flow from rocks. Mine heat load calculation. Design of refrigeration and air conditioning systems in mines. Degasification of coal mines.

Unit-III

Leakage, re-circulation and reversal of air flow. Methane drainage- control and case studies, Network analysis- controlled flow models by CPM.

Unit-IV

Natural splitting problems by Hardy-Cross and other techniques, Environmental monitoring and automatic control systems.

Text Books/References

1. G.B. Mishra. Mine Environmental Engineering. Pub: Dhanbad Publisher, Dhanbad.
2. L.C. Kaku. Numerical Problems on Mine Ventilation. Pub: Punam Publisher.
3. Mutmansky & Weng. Mine ventilation & Air conditioning. Pub: John Willey & Sons.

MI 423 (e) MAINTENANCE MANAGEMENT

Cr. Hrs. 3 (3 + 0)
L T P
Credit 3 0 0
Hours 3 0 0

Unit-I

Introduction: General objectives, Functions; Organization and administration of maintenance systems; Requirements, Concepts and structure of suitable organizations for maintenance systems.

Failure Analysis: Analysis for source identification, classification and selectivity of failure; Statistical and reliability concepts and models for failure analysis.

Unit-II

Classification of maintenance systems; Basis and models for various maintenance systems.

Cost management for maintenance: cost estimates- recording, summarizing and distributing cost data, maintenance budget.

Unit-III

Decision models for maintenance planning; Operation and control, optimum level of maintenance; replacement aspects of breakdown and preventive types, group and individual types, obsolete facility, deteriorating and completely failing facilities, replacement vs. reconditioning, economics of overhaul, addition replacement model-additive damage case, zero memory case, partially observed situation, planning horizon procedure. Spare planning and control: static spares, insurance spares with and without salvage value, low moving spares; man power planning-crew size, allocation etc. stand by machines; economical and operational aspects; scheduling planning of activities, monitoring and updating, resource allocation, Assigning priorities.

Unit-IV

Other relevant topics: work measurement for maintenance, maintenance control indices, maintenance service contract, preventive maintenance management-guidelines, procedure, general management of lubrication system, organizing preventive maintenance program using vibration signature analysis-some basic ideas, management of records for maintenance, computerization of maintenance activities, major plant shut-down procedures.

Text Books/References

1. L.T. Higging, L.C. Morrow. Maintenance Engineering Handbook, McGraw Hill (1977).
2. B.T. Newbrought. Effective maintenance management, McGraw Hill (1967).

ELECTIVE - II

MI 424 (a) EXPERIMENTAL STRESS ANALYSIS

Cr. Hrs. 3 (3 + 0)

L T P

Credit 3 0 0
Hours 3 0 0

Unit-I

Importance of experimental methods, similitude laws and design of experiments, some simple measuring instruments,

Unit-II

Bagg's deformeter. Strain gauges-principles and applications: Mechanical, optical and electrical strain gauges; semi-conductor strain gauges; strain recording instruments.

Unit-III

Photo-elasticity-two dimensional stress analysis, principles and applications, Moir's techniques, three dimensional stress analysis.

Unit-IV

Non-destructive testing, Brittle coatings. Some application of experimental stress analysis and research, design and field problems.

Text Books/References

1. Obert & Duall. Rock Mechanics and design of structures in rock. Pub: John Willey & Sons.
2. Railey & Dalley. Experimental stress analysis. Pub: McGraw Hill Book Company.
3. Vutukuri & lama. Handbook of Mechanical properties of rock Vol.I&II. Pub: Transtech, Germany.
4. Syd.S.Peng. Coal Mine Ground Control. Pub: John Willey & Sons.
5. J.C. Jeager & NGW Cook. Fundamentals of Rock Mechanics. Pub: Chapman & hall, Londaon.
6. Charles Jaeger. Rock Mechanics & Engineering. Pub: Cambridge University Press, Cambridge London.
7. Manual on Rock Mechanics, Prepared by Central Soil & Materials Research Station, New Delhi, Add: Central Board of Irrigation and power Malcha Marg, Chanakyapuri, New-Delhi- 110021.

MI 424 (b) NUMERICAL METHODS

Cr. Hrs. 3 (3 + 0)
L T P
Credit 3 0 0
Hours 3 0 0

Unit-I

Introduction to Elastic Rock Models: Fundamentals; Elastic, homogenous isotropic, non linear elastic and elasto-plastic models.

Unit-II

Finite Element Method- the concept, formation of mesh elements and finite difference patterns solution; Discretization and element configuration; Element stiffness, assemblage and solution.

Unit-III

Boundary element method: The concept, discretization, different methods of solution for isotropic and infinite media.

Unit-IV

Practical application of above methods.

Text Books/References

1. Charles Jeager. Rock Mechanics & Engineering, Pub. : Cambridge Univ. Press, London.
2. Railey & Dalley. Experimental Stress Analysis, Pub. : McGraw Hills Book Company.
3. Z.T. Bieniawski. Rock Mechanics Design in Mining & Tunneling. Pub. : A.A. Balkema.
4. L.U. Hy. Numerical Modeling of Rock fracture process under Mechanics Loading, Lulea Uni. of Technology.

MI 424 (c) ADVANCED MINERAL EXPLORATION

Cr. Hrs. 3 (3 + 0)
L T P
Credit 3 0 0
Hours 3 0 0

Unit-I

Basic Principles of Remote Sensing,, Remote Sensing Platforms, Sensors and Space Program.

Electromagnetic Radiation (EMR) and their characteristics with relevance to remote sensing, satellite orbits and Measurement

strategies, atmospheric effects in remote sensing data sets, spectral reflectance properties of earth's surface features.

Unit-II

Aerial remote sensing: Cameras, films and their characteristics, multi-band photography and its advantages. Principles of photo processing, Elements of photogrammetry, Elements of GIS and GPS

Unit-III

Digital Image Processing, statistical techniques adopted on remotely sensed data, Analysis, Image classification

Application of GPR in Mining: Various types, antennas types, softwares used for GPR data interpretation.

Unit-IV

Digital Elevation Modeling, Resources mapping and monitoring, Data integrity and spatial up scaling for process studies, Land use, Drainage analysis, Rock identification, Terrain interpretation, Mineral exploration, Geo-environmental application Forestry.

Text Books/References

1. T.S. Chouhan and K.M. Joshi. Applied Remote sensing and photo interpretation, Vigyan Prakashan Jodhpur. (1996)
2. T.M. Lillesand and K.W. Kiefer. Remote sensing and image interpretation, John Wiley and Sons, 1992.
3. F.F. Sabbins. Remote sensing-Principles and Interpretation, W.H. Freeman & Co., San Fransico, USA (1987)

MI 424 (d) ADVANCE MINERAL PROCESSING

Cr. Hrs. 3 (3 + 0)

L T P
Credit 3 0 0
Hours 3 0 0

Unit-I

Fluid -particle mechanics, Terminal settling velocity, Equal settling particle, Hindared settling, Types of classifiers: hydraulic, mechanical etc. and their performance characteristics, Classifiers efficiency, Selectivity index, Dense medium separation: no material used for

suspensions, Separatory vessels and their relative merits and demerits. Hydrocyclone ; mechanism of separation, concepts of DSO.

Unit-II

Flocculation and thickening. Design features of thickeners, flowing-flow concentration, wilfley and other types of tabling operation, Vannars and their application. Jigging: mechanism, cycle, variables in operation etc. Baum, Harz and other types of Jigs.

Unit-III

Dewatering and drying. Filtration: pressure and suction filters, their relative merits and demerits, filter and filtration cycle, rate of drying,. Compartment, rotary and other types of dryer and their operational features.

Unit-IV

Magnetic separation, Paramagnetic and diamagnetic substances. Industrial magnetic separators and their performance criteria. Electrical separation of minerals; Electrostatic and electrodynamic methods, Plate and roll type separators. Factor affecting the design of high tension roll separators. Electrostatic precipitation. Single and two stage separations. Operational features of ESMS such as cottrell precipitator.

Text Books/References

1. M.A. Gaudin. Mineral Dressing.
2. H.G. Vijendra. Handbook on Mineral Dressing.
Pub: Vikas Publishing house New-Delhi.
3. S.K. Jain. Mineral Dressing.
4. Rao. Mineral Dressing.