

STUDY AND EVALUATION SCHEME FOR  
COMMON TO THREE YEAR DIPLOMA COURSE IN  
(1) CIVIL ENGG.  
(2) CIVIL ENGG. (RURAL ENGG.)  
(3) CIVIL ENGG. (ENVIRONMENTAL POLLUTION & CONTROL)  
(4) CIVIL ENGG. (WATER RESOURCES)

(Effective from the session 2006-2007)

I YEAR :

Curriculum						Scheme of Examination										
Periods Per Week						S U B J E C T	Theory				Practical			Grand Total		
Le. c.	Tut. ori al	Dr. aw	Lab	Work Shop	Tot al		Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Sess. Marks	Total Marks	Grand Total			
3	-	-	2	-	5	1.1 Professional Communication	2.5	50	20	70	3	20	10	30	100	
3	2/2	-	-	-	4	1.2 Applied Mathematics-I	2.5	50	20	70	-	-	-	-	70	
3	2/2	-	2	-	6	1.3 Applied Physics	2.5	50	20	70	3	40	20	60	130	
3	-	-	2	-	5	1.4 Applied Chemistry	2.5	50	20	70	3	40	20	60	130	
2	2/2	-	2/2	-	4	1.5 Applied Mechanics	2.5	50	20	70	3	40	20	60	130	
-	-	8	-	-	8	1.6 Engineering Drawing	3.0	50	20	70	-	-	-	-	70	
1	-	-	3	-	4	1.7 Computer Application For Engineering	-	-	-	-	3	60	30	90	90	
-	-	-	-	8	8	1.8 Workshop Practice	-	-	-	-	4	60	30	90	90	
2	-	-	-	-	2	1.9 Building Material	2.5	50	20	70	-	-	-	-	70	
-	-	-	2	-	2	1.10 Civil Lab-I (Building Material Testing Lab)	-	-	-	-	3	50	20	70	70	
17	3	8	12	8	48	<-----TOTAL----->	-	350	140	490	-	310	150	460	950	
														Games/NCC/Social and Cultural Activities + Discipline ( 30 + 20)		50
														TOTAL		1000

- NOTE: (i) Each period will be of 50 minutes duration.  
(ii) Each semester will be of 32 weeks.  
(iii) Effective teaching will be atleast 25 weeks.  
(iv) Remaining periods will be utilized for revision, etc.  
(v) SI system of units shall be used in each subject.  
(vi) \* As for as possible Building Material and Civil Engg. Lab.-I must be allotted to same teacher.  
(vii) For community development work see annexure-I

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(Effective from the session )

II YEAR :

STUDY SCHEME						S U B J E C T S	SCHEME OF EXAMINATION								
PERIODS PER WEEK							T H E O R Y				P R A C T I C A L				
Lect	Tut.	Dra	Pract	W/s	Total		Examination	Sessl	Total	Examination	Sessl	Total	Grand		
		-w				-----	Marks	Marks	-----	Marks	Marks	Total			
							Dur.	Marks		Dur.	Marks	Marks	Total		
3	-	-	-	-	3	2.1. Ele.Elect.& Mech. Engg.	2.5	50	20	70	-	-	-	70	
3	1	-	2	-	6	2.2. Strength of Material	2.5	50	20	70	3	40	20	60	130
3	1	-	2	-	6	2.3. Hydraulics	2.5	50	20	70	2	30	15	45	115
3	-	-	2	-	5	2.4. Public Health Engg.	2.5	50	20	70	3	60	30	90	160
3	-	-	2	-	5	2.5. Soil Mechanincs & found.Engg	2.5	50	20	70	-	-	-	70	
3	-	-	2	-	5	2.6. Building const. & Maint.Engg	2.5	50	20	70	-	-	-	70	
2	-	-	2	-	4	2.7. Concrete Technology	2.5	50	20	70	-	-	-	70	
-	-	8	-	-	8	2.8. Civil Engineering Drg. I	3	75	30	105	-	-	-	105	
2	-	-	4	-	6	2.9. Surveying I	2.5	50	20	70	6	80	40	120	190
-	-	-	-	-	-	\$2.10 Civil Lab II (B.C. & Maint. Lab , Conc. Tech. Lab. & Soil Mech. Lab)	--	-	-	-	6	80	40	120	120
22	2	8	16	-	48	T O T A L	-	475	190	665	290	145	435	1100	
Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)													50		
TOTAL													1150		

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(iii) Effective teaching will be atleast 25 weeks.  
(iv) Remaining periods will be utilized for revision, etc.  
(v) SI system of units shall be used in each subject.  
(vi) Four weeks structured and supervised, branch specific, task oriented industrial/field exposure to be organised during summer vacation. Student will submit a report. Thre will be 55 marks for this exposure. 40 marks will be awarded by project examiner in the III Yr. and 15 Marks by Internal Examiner.  
(vii) Field visit and extension lectures are to be organised and manued well in advance at institute level as per need

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(4) CIVIL ENGG. (WATER RESOURCES)

(Effective from the session )

III YEAR :

STUDY SCHEME						S U B J E C T S	SCHEME OF EXAMINATION								
PERIODS PER WEEK							T H E O R Y				P R A C T I C A L				
Lect	Tut.	Dra	Pract	W/s	Total		Examination	Sessl	Total	Examination	Sessl	Total	Grand		
		-w				Dur.	Marks	Marks	Dur.	Marks	Marks	Total			
3	-	-	-	-	3	3.1. Design of Steel & Masonary Structure	2.5	50	20	70	-	-	70		
3	1	-	1	-	5	3.2. Design of Reinforced Concrete Structure	2.5	50	20	70	-	-	70		
3	-	-	1	-	4	3.3. Transporation Engineering	2.5	50	20	70	-	-	70		
2	2	-	-	-	4	3.4. Estimating, Costing & Valu.	3.0	75	30	105	-	-	105		
3	-	-	-	-	3	3.5. Construction Management, Accounts & Entrepreneurship Development	2.5	50	20	70	-	-	70		
3	-	-	8	-	11	3.6. Surveying II	2.5	50	20	70	6	100	50	150	220
-	-	8	-	-	8	3.7. Civil Engineering DrawingII	3.0	75	30	105	-	-	-	105	
3	-	-	-	-	3	3.8. Irrigation Engg.	2.5	50	20	70	-	-	-	70	
2	-	-	-	-	2	3.9. Environmental Pollution & Control	2.5	50	20	70	-	-	-	70	
2	-	-	-	-	2	3.10 Earthquake Engineering	2.5	50	20	70	-	-	-	70	
-	-	-	-	-	-	3.11 Civil Lab-III(RCC & Highway)	-	-	-	-	3	80	40	120	120
-	-	-	-	-	-	3.12 Project Work	-	-	-	-	Viva	100	50	150	150
-	-	-	-	-	-	#3.13 Field Exposure	-	-	-	-	Viva	40	15	55	55
24	3	8	10	-	45	T O T A L		550	220	770		320	155	475	1245
												Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)		50	
												TOTAL		1295	

:(For Rural Engineering)

2	1	-	-	-	3	3.14. Agriculture Engg. & Rural Development	2.5	50	20	70	3	50	30	80	150
26	4	8	10	-	48	TOTAL	-	600	240	840	-	370	185	555	1395
												Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)		50	
												TOTAL		1445	

:(For Environmental Pollution & Control)

STUDY SCHEME						S U B J E C T S	SCHEME OF EXAMINATION								
PERIODS PER WEEK							T H E O R Y				P R A C T I C A L				
Lect	Tut.	Dra	Pract	W/s	Total		Examination	Sessl	Total	Examination	Sessl	Total	Grand		
		-w				Dur.	Marks	Marks	Dur.	Marks	Marks	Total			
3	-	-	-	-	3	3.14 Environment Management	2.5	50	20	70	-	--	--	--	70
27	3	8	10	-	48	TOTAL	-	600	240	840	-	320	155	475	1315
												Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)		50	
												TOTAL		1365	

:(For Water Resource)

3	-	-	-	-	3	3.14 Water & Power Resource Management	2.5	50	20	70	-	--	--	--	70
27	3	8	10	-	48	TOTAL	-	600	240	840	-	320	155	475	1315
												Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)		50	
												TOTAL		1365	

Total Marks for Civil Engg.		Total Marks for Civil Engg. (Rural Engg.)		Total Marks for Civil Engg.(Environment Pollution & Control)/(Water Resources Management)	
30% of I Year	300	30% of I Year	300	30% of I Year	300
70% of II Year	805	70% of II Year	805	70% of II Year	805
Final Year Aggregate	1295	Final Year Aggregate	1445	Final Year Aggregate	1365
-----		-----		-----	
GRAND TOTAL	2400	GRAND TOTAL	2550	GRAND TOTAL	2470
-----		-----		-----	

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(ii) Each semester will be of 32 weeks.  
(iii) Effective teaching will be atleast 25 weeks.  
(iv) Remaining periods will be utilized for revision, etc.  
(v) SI system of units shall be used in each subject.  
(v) For Diploma in Civil Engg. group, out of total 48 periods per week, Remaining 3 periods shall be utilised for project/revision work  
(vi) Student in the group of 4 to 6 will be given a project problem. Each group will work under the guidance of one teacher and Project work will start from beginning of session.  
(viii) Field visits and extension lectures are to be organised at institute level as per need.

:(For Environmental Pollution & Control)

STUDY SCHEME						S U B J E C T S	SCHEME OF EXAMINATION								
PERIODS PER WEEK							T H E O R Y			P R A C T I C A L					
Lect	Tut.	Dra -w	Pract	W/s	Total		Examination ----- Dur.	Sessl Marks	Total Marks	Examination ----- Dur.	Sessl Marks	Total Marks	Grand Total		
3	-	-	-	-	3	3.14 Environment Management	2.5	50	20	70	-	--	--	--	70
27	3	8	10	-	48	TOTAL	-	600	240	840	-	320	155	475	1315
Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)													50		
													TOTAL	1365	

:(For Water Resource)

3	-	-	-	-	3	3.14 Water & Power Resource Management	2.5	50	20	70	-	--	--	--	70
27	3	8	10	-	48	TOTAL	-	600	240	840	-	320	155	475	1315
Games/NCC/Social & Cultural activity/Community Development+Discipline (30+20)													50		
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													TOTAL	1365	

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27	3	8	10	-	48	TOTAL	-	600	240	840	-	320	155	475	1315
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## PROLOGUE TO REVISION

In any education system that is meant for producing professionals to serve the society, there is always a need to update its curriculum to cope with the paces of developments in Science & Technology. However, it is not desirable to change the curriculum every now and then. There must be a certain gap of time after introducing a new curriculum to analyse its effect through various feed backs. At least a five year period is neither a very big span and nor a very small. The changes in the needs of the society and the state of Science and Technology during five year period are generally appreciable enough to make changes in the structure of the existing curriculum appreciable. The 3 year curriculum for Diploma in Civil Engg. is one under such considerations.

A revised curriculum has been implemented since 2003 but frequent occurrence of Earthquake in recent years has necessitated the inclusion of Earthquake Engineering as a subject in Civil Engineering curricula.

In the combined Uttar Pradesh and Uttaranchal region nearly 80% of the area is prone to strong seismic shaking, the response of many buildings in the past earthquake has been largely unsatisfactory and caused very significant loss of life and property.

Development of skilful human resource in earthquake resistant construction is an essential step in reducing earthquake vulnerability of the built environment. Engineers responsible for design and construction should be competent in earthquake technology for a successful earthquake risk mitigations programme.

Present curricula has a brief topic on earthquake under the subject building construction and Maintenance Engineering in II year.

A two day workshop was organised during July 29-30, 2003 at I.I.T., Kanpur in which a new subject named as Earthquake Engineering with detailed contents was designed and introduced in final year of Civil Engineering



## MAIN FEATURES OF THE CURRICULUM

TITLE OF THE COURSE	: 1. Diploma in Civil Engineering 2. Diploma in Civil Engg(Rural Engg.) 3. Diploma in Civil Engg(Environmental Pollution & Control) 4. Diploma in Civil Engg(Water Resource Management)
DURATION	: Three Years
PATTERN OF THE COURSE	: Annual System
INTAKE	: 30
TYPE OF COURSE	: Full Time
ENTRY QUALIFICATION	: 10 + with Science and Mathematics (Not Elementary)
MODE OF ADMISSION	: Through Joint Entrance Examination

LIST OF EXPERTS

List of experts who contributed in the revision of the curriculum for There year Diploma in Civil Engg.

1.	Dr. S.Krishnamurthy	Professor & Head Civil Engg.	TTTI Chandigarh
2.	Dr. L.N. Mittal	Professor & Head CDC	TTTI Chandigarh
3.	Dr. Gauri Shankar	Professor & Head Bio-Chemical Engg.	HBTI Kanpur
4.	Dr. C.V.S.K. Rao	Professor Civil Engg.	HBTI Kanpur
5.	Dr. C.P. Hingorami	Professor & Head Civil Engg.	MMEC Gorakhpur
6.	Dr. Y.K. Anand	Professor CDC	TTTI Chandigarh
7.	Dr. K.K. Shukla	Chief Water Analyst	Jal Sansthan Kanpur
8.	Shri Niraj Khare	Asstt. Engg.	UPSIDC Kanpur
9.	Shri H.S. Niranjan	Lecturer Civil Engg.	HBTI Kanpur
10.	Shri R.K. Diwivedi	Asst. Director(Ex)	DTE Kanpur
11.	Shri M.D. Mittal	Principal	Govt.Girl Polytechnic Moradabad
12.	Shri R.P.Ablash	HOD Civil	Lucknow Polytechnic Lucknow
13.	Shri G.D. Agarwal	HOD Civil	D.N. Polytechnic Meerut
14.	Shri S.K.Govil	HOD Civil	Govt.Polytechnic Muradabad
15.	Shri Mohan Lal	HOD Arch.	Govt.Girl Polytechnic Lucknow
16.	Shri Sonelal	Lecturer	Govt.Polytechnic Kanpur
17.	Shri S.K.Srivastava	Lecturer	Govt. Polytechnic Kanpur
18.	Shri J.P. Yadav	Dy. Director	IRDT U.P. Kanpur
19.	Shri M.R. Khurana	Asst. Professor	IRDT U.P. Kanpur

List of experts who contributed in the revision of course contents of Applied sciences -physics, chemistry and mathematics.

Shri C.K. Mishra	Lect. Physics	Govt.Poly. Unnao
Shri J.S. Bhadoria	Lecturer Physics	Govt.Poly., Kanpur
Shri Y.P.S. Gangwar	Lecturer Physics	Govt. Poly., Kanpur
Shri R.S. Tripathi	Lecturer Maths	Govt. Poly., Kanpur
Shri O.P. Sayal	Lecturer Maths	Lucknow Polytechnic Lucknow
Shri P.C. Dixit	Lecturer Chem.	Govt. Girls Poly. Lucknow
Smt. Anita Bajpai	Lecturer Chem.	I.R.D.T., U.P., Kanpur

List of experts who contributed in the workshop to revise/review the curriculum in semester scheme on 24.4.99

1. Smt Usha Birjee  
Director I. R. D. T., U.P., Kanpur
2. Dr. A. K. Nigam  
Lecturer H. B. T. I., Kanpur
3. Shri H. S. Niranjana  
Lecturer H.B.T.I., Kanpur
4. Shri S. N. Rai Sharma  
Asstt. Director D.T.E., Kanpur
5. Shri Sanjay Kumar  
Lecturer Govt. Poly., Kanpur
6. Shri Sone Lal  
Lecturer Govt. Poly., Kanpur
7. Shri A. K. Bagga  
Lecturer Govt. Poly., Kanpur
8. Shri J. P. Yadav  
Dy. Director I.R.D.T., Kanpur
9. Shri Ashraf Ali  
Professor I.R.D.T., Kanpur

List of experts who contributed in the workshop to revise/review the curriculum in semester scheme on 06.12.99

1. Smt Usha Birjee  
Director I. R. D. T., U.P., Kanpur
2. Dr. A. K. Nigam  
Lecturer H. B. T. I., Kanpur
3. Shri H. S. Niranjana  
Lecturer H.B.T.I., Kanpur
4. Shri S. N. Rai Sharma  
Asstt. Director D.T.E., Kanpur
5. Shri Sanjay Kumar  
Lecturer Govt. Poly., Kanpur
6. Shri Sone Lal  
Lecturer Govt. Poly., Kanpur
7. Shri P. C. Jain  
H.O.D. Govt. Poly., Kanpur
8. Shri J. N. Pandey  
Lecturer Govt. Poly., Lucknow
9. Shri S. K. Srivastava  
Asstt. Professor I.R.D.T., Kanpur

List of experts who contributed in the revision of the curriculum for There year Diploma in Civil Engg on dated 29-30 July 2003 at I.I.T, Kanpur.

1.	Dr. S. K. Jain	Prof. & Head	I.I.T., Kanpur
2.	Dr. Durgesh C Rai	Asstt. Prof.	I.I.T., Kanpur
3.	Shri Gurudeep Singh	Director	I.R.D.T,Kanpur
4.	Shri Hussain Abbas	Prof.	A.L.M.U,Aligarh
5.	Dr. S. K. Shukla	Asstt. Prof.	I.T.B.H.U.,Varanasi
6.	Shri Sunil Kumar	Asstt. Prof.	H.B.T.I., Kanpur
7.	Shri K. K. Bajpai		I.I.T., Kanpur
8.	Shri K. Ahamad	Principal	G.G.P,Moradabad
9.	Shri Basant Kumar	Head civil	G.P.,Deoria
10.	Shri R. D. Dixit	Deputy Sec.	B.T.E.,Lucknow
11.	Shri Vinod Kumar	Lect.civil	Hewett Poly.,Lko.
12.	Shri A. K. Misra	Lect.civil	S.G.S.J.P,Khurja
13.	Shri Salil Sharma	Lect.civil	G. P., Bijnore
14.	Shri Soney Lal	Head civil	G. P., Lucknow
15.	Shri M. K. Varshney	Lect.civil	D. N. Poly.,Meerut
16.	Dr. A. K. Nigam	Asstt. Prof.	B.I.E.T,Jhansi
17.	Shri S. K. Malviya	Dy. Director	I.R.D.T.,Kanpur
18.	Shri S. K. Srivastava	Asstt. Prof	I.R.D.T.,Kanpur
17.	Shri B. K. Srivastava	Head civil	G.P.,Kashipur

## NEED ANALYSIS

It was considered essential to revise the curriculum of diploma course in Civil Engineering to accommodate new areas of technology as well as update and modernise the existing course contents so as to make it more relevant to the needs of world of work. Accordingly, a workshop was held to look into the gaps in the existing curriculum and revise the same. Number of professionals representing various field organisations, higher technological institutions, T.T.T.I. Chandigarh and polytechnics were involved to update the curriculum of three years diploma course in Civil Engineering.

Experts from the field and higher technological institutes emphasised the need of making the courses more technology oriented and practice based. Experts from the field were also of the view that the curriculum should be broad based in nature, so as to provide larger base of employment and flexibility in functioning.

The need of developing information gathering and development of communication & problemsolving activities were also stressed. It was also suggested by the experts from higher technological institutes that it is very essential that diploma courses should have a foundation of applied sciences up to 10+2 standard. Applied sciences are very essential to develop learning skills in the students.

The professionals from the field were of the views that dead wood from the courses be deleted and courses should not be stuffed with unnecessary information.

Based on the above, curriculum of diploma course in Civil Engineering was revised. Job opportunities, activities, activity analysis into knowledge, skill and attitude requirement and curriculum objectives formed the basis of arriving at the course contents.

## PROFILE DEVELOPMENT

A tool in form of a questionnaire was design and sent to various organisations, industries, higher technological institutes and polytechnics for getting informations about job opportunities, man power requirements and job activities of diploma holders in civil engineering.

Feed back was taken from experts through questionnaire, personal interviews and workshops was analysed and a draft structure of curriculum was prepared in the workshop held at I.R.D.T., U.P., Kanpur adopting the following procedure.

1. Listing job potential and job activities.
2. Analysing activities into knowledge and skill.
3. Deriving the course objectives.
4. Deriving subject areas from course objectives.
5. Planning horizontal and vertical organisation of subjects.
6. Developing detailed course contents and coverage time.
7. Determining resource input in terms of human and information resources.

Reviev of this draft of the structure of curriculum was done in a workshop held at I.R.D.T., U.P., Kanpur through a group of experts from field , higher technological and polytechnic.

It is hope that the revised curriculum of Diploma in Civil Engg. will prove useful in producing the desired type of middle level trained man power for Civil Engg. field.

I JOB OPPORTUNITIES

S.NO.	Department/Organisation	Position/Designation
1.	State-public works Department----- (Building and Roads)	
2.	State-public Works Department (Irrigation)	
3.	a) State Public Works Deptt. (Public Health)	
	b) Sewerage Boards	
	c) Pollution Control Board	Sectional Officer/
4.	State Electricity Board	Junior Engineer
5.	State Housing Development Board	
6.	Public Sector undertakings/ corporations (State Government) Viz Warehousing Corporation, Civil Supplies Corporations, Agricultural Marketing Board, State Transport, Municipal corporations, Improvement Trusts, Urban Development Authority, Bridge Corporations, Tubewell Corporations etc.-----	
7.	Military Engineering Services	Supdt.Grade-II
8.	Central Public Works Department	Junior Engineers/ Sectional Officer
9.	Boarder Roads Organizations	
10.	Indian Railways	A.P.W.I./A.I.O.W.
11.	Oil and Natural Gas Commission, Public Sector Undertakings/Corporations.	Junior Engineer/ Sectional Officer
12.	Central Government viz. Food Corporation of India, National Building Construction	

	Corporation/NPCC, IRCON, RITES Hindustan Pre-Fab Ltd., Engineers India Ltd., Development Authorities.	
13.	Private Sector Undertaking e.g. Gammon India Ltd., Hindustan Construction Company & other construction & Builders firms. Architects & Ass- ociates, Ansal Housing & Constru- ction Ltd, New Delhi, Sahara India Housing Ltd., Lucknow.	Sectional Officer/ Supervisor/ Design Assistant/ Junior Engineer Draftsman
14.	Self employment	Contractor & Entreperneurs Architect, Consultant Valuer & Loss Accessor



## II JOB ACTIVITIES

- (A) Investigation (R & D)
1. Conducts topographical surveys.
  2. Conducts soil investigations.
  3. Undertakes survey for sources and availability of material, site selection, collection of data.
  4. Reads and interprets maps and drawings.
  5. Undertakes detailed survey for civil engineering works.
- (B) Design and Drawing
1. Designs of simple structural elements of masonry, RCC, timber and steel.
  2. Prepares drawings for simple buildings, public health engg., roads, simple irrigation structures and simple railway structures.
  3. Prepares plans and sections for roads and channels for construction and maintenance.
  4. Reads and interprets drawings.
- (C) Estimating and Costing
1. Prepares estimates for construction and maintenance of civil engg. works, e.g. roads, building, public health services, irrigation structures.
  2. Prepares valuation of property.
  3. Calculates quantity of materials for various items of works.
  4. Prepares Analysis of rates for items not given in the schedule of rates.
- (d) Construction Maintenance, Supervision and Management
1. Prepares materials, equipment and labour schedule.
  2. Prepares site layout and set out works.
  3. Inspects materials of construction.
  4. Supervises earth, masonry, concrete, RCC, steel, timber and stone construction and repair works, and rock drilling operation.
  5. Supervise construction of earthquake resistant masonry and R.C. structure and Retrofitting of masonry and R.C. buildings.
  6. Prepares bar charts for progress reports.
  7. Organises materials and labour.
  8. Controls quality of construction material and workmanship.
  9. Ensures proper storing and stocking of construction materials.
  10. Keeps record of progress of works, prepares bills and distributes wages to workers in his

section.

11. Prepares progress reports and sends the same to AE/SDO.
12. Communicates with workers and handles their grievances.
13. Receives and issues materials and tools, keeps their records and submits the returns, check stores.
14. Ensure safety measures at the site of work..

(E) Testing, Research and Development

1. Conducts laboratory and field-tests on construction materials and soil.
2. Assists Civil Engineer in research and development.

III ACTIVITY ANALYSIS (FOR KNOWLEDGE AND SKILLS REQUIRED)

S.No.	ACTIVITIES	KNOWLEDGE	SKILL
(A)	INVESTIGATION:		
	Conducts topographical surveys.	Symbols and conventions used in surveying, principle of surveying, Plane table surveying, levelling, contouring, measuring horizontal and vertical angles with theodolites, triangulation and elements of tacheometry bearing, selection and drawing of scales.	Incorporation of symbols and conventions in the preparation of topographical maps, plane table surveying, levelling, contouring, use of theodolite for measuring horizontal and vertical angles, triangulation and use of tacheometric tables observing bearing of lines, drawing of scales.
2.	Conducts soil investigation.	Purpose and planning of investigation, method of exploration, classification and identification of soils, sampling and levelling soil samples, presentation of results tools & equipment required for soil sampling.	Collection of soil samples.  Preparing boring log/soil profile.
3.	Undertakes surveying for sources and availability of materials of const., instruments, site selection & collection of data.	Sources, characteristics and use of materials, trade names, modes of transportation etc.  Knowledge about the characteristics of an ideal site.  Types of survey engineering & economics. Preparing site-plan, contour X-sections, index map. Observing geological data.	Identification of stones and other building materials, classifications of bricks.  Field tests on lime cement, aggregate and concrete.  Preparing index map, site plan, contour plan, X-section. Preparing soil profile/boring log.
4.	Reads & inter-	Essential features of	

preps maps & drawing. topographical map, index symbols & conventions used. Soil profile-boring log.

- |    |   |   |   |
|----|---|---|---|
| 5. | Undertakes detailed survey for Civil Engg. works. | Knowledge about the preparation of plans, X-sections.<br><br>Long section, site plan.<br><br>Hydraulic survey.      | Handling and use of instrument for plane tabling levelling, chaining.<br>Measuring angles data collection and plotting X-sections and long sections.<br>Observing outlet discharge, setting out of works. |
| 6. | Undertakes flow measurements.                     | Procedure for setting out works, estimating discharge and gauging stems, flow through orifices, pipes and channels. | Gauging small channel & water courses, observing outlet discharge.  |

B. DESIGN AND DRAWING

- |    |   |   |   |
|----|---|---|---|
| 1. | Design of simple structural elements masonry, RCC timber and steel.   | Concept of loads, UDL, triangular, concentrated dead, live.<br>Calculation for BM, SF, stresses, deflection.<br>Riveted and welded joints.<br>Permissible stresses, preference and use of Permissible stresses, preference and use of IS codes for RCC & steel.<br>(IS 456-1978<br>IS 800-1982) | Design of steel beams columns, compression tension members.<br><br>Design of RCC slabs, beams and columns.<br>Design of wooden beams.<br>Sketching of design details.<br><br>Use of IS codes for RCC & steel. |
| 2. | Preparing drawings for:   |   |   |
| a) | Simple buildings Public Health services roads, simple irrigations structures and simple Railway structures. | Knowledge of common public health services, roads irrigation & railway structures.  | Drawings of simple PH services, building, roads, irrigation and Railway Structures.   |

- |    |   |  |  |
|----|---|--|--|
| b) | Preparing plans & setting of roads & channels | Railway structures.<br>Plans & sections of road and channels.  | Preparing plans by performing plane table survey.<br>Plotting of x-section & long-sections.  |
| 3. | Reads and Interprets working drawing.         | Knowledge about elements of common structures such as buildings, bridges, culverts, irrigation falls, water tanks, man-holes sewers & disposal works.<br><br>Types of plans & sections for simple structures/projects. | Skill in preparing drawings of small buildings, bridges, culvert, fall, common sewer & drains man-holes.<br>Structuring of simple railway stations and crossings.<br>Road and irrigation channels. |

C. ESTIMATING & COSTING

- |    |  |  |  |
|----|--|--|--|
| 1. | Prepares estimates of civil engg. works of construction & maintenance. | Types of estimates, specifications, schedules of rates, break up of a work into sub heads, estimating of earth work.<br><br>Estimate of simple irrigation, road, public health & building works.<br><br>Analysis of rates. | Skill in preparing estimate of a small residential building culvert, road channel drain, sewer, water tank, fall, steel truss, retaining wall lining of distributories.<br>Preparation of A.M&R SR estimates of irrigation channel, road and public health works.<br>Preparation of analysis of rates. |
| 2. | Prepares valuation of property   | Purpose, Principles of valuation methods, calculation of standard rent.<br>Preparing drawing by measurement.   | Preparation of valuation report of a building drawing by measurement.<br>Calculation of standard rent.   |
| 3. | Calculating quantity of materials for various items of works.          | Norms for consumption of materials<br>Method of calculating quantities.  | Preparation of material statement.   |

D. SUPERVISION AND MANAGEMENT OF CONSTRUCTION MAINTENANCE

- |    |                     |   |  |
|----|---------------------|---|--|
| 1. | Prepares materials, | Knowledge of planning and scheduling, methods | Preparation of bar chart, Preparation of |
|----|---------------------|---|--|

	equipment & labour schedule	of scheduling, construction schedule.	construction schedule
		Material statement.	Preparing material statement from the estimate.
		Type, quantity & target dates for materials, equipment and labour construction technology.	Writing out the type & number of equipment and labour.
2.	Prepares site layout and sets out works.	Knowledge of site, layout & setting of works. Principles of storing and stocking materials at site.	Preparing site layout. Setting out earthwork for roads and canals. Setting out a small building and a culvert.
3.	Inspects materials of construction.	Knowledge of different materials for construction such as stones, bricks, tiles. Aggregate, lime, steel, timber, plastic, paints, steel, pipes, fixtures, bituminous products, damp proofing materials, and new construction materials.	Field tests of bricks, stones, cement, lime, timber aggregate and concrete. Inspection and identification of construction materials.
4.	Supervises, E/work, brick and stone masonry, concrete RCC, steel & Timber Construction & repair works. Erection & fixing of simple structural elements & temporary structures. Rock drilling	Procedure for testing out and carrying out work, and their classifications. Knowledge of methods of construction & precaution for E/work, brick & stone masonry, concrete, RCC, steel & timber works including bonding in masonry. Functions of construction management resources for construction team.	Layout of small work of masonry, concrete, RCC. Preparing bar bending schedule. Preparing foundation plans.

	Knowledge of safety measures for construction & erection.	Preparing knots & lashing.
	Knowledge of drilling operations.	Connection to electric motors, diesel or petrol engines. Grinders vibrators, mixer and other such appliances.
5.	Supervise cons. of Earthquake resistant masonry & R.C. stru. & Retrofitting of masonry & R.C. buildings	Philospy of Earthquake resistant design seismic const. of masnary buildings provisions of IS-4326 seismic const of R.C. buildings provision of I.S. 13920
		Preparation of bar bending schedule retrofitting of masnary & R. C. Building
6.	Prepares bar charts for progress report.	Knowledge of progress report.
	Methods of reporting progress.	Preparing bar chart small building and/or culvert.
	Bar chart and its preparation for a small building or a culvert.	
7.	Organises materials & labour.	Principles of organising materials and labour at the site. Labour acts, welfare and safety measures.
		Prepares site layout
8.	Controls quality of construction, material & workmanship.	principles of quality control.
	Knowledge of specifications for masnory, concrete & RCC works.	Testing of materials Sketching of simple for skilled workers.
	Public Health Services	Effective Communications.
	Precautions and critical items.	
9.	Ensures proper storing and stocking of materias.	Principles of storing in godown and at site, necessity and limit of storage, responsibilities involved.
	Sources of receipts & issues.	Prepares site plan.
10.	Keeps record of progress of work, prepares	Methods of recording progress.
	Prepares work charged	Prepares progress reports.
		Prepares work char-

	bills, distribution of wages to workers in his section.	establishment bills, muster-rolls, casual labour rolls, hand receipt, writing MB & preparing bills for works done or supplies made. Imprest, temporary advances & their accounts.	ged establishment bills, muster rolls, casual labour roll, hand receipt.  Writing MB  Keeping imprest account.
11.	Prepares progress report & sends to higher authorities	Meaning, purpose and type of information required., Methods of reporting progress.	Prepares report from muster-rolls  Reporting in term of labour or quantity & items of work done or expenditure.
12.	Communicates with workers and handles grievances.	Fundamentals of human relations and motivation. Causes of grievances and handling grievances.	Communications skills.
13.	Receives and issues materials and tools, keeps their records and submits the returns, checks stores.	Procedure for receipt and issue of stores.  Prepare indent, invoice, accounts of stock and T&P Road metal and MAS account. Maintaining log books, rules for stock verification. Rectification of mistakes. Transfer of charge.	Preparing indents, invoices, stock, T&P, road metal and MAS account returns, survey report.
14.	Ensures safety measures	Causes of accident, safety measures and precautions for excavation/scaffolding, formwork, hot bituminous works, demolitions drilling & blasting operations. Knowledge of first aid.	
E.	TESTING, RESEARCH & DEVELOPMENT		
1.	Conducts laboratory and field tests on construction materials and soil.	Should have knowledge to conduct field tests for cement, brick, stone tiles, concrete & soil and know their significance.	Identification of timber, stone and soil. Conducting lab and field tests on cement, lime, bricks tiles and concrete Conducting field



survey, boring &  
SPT for soil.  
Preparing soil  
profile.

2. Assists Civil Engineer in Research and Development. Concept of common laboratory tests for cement, concrete road metal, compaction and soil stabilization.

Should be able to prepare specimens and conduct tests of cement, strength of cement and concrete. Tests of road metal.

#### IV. CURRICULUM OBJECTIVES

##### A. KNOWLEDGE

1. Student must have knowledge of symbols, conventions and scale used in survey maps, principles of surveying, methods of chain surveying, plane table surveying, contouring, use of theodolite in topographic survey, triangulation, collecting hydraulic data and conducting hydraulic survey, setting out alignments of roads, and irrigation channels.
2. Student must acquire knowledge to plan and conduct soil investigation and field identification test, taking samples and levelling them, prepare soil profile, boring log and present results, methods for compaction and stabilisation of soil.
3. Student must acquire knowledge about the characteristics and source of construction materials, field and laboratory tests on cement, lime, brick, tiles, stones, timber, soil, aggregate and road metal, plastic, paints, pipes, bitumin plants, important properties of materials.
4. Student must know the procedure to draw sections, long-sections and plans of roads and irrigation channels, land plans, building plans and bye-pass.
5. Student must have concept of loads, types of beams, columns and their behaviour-calculations for bending moment, shear forces, stresses design of slabs, beams and columns; steel beams and columns-tension and compression members-timber beam and rivetted and welded joints.
6. Student must have knowledge of the elements and constructional details of public health works, roads, railways and irrigation works and bridge tunnel.
7.
  - a) He must know the various types of estimates, components of an estimate, break up works in the sub heads.
  - b) Analysis of rates, schedule of rates.
  - c) Estimating, works of building, small PH works, roads, culverts, falss.
  - d) Specifications.
  - e) Materials statements.
  - f) Annual Maintenance and Repair estimates, Special Repair estimates.
  - g) Values of property.
8. Student must have concept of planning and scheduling, preparing estimation, materials, equipment and losing schedules form given data-preparing for layout, selling art and for roads and channels, works for buildings and culverts, preparing bar charts, method of recording progress.
9. Student must know the priniciples for organising materials and labamour at the site of work and should acqure knowledge

about labour acts applicable to construction industry.

10. Student must know the elements of inspection and checks, quality control.
11. Student must know about the procedure and sources for receipt and issue of stores, accounting of stores, principles of storing and storing methods in godown and at site, filling daily based report and indent, submitting returns of store, MAS accounts, survey report, loss of work and transfer of charge.
12. Student must know methods of procedures of setting out, carrying out work, writing MB and preparing bills, preparing M-Rolls, bills of work charge establishment, casual base roll, daily base reports, hand receipts etc.
13. Student have knowledge about construction, resources for construction, functions of construction management, human relations, material techniques, cause and handling grievances of workers.
14. Student must have acquire knowledge about ideal site for a bridge and collection of hydraulic data.
15. Student must know the method of estimating discharge of stream, gauging flow through pipes and channels.
16. Student must know the cause of accidents and safety measures in building work, bituminous work, excavation and demolition form work and scaffolding, drilling and blasting operations.
17. Student must be aware of making connections and elements of faults of electric motors, diesel and petrol engines, grinders, vibrators and mixers and other such appliances.

#### B. SKILLS

1. Student must acquire skill in chain surveying, plane table surveying, levelling, centering, measuring horizontal & vertical angles with theodolite, triangulation, use of techeometric tables, measuring bearings, data collection & plotting with compass, bituminous dry sections, conducting hydraulic survey.
2. Student must have be skilled in taking samples of soils identification of soil-preparing soil profiles and boring logs-conducting SPT, field density, OMC, consistency limits sieve analysis and tests of soil.
3. Student must develop skill in identification of stone, timber, classification of bricks, conducting laboratory and field tests on cement, concrete, aggregates, soil and timber.
4. Student must develop skill in designing RCC slabs, beams, stairs and columns, steel beams, and columns, tension and

compression members and fittings.

5. Student must acquire skill in preparing plans and drawings of roads, irrigation channels, simple buildings, common public health services, and irrigation structures, simple bridges and culverts-site plans, index map and topographical map.
6. Student must develop skills in preparing estimate of small and simple buildings, earth work in channels, culverts, roads, lining of small channels, small lake, steel roof truss, retaining wall, drains and sewers septic tank, domestic water supply, AM & R and SR estimates of irrigation channels, roads, and small public health works.
7. Student must acquire skill in preparing foundation plans layout of small buildings and setting out earth work for roads and irrigation channels, aligning roads and channels.
8. Student must develop skill in preparing materials statements from estimate and quality of work, prepares site layout and construction/schedules.
9. Student must acquire skill in preparing analysis of rates from given data.
10. Student must develop skill in common tools.
11. Student must acquire skill in preparing bar charts, reporting progress of works.
12. Student must have skill in preparing establishment bills, muster roll, casual muster roll, daily labour reports, imprest account, hand receipts, accounts of stores, indents, invoices, MAS accounts survey report.
13. Student must develop skill for observing discharge of a small channel by measurement of velocity and by notches.

C. BROAD SKILLS REQUIRED

(I) Professional Skills

After undergoing the diploma in Civil Engineering the students must develop following professional skills:

1. Read and interpret working drawings of simple Civil Engg. Structures.
2. Draw and sketch construction specification for small jobs.
3. Interpret and formulate construction specification for small jobs.
4. Measure and collect data required for preparation of topographical and other maps.

5. Prepare estimates, of small construction jobs.
6. Carry out quality control tests of construction materials and soil investigations.
7. Design simple structural elements of common engineering materials.
8. Supervise construction, repair, maintenance, activities of simple Civil Engg. jobs including PH engineering services.
9. Organise construction of simple Civil Engineering jobs.
10. Organise safety in construction, installations, erections and repair jobs.

VI. CURRICULUM ANALYSIS FOR IDENTIFICATION OF SUBEJECTS

A) KNOWLEDGE		
Irrigation	1. Student must have knowledge of symbols, conventions and scale used in survey maps, principles of surveying, methods of chain surveying, plane tabling, topographic survey, triangulation, hydraulic data and conducting hydraulic survey, setting out alignments of roads, and irrigation channels.	1. Surveying 2. Hydraulics and Engg.
	2. Student must acquire knowledge to plan and conduct soil identification tests taking samples and labelling them, prepare soil profile, boring log and present results, methods for compaction and stabilization of soil.	Soil Engg.  Highway Engg.
Engg. Materials  Technology,  Construction	3. Student must acquire knowledge about the characteristics and sources of construction materials, field and laboratory tests on cement, lime, brick, tiles, stones, timber, soil, aggregate and road metals, plastic, paints, pipes, bitumen plants, important properties materials.	Concrete  Soil engg. Building
	4. Student must know the procedure to draw sections, longitudinal sections and plans of roads and irrigations channels, land plans, building plans and bye-pass.	Civil  Drawing, Highway  Irrigation  Bld.
Structure  Drawing-II	5. Student must know concept of loads, types of beams columns, and their behaviour-calculations for bending moment, shear force, stresses, design of slab, beams and columns steel beams and columns tension and compression members revetted and welded joints.	SOM Design of Steel & RCC  CE
	6. Student must have knowledge of the elements and constructional details of public health works roads, railways, irrigation works and bridges, tunnels.	Building  PHE,  Engg.
Construction, Highway Railway		

Irri-

Bridge &

gation,tunnels.

7. a)	Student must know the various types of estimates components of an estimates, break up works in the sub-heads.	Estimating
b)	Analysis of rates, schedule of rates.	Costing.
c)	Estimating,well, building, small works, culverts and falls.	P.H.Engg.
d)	Specifcations.	Building
e)	Material statements.	Highway
f)	AM & R estimates, SR estimates.	Irrigation
g)	Values of property.	
8.	Student must have concept of planning and scheduling, preparing estimates of materials & equipments for civil engineering works like building,road, public health engg. and irrigation etc.from given data-preparing layout of building and culvert, setting alignment for roads and channels, preparing bar charts, methods of recording progress. of recoring progress.	Management
9.	Student must know the principles for organising materials and labour at the site of work and should acquire knowledge about labour acts applicable to construction industry.	Account
10.	Student must know the elements of inspection and checks quality control.	Irrigation and
11.	Student must know about the procedure and sources for receipt and issue of stores, accounting of stores,principles of storing and storing methods in godown and at site. Filling daily base reports and indents submitting returns of stores, MAS accounts, survey report, loss of work and transfer of charge.	Management

<p>12. Student have knowledge about construction, Construction Accounts.</p>	<p>resource for construction, functions of construction management-human relations, material techniques cause &amp; handling grievances of workers.</p>	<p>Management and</p>
<p>13. Student must know methods of procedures of setting Construction Accounts.</p>	<p>out carrying out work, writing MB and preparing bills, preparing M. Rolls, bills of work charge establishment, casual base roll, daily base reports hand receipts etc.</p>	<p>Management and</p>
<p>14. Student must acquire knowledge about ideal site for a bridge and collection of hydraulic data.</p>		<p>Bridge surveying.</p>
<p>15. Method of estimating discharge stream gauging flow through pipe and channels. Irrigation, PHE</p>		<p>Hydraulic</p>
<p>16. Student must know the cause of accidents and safety Construction &amp; Bldg. Construction</p>	<p>measures in building work, bituminous work, excavation demolition formwork and scaffolding, drilling and blasting operations.</p>	<p>Management Accounts,</p>
<p>17. Student must have the knowledge of resources for Entrepreneurship Development</p>	<p>financing the project for starting his own enterprize like Contractorship/Builders firm.</p>	

#### CURRICULUM OBJECTIVES

##### B. SKILLS

- |  |                   |
|--|-------------------|
| <p>1. Student must acquire skill in the chain surveying plane table surveying, levelling, centering, measuring, horizontal and vertical engles with theodolite, triangulation, use of techeometric tables, measuring bearings, data collection and plotting with compass bituminous dry sections, conducting survey.</p> | <p>Surveying</p>  |
| <p>2. Student must be skilled in taking samples of soil,</p>   | <p>Soil Engg.</p> |



identification of soil preparing soil profiles and boring logs-conducting SPT field density, OMC consistency limits and sieve analysis tests of soil.

3. Engineering	Student must develop skill in identification of stone, timber classification of bricks conducting laboratory and field tests on cement, concrete, aggregates and soil and timber.	Materials, Concrete Technology Soil Engg.
4. RCC	Student must develop skill in designing RCC slabs beams, stairs and columns, steel beams, columns, tension and compression members and fittings wooden beams.	Design of Steel & Structures CE
Drawing-II		
5. Engg.	Student must acquire skill in preparing plans and drawings of roads, irrigation channels, simple buildings, common public health services, and irrigation structure simple bridges and culverts-site plans index map and topographical map.	Highway Irrigation Building Public Engg. Surveying, Civil
Constn. Health Bridges		
Engg. I,II		Drawing-
6. Costing	Student must develop skills in preparing estimate of small and simple buildings, earth work in channels, culverts, roads, lining of small channels, small lake steel root truss, retaining wall, drains, and sewers, septic tank, domestic water supply, AM and & and SR	Estimating and Surveying PHE Irrigation Civil
Engg.	estimates of irrigation channels, road and small public health works, relation of buildings, calculation of standard rates.	Drawing.
7. Construction	Student must acquire skill in preparing foundation plans layout small buildings and setting out earth work for roads and irrigation channels, aligning roads and channels.	Building Surveying
&		
Construction	Student must develop skill in preparing materials statements from estimate and quality of works prepare site layout and construction/schedules	Estimating Costing.

		Management Accounts.
&	9 Student must acquire skill in preparing analysis of rates from given data.	Estimating Costing.
Construction.	10. Student must develop skill in common knots and lashings.	Building
Construction	11. Student must acquire skill in preparing bar charts.	
with Construction Management.	12. Student must have the knowledge of preparing establishment bills, muster roll, casual muster roll, daily labour reports, imprest accounts, hand receipts, accounts of stores, indents, invoices, MAS accounts, survey report,	Accounts grouped
and Engg.	13. Student must develop skill for observing discharge of a small channel by measurement of velocity and by notches.	Hydraulics Irrigation
Mech. Engineering	14. Student must develop skill in making connection and elementary faults of electric meters, diesel and petrol engines, grinders, vibrators and mixers and other such appliances.	Elect.&
	15. Philosophy of Earthquake resistant design seismic const. of masonry buildings provisions of IS-4326 seismic const of R.C. buildings provision of I.S. 13920. Retrofitting of masonry & R. C. Building.	Earthquake Engg.
Entrepreneur- develop-	16. Student must develop skill for establishing his own enterprise.	ship ment.

## YEAR WISE DISTRIBUTION OF PAPERS

### I Year

- 1.1 Professional Communication
- 1.2 Applied Mathematics-I
- 1.3 Applied Physics
- 1.4 Applied Chemistry
- 1.5 Applied Mechanics
- 1.6 Engg. Drawing
- 1.7 Introduction to Computers
- 1.8 Workshop practice
- 1.9 Building Materials
- 1.10 Civil lab-I (Building Material Testing lab)

### II Year

- 2.1 Elementary Elect. & Mech. Engg.
- 2.2 Strength of Materials
- 2.3 Hydraulics
- 2.4 Public Health Engineering
- 2.5 Soil Mechanics & Foundation Engg.
- 2.6 Building Construction and Maintenance
- 2.7 Concrete Technology
- 2.8 Civil Engg. Drawing I
- 2.9 Surveying - I
- 2.10 Civil Lab -2 (B.C & Maintenance Lab, Conc. Tech. Lab & Soil Mech. Lab)

### III Year

- 3.1 Design of Steel & Masonary Structures
- 3.2 Design of Reinforced concrete Stru.
- 3.3 Transportation Engineering
- 3.4 Estimating, Costing and Valuation
- 3.5 Construction management, accounts & Entrepreneurship Development
- 3.6 Surveying - II
- 3.7 Civil Engineering Drawing II
- 3.8 Irrigation Engineering
- 3.9 Environmental Pollution and Control
- 3.10 Earthquake Engineering Concept
- 3.11 Civil Lab - 3 (R.C.C. & Highway)
- 3.12 Project Work & Visit
- 3.13 Field Exposure done in II year

For Spl. in Rural Engg.

- 3.14 Agriculture Engg. & Rural Dev.  
For Spl. in Environmental Pollution & Control
- 3.14 Environment Management

For Spl in Water Resources

- 3.14 Water & Power Resource Management

I YEAR

1.1 PROFESSIONAL COMMUNICATION

[ Common to All Engineering/Non Engineering Courses]

L T P  
3 - 2

Rationale:

Communication forms an important activity of diploma holder. It is essential that he/she should be in a position to communicate in writing and orally with superiors, equals and subordinates. This subject aims at providing working knowledge of languages like Hindi and English so as to train the students in the art of communication. It is suggested that maximum attention should be given in developing Communication abilities in the students while imparting instructions by giving maximum emphasis on practice.

Sr.No.	Units	Coverage time		
		L	T	P
1.	Introduction to communication methods meaning, channels & media written and verbal.	5	-	-
2.	Development of comprehension of English & Hindi through study of text material & language exercises.	20	-	-
3.	Development of expression through A. Letters (English & Hindi) B. Report writing (English) Note making and minutes writing	10 10	-	-
4.	Composition	10	-	-
5.	Grammar	20	-	-
		75	-	50

1. PART I : COMMUNICATION IN ENGLISH

1.1 Concept of communication, importance of effective communication, types of communication, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writing and speaking, Barriers in communication, Modern tools of communication- Fax, e-mail, Telephone, telegram, etc.

1.2 Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Letters :

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters. Application for a job.

1.3.2 Report writing and Note making and minutes writing.

1.4 Grammer : Transformation of sentences, Preposition, Articles, Idioms and Phrases, One word substitution, Abbreviations.

1.5 Composition on narrative, descriptive, imaginative, argumentative, discussion and factual topics.

2. PART II : COMMUNICATION IN HINDI

2.1 Development of comprehension and knowledge of Hindi usage through rapid reading and language exercises based on prescribed text material developed by IRDT.

2.2 Development of expression through ;

Letter writing in Hindi:

Kinds of letters:-

Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters, Application for a job.

(1) Paper should be in two parts, part I - English and part II Hindi.

COMMUNICATION AND PRESENTATION PRACTICES

1.A. Phonetic transcription

B. Stress and intonation :

(At least 10 word for writting and 10 word for pronunciation)

2. ASSIGNMENT : (Written Communication)

Two assignment of approximately 400 word each decided by the teachers.

SUGGESTED ASSIGNMENTS :

1. a picture/photograph
2. an opening sentence or phrase
3. a newspaper/magzine clipping or report
4. factual writting which should be informative or argumentative.

3. Oral Conversation:

1. Short speeches/declamation : Bid farewell, Felicitate somebody, Celebrate a public event, Offer condolences

2. Debate on current problems/topics
3. MockInterview : Preparation, Unfolding of personality and Expressing ideas effectively
4. Group discussion on current topics/problems
5. Role Play/ general conversation : Making polite enquiries at Railway Station, Post Office, Banks and other Public places, Replying to such enquiries, enquiring about various goods sold in the market and discussing their prices. Complaining about service at Hotel, restaurant, Offering apologies in reply to such complaints, complain to a company about a defective product you have brought, reply to such complaints.
6. Presentation skill, Use of OHP and LCD.

4. Aural :

Listening to conversation/talk/reading of short passage and then writting down the relevant or main points in the specified number of words and answering the given questions

The assignments/projct work are to be evaluated by the internal/ external examiner. The distribution of 30 marks e.g.

10 marks for assignment (Given by subject teacher as sessional marks)

10 marks for conversation and viva-voce

10 marks for phonetic transcription

#### STRUCTURE OF COMMUNICATION TECHNIQUE PAPER

##### Distribution of Marks

Theory Paper : 50 Marks

Sessional : 20 Marks

Practices : 30 Marks

- Q1. Question based on the topics prescribed text material will be set to test the candidates ability to understand the content, explain words and phrases, making sentence of given words and ability to summarise will be included. All questions will have to be answered.

A. from English Text Book 10 Marks

B. from Hindi Text Book 5 Marks

- Q2. Candidates will be required to write one letter (English) and one letter in (Hindi) from a choice of two -

A. English Letters 5 Marks

B. Hindi Letters 5 Marks

- Q3. Report Writting on given outlines 5 Marks

- Q4. There will be a number of short answer questions to test the candidates knowledge of functional grammer, structure and usage of the language. All the items in this question will

be compulsory. The grammar questions has four parts -

(Total Part: A For 5 Marks, B For 3 Marks, C For 3 Marks and D For 4 Marks)

A. This part of the question has to do with the transformation of sentences. English uses several patterns of sentence formation and the same meaning can be expressed by several patterns e.g. Active to Passive voice and vice versa, Direct to Indirect and vice versa, Reframing sentences by changing part of speech e.g. Noun to Adjective, Interchanging degree of comparison.

Interchanging Moods - Affirmative to Negative, Assertive to Interrogative or to exclamatory

B. The second part usually requires blanks in a sentence to be filled in with a suitable preposition and articles.

C. The third part is usually an exercise on tenses.

D. The fourth part concerns with one word substitution and abbreviation, uses of idioms and Phrases.

Q5. COMPOSITION : (About 300 Words) (5 marks)

Candidates will be required to select one composition topic from a choice of five. The choice will normally include narrative descriptive, argumentative, discussion and factual topics. The main criteria by which the composition will be marked are as follows

A. the quality of the language employed, the range and appropriateness of vocabulary and sentence structure the correctness of grammatical construction, punctuation and spelling.

B. The degrees to which candidate have been successfully in organising both the composition as a whole and the individual paragraphs.

## 1.2 APPLIED MATHEMATICS I

[ Common to All Engineering Courses]

L    T    P  
3   2/2   -

Rationale:

The study of mathematics is an important requirement for the understanding and development of any branch of engineering. The purpose of teaching mathematics to diploma engineering students is to impart them basic knowledge of mathematics which is needed for full understanding and study of engineering subjects.

S.N.	Units	Coverage Time		
		L	T	P
1.	Algebra-I	18	6	-
2.	Trigonometry	7	2	-
3.	Coordinate Geometry	15	5	-
4.	Differential Calculus-I	15	5	-
5.	Integral Calculus-I	20	7	-
		75	25	-

### DETAILED CONTENTS:

1. ALGEBRA-I :
  - 1.1 Series : AP and GP; Sum, nth term, Mean
  - 1.2 Binomial theorem for positive, negative and fractional index (without proof). Application of Binomial theorem.
  - 1.3 Determinants : Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Crammer's rule
  - 1.4 Vector algebra : Dot and Cross product, Scaler and vector triple product. Application to work done, Moment of a force, Plane geometry.
2. TRIGONOMETRY :
  - 2.1 Relation between sides and angles of a triangle : Statement of various formulae showing relation ship between sides and angle of a triangle.
  - 2.2 Complex number.
 

Complex numbers, Representation, Modulus and amplitud Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties..
3. CO-ORDINATE GEOMETRY :



### 3.1 Standard form of curves and their simple properties -

Parabola  $x^2=4ay$ ,  $y^2=4ax$ ,

Ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Tangent and normals

### 3.2 Straight lines, planes and spheres in space -

Distance between two points in space, direction ratios, Finding equation of a straight line, and shortest distance between two lines

Under different conditions equation of a plane  $lx+my+nz=c$ , relation between lines and planes, sphere  $x^2 + y^2 + z^2 + 2gx + 2fy + 2wz=d$

## 4. DIFFERENTIAL CALCULUS - I :

4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.

4.2 Methods of finding derivative, - Function of a function, Logarithmic differentiation, Differentiation of implicit functions, Higher order derivatives, Leibnitz theorem.

4.3 Special functions (Exponential, Logarithmic, Hyperbolic, Inverse circular and function), Definition, Graphs, range and Domain and Derivations of each of these functions.

4.4 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, sketching of some simple curves (without assumptions, question, not to be asked in the examination), Rate, Measure, velocity, Acceleration, Errors and approximation.

## 5. INTEGRAL CALCULUS - I :

5.1 Methods of Indefinite Integration :- Integration by substitution, Partial fraction and by parts, Integration of special function of 4.3.

5.2 Meaning and properties of definite integrals, Evaluation of definite integrals.

- 5.3 Application : Finding areas bounded by simple curves, Length of simple curves, Volume of solids of revolution, centre of mean of plane areas.
- 5.4 Simpsons and Trapezoidal Rule : their application in simple cases, Concept of error for simple function.

### 1.3 APPLIED PHYSICS

[ Common to All Engineering Courses]

L T P  
3 2/2 2

Rationale:

Engineering physics is a foundation Course. Its purpose is to develop proper understanding of physical phenomenon and scientific temper in the students. While teaching the subject, teachers should make maximum use of demonstrations to make the subject interesting to the students.

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Measurement	4	1	-
2.	Vector	3	1	-
3.	Force and Motion	4	1	-
4.	Dynamics of rigid body (Rotational Motion)	4	1	-
5.	Fluid Mechanics and Friction	4	1	-
6.	Work, Power and Energy	4	2	-
7.	Elasticity	2	1	-
8.	Simple Harmonic Motion	4	1	-
9.	Heat Transfer & Radiation	4	2	-
10.	Application of Sound Waves, Acoustics and Ultrasonics	6	2	-
11.	A. Optics	4	1	-
	B. Fiber Optics	4	1	-
12.	D.C. Circuits	4	1	-
13.	Dielectrics	4	2	-
14.	Magnetic Fields and Materials	4	2	-
15.	Semi Conductor Physics	5	1	-
16.	Nuclear Physics	4	2	-
17.	Laser & its Application	4	1	-
18.	Non-conventional energy sources	3	1	-
		75	25	50

#### DETAILED CONTENTS:

1. Measurement

a) Units and Dimensions

Fundamental and derived units :

S.I. Units & Dimensions of physical quantities, Dimensional formula and dimensional equation. Principle of homogeneity of dimensions and applications of homogeneity principle to:

i) Checking the correctness of physical equations,

- ii) Deriving relations among various physical quantities,
  - iii) Conversion of numerical values of physical quantities from one system of units into another. Limitations of dimensional analysis.
- b. Errors in measurements, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement (Combination of errors in addition, subtraction, multiplication and powers). Significant figures, and order of accuracy in respect to instruments, Standard deviation, Variance.
- 2. Vector :
 

Scalar and vector quantities; Addition, Subtraction, Resolution of vector- Cartesian components of vector, Scalar and vector product of two vector.
- 3. Force and Motion
 

Parabolic motion, projectiles thrown horizontally and at an angle. Problems on time of flight, horizontal range, and maximum horizontal range. Central forces. Circular motion, angular velocity, angular acceleration and centripetal acceleration. Relationship between linear and angular velocity and acceleration. Centripetal and centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge. Gravitational force, Motion of satellites, Kepler's laws, Escape velocity, Geostationary satellite, Concept of Black holes, Jet propulsion theory, Motion of Multi-stage Rocket, SLV, PSLV and GSLV Rockets.
- 4. Dynamics of Rigid Body (Rotational Motion)
 

Rigid body, Rotational motion, Moment of inertia, Theorems (Perpendicular and Parallel axis) of moment of inertia (Statement). Expression of M.I. of regular bodies, Radius of gyration, angular momentum, Conservation of angular momentum, Torque, Rotational kinetic energy. Rolling down the slant planes.
- 5. Fluid Mechanics & Friction
 

Surface tension, Capillaries, Equation of continuity ( $A_1V_1=A_2V_2$ ), Bernoulli's theorem, stream line and Turbulent flow, Reynold's number.

Introduction, Physical significance of friction, Advantage and disadvantage of friction and its role in every day life. Static and dynamic frictional forces. Coefficients of static and dynamic friction and their measurements. viscosity, coeff. of viscosity, & its determination by stoke's method.
- 6. Work, Power and Energy

Work done by force on bodies moving on horizontal and inclined planes in the presence of frictional forces, Concept of power and its units. Calculation of power (simple cases). Concept of kinetic and potential energy, various forms of energy, Conservation of energy. Force constant of spring, potential energy of a stretched spring.

7. Elasticity

Elasticity, stress and strain. Hooke's law, elastic limit. Yielding point and breaking point. Modulus of elasticity Young's modulus, bulk modulus and modulus of rigidity, Poisson ratio, Resilience.

8. Simple Harmonic Motion

Periodic Motion, characteristics of simple harmonic motion; equation of S.H.M. and determination of velocity and acceleration. Graphical representation. Spring-mass system. Simple pendulum. Derivation of their periodic time. Energy conservation in S.H.M. Definition of free, forced, undamped and damped vibrations, Resonance and its sharpness, Q-factor.

9. Heat Transfer and Radiation

Modes of heat transfer, coefficient of thermal conductivity and its determination by (i) Searle's method for good conductors, and (ii) Lee's method for poor conductors. Conduction of heat through compound media, Conduction and convection, Radial flow of heat, Blackbody radiation, Stefan's law, Wien's displacement and Rayleigh-Jeans laws, Planck's Law.

10. Application of Sound Waves

Acoustics

Standing waves, Closed and Open organ pipes, Resonance, End-correction. Definition of pitch, loudness, quality and intensity of sound waves. Echo and reverberation and reverberation time. Sabine's formula. Control of reverberation time (problems on reverberation time). Acoustics of building defects and remedy.

Ultra-Sonic :

Generation, Magnetostriction, Piezoelectric effect, Application in new technology

11.A Optics

Quantum nature of light, Coherence (Spatial and temporal), Duality of wave and particle, Concept of Interference, Biprism, Fraunhofer single and N-slit diffraction, Grating, Resolving and dispersive power, Elementary concept of

polarisation.

B. Fibre Optics :

Critical angle, Total internal reflection, Principle of fibre optics, Optical fibre, Pulse dispersion in step-index fibres, Graded index fibre, Single mode fibre, Optical sensor.

12. D.C. Circuits

Principle of Wheat Stone bridge and application of this principle in measurement of resistance (Meter bridge and Post Office Box); potentiometer, Kirchoff's Law and their simple application. Principle of Carey-Foster's bridge. Electric potential, potential energy, Energy of a charged capacitor. Fleming left hand rule, torque on a current loop, Moving coil, Galvano meter. Charging/discharging of capacitors, Ballistic galvanometer, its charge sensitivity and Current sensitivity.

13. Dielectrics :

Electric dipole; effect of electric field on dielectrics, polarisation.

14. Magnetic Fields & Materials :

Dia, Para and Ferro-magnetism, Ferrites, Hysteresis, Methods of plotting, Hysteresis curve of a ferro magnetic materials and their uses, Magnetic circuits, Energy stored in magnetic fields, Basic idea of super conductivity, Meissner's effect, Applications.

15. Semiconductor Physics

Energy bands in solids, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semiconductors, Electrons and holes as charge carriers in semiconductors, Effect of temperature in conduction in semiconductors, P-type and N-type semiconductors, P-N junction formation, barrier voltage, Forward and reverse biasing of a junction diode, P-N junction device characteristics, Formation of transistor, transistor-action, Majority and Minority charge carriers, Base, emitter and collector currents and their relationship LED's, Photo-electric effect and photo devices.

16. Nuclear physics

Radioactivity, Nuclear stability, Radioactive emission, radiation damage, Nuclear fission and fusion, Nuclear reactors (PHWR-type and fast breeder) and their application, Mass-energy relation, Atomic mass unit, Mass defect and binding energy.

17. Lasers and its Applications

Absorbtion and Emission of energy by atom, Spontaneous and Stimulated Emission, Einstein's co-efficients, Poluation inversion, Main component of laser and types of laser- Ruby Laser, He-Ne and Semi-conductor laser and their applications. Principles of Holography, Introduction to MASER.

18. Non-conventional energy sources:

- (a) Wind energy : Introduction, scope and significance, measurement of wind velocity by anemometer, general principle of wind mill, Indian wind energy programme.
- (b) Solar energy: Solar radiation and potentiality of solar radiation in India, unit of solar radiation, Solar constant measurement of solar radiation by pyrometer, and by Insolation meter (suryamapi) uses of solar energy: Solar Cooker, solar water heater, solar photovoltaic cells, solar energy collector, Solar PV plants in India, Modern applications in technology.

## PHYSICS LAB

Note: Any ten experiments are to be performed.

1. Determination of coefficient of friction on a horizontal plane.
2. Determination of 'Y' (Young's Modulus) by Searle's Method.
3. Determination of 'g' by plotting a graph  $T^2$  versus  $l$  and using the formula  $g=4n^2/\text{Slope of the graph line}$
4. Determination of Spring constant.
5. Determination of viscosity coefficient of a lubricant by Stoke's law.
6. Determination of 'k' for good conductor (Searle's Method).
7. Determination of frequency of AC mains by melde's methods (Transverse and Longitudinal Mode)
8. Determination of velocity of sound by resonance tube.
9. Determination of  $E_1/E_2$  by potentiometer.
10. Determination of specific resistance by Carry Foster bridge.
11. Determination of resistivity by P.O.Box.
12. Verification of Kirchoff's Law.
13. To observe Characteristics of p-n Junction diode on oscilloscope.
14. To measure instantaneous and average wind velocity by indicating cup type anemometer/hand held anemometer.
15. To measure solar intensity (determine solar constant) with the help of Insolation meter (Suryamapi).
16. Demonstration of He-Ne laser (Interferometer)
17. Determination of internal resistance by potentiometer.

NOTE :

Students should be asked to plot a graph in experiments (where possible) and graph should be used for calculation of results. Results should be given in significant figures only.



## 1.4 APPLIED CHEMISTRY

[ Common to All Engineering Courses]

L T P  
3 - 2

### Rationale:

Engineering Chemistry has profound and deep relationship with the industrial and environmental technology. This curriculum intends to impart technical knowledge alongwith productive practice to the students of the diploma engineering. The teachers are expected to guide the students in the classroom and the laboratories according to the curriculum by demonstrations and by showing relevant materials and equipments to inculcate interests in learning among students.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Atomic Structure	4	-	-
2.	Chemical Bonding	6	-	-
3.	Classification of Elements	3	-	-
4.	Instrumental Methods	4	-	-
5.	Electro Chemistry	6	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	3	-	-
8.	Solid State	3	-	-
9.	Colloids	3	-	-
10.	Lubricants	3	-	-
11.	Environmental Pollution and Control	3	-	-
12.	Water Treatment	5	-	-
13.	Corrosion	3	-	-
14.	Fuels	3	-	-
15.	Glass and Ceramics	3	-	-
16.	Streochemistry of Organic Compounds	4	-	-
17.	Organic Reactions	6	-	-
18.	Organic Materials	9	-	-
		75	-	50

### DETAILED CONTENTS:

#### 1. ATOMIC STRUCTURE :

Basic concept of atomic structure, Matter wave concept, Schrodinger wave equation, Quantum number, Haisenberg's Uncertainty Principle, Shaples of orbitals.

#### 2. CHEMICAL BONDING :

Overview of basic concept, Hydrogen bonding, Valence bond

theory, Hybridisation, VSEPR theory, Molecular orbital theory, Co-ordination bond, Crystal field theory for tetrahedral carbon.

3. CLASSIFICATION OF ELEMENTS :

Modern classification of elements (s,p,d and f block elements), Periodic properties : Ionisation potential, electronegativity, Electron affinity, Born-Haber cycle.

4. INSTRUMENTAL METHODS :

UV-visible, IR and NMR spectroscopy, Basic principles, Beer-Lamberts Law and Application of spectroscopy.

5. ELECTRO CHEMISTRY :

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and its measurement by pH meter. Buffer solutions, Indicators, Solubility product, Common ion effect with their application, Redox reactions, Electrode potential (Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electrochemical series and its application.

Concentration cells, reference electrodes (Hydrogen electrode) cells - Primary, Secondary and Fuel cell, Leclanche's or dry cell, Acid storage cell (Lead accumulator) and Alkali storage cell (Edison accumulator), Fuel cell, Solar cell (Photovoltaic cell), Numerical problems based on topics.

6. CHEMICAL KINETICS :

Introduction, order and molecularity of reaction. Activation energy, Rate law, rate constants, 1st order reactions and 2nd order reactions.

7. CATALYSIS :

Definition Characteristics of catalytic reactions, Catalytic promoters and poisons, Autocatalysis and Negative catalysis, Activation energy, Theory of catalysis, Application

8. SOLID STATE :

Types of solids (Amorphous and Crystalline), Classification (Molecular, Ionic, Covalent, Metallic), Band theory of solids (Conductors, Semiconductors and Insulators), types of Crystals, FCC, BCC, Crystal imperfection.

9. COLLOIDAL STATE OF MATTER :

Concept of colloidal and its types, Different system of colloids, Dispersed phase and dispersion medium. Methods of preparation of colloidal solutions, Dialysis and electro dialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation. relative stability of hydrophillic and hydrophobic colloids. Protection and protective colloids. Emulsion, Types, preparation, properties and uses. Application of colloids chemistry in different industries.

10. LUBRICANTS :

Definition, classification, Necessasity and various kinds of lubricants. Function and mechanism of action of lubricants and examples. Properties of lubricants, Importance of additive compunds in lubricants, Synthetic lubricants and cutting fluids. Industrial application, its function in bearing.

11. ENVIRONMENTAL POLLUTION AND ITS CONTROL :

Concept and various types of environmental pollution with special reference to air pollution and water pollution. General measures to control environmental pollution. depletion of Ozone layer, Green house effect, Acid rain, Smog formation, Chemical and photochemical reaction, Various species in atmosphere. Specific industrial pollution like Euro-I and Euro-II.

12. WATER TREATMENT :

Concept of hard and soft water, Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Sods lime, Zeolote and Ion exchange resin process). Disadvantage of hard water in different industries, Boiler feed water boiler scale formation, Corrosion, Caustic embrittlement, primming and foarming.

Characteristics imparted by various impurities or contaminants such as colour, odour, taste and sediments and their analysis.

Analysis of Water :

- A. Estimation of chlorides in water.
- B. Determination of dissolved oxygen.

Disinfecting of Water :

By Chloramic, Ozone and Chlorination with its mechemism, Advantage and disadvantage of chlorinational, Break point chlorination (Free residual chlorination ). Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Recycling of water-Theory and Process.

Numerical problems based on topics.

13. CORROSION :

Concept of metallic corrosion, Types of corrosion and factors affecting the corrosion rate, Chemical and electrochemical theory of corrosion, Oxide film formation and its characteristics, tarnishing fogging and rusting, Prevention of corrosion by various methods.

14. FUELS :

Definition of fuel, its classification and their composition, Calorific value and determination of calorific value of solid and liquid fuels by Bomb calorimeter by Dulong's formula.

Liquid fuel - Petroleum and its refining, distillate of petroleum (Kerosene oil, Diesel and Petrol), Benzol and Power alcohol.

Knocking, Anti-knocking agents, Octane number and Cetane number.

Cracking and its type, Gasolining from hydrogenation of coal (Bergius process and Fischer tropesch's process)

Gaseous Fuel - Coal gas, Oil gas, Water gas, Producer gas, Bio gas, LPG, CNG and Solar energy

Numerical Problems based on topics

15. GLASS AND CERAMICS :

Concept of glass and its constituents, Classification and uses of different glass, Elementary idea of manufacturing process of glass. Introduction to ceramics materials, Its constituent. Industrial application of glass and ceramic.

16. STEREOCHEMISTRY OF ORGANIC COMPOUND:

- Isomerism
- Types of isomerism
  1. Structural isomerism
  2. Stereoisomerism (a) Geometrical (b) Optical
- Definition of chiral, achiral stereogenic centre, plane of symmetry.
- Types of stereoisomers-
  1. Conformers or Rotamers (Only ethanes)
  2. Configurational isomers
    - a. Enantiomers
    - b. Diastereoisomers

17. ORGANIC REACTIONS :

1. Fundamental aspects -

- A. Regents electrophiles and nucleophiles
- B. Reaction Intermediates
  - i. Free radical
  - ii. Carbocation
  - iii. Carbanion
- C. Various effects of substituents - Inductive, Mesomeric, Electromeric.

2.A. Mechanism of addition reaction (Markonicon's Rule, Cyanohydrin and Peroxide effect),

- B. Mechanism of Substitution reactions (Nucleophilic-hydrolysis of alkyl halide, electrophilic substitution halogenation, Sulphonation, Nitration and Friedel-Craft reaction.

C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehydrohalogenation of primary alkyl halide.

18. ORGANIC MATERIALS :

A. POLYMERS :

1. Introduction to basic terms used in polymer chemistry and technology. Monomers, Average degree of polymerisation, Average molecular weight, Polymers, Polymerisation.

2. Characteristics of Polymers and their classification

- A. Addition polymers and their industrial application - Polystyrene, PVA, PVC, PAN, PMMA, Buna-S, Buna-N, Teflon.

- B. Condensation polymer and their industrial application : Nylon 6, Nylon 6,6, Bakelite, Melamine formaldehyde, Urea formaldehyde, Terylene or Decron, Polyurethanes.

3. Free radical polymerisation (Mechanism)

4. General idea of Bio polymers

5. Brief idea of bio degradable polymers.

6. Inorganic polymers - Silicones

B. SOAPS AND DETERGENTS :

1. Introduction - A. Lipids, B. Fats and Oils

2. Saponification of fats and oils , Manufacturing of soap.

3. Synthetic detergents, types of detergents and its manufacturing.

C. EXPLOSIVES: TNT, RDX, Dynamite.

E. Paint and Varnish

F. Adhesives

## LIST OF PRACTICAL

1. To analyse inorganic mixture for two acid and basic radicals from following radicals
  - A. Basic Radicals :  
NH<sub>4</sub><sup>+</sup>, Pb<sup>++</sup>, Cu<sup>++</sup>, Bi<sup>+++</sup>, Cd<sup>++</sup>, As<sup>+++</sup>, Sb<sup>+++</sup>,  
Sn<sup>++</sup>, Al<sup>+++</sup>, Fe<sup>+++</sup>, Cr<sup>+++</sup>, Mn<sup>++</sup>, Zn<sup>++</sup>, Co<sup>++</sup>  
Ni<sup>++</sup>, Ba<sup>++</sup>, Sr<sup>++</sup>, Ca<sup>++</sup>, Mg<sup>++</sup>
  - B. Acid Radicals :  
CO<sub>3</sub><sup>--</sup>, S<sup>--</sup>, SO<sub>3</sub><sup>--</sup>, CH<sub>3</sub>COO<sup>-</sup>, NO<sub>2</sub><sup>-</sup>,  
NO<sub>3</sub><sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, SO<sub>4</sub><sup>--</sup>
2. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.
3. To determine the total hardness of water sample in terms of CaCO<sub>3</sub> by EDTA titration method using E Br indicator.
4. To determine the strength of given HCl solution by NaOH solution using pH meter
5. To determine the Chloride content in supplied water sample by using Mohr's methods.
6. Determination method of temporary hardness of water sample by O-hener's method.

## 1.5 APPLIED MECHANICS

[ Common to three years Diploma Course in Civil Engg., Agriculture, Dairy, Ceramic, Civil & Rural Engg., Chemical Engineering, Architecture Assistantship, Computer Engineering]

[ Also Common to Four year Part-time Diploma Course in Mechanical Engineering (Spacialization In Production Engineering )

[ Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology ]

L T P  
2 2/2 2/2

### RATIONALE

The subject Applied Mechanics deals with fundamental concepts of mechanics which are useful for the students for further understanding of the second & final year subjects like S.O.M. and theory and design of steel & masonry structures as well as RCC designs. The subject enhances the method ability of the students.

### TOPIC WISE DISTRIBUTION OF PERIODS

SL.No.	Topic	L	T	P
1.	Introduction	2		
2.	Force Analysis	8	4	
3.	Moment and Couple	4	2	
4.	General condition of equilibrium	4	3	
5.	Friction	6	3	
6.	Machines	6	3	
7.	Stress & Strain	8	4	
8.	Beam & Trusses	6	3	
9.	Thin cylindrical & spherical shells	6	3	
Total		50	25	25

### DETAILED CONTENTS

#### 1. Introduction:

Mechanics and its utility. Concept of scalar and vector quantities. Effect of a force. Tension & compression. Rigid body. Principle of physical independence of force. Principle of transmissibility of a force.

#### 2. System of Forces :

Concept of coplaner and non-coplaner forces including parallel forces. Concurrent and non-concurrent forces. Resultant force. Equilibrium of forces. Law of parallelogram of forces. Law of triangle of forces and its converse. Law of polygon of forces. Solution of simple engineering problems by analytical and graphical methods such as simple wall crane, jib crane and other structures. Determination of resultant of any number of forces in one plane acting upon a particle, conditions of equilibrium of coplaner concurrent force system.

3. Moment & couple:

Concept of Varignon's theorem. Generalised theorem of moments. Application to simple problems on levers-Bell crank lever, compound lever, steel yard, beams and wheels, lever safety valve, wireless mast, moment of a couple; Properties of a couple; Simple applied problems such as pulley and shaft.

4. General Condition of Equilibrium:

General condition of equilibrium of a rigid body under the action of coplaner forces, statement of force law of equilibrium, moment law of equilibrium, application of above on body.

5. Friction:

Types of friction:statical, limiting and dynamical friction, statement of laws of sliding friction, Coefficient of friction, angle of friction; problems on equilibrium of a body resting on a rough inclined plane, simple problems on friction. Conditions of sliding and toppling.

6. Machines:

Definition of a machine. Mechanical advantage, velocity ratio, input, output, mechanical efficiency and relation between them for ideal and actual machines. Law of a machine Lifting machines such as levers, single pulley, three system of pulleys. Weston differential pulley, simple wheel and axle, differential wheel and axle. Simple screw jack, differential screw jack, simple worm and worm wheel.

7. Stresses and strains:

Concept of stress and strain. Concept of various types of stresses and strains. Definitions of tension, compression shear, bending, torsion. Concept of volumetric and lateral strains, Poisson's ratio. Changes in dimensions and volume of a bar under direct load (axial and along all the three axes). Ultimate stress, working stress. Elasticity, Hook's law, load deformation diagram for mild steel and cast iron. Definition of modulus of elasticity, yield point, modulus of rigidity and bulk Modulus. Stresses and strains for homogeneous materials and composite sections.



8. Beams & Trusses:

Definition of statically determinate and indeterminate trusses. Types of supports. Concept of tie & strut, Bow's notation, space diagram, polar diagram, funicular polygon; calculation of reaction at the support of cantilever and simply supported beams and trusses graphically and analytically; graphical solution of simple determinate trusses with reference to force diagram for determining the magnitude and nature of forces in its various members. Analytical methods: method of joints and method of sections.(simple problems only)

9. Thin cylindrical and spherical shells:

Differentiation between thick and thin shells, cylindrical and spherical shells, thin spherical and cylindrical shells subjected to internal pressure, longitudinal stresses, circumferential or hoop stresses. longitudinal, circumferential and volumetric strains. Changes in the dimensions and volume of a thin shell subjected to internal fluid pressure.

### Applied Mechanics Lab : Practicals

1. To verify the law of Polygon of forces.
2. To verify the law of parallelogram and triangle of forces.
3. To verify the law of principle of moments.
4. To find the coefficient of friction between wood, steel, copper and glass.
5. To find the reaction at supports of a simply supported beam carrying point loads only.
6. To find the forces in the jib & tie of a jib crane
7. To find the forces in the members of a loaded roof truss.  
(King / Queen post truss)
8. To find the mechanical advantage, velocity ratio and efficiency of any three of the following machines:
  - (i) Simple wheel & axle
  - (ii) Differential wheel & axle
  - (iii) Differential pulley block
  - (iv) Simple Screw jack
  - (v) Simple Worm & worm wheel
  - (vi) System of Pulleys (any type).

### 1.6 ENGINEERING DRAWING

[ Common to Three years Diploma Course in Mechanical Engg., Electrical Engg., Chemical Engg., Dairy, Ceramic, Textile Technology, Textile Chemistry]

[ Also Common to Four year Part-time Diploma Course in Electrical Engineering, Mechanical Engineering (Specilization in Production Engineering)]

[ Also common to First year Diploma Course in Chemical Technology : (1) Fertilizer Technology, (2) Rubber and Plastic Technology]

L T P  
- - 8

#### Rationale

Drawing, which is known as the language of engineers, is a widely used means of communication among the designers, engineers, technicians, draftmen and craftsmen in the industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus, for the effective and efficient communication among all those involved in an industrial system, it becomes necessary that the perosnnel working in different capacities acquire appropriate skills in the use of this graphic language in varying degrees of proficiency in accordance with their job requirements.

Generally speaking, an engineering technician working at the middle level of the threetier technical manpower spectrum, is required to read and interpret the designs and drawings, providedto him by technologists and subsequently to translate them to the craftsmen for actual execution of the job.

This course in Engineering Drawing has been designed, keeping in view, the above refered job functions of a technician in the industry. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects. The contents of the course have been selected as to form a core for the various deversified fields of engineering. It is expected that at the end of this session, the students acquires sufficient skill drafting and some ability in spetial visualization of simple objects.

Sl.N.	Units	Coverage Time		
		L	T	P
1.	Drawing Instruents and their use	-	-	4
2.	A. Lettering techniques	-	-	8
	B. Introduction to scales	-	-	8
3.	Conventional Presentation	-	-	8
4.	Principles of projections	-	-	16
5.	Orthographic projection of simple geometrical solids	-	-	24
6.	Section of Solids	-	-	20
7.	Isomatic Projection	-	-	20
8.	Free Hand Sketching	-	-	16
9.	Development of surfaces	-	-	24
10.	Assembly and dissembly drawing	-	-	24
11.	Orthographics Projection of Machine Parts	-	-	12

12.	Practice on Auto Cad	- - 16
		- - 200

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## C O N T E N T S

NOTE : Latest Indian Standards Code of Practice to be followed.

- 1
1. Drawing, instruments and their uses.
    - 1.1 Introduction to various drawing, instruments.
    - 1.2 Correct use and care of Instruments.
    - 1.3 Sizes of drawing sheets and their layouts.
  2. (a) Lettering Techniques 1 Sheet

Printing of vertical and inclined, normal single stroke capital letters.

Printing of vertical and inclined normal single stroke numbers.

Stencils and their use.
  - (b) Introduction to Scales 1 Sheet

Necesssity and use, R F

Types of scales used in general engineering drawing. Plane, diagonal and chord scales.
  3. Conventional Presentaion : 2 Sheet

Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts.
  4. (a) Principles of Projection 1 Sheet

Orthographic, Pictorial and perspective.

Concept of horizontal and vertical planes.

Difference between I and III angle projections.

Dimensconing techniques.
  - (b) Projections of points, lines and planes. 1 Sheet
  - 5 (a) Orthographic Projections of Simple 3 Sheet

## Geometrical Solids

Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making given angles with reference planes.

- (b) Orthographic views of simple composite solids from their isometric views.
- (c) Exercises on missing surfaces and views
6. Section of Solids 1 Sheet
- Concept of sectioning
- Cases involving cutting plane parallel to one of the reference planes and perpendicular to the others.
- Cases involving cutting plane perpendicular to one of the reference planes and inclined to the others plane, true shape of the section
7. Isometric Projection. 2 Sheet
- Isometric scale
- Isometric projection of solids.
8. Free hand sketching 1 Sheet
- Use of squared paper
- Orthographic views of simple solids
- Isometric views of simple job like carpentary joints
9. Development of Surfaces 1 Sheet
- Parallel line and radial line methods of developments.
- Development of simple and truncated surfaces (Cube, prism, cylinder, cone and pyramid).
10. Assembly and Disassembly Drawings 2 Sheet
- Plummer block  
Footstep bearings  
Couplings etc.  
Rivetted & Welded Joints
11. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet
- Nut and Bolt, Locking device, Wall bracket

12. PRACTICE ON AUTO CAD :

To draw geometrical figures using line, circle, arc, polygon, ellipse, rectangle - erase and other editing commands and osnap commands (two dimensional drawing only)

NOTE :

The drawing should include dimension with tolerance wherever necessary, material list according to I.S. code. 25% of the drawing sheet should be drawn in first angle projection and rest 75% drawing sheet should be in third angle figure

## 1.7 COMPUTER APPLICATION FOR ENGINEERING

[Common with Civil Engg., Civil (Spl. With Rural), Mechanical Engg., (Specialisation in Production, Automobile, Refrigeration and Air conditioning), Electronics Engg., Instrumentation and Control Engg., Dairy Engg., Leather Technology, Footwear and Leather Goods Tech., Cermics, Chemical Engg. (Four year Sandwich), Chemical Tech. (Rubber & Plastic), Chemical Tech. (Fertilizer) ]

L    T    P  
1    -    3

### Rationale:

Computers are being used for design and information processing in all branches of engineering. An exposure to fundamentals of computer programming is very essential for all diploma holders. This subject has been included to introduce students in the use and application of computers in engineering.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Introduction to Computer	5	-	-
2.	Introduction To Operating System MS DOS/Windows	3	-	-
3.	Ms-Word	4	-	-
4.	Ms-Excel	3	-	-
5.	Ms-Power Point	3	-	-
6.	Ms-Access	3	-	-
7.	Introduction to Internet	2	-	-
8.	Concept of Programming	2	-	-
		25	-	75

### DETAILED CONTENTS

#### 1. Introduction to Computer:

Block Diagram of Computer, Types Of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devices and memories. Visual Display Unit, Keyboard, Floppy disk drive, Hard disk drive, CD-ROM Drive, Magnetic & Tape Drive

Number system( Conversion) Binary, Octal, Hexa decimal number system, Conversion from Decimal to Other System and vice-versa Bit, Byte and Word.

#### 2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:)

What is operating system, its significance, Commands of DOS, Features/Application of window.

3. MS WORD:

File : Open, Close, Save, Save as, Search, Send to, Print Preview, Print and Page Setup  
Edit : Cut, Copy, Paste, Office Clipboard, Select All, Find, replace, Goto, etc.  
View : Normal/Web Layout/Print Layout; Tool Bars; Header/Footer; Zoom, etc.  
Insert: Break, Page Number, Date & Time, Symbol, Comment, Reference, etc.  
Format: Font, Paragraph, Bullets & Numbering, Borders & Shading, Column, Change case, Back ground, etc.  
Tools : Spelling & Grammer, Language, Word Count, Letters & Mailing, Options, Customize, etc.  
Table : Draw, Insert, Delete, Select, Auto Format, AutoFit, Convert, Sort, Formula, etc.

4. MS EXCEL:

Introduction, Use of Tools/Icons for preparing simple applications.

5. MS POWER POINT :

Introduction, Use of Tools/Icons for preparing simple presentation on Power Point.

6. MS ACCESS :

Introduction, Use of Tools/Icons for preparing simple applications.

7. Introduction to Internet:

What is Network, How to send & receive messages, Use of Search Engines, Surfing different web sites. Creating Mail ID, Use of Briefcase, Sending./replying emails.

8. Concept of Programming :

Flowcharting, Algorithm techniques, etc.

List Of Practicals

1. Practice on utility commands in DOS.
2. Composing, Correcting, Formatting and Article (Letter/Essay/Report) on MS Word and taking its print out.
3. Creating, editing, modifying tables in MS ACCESS.
4. Creating labels, report, generation of simple forms in MS ACCESS.
5. Creating simple spread sheet, using in built functions in MS EXCELL.
6. Creating simple presentation on Power Point.
7. Creating mail ID, Checking mail box, sending/replying e-mails.
8. Surfing web sites, using search engines.



## 1.8 WORKSHOP PRACTICE

[Common with Mechanical Engg. & All Mechanical Engg. Spl., Electrical, Ceramic, Dairy, Agriculture, Chemical Technology (Rubber & Plastic), Chemical Technology (fertilizer), Four year chemical Engg.]

[Four year Past time Mechanical Engg. (sp. in Production Engg.)]

L	T	P
-	-	8

### Rationale

A diploma holder in any branch of engineering has to work in between a skilled workman and an Engineer. In order to have effective control over skilled workmen it is necessary that the supervisory staff must have adequate knowledge and skill. For development of skills workshop practice is very essential.

Sl.No.	Units	Coverage Time		
		L	T	P
1.	Carpentry shop	-	-	24
2.	Painting & polishing shop	-	-	16
3.	Sheet metal and sodering shop	-	-	24
4.	Fitting shop	-	-	24
5 A.	Plumbing shop	-	-	16
5 B.	Foundry shop	-	-	20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
9.	Fastening Shop	-	-	12
		-	-	200

### DETAILED CONTENTS

1. Carpentry Shop :
  - EX-1 Introduction & demonstration of tools used in carpentry shop
  - EX-2 Planing and sawing practice
  - EX-3 Making of lap joint
  - EX-4 Making of mortise and tenon joint
  - Ex-5 Making of bridle joint
  - EX-6 Making of dovetail joint
  - Ex-7 Making of any one utility article such as wooden-picture frame, hanger, peg, name plate, etc.
  
2. Painting and Polishing Shop:
  - EX-1 To prepare a wooden surface for painting apply primer

on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.

Ex-2 To prepare metal surface for painting, apply primer and paint the same.

EX-3 To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

\* EX-4 Buffing and abrasive polishing of brass job.

Ex-5 Zinc coating by electroplating method.

Ex-6 To prepare any utility job.

\* The sequence of polishing will be as below:

i) Abrasive cutting by leather wheel.

ii) Polishing with hard cotton wheel and with polishing material.

iii) Buffing with cotton wheel or buff wheel.

3. Sheet Metal Working and Soldering Shop :

EX-1 Introduction & demonstration of tools used in Sheet metal working shop.

EX-2 Cutting, shearing and bending of sheet.

EX-3 To prepare a soap case by the metal sheet.

EX-4 To make a funnel with thin sheet and to solder the seam of the same.

EX-5 To make a cylinder and to solder the same.

EX-6 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired joints.

EX-7 Study and sketch of various types of stakes/anvil.

EX-8 To braze small tube/conduit joints.

4. Fitting Shop :

EX-1 Introduction & demonstration of tools used in Fitting Shop.

EX-2 Hacksawing and chipping of M.S. flat.

EX-3 Filing and squaring of chipped M.S. job.

EX-4 Filing on square or rectangular M.S. piece.

EX-5 Making bolt & nut by tap and die set.

Ex-6 To drill a hole in M.S. Plate and tapping the same to create threads as per need.

EX-7 Utility article-to prepare a screw driver or paper weight, double open mouth spanner for 18" hexagonal head of a bolt.

5 A. Plumbing Shop :

EX-1 Cutting and threading practice for using socket, elbow and tee etc. and to fit it on wooden practice board.

EX-2 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc.

5 B. Foundry Work

Ex-1 Study & sketch of the foundry tools.

Ex-2 Study & sketch of cupola & pit furnace.

- Ex-3 To prepare the green moulding sand and to prepare moulds (single piece and double piece pattern sweep mould)
- Ex-4 Casting of non ferrous (lead or aluminium) as per exercise 3.

6. Smithy Shop :

- EX-1 Study & Sketch of Tools used in smithy shop.
- EX-1 To prepare square or rectangular piece by the M.S. rod.
- EX-2 To braze M.S. Flats/Tipped tools on M.S. shank.
- EX-3 To make a screw driver with metallic handle.
- EX-4 To make a square or hexogonahed bolt.
- EX-5 To make a ring with hook for wooden doors.
- EX-6 Utility article-to preapre a ceiling fan hook.

7. Welding Shop :

- EX-1 Welding practice-gas and electric.
- EX-2 Welding for lap joint after preparing the edge.
- EX-3 Welding of Butt joint after preparation of the edge.
- EX-4 'T' joint welding after preparation of edge.
- EX-5 Spot welding, by spot welding machine.
- EX-6 Welding of plastic pieces by hot strip method.
- EX-7 Welding practice by CO2 gas welding

8. Machine Shop

- EX-1 Study & sketch of lathe machine.
- Ex-2 Plain and step turning & knurling practice.
- Ex-3 Study and sketch of planning/Shaping machine and to plane a Ractangle of cast iron.

9. Fastening Shop

- EX-1 Practice of bolted joints
- EX-2 To prepare a rivetted joint
- EX-3 To make a pipe joint
- EX-4 To make a threaded joint
- EX-5 Practice of sleeve joint

## 1.9 BUILDING MATERIALS

(Common to Diploma in Civil Engg. with spl. in Rural Engg., Environmental Pollution & control, Water & Power Resource Management)

L T P  
2 - -

### RATIONALE:

Diploma holders in Civil Engineering have to deal with various types of building materials like stones, bricks, lime, cement, timber, paints & varnishes, glass, plastics and insulating materials. Diploma holders should know the properties of various materials, their testing procedures and specifications. Therefore, the subject of building material is very important. While teaching this subject, teachers should organise field visits, conduct demonstrations, encourage students to collect various kinds of materials, their rates and availability.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	L	T	P
1.	Building Stones	8		
2.	Bricks and Clay Products	9		
3.	Lime	5		
4.	Cement	6		
5.	Timber and wood based products	4		
6.	Paints & Varnishes	4		
7.	Insulating Materials	3		
8.	Glass	3		
9.	Plastics	3		
10.	Water Proofing Materials	2		
11.	Exposure to non conventional & Waste Byproduct	3		
Total		50	-	-

### CONTENTS:

- Building Stones:**  
Classification of rocks: Geological and physical classification; Common rock forming minerals; Testing of stones for specific gravity, water absorption, durability, weathering, hardness by Moh's scale, identification of rocks.  
  
Quarrying: Terminology used in quarrying; basic principles involved, methods of quarrying. Blasting: where used, principles of blasting, line of least resistance, drilling of holes (manually and mechanically), charging, tamping, firing, fuses and detonators, safety precautions, common explosives only names, their uses and storage. Wedging: where used, tools required and operation of wedging. Stone crushing: process &

equipment used, crushers, grinding mills like hammer mill, ball mill & screens. Availability, characteristics and uses of the following stones:  
Granite, sandstone, limestone, dolomite, slate, basalt, trap, quartzite and marble. Availability of different stones in state.

2. Bricks and Clay Products:

Raw materials for brick manufacture, properties of good brickmaking earth, field testing of brick clay. Manufacture of bricks: Preparation of clay-manually/mechanically. Moulding: hand moulding and machine moulding. Drying of bricks. Burning of bricks. Clamps. Types of kilns, details of Bull's trench kiln and Hoffman's Kiln, process of burning, size of standard bricks. IS Classification of bricks as per IS: 1077 and testing of common building bricks as per IS: 3495 recommendations. Compressive strength, water absorption, efflorescence test; refractory bricks: composition, properties and uses. Building tiles: types-wall, ceiling, roofing and flooring tiles, their properties, and uses. Other clay products: earthenware and stoneware, their properties and uses.

3. Lime

Natural sources of lime. Definitions of quick lime, fat lime, hydraulic lime, hydrated lime, lump lime, calcination, slaking, manufacture of lime. Process of setting and hardening action of lime. Field tests of lime as per IS 1624. Pozzolonic materials. Types, properties and uses.

4. Cement

Natural and artificial cement, raw materials, manufacture of ordinary portland cement, flow diagrams for dry and wet process. setting and hardening of cement, types of cement, properties of cement, tests of cement as per IS.

5. Timber and wood based Products:

Classification of trees. Cross-section of an exogenous tree and explanation of terms. Identification of different types of timber: teak, chir, shisham, sal, mango, devdar, kail etc. Market forms of converted timber as per IS. Seasoning of timber: purpose, types of seasoning. air seasoning, water seasoning, kiln seasoning, chemical seasoning, Solar seasoning kiln. Defects in timber. Decay in timber. Preservation of timber and methods of treatment. Properties of good timber. Common structural timbers in India, their availability, and uses. Plywood, veneers; manufacture of plywood, uses of plywood. Other wood based product their brief description, manufacture and uses.

Laminated boards: block boards, fibre boards, resistant board, hardboard, plastic coated finishes, water and fire resistant ply wood, PVC boards.

6. Paints

Various types of paints. Constituents of oil paints, their functions and properties. Cement paints, their properties and uses, Varnish and polish: types, properties and uses. Lacquars and enamels: their properties and uses. Trade names of different products.

7. Insulating Materials

Properties, uses and requirements of heat and sound insulating materials. Properties and uses of: cork, rockwool, glass wool, concrete, aluminium foil, asbestos sheets for ceiling, commercial names of different insulating materials.

8. Glass

Types of glasses and their properties: Sheet glass, plate glass, frosted glass, wired glass, fibre glass bullet resisting glass, coloured glass and glass wool. Commercial sizes, forms and their uses.

9. Plastics

Methods of moulding and types, properties and uses of plastics. Important commercial product, uses of plastic in Civil Engineering: plastic pipes, taps, valves, plastic coated paper, polythene sheets, thermocole, bakalyte, PVC, rexine and linolium.

10. Water proofing materials.

Properties & commercial trade names.

11. Exposure to non conventional & waste by product

Fly ash, Stone Cladding and other finishing materials.

1.10 CIVIL LAB - I  
(Building Material Testing Lab)

L T P  
- - 2

LIST OF PRACTICALS:

1. Identification of different types of stones and aggregates (visual identification).
2. Identification of timbers: teak, sal, chir, shisum, siras, deodar, kail and mango. (visual identification)
3. To conduct field tests of cement.
4. To determine normal consistency of cement.
5. To determine setting time (initial and final) of cement.
6. To determine fineness of given sample of cement.
7. To determine compressive strength of bricks.
8. To determine water absorption of bricks
9. To determine soundness of cement.
10. To identify hydraulic & fat lime.

IIYEAR

2.1 ELEMENTRY ELECTRIAL AND MECHANICAL ENGG.

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg.,Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
3 - -

RATIONAL

Civil Engg. Diploma Holder has to interact with engineering and technicians in the Field of mechanical and electrical engineering. This subject has been kept in the curriculam to provide a general introduction to mechanical and electrical engineering elements. Teachers should lay more emphasis on basic concept while teaching this subject.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
(A)	Elements of Mechanical Engineering			
1.	I.C. Engines	8		
2.	Compressors	4		
3.	Gears	6		
4.	Material Handling Equipments	6		
5.	Lathes, Milling and drilling machines	8		
6.	Machine tools and Equipments	8		
(B)	Elements of Electrical Engineering			
1.	A.C. Machines	4		
2.	Measuring Instruments	6		
3.	Illuminating Devices	7		
4.	Electrical Services	8		
5.	House wiring	6		
6.	Earthing	2		
7.	Safety		2	
TOTAL		75	-	-



(A) Elements of Mechanical Engineering

1. Construction and working of I.C. Engines, their classifications (2 stroke and 4 stroke), details of 4 stroke I.C. Engines.
2. Types of compressors and their uses
3. Different type of gears and their applications.
4. Conveyers, hoists and other material handling equipments-their functioning and uses.
5. Different kinds of lathes, milling machines and drilling machines.
6. Different kinds of Jacks & Hammers and their uses.

(B) Elements of Electrical Engineering

1. A.C.Machines  
(a) Transformers (b) Alternators (c) Induction Motor - their types, uses and Physical & Electrical specification.
2. General idea of electrical measuring instruments like Ammeter, Voltmeter, Wattmeter and Megger and their uses.
3. Different types of lamps like incandescent lamps, sodium vapour lamps, florescent tube. Halogen lamps - CFL, their merits, demerits and use.
4. Bye laws pertaining to electrical installations, Fans and AC's different types of artificial lighting systems, Lighting systems for residential buildings, public building, schools, colleges, hotels, hospital, exhibition hall, library etc.(IS)
5. Simple electrical circuits used in house wiring
6. Earthing - need and procedure.
7. Safety against electrical shocks.

## 2.2 STRENGTH OF MATERIALS

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

### RATIONALE

L	T	P
3	1	2

The subject is an important part of Civil Engineering Curriculum. Study of this subject enables the student to distinguish between different types of stresses and strains in a material, under the action of external forces. The student will learn to analyse simple structural elements for their design, which he usually needs in his professional life. The contents of the subject have been selected in such a way as to form the basis of structural design proposed to be taught in the succeeding year.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Principal Stress and Principal Planes	12	4	
2.	Bending Moment and Shear Forces	12	4	
3.	Bending and Shear Stresses	12	4	
4.	Combined Direct & Bending Stresses	10	3	
5.	Slopes and Deflection of beams	8	3	
6.	Columns & Struts	8	2	
7.	Torsion	9	3	
8.	Fixed and continuous beams	4	2	
Total		75	25	50

### DETAILED CONTENTS

1. Principal Stress and Principal Planes :

Principal stress and principal plane under direct and shear stress. Graphical determination by Mohr's circle method.

2. Bending Moment and Shear Force:

Concept of a beam, and supports (Hinged, Roller and Fixed). Types of Beams: Simply supported, cantilever, fixed, overhang and continuous beams. Types of loads (distributed, point and varying). Concept of Bending Moment & Shear Force. Sign conventions. Bending moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to uniformly distributed, concentrated and uniformly varying loads. Relationship between load, shear force and bending moment. Point of maximum B.M. and contraflexure, concept of fixed and continuous beams.

### 3. Bending and Shear Stresses

Assumption of theory of simple bending. Derivation of the equation.  $M/I = F/Y = E/R$ . Concept of centroid and second moment of area, Radius of gyration, Theorems of parallel and perpendicular axes, Second Moment of area for sections: rectangle, triangle, circle, trapezium, angle, Tee, I, Channel and compound sections. Moment of resistance, section modulus and permissible bending stresses, Bending stresses in circular, rectangular, I, T and L section. Comparison of strength of the above sections. Concept of shear stresses in beams, Shear stress distribution in rectangular, I and T section.

### 4. Combined Direct & Bending Stresses:

Concentric and eccentric loads, eccentricity, effect of eccentric load on the section, middle third rule; stresses due to eccentric loads. Examples in the case of short columns, chimneys and dams.

### 5. Slopes and Deflections of Beams:

Definition of slope and deflection, sign convention. Circular bending. Calculation of maximum slope and deflection for the following standard cases by double integration or moment area method.

- (1) Cantilever having point load at the free end.  
Cantilever having point load at any point of the span.  
Cantilever with uniformly distributed load over the entire span  
Cantilever having U.D.L. over part of the span from free end  
Cantilever having U.D.L. over a part of span from fixed end
- (2) Simply supported beam with point load at centre of the span.  
Simply supported beam with U.D. load over entire span.

NOTE: All examples will be for constant moment of inertia without derivation of formula.

### 6. Columns & Struts:

Definition of long column, short column and strut, slenderness ratio, equivalent length, critical load, collapse Load, End conditions of column. Application of Euler's and Rankine's formula (no derivation), simple numerical problems based on Euler's and Rankine's formulae.

### 7. Torsion

Definition of torque and angle of twist. Derivation of torsion equation. Polar moment of inertia. Strength of hollow and solid shaft, advantage of a hollow shaft over a solid shaft. Comparison of weights of solid and hollow shafts for

same strength. Horse Power transmitted. Calculation of shaft diameter for a given Horse Power.

8. Fixed and Continuous Beam:

Effect of fixing and continuity, fixed beams with point loads and U.D. Load. Continuous beam of uniform section covering three spans with free ends (supports being at the same level) B.M. & S.F. Diagram. Points of Contraflexure of fixed and continuous beams.

LABORATORY WORK

1. Determination of shear force at different sections on a simply supported beam under points loads.
2. Determination of bending moment at different sections on a simply supported beam under different types of loading.
3. Determination of yield stress, ultimate stress, percentage elongation, plot the stress strain diagram and compute the value of Young's Modulus of mild steel.
4. Determination of the maximum deflection and Young's Modulus of elasticity by deflection apparatus.
5. Determination of modulus of rigidity of material by Torsion apparatus.
6. Determination of stiffness/deflection of a helical spring.
7. Determination of hardness of a metal plate by Rock Well Brinell hardness testing machine.
8. To perform impact test on Izod Impact testing machine.

## 2.3 HYDRAULICS

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
3 1 2

### RATIONALE

Hydraulics is a subject which helps in solving problems in the subject of Public health Engg./ Environmental Engg. and irrigation engineering. Principles of Hydraulics finds its application in Bridge Engg. and in many other Civil Engg. fields. The subject deals with basic concepts and principles in hydrostatics, hydrokinematics and hydrodynamics and their application, in solving fluid flow problems.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Periods		
		L	T	P
1.	Introduction	3	-	
2.	Properties of Fluids	6	2	
3.	Hydrostatic Pressure	8	4	
4.	Measurement of pressure	8	2	
5.	Fundamentals of fluid flow	8	3	
6.	Orifices	6	2	
7.	Flow through pipes	8	3	
8.	Flow through open channels	8	3	
9.	Flow measurement	8	4	
10.	Hydraulic Machine	12	2	
Total		75	25	50

1. Introduction:
  - 1.1 Fluid : Real fluid, ideal fluid.
  - 1.2 Fluid Mechanics, Hydraulics, Hydrostatics, Hydrokinematics and Hydrodynamics.
2. Properties of Fluids
  - 2.1 Mass density, specific weight, specific gravity, cohesion, adhesion, viscosity, surface tension, capillarity, vapour pressure and compressibility.
3. Hydrostatic Pressure:
  - 3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications.
  - 3.2 Total pressure, resultant pressure, and centre of pressure.

- 3.3 Total pressure and centre of pressure on vertical and inclined plane surfaces:
  - 3.3.1 Rectangular
  - 3.3.2 Triangular
  - 3.3.3 Trapezoidal
  - 3.3.4 Circular
- 4. Measurement of Pressure
  - 4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.
  - 4.2 Piezometers, simple manometer, differential manometer and mechanical gauges. Measurement of pressure by manometers and pressure gauges.
- 5. Fundamental of Fluid Flow
  - 5.1 Types of Flow:
    - 5.1.1 Steady and unsteady flow
    - 5.1.2 Laminar and turbulent flow
    - 5.1.3 Uniform and non-uniform flow.
  - 5.2 Discharge and continuity equation (flow equation)
  - 5.3 Types of hydraulic energy.
    - 5.3.1 Potential energy
    - 5.3.2 Kinetic energy
    - 5.3.3 Pressure energy
  - 5.4 Bernoulli's theorem; statement and description (without proof of theorems).
  - 5.5 Venturimeter (horizontal and inclined) and Orifice Plate meter.
- 6. Orifice:
  - 6.1 Definition of Orifice, and types of Orifices,
  - 6.2 Hydraulic Coefficients.
  - 6.3 Large vertical orifices.
  - 6.4 Free, drowned and partially drowned orifice.
  - 6.5 Time of emptying a rectangular/circular tanks with flat bottom.
- 7. Flow through Pipes
  - 7.1 Definition, laminar and turbulent flow explained through Reynold's Experiment.
  - 7.2 Reynolds Number, critical velocity and velocity distribution.

- 7.3 Head Losses in pipe lines due to friction, sudden expansion and sudden contraction entrance, exit, obstruction and change of direction (No derivation of formula)
- 7.4 Hydraulic gradient line and total energy line.
- 7.5 Flow from one reservoir to another through long pipe of uniform and composite section.
- 7.6 Water Hammer Phenomenon and its effects. (only elementary treatment)
- 8. Flow through open channels.
  - 8.1 Definition of a channel, uniform flow and open channel flow .
  - 8.2 Discharge through channels using
    - (i) Chezy's formula (no derivation)
    - (ii) Manning's formula
  - 8.3 Most economical sections
    - (i) Rectangular
    - (ii) Trapezoidal
- 9. Flow Measurements
  - 9.1 Measurement of velocity by
    - (i) Pitot tube
    - (ii) Current-meter
    - (iii) Surface Float
    - (iv) Velocity rods.
  - 9.2 Measurement of Discharge by a Notch
    - 9.2.1 Difference between notches and orifices.
    - 9.2.2 Discharge formulae for rectangular notch, triangular Notch, trapezoidal notch, and conditions for their use. (with derivation)
  - 9.3 Measurement of discharge by weirs.
    - 9.3.1 Difference between notch, weir and barrage.
    - 9.3.2 Discharge formula for free, drowned, and broad crested weir with and without end contractions ; velocity of approach and condition of their use.
    - 9.3.3 Venturi flumes to measure flow.
  - 9.4 Measurement of Discharge by velocity area-method.
- 10. HYDRAULIC MACHINE :

10.1 Reciprocating pumps

10.2 Centrifugal pumps

10.3 Impulse Turbines

10.4 Reaction Turbines

Sketching and description of principles of working of above mentioned machines

#### LABORATORY WORK

- (i) To verify Bernoulli's Theorem.
- (ii) To find out venturimeter coefficient.
- (iii) To determine coef. of velocity ( $C_v$ ), Coef. of discharge ( $C_d$ ) Coef. of contraction ( $C_c$ ) and verify the relation between them.
- (iv) To perform Reynold's Experiment.
- (v) To determine Darcy's coefficient of friction for flow through pipes.
- (vi) To verify loss of head due to:
  - (a) Sudden enlargement
  - (b) Sudden Contraction.
- (viii) To determine velocity of flow of an open channel by using a current meter.
- (ix) To determine coefficient of discharge of a rectangular notch/triangular notch.
- (x) Study of the following
  - (i) Reciprocating Pumps or Centrifugal Pumps.
  - (ii) Impulse turbine or Reaction turbine
  - (iii) Pressure Gauge/water meter/mechanical flow meter/pitot tube.



## 2.4 PUBLIC HEALTH ENGG.

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
3 - 2

### RAITIONALE

This subject deals with the basic of water supply and sanitary engineering so as to enable the students to work in the department of Public Health Engg. Teachers are expected to organise field visits to show various elements and processes contained in the subject.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sr.No.	Topics	L	T	P
(A) Water Supply Engg.				
1.	Introduction	3		
2.	Sources	4		
3.	Water treatments	9		
4.	Water distribution	7		
5.	Laying of pipes	5		
6.	Building water Supply	4		
7.	Maintenance	2		
(B).Sanitary Engineering				
8.	Introduction	3		
9.	Quantity of sewage	6		
10.	Sewage systems	6		
11.	Building drainage	4		
12.	Rural sanitation	4		
13.	Maintenance	6		
14.	Sewage disposals	6		
15.	Sewage treatments	6		
Total		75	-	50

#### (A) Water Supply Engg.

##### 1. Introduction

Necessity and brief description of water supply system. Water requirement: Per capita consumption for domestic, industrial, public and firefighting uses as per IS standards. Consumption, demand and its variation.

##### 2. Sources of Water

a. Surface water sources : Rivers, canal, inponding

reservoir and lakes, their quality of water and suitability.

### 3. Water Treatment

Suspended, colloidal and dissolved impurities. Physical, chemical and bacteriological tests and their significance. Minimum standards required for drinking water, Principles of Sedimentation, Coagulation, Flocculation, Filtration, Disinfection (Chlorination) including Jar Test, Break point chlorination, Residual chlorine.

Flow diagram of different treatment units. Function, constructional details, working and operation of

(i) Aeration fountain (ii) Mixer (iii) Flocculator (iv) Clarifier (v) Slow and rapid sand filter (vii) Chlorination chamber (viii) Water softening (ix) Removal of Iron and Magnese.

Chemicals required for water treatment, their uses, and feeding devices. Simple design of sedimentation tank, and filters.

### 4. Water Distribution

(i) Pipes:

Different types of Pipes:

Cast iron, steel, plastic, (PVC, LDPE, HDPE), asbestos cement, concrete, plastic, GI and lead pipes. Details of their sizes, joints and uses.

(ii) Appurtenances:

Sluice (Gate and spindle), air, reflux, scour and safety valves, fire hydrants, their working and uses.

(iii) Distribution system:

Requirements of distribution: Minimum head and rate. Types of lay out- dead end, grid, radial and ring systems. System of water supply- intermittent and continuous. Service reservoirs- types, necessity and accessories.

(iv) Storage:

Necessity, types of storing tanks: G.I. Sheet Tank, P.V.C. tank, over head tanks.

### 5. Laying of Pipes:

Setting out alignment of pipe line.

Excavation in different types of soils and precautions taken.

Precautions taken for traffic control, bedding for pipe line. handling, lowering, laying and jointing of pipes, testing of pipe lines and back

filling. Use of boning rods.

6. Building Water Supply

- (i) General layout of water supply arrangement for a building (single and multistoried) as per IS Code of practice. Water supply fixtures and their installation. Tapping of water mains.
- (ii) Hot and Cold Water supply in buildings. Use of Solar water heaters.
- (iii) Rural water supply: Sources, treatment and distribution.

7. Maintenance

Leakage detection and prevention. Replacement of damaged pipe. Maintenance of domestic plumbing fixtures.

(B) SANITARY ENGINEERING

8. Introduction:

Waste: Dry, semiliquid, liquid, Necessity of systematic collection and disposal of waste. Brief description of sewage disposal system. Conservancy and water carriage system, their advantages and disadvantages.

9. Quantity of Sewage:

- (i) Sewage: Domestic, industrial and storm water.
- (ii) Volume of domestic sewage (DWF), variability of flow, limiting velocities in sewers.
- (iii) Use of table as per I:S 1742-1983 to determine relationship between gradient, diameter, discharge and velocity.

10. Sewerage Systems:

- (i) Types of sewerage systems separate, combined and partially separate.
- (ii) Sewers : Stone ware, cast iron, concrete and masonry sewers their sizes and joints.
- (iii) Appurtenances: (Location, function and construction) manholes, drop manhole, lamp hole catch basin, inverted syphon, flushing tanks, ventilating shafts and storm water flows.
- (iv) Laying of sewers:  
Setting out alignment of sewer.  
Excavation, checking the gradient with the

help of boning rods, preparation of bedding, handling, lowering, laying and jointing, testing and backfilling.

- (v) Construction of surface drains and different sections required.

#### 11. Building Drainage

- (i) Aims of building drainage and its requirements. General layout of sanitary fittings and house drainage arrangement for a building (single and multistoreyed) as per IS 1742-1983.
- (ii) Different sanitary fittings and their installation.
- (iii) Traps, seal in traps, causes of breaking of seal, precautions taken, Gully, Intercepting and Grease traps.
- (iv) Testing of house drainage.

#### 12. Rural Sanitation:

- (a) Drainage: Topography, alignment of lanes and bylanes, storm water, natural passage, development of drains, alignment, size and gradient. Phase Programme.
- (b) Disposal of night soil and village latrines :
  - (i) Collection and disposal of garbage and refuse.
  - (ii) Septic tanks, cess pools/soak pit (design of septic tank, soak pit/cess pools), privy pit and bore hole latrines.
  - (iii) Biogas plant, constructional details, uses and maintenance.
- (c) Guide lines for future development of village.

#### 13. Maintenance:

Inspection of mains, cleaning and flushing of sewers. Precautions during cleaning, maintenance of traps, cleaning of house drainage line. Tools and equipment needed for maintenance.

#### 14. Sewage Disposal

- (i) General composition of sewage, importance & method of determination of O.D., B.O.D. and C.O.D.
- (ii) Disposal methods. Land disposal, disposal by dilution and disposal in sea. Merits and demerits.
- (iii) Nuisance due to disposal, self purification of streams, conditions of disposal.

#### 15. Sewage Treatment:

- (i) Meaning and principle of primary and secondary treatment, constructional details of screening chamber, grit chamber, clarifier, trickling filters, secondary clarifiers/airation tank.
- (ii) Sludge treatment, sludge digestion, sludge drying; sludge disposal.
- (iii) Oxidation ponds.

Practicals  
Public Health Engg. Lab

1. To determine dissolved and suspended solids in water.
2. To determine pH value of water sample.
3. To determine turbidity of water.
4. To calculate :
  - i. Oxygen Demand (OD)
  - ii. Biological Oxygen Demand (BOD)
  - iii. Chemical Oxygen Demand (COD)
5. To determine residual chlorine in water sample.
6. To perform Jar Test for Coagulants.
7. To collect samples of water from shallow & deep wells.
8. To perform chlorine demand test.
9. To determine hardness of water.
10. To determine available chlorine in bleaching powder.
11. To perform field test for the detection of intermediate pollution in drinking water by OT test.
12. To visit and write specific report for the following.:  
(Any three)
  - a. Water treatment plant for moderate town (say Population 1lacs)
  - b. Sewage treatment plant for 5 lac to 10 lac population
  - c. Sewage disposal work
  - d. Construction site for layout of water supply & sewerage system.
  - e. Industrial effluent treatment plant

## 2.5 SOIL MECHANICS AND FOUNDATION ENGINEERING

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
3 - 2

### RATIONAL

Supervision of earth work in the construction of dams, road embankment, pavement and other Civil Engineering structures, is one of the important functions of a civil engineering technician. The analysis of these functions indicate that basic knowledge of soil mechanics, a modern subject in the field of civil engineering is essential for the engineers for the safe construction.

The topics will cover only elementary knowledge of the subject dealing with formation and properties of soil, difinitions etc, so that technician is able to identify their common types, their selection and proper use in the field of engineering construction. Weight and volume relationship. Index properties, grain size analysis and classifcation, field identification, permeability shear strength, compaction, consolidation, earth pressure, and retaining structures. Shallow and deep foundations, bearing capacity, sub-surface explorations are dealt with. Finally to develop skills in identification of soil type suitable laboratory work with simple equipments is also suggested. Teaching should cover the field practices where ever applicable.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Topics	L	T	P
1.	Introduction	3		
2.	Fundamental definition & their relationship	15		
3.	Classifcation of soils	4		
4.	Permeability of soils	8		
5.	Campaction	8		
6.	Consolidation	4		
7.	Shear strength	8		
8.	Earth pressure and earth retaining structure	8		
9.	Shallow and deep Foundation	8		
10.	Stablization of Soils	3		
11.	Soil exploration & sampling	6		
<b>Total</b>		<b>75</b>		<b>50</b>

1.	Introduction			
	1.1 Definition of soil Mechanics and foundation engineering.			

- 1.2 Soil formation - different kinds of soils and soil structures.
2. Fundamental Definitions and their Relationships
  - 2.1 Graphical representation of soils as a three phase system.
  - 2.2 Definitions of moisture content unit weight of soil mass such as bulk density, saturated density, submerged density and dry density, specific gravity, mass specific gravity, void ratio, porosity and degree of saturation, percentage air voids and their content, density index.
  - 2.3 Relationships between various terms stated above.
  - 2.4 Consistency limits Liquid limit, Plastic limit, Shrinkage limit, Plasticity index, Consistency index.
  - 2.5 Grain size analysis - Sieve and Hydrometer analysis, C.C. and C.U.
3. Classification of Soils
  - 3.1 Particle size classification - M.I.T., and I.S., U.S. bureau of soils and U.S. P.R.A.
  - 3.2 Textural classification chart, brief description of plasticity chart.
  - 3.3 I.S. soil classification.
4. Permeability of Soils
  - 4.1 Definition of permeability.
  - 4.2 Interpretation of Darcy's law, definition of discharge, velocity and seepage velocity and coefficient of percolation.
  - 4.3 Factors affecting permeability.
  - 4.4 Laboratory methods of falling head and constant head, field methods of pumping-out tests and pumping-in tests.
5. Compaction
  - 5.1 Definition of Compaction.
  - 5.2 Standard & modified Proctor compaction test.
  - 5.3 Different methods of compaction.
  - 5.4 Factors affecting compaction.
  - 5.5 Brief discription of field compaction methods.

- 5.6 Compacting equipments and field control.
- 5.7 Indian Standards.
- 6. Consolidation
  - 6.1 Definition of consolidation and its importance on foundation settlement.
  - 6.2 Difference between consolidation and compaction.
- 7. Shear Strength
  - 7.1 Definition of shear strength.
  - 7.2 Definition of Cohesive & noncohesive soil. with reference to  $c$  and  $\phi$  (phy) soil.
  - 7.3 Coulomb's equation.
  - 7.4 Shear box and unconfined compression tests.
- 8. Earth Pressure and Retaining Structures
  - 8.1 Definition of earth pressure, active and passive earth pressures, terms and symbols relating to a retaining wall.
  - 8.2 Relation between movement of wall and earth pressure
  - 8.3  $K_a$  and  $K_b$  by Rankin's Method.
  - 8.4 Simple earth pressure calculations without surcharge.
- 9. Shallow and Deep Foundations
  - 9.1 Definitions of shallow and deep foundations
  - 9.2 Application of Terzaghi's bearing capacity formulae for different types of foundations.
  - 9.3 Factors affecting depth of shallow foundation
  - 9.4 Plate load test for shallow foundations
- 10. Ground Improvement Techniques
  - Concept of stablization, materials used, advantages of lime & cement as stablizing agents. Strength of stablized soil. Deep compaction - Heavy tamping, Explosion, Grouting, Reinforcement.
- 11. Soil Exploration and sampling
  - 12.1 Methods of exploration



## 12.2 Types of soil samples and samplers

### LABORATORY EXPERIMENTS

#### SOIL MECHANICS LAB

1. Determination of moisture content by oven drying method
2. Determination of specific gravity of soil particles by specific gravity bottle/pycnometer
3. Determination of soil particles size distribution by sieving
4. Determination of liquid limit and plastic limit of soil
5. Determination of permeability by constant Head Permeameter and falling head permeameter.
6. Shear strength of sand by Direct Shear test.
7. Unconfined compression test
8. Standard Proctor compaction test.
9. Determination of field density of soil by sand replacement and core cutter methods.
10. Demonstration of Standard Penetration Test.

## 2.6 BUILDING CONSTRUCTION AND MAINTENANCE ENGG.

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L	T	P
3	-	2

### RATIONALE

The important job of a civil engineering technician is to supervise the construction of various civil engineering structures. This subject deals with broad aspects of construction, primarily of building construction. The topics detailed in the contents are intended to acquaint student about the procedure of construction so that he is better equipped to perform his duties in the field. It is important that teachers organise regular field visits to show buildings under construction. Some experts from field shall be invited to deliver extension lectures.

### TOPIC WISE DISTRIBUTIONS OF PERIOD

Sr. No.	Topics	L	T	P
1.	Introduction	4		
2.	Foundations	6		
3.	Walls	8		
4.	Arches & Lintels	4		
5.	Doors & Windows	8		
6.	Damp proofing	3		
7.	Floors	4		
8.	Roofs	6		
9.	Stairs & stair case	4		
10.	Surface finishes	4		
11.	Ventilation & Air Conditioning	4		
12.	Fire fighting	4		
13.	Principle of maintenance	2		
14.	Maintenance practice	4		
15.	Safety in Maintenance	2		
16.	Water Harvesting	8		
Total		75	-	50

### DETAILED CONTENTS:

1. Introduction:
  - (i) Definition of a building, classification of buildings based on occupancy.
  - (ii) Different parts of a building. Orientation of buildings. Site selection.
  - (iii) Exposure to building bylaws/master plan and building approval.

## 2. Foundation

- (i) Concept of foundation and its purpose.
- (ii) Types of foundations-shallow and deep.
  - (a) Shallow foundation - Constructional details of:

Spread foundations for walls, Thumb rules for depth and width of foundation and thickness of concrete block stepped foundation, masonry pillars and concrete columns, raft foundation, Grillage foundation and machine foundation.
  - (b) Deep foundations. Pile foundations, their suitability, classification of piles according to function, material and installation of concrete piles (underreamed, bored, compacted).
  - (c) Construction-preparing foundation plans, setting out, excavation, timbering and dewatering. Well point system.

## 3. Walls

- (i) Purpose of walls;
- (ii) Classification of walls-Load Bearing and Non Load Bearing. Dwarf wall.
- (iii) Classification of walls as per materials of construction, brick, stone, reinforced brick, reinforced concrete, precast hollow and solid concrete block and composite masonry walls.
- (iv) Brick masonry-Definition of terms; mortar, bond, facing, backing, hearting, column, pillar, jambs, reveals, soffit, plinth, plinth masonry, Brick: header, stretcher, bed of brick, bat, queen closer, king closer, frog and quoin.
  - (a) Bond-Meaning and necessity: Types of bond and their suitability (English, Flemish, Header and Stretcher) 1, 1-1/2 and 2 Brick thick walls in English Bond. T, X and right angled corner junctions. Sketches for 1, 1-1/2 and 2 brick square pillars in English Bond.
  - (b) Construction of Brick walls-Method of laying bricks in walls, precautions observed in the construction of walls, method of bonding new brick work with old (Toothing, raking

back and block bonding).

(c) Construction and Expansion Joints.

(v) Stone Masonry

(a) Glossary of terms-Natural bed of a surface, bedding planes, string course, corbel, cornice, block-incourse, grouting, mouldings, templates, throating, through stones, parapet, coping, spalls, pilaster and buttress.

(b) Types of Stone Masonry:

Rubble Masonry; random and coarsed, Ashlar Masonry, Ashlar fine, Ashlar roughtooled Ashlar facing, specifications for coarsed rubble masonry, principles to be observed in construction of stone masonry walls.

vi) Partition walls: Constructional details, suitability and uses of brick and wooden partition walls.

(vii) Mortars-preparation, use and average strength of cement, lime, lime cement, lime surkhi and mud mortar.

(viii) Scaffolding: Constructional details and suitability of Mason's Brick Layers and Tubular scaffolding Centering & Shultering.

(ix) Shoring & under pinning: Types and uses.

(x) Safety in construction of low rise and high rise buildings.

4. Arches and Lintels

(i) Meaning and use of Arches and Lintels.

(ii) Glossary of terms used in Arches and Lintels- Abutment, Peir, Arch ring, Intrados, Soffit Extrados, Voussoiers, Springer, Springing line, Crown, Key stone, Skew back, Span, Rise, Depth of an Arch, Haunch, Spandril, Jams, Bearing, Thickness of lintel, Effective span.

(iii) Arches:

(a) types of Arches-Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving.

(b) Stone arches and their construction.

(c) Brick arches and their construction.

5. Doors and windows:

(i) Glossary of terms, used in Doors and Windows.

(ii) Doors-Name;uses and sketches of Metal doors; Ledged and Battened Doors;Ledged, battened and braced door;Framed and Panelled doors;glazed and panelled doors;flush doors;collapsible doors; Rolling steel shutters, side sliding doors;Door frames, PVC shutters & metal doors.

(iii) Windows-names,uses and sketches of metal windows,fully panelled windows, fully glazed windows, casement windows, fanlight windows and ventillators, sky light window frames, Louvered shutters ( emphasis shall be given for using metals and plastics etc. in place of timber).

6. Damp Proofing

(i) Dampness and its ill effects on bricks, plaster, wooden fixtures, metal fixtures and reinforcement, damage to asthetic appearance. Damage to heat insulating materials, Damage to stored articles and health.

(ii) Types of dampness-moisture penetrating the building from outside e.g. rainwater, surface water, ground moisture.

Moisture entrapped during constrcution i.e. moisture in concrete, masonry construction and plastering work etc.

Moisture which originates in the building itself i.e water in kitchen and bath rooms etc.

(iii) Damp proofing materials and their specifications rich concrete and mortar, bitumen, bitumen mastic.

(iv) Methods of damp proofing basement, ground floors, plinth and walls, special damp proofing arrangements in bathrooms, W.C. and Kitchen, Damp Proofing for roofs and window sills.

(v) Plinth Protection and Aprons.

7. Floors

- (i) Ground floors:
    - (a) Glossary of terms-floor finish, topping, under layer, base course, rubble filling and their purpose.
    - (b) Types of floor finishes-cast in situ concrete flooring (monolithic, bonded) Terrazo tile flooring. Terrazo flooring, Timber flooring. Description with sketches of the methods of construction of the floors and their specifications. Floor polishing equipment.
  - (ii) Upper floors:
    - (a) Flooring on RCC Slab.
    - (b) Flooring on R.B. Slab.
8. Roofs:
- (i) Glossary of terms for pitched roofs-batten, eaves, barge, fascia board, gable hip, lap, purlin, rafter, rag bolt, valley, ridge.
  - (ii) Pitched roof, steel trusses, fink truss, arched trusses, North light truss.
  - (iii) Roof coverings for pitched roofs-Asbestos sheeting, big six, trafford sheets, Mangalore tiles, method of arranging and fixing to the battens, rafters, purlins-both steel and wooden.
  - (iv) Drainage arrangement for pitched roofs.
  - (v) Concept of Flat roofs, RCC, RB, Coffer & folded slabs.
  - (vi) Drainage arrangements for flat roofs.
9. Stairs and staircase:
- (i) Glossary of terms: Stair case winders landing, strings, newel, baluster, riser, tread, width of staircase, hand rail, nosing.
  - (ii) Planning and layout of staircase: Relations between rise and tread, determination of width of stair, landing etc. Various types of layout-straight flight, dog legged, open well, quarter turn, half turn, (Newel and geometrical staircase). Bifurcated stair, spiral stair.
10. Surface Finishes:
- (i) Plastering-Classification according to use

and finishes like grit finish, rough cast, pebble dashed, plain plaster etc. Dubbing, Proportion of mortars used for different plasters, preparation of mortars, techniques of plastering and curing.

- (ii) Pointing-Different types of pointing, mortar used and method of pointing.
- (iii) Painting-preparation and application of paints on wooden, steel and plastered wall surfaces.
- (iv) White washing, colour washing and distempering. Application of cement and plastic paints.
- (v) Commonly used water repelants for exterior surfaces, their names and application.

#### 11. Ventilation and Air Conditioning

Natural and Artificial Ventilation. Requirements of comfort conditions, temperature control, mechanical ventilation, plenum system, exhaust system, air filter of different types, principle of Air Conditioning Plant (no construction detail).

#### 12. Fire Fighting

Causes of fire, spread of fire, fire fighting equipment and different method, of fire fighting, sprinklers, fire regulations and requirement. Fire insurance. Indian Standard.

#### 13. Principles of Maintenance

- 13.1 Definition, of maintenance, decay and deterioration of building/building components.
- 13.2 Sources and causes of deterioration and decay in building.
- 13.3 Factors influencing the decision to carry out maintenance of building.

#### 14. Maintenance Practice

- 14.1 Defects, causes and repairs in structural elements of buildings such as
  - (i) Foundation
  - (ii) Walls
  - (iii) Floors
  - (iv) Roof
  - (v) Components such as doors, windows and ventilators etc.

14.2 Defects, causes and repairs in surface finishes such as

- (i) White and colour washing
- (ii) Distempering
- (iii) Cement Plastering,
- (iv) Painting of timber and steel surface

14.3 Defects, causes and repairs in building due to leakage and seepage & their prevention

14.4 Defects causes and repair in internal environment of building such as

- (i) Heating
- (ii) Ventilation and Air conditioning
- (iii) Lighting

14.5 P.W.D. Practices with respect to maintenance of building e.g. annual repairs, special repairs.

15. Safety in Maintenance

Necessity, specific safety measures at site e.g. barricades, signals, helmets.

16. Water Harvesting :

- i. Causes of depletion of water level in state.
- ii. Present scenario of ground water in state.
- iii. Significance of hydrological parameters.
- iv. Rain water harvesting.
- v. Roof top rain water harvesting.
- vi. Methods of ground water recharging.
- vii. Precaution in ground water recharging.
- viii. Laws and regulation.



LABORATORY WORK

Building Construction & Maintenance Lab

- (i) Layout of a building.
- (ii) To construct brick bonds (English and Flemish bonds) in one, one and half and two brick thick (a) walls. L, T and cross junction. (b) Columns
- (iii) Visit to construction site for showing the following item of works and to write specific report about the works seen.
  - (a) Timbering of excavated Trenching
  - (b) Construction of Masonry Walls
  - (c) Flooring: Laying of flooring on an already prepared lime concrete base.
  - (d) Plastering and Pointing of wall
  - (e) Finishing of wall surface by Lime, Distemper, Snowcem, etc. and calculation of material in 100 Sqm. wall area
  - (f) Use of Special type of shuttering/crains/heavy machines in construction work.

## 2.7 CONCRETE TECHNOLOGY

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
2 - 2

### RATIONALE

Concrete Technology is very important subject for Civil Engg. Diploma holders students should have deep understanding of material principles and processes used in making and using the concrete.

This will help the student to supervise and control the quality of concreting operations in various situations. Demonstration, field visit and laboratory work should be so organised as to develop comprehension of subject in the students.

### TOPIC WISE DISTRIBUTION OF PERIODS

Sr.No	TOPICS	L	T	P
1.	Introduction	2		
2.	Ingredients of Concrete	4		
3.	Water Cement ratio	4		
4.	Workability	4		
5.	Proportioning for Ordinary Concrete	4		
6.	Formwork	4		
7.	Concrete Operations	6		
8.	Properties of Concrete	6		
9.	Quality Control at site	6		
10.	Hot weather concreting	2		
11.	Cold weather Concreting	2		
12.	Repair and maintenance	2		
13.	Special type of concrete	4		
Total		50	-	50

### DETAILED CONTENTS

#### 1. Introduction

Definition of concrete. Brief introduction to properties of concrete. Advantages of concrete. Uses of concrete in comparison to other building materials.

#### 2. Ingredients of Concrete:

(i) Cement

The chemical ingredients causing changes in properties, situations of use and special precautions in use of the following types of cement:

Ordinary Portland cement, rapid hardening cement, low heat cement, high alumina cement, blast furnace slag cement, quick setting, white and coloured cements.

(ii) Aggregates:

Classification of aggregates according to source, size and shape. Characteristics of aggregates particle size and shape, surface texture; specific gravity of aggregate; bulk density, water absorption surface moisture, bulking of sand and deleterious materials in the aggregate. Grading of Aggregate:-Coarse aggregate, fine aggregate; All in-aggregate; fineness modulus; interpretation of grading charts and combination of two aggregates.

(iii) Water:

Limits on the impurities as per ISI; affect of excessive impurities on concrete, Ascertaining the suitability of water with the help of concrete cube test.

3. Water Cement Ratio

Hydration of cement, Effect of various W/C ratios on the physical structure of hydrated cement, water cement ratio law and conditions under which the law is valid; internal moisture, temperature, age, and size of specimen. Definition of cube strength of concrete. Relations between water cement ratio and strength of concrete. Use of CBRI chart.

4. Workability:

Definition, of workability. Concept of: Internal friction,, Segregation, Harshness. Factors affecting workability; water content, shape, size and percentage of fineness passing 300 mic. Measurement of workability slump test, compaction factor test. Recommended slumps for placement in various conditions. Vee-Bee Consistometer.

5. Proportioning for Ordinary Concrete:

Object of mix design, Strength required for various grades as per IS 456, Preliminary test, Works cube test. Proportioning for ordinary mix as prescribed by IS and its interpretation. Adjustment on site for: Bulking, water content, Absorption, Workability Design data for moisture, bulking, absorption and suitable fine aggregate and coarse aggregate ratio. Difference between ordinary and controlled concrete.

6. Form Work:

- (i) Concept of factors affecting the design of form work (shuttering and staging)
- (ii) Materials used for form work.
- (iii) Sketches of form work for column, beams slabs.
- (iv) Stripping time for form work as per IS (No problems on the design of form work).
- (v) Removal of formwork.
- (vi) Precautions to be taken before, during and after RCC Construction.
- (vii) Special type of formwork

7. Concrete Operations:

- (i) Storing  
Cement:

- (a) Storing of cement in the warehouse.
- (b) Storing of cement at site.
- (c) Effect of storage on strength of cement.

Aggregate:

Storing of aggregate on site for maintaining uniformity of moisture and cleanliness.

- (ii) Batching:

- (a) Batching of cement.
- (b) Batching of aggregate:

Batching by volume, using gauge box, selection of proper gauge box,

Batching by weight-spring balances and by batching machines.

- (c) Measurement of water.

- (iii) Mixing

- (a) Hand mixing
- (b) Machine mixing-types of mixer, capacities of mixers, choosing appropriate size of mixers, operation of mixers, mixing of water.
- (c) Maintenance and care of machines.

- (iv) Transportation of Concrete:

Transportation with and situations of use of the following- pans, wheel barrows, truck mixers, chutes, belt conveyors, pumps, tower cranes.

- (v) Placement of Concrete:
  - (a) Prior preparation before placement; when put on natural soil, rocky base, specially prepared sub-base (brick soling and water bound macadam base), hardened concrete base, checking of form work, checking provision for joints.
  - (b) Placement of concrete-precautions to be taken.
- (vi) Compaction:
  - (a) Hand compaction-pavement, narrow and deep members.
  - (b) Machine compaction-types of vibrators (internal screed vibrators and form vibrators) Method of handling screed vibrators and immersion vibrators. Suitability of concrete mixes for compaction with vibrators. Selection of suitable vibrators for various situations.
- (vii) Finishing concrete slabs-screeding, floating, and trowelling.
- (viii) Curing
 

Object of curing, Method of curing, shading concrete works, covering surfaces with hesian, gunny bags, sprinkling of water, ponding method and membrane curing, steam curing. Recommended duration for curing.
- (ix) Jointing
 

Location of construction joints, treatment of construction joint before the concrete is poured, concreting at these joints. Expansion joints in concrete in buildings-their importance and location.

8. Properties of Concrete:

- (i) Properties in plastic stage:
  - (a) Workability
  - (b) Segregation.
  - (c) Bleeding.
- (ii) Properties of hardened concrete:
  - (a) Strength. Characteristic strength
  - (b) Durability

- (c) Impermeability.
- (d) Dimensional changes.

- (iii) Admixture (uses and effect)
  - (a) Accelerators and retarders.
  - (b) Air entraining agents.
  - (c) Water reducing and set controlling agents.

9. Quality Control at site:

Control tests on cement, aggregate water and concrete. Concept of quality control.

10. Hot Weather Concreting:

Effect of high temperature on concrete strength with reference to mass concreting, cooling of concrete materials, precautions before, during and after concreting, Use of retarders.

11. Cold Weather Concreting:

Effect of low temperature on concrete strength, Heating of concrete materials. Precaution before, during and after concreting. Use of accelerators.

12. Repair and Maintenance

Method of repairing by grouting new and old concrete work for cracks and holes. Repairs under water.

13. Special types of concrete

General idea of special types of concrete , High strength concrete, fibre reinforced concrete, polymer concrete, ferrocement concrete. readymix concrete.

LABORATORY WORK

CONCRETE TECHNOLOGY LAB

- (i) To determine flakiness index and elongation index of coarse aggregate (ISI:2386-pt.1-1963)
- (ii) Field method to determine fine silt in aggregate.
- (iii) Determination of specific gravity and water absorption of aggregates (IS:2386 Part-III-1963) (for aggregates 40mm to 10mm)
- (iv) Determination of bulk density and voids of aggregates (IS:2386-Part-III-1963)
- (v) Determination of surface moisture in fine aggregate by displacement method (IS:2383-Part-III-1963)
- (vi) To determine necessary adjustment for bulking of fine aggregate by field method (IS:2383-Part-III-1983).
- (vii) Test for workability (slump test);
  - (a) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/cement ratio on slump.
  - (b) To test cube strength of concrete with varying water cement ratio.
- (viii) Compacting factor test for workability (IS:1199-1959)
- (ix) Workability of concrete by Vee-Bee consistometer.
- (x) Fineness modulus of sand.

2.8 CIVIL ENGINEERING DRAWING-I

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg.,Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
- - 8

RATIONALE

A Civil Engineering Technician should be able to communicate through the language of Engineers i.e. Drawing. Through this subject he should develop skill in preparing and reading drawings relating to the constructional details of building. Considerations which go with the planning of a small building should also be covered in this subject.

The subject is however mainly related to building construction, which is supposed to form a part of Junior Engineers duties in all the departments. Emphasis should be laid to prepare working drawings as far as possible.

TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Topics	No.of Plate	No.of Periods
1.	Symbols and conventions of materials & fittings in Civil Engineering.	1	1x4
2.	Symbols & conventions of electrical fittings.	1	1x4
3.	Foundations.	1	1x4
4.	Doors & windows.	2	4x4
5.	Roofs:Wooden roof truss details. Section of RCC & RB flat roofs.	2	4x4
6.	Floors.	1	

6. Floors:
- (i) Detailed cross-sections of the following types of concrete flooring as per IS:2571-1970.



- (a) Concrete floor finish over ground floor.
  - (b) Terrazo floor finish over ground floor.
  - (c) Concrete floor finish with structured slab.
  - (d) Terrazo floor finish structured slab.
  - (e) Terrazo tile floor finish over ground.
7. Working drawing of a two roomed building with kitchen and bath having pitched roof.
8. Working drawing of a three roomed bulding from a given line plan and given data.
9. Working drawing of a three bed room double storyed flat roofed residential building.
10. Stair case
- a. Details of dog legged stairs (Wodden & RCC).
  - b. Plans of remaining type of stairs.
11. a. Details plan and section of an inspection chamber and manhole.
- b. Detailed plan and cross section of a domestic septic and soak pit for 10 users as per IS:2470 Part I.
12. Detailed plan and cross section of bathroom, kitchen and W.C. connections.
13. Detailed drawing of pipe joints commonly used in water supply and sewerage system.
14. Two Room building working drawing with AutoCad
15. Three Room building working drawing with AutoCad
- (Plate No. 14 & 15 should be prepared by AutoCad Alos)

## 2.9 SURVEYING - I

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
2 - 4

### RATIONALE

The important functions of a Civil engineering technician includes the jobs of:

- (i) Detailed Surveying,
- (ii) Plotting of Survey data,
- (iii) Preparation of Survey maps and setting out works.

While framing the curriculum for the subject of "surveying" stress has been given to the development of the skill in each type of survey like chain surveying, compass surveying and levelling - that the Civil Engineering Diploma holder will normally be called upon to perform.

Field work should be so selected that, as far as possible, the student can check his work and have an idea of the results, that is the extent of error in the work done by him. As far as possible, the surveys done should be got plotted, as this will also reveal errors in the work and develop skill in plotting.

### TOPIC WISE DISTRIBUTION OF PERIODS

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Sl.No.	Topics	L	T	P
1.	Introduction	4		
2.	Chain Surveying	10		
3.	Compass Surveying	16		
4.	Levelling	16		
5.	Minor Instruments	4		
Total		50	-	100

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### DETAILED CONTENTS

#### 1. Introduction

Concept of surveying, purpose of surveying, Measurements linear and angular, units of measurement, instruments used for taking these measurements. Classification of survey based on instruments. Basic principles of surveying.

#### 2. Chain Surveying

Purpose of chain surveying, Principles of chain surveying. Equipment used in chain surveying Viz. chains, tapes, ranging rods, arrows, pegs, cross staffs, Indian optical square

their construction and uses.

Different operations in chain surveying: Ranging (direct/indirect), offset (perpendicular/oblique), chaining (flat and sloping ground), conducting chain survey over an area. Recording the field data, plotting the chain survey, conventional sign. Obstacles in chain surveying.

- (a) Errors in chain surveying.
- (b) Correction for erroneous length of chain, simple problems. Testing and adjustment of chain.

### 3. Compass Surveying

Purpose of compass surveying. Construction and working of prismatic compass. Use of prismatic Compass, Method of setting and taking observations. Concept of following:

- (a) Meridian - Magnetic, true and arbitrary.
- (b) Bearing- Magnetic, true and arbitrary.
- (c) Whole circle bearing and reduced Bearing,
- (d) Fore and back bearing.
- (e) Magnetic dip and declination

Local attraction-causes, detection, errors and correction. Problems on local attraction, magnetic declination and calculation of included angles in a compass traverse. Concept of a traverse-Open and closed traverse. Traversing with a prismatic compass. Checks for an open and closed traverse. Plotting of a traverse - By included and deflection angles. Concept of closing error. Adjustment of traverse graphically by proportionate method. Errors in compass surveying. Testing and adjustment of a prismatic compass. Use of surveyers compass and its construction details, comparison with prismatic compass.

### 4. Levelling

Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks. Principle and construction of dumpy, I.O.P. (tilting) levels. Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis. Levelling staff (i) single piece (ii) folding (iii) spirit level (iv) invar precision staff. Temporary adjustment: setting up and levelling, adjusting for parallax of Dumpy and I.O.P. level. Differential levelling, concept of back sight, fore sight, intermediate sight, station, change point, height of instrument. Level book and reduction of levels by (a) Height of collimation method and (b) Rise and fall method. Arithmetical checks. Problem on reduction of levels. Fly levelling, check levelling and profile levelling (L-section and X-section) Errors in levelling, and precautions to minimise them and permissible limits. Reciprocal levelling. Difficulties in levelling. Concept of curvature and refraction. Testing and adjustment of dumpy and IOP level. Numerical problems.

### 5. Minor Instruments :

Principle construction and uses of the following minor instruments:

- (a) Abney's level
- (b) Tangent clinometer
- (c) Ceylone Ghat Tracer
- (d) Pentagraph
- (e) Planimeter

#### FIELD WORK

#### ( Field Surveying - I )

##### Chain Surveying

- Ex.(i) (a) Ranging a line.
  - (b) Chaining a line and recording in the field book.
  - (c) Testing and adjustment of chain.
- Ex.(ii) (a) Chaining of a line involving reciprocal ranging.
  - (b) Taking offsets and setting out right angles with cross staff and Indian optical square.
- Ex.(iii) Chain survey of a small area. Plate I
- Ex.(iv) Chaining a line involving obstacles in ranging.

##### Compass Survey

- Ex.(v) (a) Setting the compass and taking observations.
  - (b) Measuring angles between the lines meeting at a point by prismatic compass.
- Ex.(vi) Traversing with the prismatic compass and chain of a closed traverse. (recording and plotting by included angles) Plate II  
Setting a regular Pentagon of given side & bearing Plate III
- Ex.(vii) Traversing with the Prismatic compass and chain of a closed and open traverse (Recording and plotting by deflection angles) Plate IV
- Ex.(viii) Determination of local attraction at a station by taking fore and back bearing.
- Ex.(ix) To find true bearing of a line at a place.

##### Levelling:

- Ex.(x) To find the difference of level between two distant points by taking staff readings on different stations from the single setting.

- Ex.(xi) To find the difference of level between two points by taking atleast four change points.
- Ex. (xii) Longitudinal sectioning of a road. Plate V
- Ex.(xiii) Cross-sectioning of a road. Plate VI
- Ex.(xiv) Setting a gradeint by IOP level.

Minor Instrument :

- Ex.(xv) Setting and checking grades with Abney's level. Setting and checking grades with Ceylone Ghat Tracer.
- Ex.(xvi) Finding heights by Indian Pattern Clinometer (Tangent Clinometer)
- Ex.(xvii) Use of planimeter for computing areas.
- Ex.(xviii) Enlargment/ reduction of a plan by the use of pentagraph.

2.10 CIVIL LAB-2 (B.C. & Maintenance Lab, Conc. Tech. Lab  
And Soil Mechanics Lab)

Details of Curriculum are mentioned in theory Paper

III Year

### 3.1 DESIGN OF STEEL AND MASONRY STRUCTURES

[Common to Three Year Diploma Course in Civil Engg., Civil Engg. Spl. In Rural Engg.]

L T P  
3 - -

#### RATIONALE

This subject follows the subjects of Applied Mechanics and strength of Materials taught in the previous years. They have acquired analytical skills. A diploma holder in Civil Engg. will be required to handle such simple structures in his professional life. This subject covers designing simple structures out of homogenous materials (steel). The students will also learn to use the latest relevant IS codes in his design practice. (IS: 800-1984)

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sr.No.	Topics	DISTRIBUTION OF PERIODS		
		L	T	P
1.	Structural Steel & Sections	3	-	
2.	Structural Steel Connections	8	-	
3.	Tension Members	10	-	
4.	Struts and Columns	10	-	
5.	Beams	10	-	
6.	Columns Bases	10	-	
7.	Steel Roof Trusses	12	-	
8.	Masonry and Foundation Structures	12	-	
Total		75	-	-

#### DETAILED CONTENTS

1. Structural Steel and Sections
  - (i) Properties of structural steel as per IS:226 and IS:1977.
  - (ii) Designation of structural steel sections as per IS Handbook and IS:800.
2. Structural Steel Connections
  - (i) Riveted connections - types of rivets, permissible stresses in rivets. Types of riveted joints, Failure of riveted joints, Assumptions made in the design of riveted joints. Specification for riveted joints. Design of riveted joints for

axially loaded members.

(ii) Welded Connections

Comparison between riveted and welded joints, types of welds, permissible stresses in welds, types of welded connections, strength of welded joint, Design of welded joints for axially loaded members.

3. Tension Members

Forms of common sections. Permissible Stresses in tension for steel. Strength of a tension member. Design of tension members (flats, angles & Tee Sections only). Tension splice and their design.

4. Compression Members

Design of struts and columns as per IS:800. Effective length, slenderness ratio and permissible stresses, simple and built up sections, concept of lacings in built up columns.

5. Beams

Design criteria, allowable stresses, Design of laterally restrained beams including simple built-up sections. Checks for web buckling, web crippling and deflection.

6. Column Bases:-

Column bases, design of simple column base

7. Steel Roof Trusses:-

Different types of trusses, Loads on roof trusses. Various combination of loads to cause worst condition. Design of angle and tubular trusses (Tension and compression members), Design of purlins.

8. Masonry and Foundation Structures

Gravity masonry dams, retaining walls and chimnies subjected to lateral pressures. Design of masonry wall foundation (stepped footing)



### 3.2 DESIGN OF REINFORCED CONCRETE STRUCTURE

[Common to Three Year Diploma Course in Civil Engg., Civil Engg. Spl. In Rural Engg.]

L T P  
3 1 1

#### RATIONALE

This subject follows the subjects of Applied Mechanics and strength of materials taught in previous years. They have acquired analytical skills which are applied here to design simple structural elements. A diploma holder in civil engg. will be required to handle such simple structures in his professional life.

This subject covers designing of simple structures out of heterogenous materials (RCC). The student will also learn to use the latest relevant IS codes in his design practice.

(Use of IS:456-1984 is allowed)

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Concept	DISTRIBUTION OF PERIODS		
		L	T	P
1.	Introduction	6	-	
2A.	Design based on working stress method			
	I Fundamentals	3	-	
	II Singly reinforced beam	6	2	
	III Lintels	4	-	
	IV Cantilever beam and slabs	4	-	
	V Doubly Reinforced Beam	4	2	
	VI Reinforced concrete Slabs	4	2	
	VII Reinforced brick work	4	1	
	VIII Tee beams	4	2	
	IX Columns & Struts	4	1	
	X Cantilever Retaining Walls	4	2	
	XI Component of over head tank	4	2	
	XII Components of Multistoried Framed Structures	4	2	
2B.	Design based on limit state method			
	I Fundamentals	4	2	
	II Design requirements	4	2	
	III Design of following:			
	i. Beam	4	2	
	ii. Slab	4	1	
3.	Pre-Stressed Concrete	4	2	
Total		75	25	25

NOTE : One compulsory question should be asked from 2B in B.T.E. Exam.

#### DETAILED CONTENTS

#### 1. Introduction

Concept of reinforced concrete structures, advantages and disadvantages. Different materials used in RCC with their properties. Load and loading standard as per IS:875 Concept of design of reinforced concrete based on working stresses method and limit state method and their difference.

#### 2(A) Design based on Working Stress Method

##### I. Fundamental of working stress method:

(i) Assumptions in the theory of simple bending for RCC beams.

(ii) Flexural strength of a singly reinforced RCC beam. Position of the Neutral Axis. Resisting moment of the section, critical neutral axis, actual neutral axis, concept of balanced, under reinforced and over-reinforced sections.

(iii) Shear Strength :  
Permissible shear stresses as per IS:456. Development of stresses in reinforcement, development length and anchoring of bars.

(iv) Bond Strength:  
Concept of bond, local and average, permissible bond stresses for plain and deformed bars as per IS, minimum length of embedment of bars, minimum splice length, actual bond stress in RCC beams and slabs, bond length as per IS: 456.

II. Design of singly reinforced concrete beams as per IS:456 from the given data such as span, load and properties of materials used.

III. Design of lintel.

IV. Design of a cantilever beam and slab.

V. Design of Doubly Reinforced Concrete Beams:

(i) Doubly reinforced concrete beam and its necessity.  
(ii) Strength of a double reinforced concrete beam section.

(iii) Method of design: Simple problems only.

(iv) Reinforcement details of doubly reinforced concrete beam.

VI. Design of RCC Slabs:

- (i) Structural behaviour of slabs under uniformly distributed load (UDL).
- (ii) Types of end supports.
- (iii) Design of one way slab.
- (iv) Design of Two-way slab with the help of tables of IS:456.(Corners not held down)-IS-code method.
- (v) Detailing of reinforcement.

VII. Design of Reinforced Brick-Work

- (i) Plain brick masonry, permissible stresses.
- (ii) Reinforced Brick work and its use in slabs and lintels.
- (iii) Limitations of the use of R.B. Work.
- (iv) General principles of design of reinforced brick lintels and slabs.
- (v) Design of R.B. beams, slab and lintels.

VIII. Design of Tee Beams:

- (i) Structural behaviour of a beam and slab floor laid monolithically.
- (ii) Rules for the design of T-Beams.
- (iii) Economical depth of T-Beams, Strength of T-Beams.
- (iv) Design of singly reinforced Tee-Beams.
- (v) Detailing of reinforcement.

IX. Design of Columns & Column Footings

- (i) Concept of long and short columns.
- (ii) Is specifications for main and lateral reinforcement.
- (iii) Behaviour of RCC column under axial load.
- (iv) Design of Axially loaded short and long columns with hinged ends (circular, square and rectangular as per IS specifications).
- (v) Concept of column footing. Design criteria. Design of square isolated column footings.
- (vi) Detailing of reinforcement.

X. Cantilever Retaining Wall:

Concept of design and function of different parts of a cantilever retaining wall and reinforcement details (No numericals shall be asked in the examination)

XI. Components of Overhead Water Tanks (Dome Shaped):

Description of different component e.g. roof, side wall and ring beam, floor slabs, supporting structure and foundations (only reinforcement details be shown and emphasised).

XII. Components of Multi-Storied Framed Structures:

General concept of multistoried framed structures of columns, beam, slabs, and footing, design criteria and method of placing reinforcement in framed structures. Lifts basements (only diagrams to be taught.No numerical shall be asked in the examination)

2(B) Design Based on Limit State Method:

I. Fundamentals of Limit State Method

- i. Theory of limit state method.
- ii. Partial safety factors.
- iii. Flexural strength.
- iv. Shear Strength.
- v. Development Length of bars.

II. Design requirements.

III. Design of the following :

- i. Singly reinforced rectangular beam.
- ii. One way slab (simply supported)

3. Pre-Stressed Concrete

- i. Concept of prestressing.
- ii. Situations where prestressed concrete is used.
- iii. Materials used in prestressed concrete and their specifications as per IS.
- iv. Post-tensioning and pre-tensioning.
- v. Systems of prestressing.
- vi. Freyssinet, Magnol-Blaten and Lee-Mecall

systems

- vii. Sketch showing Prestressing arrangement for RCC beam (No numerical problems be asked in the examination)

PRACTIALS

(R.C.C. LAB)

Preparation of bar bending schedule and to bend the bars accordingly for the following :

- (i) Singly reinforced concrete beam
- (ii) Doubly reinforced concrete beam
- (iii) Reinforced concrete column
- (iv) Reinforced concrete slab

### 3.3 TRANSPORTATION ENGINEERING

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
3 - 1

#### RATIONALE

Highways, railways & bridges is an applied engineering subject. Knowledge of basic concepts and principles of highways engineering will help the Civil Engineering technician to read design and drawing of proposed structures, give layout plan, traffic sign and signal and supervise the construction in plains and hills and maintain the existing roads.

The study of Railways and Bridges will cater to the needs of the technician engaged in investigation, planning and construction of railways, and bridges. The study of technology behind the layout, construction and maintenance of railways and bridges is extremely important.

#### TOPICWISE DISTRIBUTION OF PERIODS

Sr.No.	TOPICS	L	T	P
	(A) Highways			
1.	Introductions	1		
2.	Road Geometrics	3		
3.	Highway Surveys & Plan	3		
4.	Traffic Engineering	3		
5.	Road Materials	3		
6.	Road Pavements	4		
7.	Hill Roads	3		
8.	Road drainage	3		
9.	Road Maintenance	3		
10.	Construction equipments	3		
11.	Arboriculture	1		
	(B) Railways			
1.	Introduction	2		
2.	Permanent way	3		
3.	Track materials	3		
4.	Geometrics	4		
5.	Points and crossing	4		
6.	Track laying	3		
7.	Maintenance	4		
	(C) Bridges			
1.	Introduction	1		
2.	Classification	3		
3.	Site selection	2		
4.	Piers, abutments and wing walls	4		
5.	Bearings	2		
6.	Temporary Bridges	2		
7.	Maintenance	2		

D.Air Port	3
E.Tunnel	3
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Total	75 - 25

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DETAILED CONTENTS

A : HIGHWAYS

1. Introduction

- (i) Importance of Highway transportation.
- (ii) Functions of IRC.
- (iii) IRC classification of roads.
- (iv) Organisation of state highways department.

2. Road Geometrics:

- (i) Glossary of terms used in geometrics and their importance; Right of way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient.
- (ii) Design and average running speed, stopping and passing sight distances.
- (iii) Curves necessity, horizontal and vertical curves including transition curves and superelevation, Methods of providing superelevation.
- (iv) Use of IRC design tables and specifications for finding elements of Road geometrics. Drawing of typical cross-sections in cutting and filling on straight and at a curve.
- (v) Under pass & over pass (fly overs and bridges)

3. Highway Surveys and Plans

- (i) Designation of a topographic map. Reading the data given on a topographic map.
- (ii) Basic considerations governing alignment for a road in plain and hilly area.
- (iii) Highway location.  
Marking of alignment.  
Importance of various stages viz:
  - (a) Reconnaissance survey: Conduct reconnaissance and

prepare reconnaissance report.

- (b) Preliminary survey: Object, organizing, conducting and informations to be collected.
- (c) Location survey.
- (d) Standards for preparing the highway plans as per Ministry of Transport.

4. Traffic Engineering

- (i) Traffic studies , Methods of collection and presentation of volume count data.
- (ii) Traffic control devices - Signs, markings and signals, their effectiveness and location, installation of signs, IRC standards.
- (iii) Segregation of traffic.
- (iv) Types of intersections and choice of each.
- (v) Accidents: Types, causes and remedies.

5. Road Materials:

- (i) Different types of road materials in use; soil, aggregates binders.
- (ii) Function of soil as Highway subgrade.
- (iii) C.B.R; Method of finding. CBR value and its significance.
- (iv) Testing aggregates : Abrasion test, impact test, crushing strength test, water absorption test and soundness test.
- (v) Aggregates : Availability of road aggregates in India, requirements of road aggregates as per IS specifications.
- (vi) Binders: Common binders; cement, bitument and Tar, properties as per IS specifications, penetration and viscosity test , procedures and significance. cut back and emulsion and their uses.

6. Road Pavements ; Types and Their Construction:

- (i) Road pavement : Flexible and rigid pavement, their merits and demerits, typical cross-sections , functions of various components.
- (ii) Sub-grade preparation -  
Setting out alignment of road, setting out bench



marks, control pegs for embankment and cutting, borrow pits, mutams, making profiles of embankment, construction of embankment, compaction, stabilization, preparation of subgrade. methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation.

- (iii) Flexible pavements: sub base necessity and purpose. stabilized sub base; purpose of stabilization.

Types of Stabilization:

- (a) Mechanical stabilization.
- (b) Lime stabilization.
- (c) Cement stabilization.
- (d) Fly ash stabilisation.
- (e) Grannular sub base

- (iv) Base course:

- (a) Brick soling.
- (b) Stone soling.
- (c) Metalling: water bound mecadam and bituminous macadam.

Methods of construction as per Ministry of Shiping and transport (Government of India).

- (v) Surfaceing:

Types of surfacing;

- (a) Surface dressing.
- (b) (i) Premix carpet.  
(ii) Semi dense carpet (S.D.C)
- (c) Asphalt concrete.
- (d) Grouting.

Methods of constructions as per Mininstry of Surface and Transport, Government of India, specifications and quality control; equipment used .

- (vi) Rigid pavements

Construction of concrete roads as per IRC specifications:

Form laying, mixing and placing the concrete, compacting and finishing, curing, joints in concrete pavement, equipment used.

## 7. Hill Roads:

- (i) Introduction:

Typical cross-sections showing all details of a typical hill road in cut, partly in cut and partly in fill.

- (ii) Landslides :  
Causes, preventions and control measures.

8. Road Drainage:

- (i) Necessity of road drainage work, cross drainage works.
- (ii) Surface and subsurface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage. Intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross-sections.

9. Road maintenance:

- (i) Common types of road failures-their causes and remedies such as bagie action.
- (ii) Maintenance of bituminous roads such as patch work and resurfacing.  
Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices.

10. Construction Equipment:

Output and use of the following plant and equipments:

- (i) Hot Mix Plant & Mix all battery.
- (ii) Tipper, tractors (wheel and crawler) scraper, bull-dozer, dumpers, showels, grader, roller, dragline.
- (iii) Asphalt mixer and tar boilers.
- (iv) Road pavers.

11. Arboriculture:

Names of trees used in aboriculture, distance of trees from centre of roads and distance between centre to centre of trees, tree gaurds, maintenance and revenue from trees.

B : RAILWAYS

1. Introduction:

Railways - An important system of communication in India.

2. Permanent Way:

Definition of a permanent way; components of a permanent way, subgrade, ballast, sleepers, rails, fixtures and fastenings. Concept of gauge and different gauges prevalent in India. Suitability of these gauges under

different conditions.

3. Track Materials:

(i) RAILS: Function of rails. Different types of rail sections-doubleheaded, bull headed and flat footed their standard length, weights and comparison. Welded rails-appropriate length of welded rails and advantages of welded rails.

Creep: Its definition, causes, effects and prevention. Wear of rails: its causes and effects.

(ii) SLEEPERS: Function of sleepers; Different types of sleepers: wooden, steel, cast iron (pot type), concrete and prestressed concrete, their sizes, shapes, characteristics and spacing.

(iii) BALLAST: Function, materials used for making ballast stone, brick, slag and cinder, their characteristics.

(iv) FIXTURES AND FASTENINGS:

(a) Connections of rail to rail-Fishplate and fishbolts.

(b) Connection of Rail to sleepers: Sketches of connection between flat footed rails with various types sleepers with details of fixtures and fasteners used.

4. Geometrics for Broad Gauge:

Typical Cross-sections of single and double broad gauge railway tracks in cutting and embankment. Permanent and temporary land width. Gradients-ruling, maximum, minimum for drainage. Gradients in station yards. Curves; Limiting radius of a curve for broad gauge. Transition length to be provided for railway curves as per railway code. Super-elevation-its necessity and limiting value. Definition of equilibrium cant and cant deficiency, widening of gauge on curves.

5. Points and Crossings:

Necessity and details of arrangement; sketch of a turnout definition of stock rail, tongue rail, check rail, lead rail, wing rail, point rail, splice rail, stretcher bar, throw of switch, heel of switch, nose of crossing, angle of crossing, overall length of turnout, facing and trailing points, diamond crossing, cross over, triangle.

6. Track Laying

Preparation of subgrade. Collection of materials setting up of material depot and carrying out initial operations such as adzing of sleepers, bending of rails and assembling of crossings. Definitions of base and rail head. Transportation by material trollies, rail carriers and material trains. Method of track laying (parallel, telescopic and American methods). Organisation of layout at rail head. Ballasting of the track.

7. Maintenance of Track:

- (i) Routine maintenance of formation and side slopes, rails, fixtures and drainage.
- (ii) Special maintenance - Replacement of defective sleepers and rails.
- (iii) Tools used for the above operations.

NOTE: The study of the subject must be supplemented by a visit to a nearby railway station.

C : BRIDGES

1. INTRODUCTION;

Bridge: Its function and component parts, different parts, difference between a bridge and a culvert.

2. CLASSIFICATION OF BRIDGES:

Their structural elements and suitability:

- (i) According to life: Permanent and temporary.
- (ii) According to road way level : Deck, through and semi-through.
- (iii) According to material: Wooden, steel, RCC, pre-stressed and masonry.
- (iv) According to structural form:
  - (a) Beam type-RCC, T-Beam, steel girder bridges, plate girder and box girder, trussed bridges N and warren girder bridges.
  - (b) Arch type-open spandril and filled spandril, barrel and rib type.
  - (c) Suspension type-Unstiffened sling type, its description with sketches.
  - (d) According to the position of highest flood level: submersible and non submersible.

3. Site selection and collection of data:

Factors affecting the selection of site for a bridge data to be collected.

Bridge span : Economical span and factors affecting it.

4. Piers, abutments and wing walls:

Piers:Definition parts.Types:solid (masonry and RCC); Open cylindrical and abutment piers. Definition of the following terms;height of pier,water way (natural and artificial),afflux and clearance. Abutments and wing walls: Difinition, types of abutments (straight and tee) abutment with wing walls (straight, splayed, return and curved).

5. Bridge Bearings:

Purpose of bearings:Types of bearings:Fixed plate, sliding plate, deep cast base, rocker and roller bearings, their functions with sketches.

6. Temporary Bridges:

Necessity, description with sketches of pontoon and boat bridges.

7. Maintenance of Bridges: Inspection of bridges, routine maintenance.

D. Air Port :

Basic Element, Runway and Taxi Way.

E. Tunnel :

Introduction, Classification and Construction Method.

PRATICALS

Highway Engg. Lab.  
( C-3 Lab )

List of Experiments

1. Determination of resistance to abrasion of aggregates by Los Angel's Abrasion Testing Machine.
2. Determination of Aggregate impact value by aggregate impact tester.
3. Determination of C.B.R. Value of sub grade soil.
4. Determination of Aggregate crushing value by aggregate crushing test apparatus.
5. Determination of Penetration Value of bitumen.
6. Determination of softening point of bitumen.
7. Determination of ductility of bitumen.
8. Determination of flash and fire point of bitumen.

Field Visits of atleast 3 of the following  
(in different fields):

1. Railway yard and station, points and crossing, rack, communication, control and panel Board
2. Railway Museum for the development of Railways, Rails Mono Rails, Sleepers--  
R.D.S.O. Lucknow & Rail Bhawan Delhi
3. Bridges under construction.
4. Grade seperator.
5. Factory for construction of prestressed sleepers or other fixtures.
6. P.W.D. Research Lab at Lucknow/C.B.R.I. Roorkee.
7. Hume Pipe Factory.

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### 3.4 ESTIMATING, COSTING AND VALUATION

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
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#### RATIONALE

This is an applied engineering subject. Knowledge of this subject will enable the Civil Engineering Technician to work out the quantities and cost of a works relating to buildings, roads, irrigation, canals and public health. Teachers should lay more emphasis on practical (as much as possible).

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sr.No.	Topics	Lect.	Tuto.
(A)	Buildings		
1.	Introduction	1	-
2.	Units of Measurement & payments	1	-
3.	Method of taking out quantities	3	-
4.(a)	Detailed estimates of a small residential buildings with a flat Roof	5	7
(b)	Detailed estimates of a small building having pitched roof with steel truss.	5	7
5.	Specifications	2	2
6.	Analysis of rates	4	4
7.	Tendering and preparation of tender document	3	1
(B)	Irrigation		
8.	Preparation of a detailed estimate for a brick lined distributary from a given section	3	3
(C)	Public Health Engineering		
9.	Detailed estimate of laying a water supply line (C.I.Pipe)	3	4
10.	Detailed estimate of Sanitary and water fittings in a domestic building containing one set of toilet and septic tank	2	5
(D)	Roads		
11.	Method of calculating earth work	3	-
12.	Calculation of quantities of materials for road in plains from given drawing	4	1
13.	Detailed estimates using quantities of item 12	2	4
14.	Detailed estimating of a single span slab culvert	2	4
15.	Calculation of quantities for different item for a retaining wall from given drawing	2	3
E)	Valuation		
16.	Purpose & principles	1	-
17.	Definition of terms. Depreciation, sinking fund, salvage and scrap value	2	1

18. Valuation of building property	1	2
19. Calculation of standard rent	1	2
	50	50 -

#### DETAILED CONTENTS

##### A Buildings

1. Introduction to Estimating:Types of estimates, drawings, (to be attached with these estimates. Preparation of rough cost estimates).
2. Units of measurement, and units of payment of different items of work.
3. Different methods of taking out quantities:Centre line in-to-in/out-to-put methods.
4. (a) Preparation of a detailed estimate, complete with detailed reports, specifications, abstract of cost and material statement for a small residential building with a flat roof.  
  
(b) Preparation of a detailed estimate with specification, abstract of cost and material statement for pitched roof with steel truss only.
5. Specifications  
  
Need, general and detailed specifications, method of writing specifications,  
  
Analysis of rates:  
  
(i) Steps in the analysis of rates for any item of work,requirement of material, labour, sundries T.& P. contractors profit.  
  
(ii) Calculation of quantities of materials for:  
  
(a) Plain cement concrete of different proportions.  
  
(b) Brick masonry in cement and lime mortar.  
  
(c) Plastering and pointing with cement mortar in different proportions.  
  
(d) White washing.
6. Analysis of Rates  
Analysis of rates of the following item of work when the data regarding labour, rates of material and rates of labour is given.



- (a) Earth work in excavation and filling with a concept of lead and lift.
  - (b) Cement concrete in foundation.
  - (c) R.C.C. and R.B. in roof slabs.
  - (d) First class burnt brick masonry in cement mortar.
  - (e) Cement plaster.
  - (f) Cement pointing: Flush, deep pointing.
7. Tender and preparation of tender document.
- B. Irrigation
8. Preparation of detailed estimate for a brick lined distributory from a given section.
- C. Public health
9. Preparation of detailed estimate for laying a water supply line (C.I. Pipe).
10. Preparation of detailed estimate for sanitary and water supply fittings in a domestic building containing one set of toilets and septic tank.
- D. Roads
11. Methods for calculating earth work using:
- (i) Average depth.
  - (ii) Average cross sectional area.
  - (iii) Graphical method.
12. Calculations of quantities of materials for roads in plains from given drawings.
13. Preparation of detailed estimate using the above quantities.
14. Detailed estimate of a single span slab culvert with return wing walls.
15. Calculation of quantities of different items of work for a masonry retaining wall from given drawings.
- E. Valuation
16. Purpose of valuation, principles of valuation.
17. Definition of terms such as depreciation, sinking fund, salvage and scrap value.
18. Valuation of a building property by replacement cost method and rental return method.
19. Method of calculation of standard rent-Concept of capitalized value and years purchase.

### 3.5 CONSTRUCTION MANAGEMENT, ACCOUTS & ENTREPRENUERSHIP DEVELOPMENT

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

L T P

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#### RATIONALE

Construction management is an applied engineering subject. Knowledge of this subject will help the civil engineering technician in planning, execution repair of works, maintain stores, prepare accounts of men and materials engaged on the works and maintain accounts of all departmental jobs.

It has been experienced that all students who pass out diploma do not go for jobs. Students who posses entrepreneurial traits and attributes prefer setting up their own contractorship firms/industrial or business ventures instead of seeking jobs. So the percentage of students who like to set up their own industrial/business venture could be increased by introducing entrepreneurship development in civil engineering curriculum.

The contents of this subject has been developed to cater the above needs.

#### TOPIC WISE DISTRIBUTION OF PERIODS

S. No.	Topics	L	T	P
(A)	Construction Management			
1.	Introduction	4		
2.	Construction Planning	4	-	
3.	Organisation	4	-	
4.	Site Organisation	3	-	
5.	Construction Labour	3	-	
6.	Control of Progress	3	-	
7.	Inspection and Quality Control	2	-	
8.	Accidents and Safety in construction	2	-	
9.	Professional Practice	2	-	
(b)	Accounts			
10.	Introduction	4	-	
11.	Organisation	2	-	
12.	PWD System of Accounts	2	-	
13.	Cash	4	-	
14.	Stores	8	-	
15.	Works	4	-	
16.	Payment of works	4	-	
17.	Miscellaneous	4	-	
(c)	Entrepreneurship Development			
18.	Introduction	2	-	
19.	Financing agencies	2	-	
20.	Industrial Legislation	2	-	

21. Proje report	4	-
(d) Intellectual Property Right	6	
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Total	75	-

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DETAILED CONTENTS;

PART A : CONSTRUCTION MANAGEMENT

1. Introduction:

- (i) Classification of construction into light, heavy and industrial construction.
- (ii) Stages in construction from conception to realization.
- (iii) The construction team: Owner, engineer and contractors, their functions and inter-relationship.
- (iv) Resources for construction industry; men, machines, materials, money and management.
- (v) Main objectives of Civil engineering management.
- (vi) Functions of construction management, planning, organising, staffing, directing, controlling and co-ordinating, meaning of each of these with respect to a construction job.

2. Construction Planning:

- (i) Stages at which planning is done. Pre tender and contract planning by the contractor.
- (ii) Scheduling: Definition, Methods of scheduling: bar charts and CPM, advantages of scheduling. No problem on CPM to be set in the examination.
- (iii) Planning and scheduling of construction jobs by bar charts.
- (iv) Preparation of construction schedule, labour schedule, material schedule, and equipment schedule.
- (v) Limitations of bar charts.

- (vi) Cost-time balancing.
3. Organisation:
- (i) Types of organisation: Line, staff, functional and their characteristics.
  - (ii) Principles of organisation; (only meanings of the following and their significance); Span of control ; Delegation of authority and responsibility ; Ultimate authority and responsibility; Unity of command; contact; unity of assignment; job definition; increasing organisation relationship.
  - (iii) Motivation and human relationship concept, need and fundamentals.
4. Site Organisation:
- (i) Factors influencing, job layout from site plan.
  - (ii) Principle of storing and stacking materials at site.
  - (iii) Location of equipment.
  - (iv) Preparation of actual job layout for a building.
  - (v) Organizing labour at site.
5. Construction Labour
- (i) Conditions of construction workers in India, wages paid to workers.
  - (ii) Trade unions connected with construction industry and trade Union Act.
  - (iii) Labour welfare.
  - (iv) Payment of wages Act. Minimum wages Act.
  - (v) Workmen compensation Act.
  - (vi) Contract Labour Act.
6. Control of Progress:
- (i) Methods of recording progress.
  - (ii) Analysis of progress.
  - (iii) Taking corrective actions keeping head of office informed.
7. Inspection and Quality Control

- (i) Principles of inspection.
- (ii) Major items in construction job requiring quality control.

8. Accidents and Safety in Construction:

- (i) Accidents - causes.
- (ii) Safety measures for:
  - (a) Excavation work
  - (b) Drilling and blasting.
  - (c) Hot bituminous works.
  - (d) Scaffolding, ladders, form work.
  - (e) Demolitions.
- (iii) Safety campaign.

9. Professional practice.

PART B : ACCOUNTS

10. Introduction:

- (i) Necessity of account.
- (ii) List of reference book on accounts:
  - (a) Civil Services Rules, Vol, I, II and III
  - (b) PWD Accounts codes.
  - (c) Manual of orders.
  - (d) Departmental financial rules.
  - (e) State Treasury rules.

11. Organisation

- (i) Establishments in the PWD.
- (ii) Regular establishment:
  - (a) Permanent establishment.
  - (b) Temporary establishment.
- (iii) Work charged establishment.
- (iv) Contingency establishment.

12. Outline of P.W.D. System of Accounts:

- (i) Necessity of a system of accounts.
- (ii) P.W.D. system of accounts.
- (iii) Classification of transactions:
  - (a) Necessity of maintaining the accounts by Head of Accounts:
  - (b) Heads of Account:
    - Major Heads.
    - Minor Heads.
    - Detailed Heads.

(Detailed Heads of Accounts not to be

memorised).

13. Cash

- (i) Definition of cash.
- (ii) Precautions in custody of cash.
- (iii) Treasury challan-procedure to fill the prescribed form.
- (iv) Imprest account and temporary advance.
- (v) Definition of imprest and rules for maintaining imprest account. Actual filling of the prescribed form.
- (vi) Definition of temporary advance; Its difference from the imprest account ; maintenance of temporary advance account.

14. Stores:

- (i) What are stores, their necessity and safe custody.
- (ii) Classification of Stores:
  - (a) Stores debitible to suspense heads-stock.
  - (b) Stores debitible to final heads:
    - Tools and plant.
    - Road metal
    - Material charged direct to works.
- (iii) Stock
  - (a) Kind of articles in stock;
  - (b) Sources of stock receipt;
    - Suppliers.
    - Other departments, divisions and sub-divisions.
    - Manufacturers.
    - Works
  - (c) Sub heads of stock.
  - (d) Quantity accounts of stock.
    - Rules for preparing indent and invoices; preparation of indent in proper form.
    - Register of stock receipts and issues, procedure for recording entries in proper form. Actual filling of the form.
  - (e) Return of monthly transaction of stock and half yearly return of stock.
  - (f) Stock taking of stores-general rules.
  - (g) Surpluses and shortages of stock-action for rectification of mistakes in stock accounts.
  - (h) Losses of stock-reporting the loss, estimates for loss of stock and writing off.

- (iv) Tools and Plants (T&P)
  - (a) Meaning.
  - (b) Classification of T&P
    - Register of T&P receipts and issues-Rules for actual filling of the prescribed form.
    - Statement of receipts and issues of T&P in prescribed form.
  - (c) Sources of receipt of T&P
  - (d) Authority of issue of T&P.
  - (e) Surpluses and shortage of T&P-reconciliation of accounts.
  - (f) Points of difference in accounts of stock and T&P.
  - (g) Disposal of unserviceable articles of T&P. Preparation of survey report in prescribed form.
  
- (v) Road Metal:
  - (a) Meaning.
  - (b) Rules for maintaining road metal returns-filling up the prescribed form.
  - (c) Method of checking.
  - (d) Shortages and surpluses.
  
- (vi) Materials charged direct to works:-Necessity, circumstance under which materials are directly charged to work.
  - (a) Material at site Accounts (M.A.S), Rules for actual filling of prescribed form i.e.
    - Detailed statement of materials compared with estimated requirements and
    - Report of the value and verification of unused materials.
  - (b) Disposal of surplus materials at the work site.
  - (c) Definition of:
    - Issue rate.
    - Storage rate.
    - Storage charges.
    - Supervision charges
    - Assets and liabilities.
  
- (viii) Issue of materials to contractors.

15. Works:

- (i) Categories:
  - (a) Original works.
  - (b) Repair works.

- (ii) Classification of works according to cost
  - (a) Major works.
  - (b) Minor works.
  - (c) Petty works.
- (iii) Conditions to be fulfilled before a work can be taken in hand:
  - (a) Administrative approval.
  - (b) Technical sanction.
  - (c) Appropriation of funds.
  - (d) Expenditure sanction (for plan works)
- (iv) Methods of carrying out works:
  - (a) Departmentally through daily labour
  - (b) Through contractors
    - Piece work system - work order
    - Contract system - Agreement.
- (v) Different types of contract:
  - (a) Item rate contract.
    - Labour rate (%age above or below)for various items or for covered areas construction (Private construction only)
    - Through rate basis (%age above or below)
  - (b) Lump-sum contract.
- (vi) Allotment of works:
  - (a) Concept of quotations and tenders
  - (b) Work order - Rules and Form.
- (vii) Definition of deposit works and Taccavi works.

16. Payment for Works:

- (i) Daily labour:
  - (a) Meaning.
  - (b) Muster roll.
    - Rules.
    - Instruction for maintenance.
    - Three parts of M.R. - Nominal roll, unpaid wages, detail of work done and filling of prescribed form.
  - (c) Daily labour report, filling of prescribed form.
  - (d) Casual labour-Rolls Its difference from M.R.
  - (e) Mistakes of common occurrence.
- (ii) Payment of work charged establishment-preparation of pay bill on prescribed form.



- (iii) Payment to contractors and suppliers:
  - (a) Record of measurement.  
Measurement book (M.B.)  
General Instructions.  
Method of payment after measurements are recorded in M.B.  
Common mistakes in the use and maintenance of M.B.  
Studnet may be directed to record the measurement of different items such as W/w, Distemper, Painting, Glass fitting, Plastering, etc. for maintenance of a building.
  - (b) Check measurement Book (C.M.B.)  
  
Purpose, administration with regard to its maintenance.
  - (c) Standard measurement book (SMB)  
  
Purpose and instruction with regard to its maintenance.
- (iv) Different types of payment
  - (a) First and final payment.
  - (b) Running payment.  
Secured advance.  
On account payment.  
Advance payment.  
Running and final payment.
- (v) Hand receipt.
- (vi) Clause in which the detailed measurements are dispensed with.

17. Miscellaneous

- (i) Duties of Junior Engineer/S.O. and S.D.O.
- (ii) Instructions on transfer of charge.
- (iii) Maintenance of log books of vehicles and machinery.
- (iv) Manufacturers accounts and out turn of machinery.
- (v) Dealing with railways-booking of consignment, taking delivery, credit note, demurrage and wharfage charges and damaged consignment.

NOTE: Students will not be required to draw out and memorize the forms. They are expected to know only how to fill up the forms supplied for the purpose from the given data.

PART C : ENTREPRENEURSHIP DEVELOPMENT

18. Introduction:

Entrepreneur, entrepreneurship, its meaning & importance. Qualities of an entrepreneur. Entrepreneur Motivation Training.

19. Financing Agencies :

Financial agencies for land, infra structure, machinery, raw material, import of raw material and machinery. Role and function of Govt. department connected with the development of industries/business ventures in the State.

20. Industrial Legislation and taxes:

Industrial and labour laws, production tax, local tax, trade tax, exise duty and income tax.

21. Project Report:

Component of project report - Land, building, electricity, water, equipment and other utilities. Materials, its availability, cost, labour availability and wage rates. Project report preparation, provisional registration and plan of acquiring finance from proper source (financing agencies).

D. INTELLECTUAL PROPERTY RIGHTS :

Introduction to IPR (Patents, Copy Right, Trade Mark), Protection of undisclosed information, Concept and history of patents, Indian and International Patents Acts and Rules, Patentable and Nonpatentable invention including product versus Process.

### 3.6 SURVEYING II

(Common to three year Diploma course in Civil Engg.spl.in Rural Engg., Environmental Pollution & Control and Water & Power Resource Management.)

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3 - 8

#### RATIONALE

One of the main concerns of Civil Engineering technicians is survey work required to be carried out for any civil Engineering Project either in its preparation or in its implementation. They require a thorough knowledge of methods of surveying and levelling, plotting of the survey work done and also setting out works for excavation. The technician has to be skilled in the use of survey instruments.

In the Second year, the students would have gained knowledge of chain, compass and levels. In this year, they will gain knowledge of plane table, contouring theodolite and curves. A number of field exercises have been set through which they will gain knowledge and skills in methods of surveying and use of instruments. The exercises also, will cover the problems which the technicians have to deal with commonly in their professional life.

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sr.No.	Topics	L	T	P
1.	Plane Table Surveying	16		
2.	Contouring	15		
3.	Theodolite Surveying	20		
4.	Total Station & Auto Level	4		
5.	Curves	20		
TOTAL		75		200

#### DETAILED CONTENTS

1. Plane Table surveying
  - (i) Purpose of plane table surveying. Equipment used in plane table survey (a) Plane table, (b) Alidade (Plain and Telescopic), (c) accessories.
  - (ii) Method of plane tabling (a) centering (b) levelling (c) Orientation.
  - (iii) Methods of plane table surveying (a) Radiation, (b) Intersection, (c) Traversing (d) Resection.
  - (iv) Two point problem.

- (v) Three point problem by
  - (a) Mechanical Method (Tracing paper)
  - (b) Bessel's Graphical Method.
  - (c) Trial and error method.

Errors in plane table survey and precautions to control them. Testing and adjustment of plane table and alidade.

## 2. Contouring

Concept of contour: Purpose of contouring; Contour interval and horizontal equivalent; Factors affecting contour interval; characteristics of contour; Methods of contouring direct and indirect, use of stadia measurements in contour survey. Interpolation of contours; Use of contour map; Drawing cross section from a contour map; Marking alignment of a road, railway and a canal on a contour map; Computation of earthwork and reservoir capacity from a contour map.

## 3. Theodolite Surveying:

Working of a transit vernier theodolite, Fundamental axes of a theodolite and their relation; Temporary adjustments of a transit theodolite; least count and concept of transiting, swinging, face left, face right and changing face; Measurement of horizontal and vertical angles. Prolonging a line (forward and backward) Measurement of bearing of a line; Traversing by included angles and deflection angle method; traversing by stadia measurement; Theodolite triangulation and plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected); Errors in theodolite survey and precautions taken to minimise them; Limits of precision in theodolite traversing. Principle and working of a micro-optic theodolite. Brief introduction to tachometry.

## 4. Total Station & Auto Level :

Working and application of total station and auto level.

## 5. Curves

Simple circular curves:

- (i) Need and definition of a simple circular curve; Elements of simple circular curve, Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord, deflection angle, apex distance and mid-ordinate. Setting out of simple circular curve:
  - (a) By linear measurements only:
    - Offsets from the tangents.
    - Successive bisection of arcs.
    - Offsets from the chord produced.

(b) By Tangential angles using a theodolite.

(ii) Transition Curves:

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curves; length of transition curves for roads by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only.

(iii) Vertical curves

Setting out of a vertical curve.

#### PRACTICALS

##### Field Surveying II

- Ex. (i) (a) Setting the plane table Plate-1.  
(b) Marking the North direction.  
(c) Plotting a few points by radiation method.
- Ex. (ii) (a) Orientation by Plate-1.  
- Trough compass  
- back sighting.  
(b) Plotting a few points by intersection method.
- Ex. (iii) Traversing an area with a plane table (at least five lines) Plate-1.
- Ex. (iv) (a) Two point problem. Plate-2.  
(b) Three point problem by  
- Tracing paper method.  
- Bessel's graphical method.  
- Trail and error method.

##### Contouring

- Ex. (v) Preparing a contour plan by radial line method by the use of a Tangent clinometer/Tacheometer. Plate-1.
- Ex. (vi) Preparing a contour plan by method of squares. Plate-1.

##### Theodolite

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The study of the subject will enable the civil Engineering Technician to deal with preparation and reading drawings of the Steel & R.C.C structure and public health engg..

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Topics	No. of Plates	Periods
(A)	Steel Structures		
1.	Working drawing of a roof truss	1	4x4
2.	Details of Roof truss with tubular section & north light	1	3x4
3.	Steel Connection	1	3x4
(B)	R.C.C.Structures (At least 4 plate from this part should be prepared by Auto Cad)		
a.	Public Building atleast double storyed with details of following R.C.C. elements	1	8x4
1.	(i) Beams - singly and doubly rainforced (ii) Columns (iii)Cantilever beam	2	4x4
2.	Slab : One way and Two Way Slab	1	3X4
3.	(i)Internal and corner column of a two storyed Building	1	2X4
	(ii)Junction of a secondary beam with main beam	1	2X4
4.i.	T Beam with slab	1	3x4
	ii.Cantilever retaining wall	1	3x4
	iii.Circular Overhead water tank	1	4x4
(C)	Irrigation Engg.		
	(i) Typical sections of a channel.	1	1x4
	(ii)Plan & cross-section of a tube well with Pump House.	1	3x4
	(iii)Distributory Fall.	1	3x4
(D)	Reading & Interpreting of Civil Engg Drawing.	-	4x4

DETAILED CONTENTS

PART A : STEEL STRUCTURAL DRAWING

1. Preparation of a working drawing (elevation, plan, details of joints at ridge, eaves and other connections) for a riveted steel roof truss resting on a masonry wall for the given span, shape of the truss and the design data regarding the size of the members and the connections. Also calculate the quantity of steel for the truss.
2. Tubular Steel Roof Trusses : Types of trusses for different spans. Details of column -truss connection. Simple trusses using tubular sections. North light provision.
3. Steel connections (a,b,c,d) rivetted and (e) welded All unstiffened.
  - (a) Beam to beam connections (seated and framed)
  - (b) Beam to column (seated and framed)
  - (c) Column base connections (slab base & gusseted base)

PART B : R.C.C. STRUCTURES( On Computer by AutoCad

- a. PUBLIC BUILDING :Plan elevation & sections of a public building like school.hospital,canteen,community hall, guest house.atleast double storeyed showing details of followingRCC elements:
    - (i) R.C.C. beam singly reinforced and doubly reinforced giving the size and number of bars, stirrups their size and spacing.
    - (ii) Details of reinforcement for a RCC square and circular column with isolated square footing.
    - (iii) Details of reinforcement for a cantilever beam with given data regarding the size of the beam and the reinforcement. Anchorage of reinforcement.
- NOTE: Bar bending schedules for each of the three above items will be prepared:
2. Details of reinforcement in plan and section for a simply supported RCC. One way slab with intermediate support and two way slab. Bar bending schedule should be prepared.
  3. Details of reinforcement of a two storeyed internal

reinforcement

and corner column. In this, the details of  
at the junction with beams must be shown.

Details of reinforcement of the junction of a  
secondary beam with the main beam with the given  
data.

- 4.i. Sectional details of T-beam showing details of bars
- ii. Details of reinforcement for a cantilever retaining wall with the given design data regarding the reinforcement, size and shape of the wall.
- iii. Details of reinforcement in a simple circular overhead water tank.

PART C : IRRIGATION ENGINEERING :

- (i) a. Typical sections of a channel. Typical cross-section of an unlined and lined channel in cutting, partly cutting and fully in filling.  
b. Typical L-section of a distributory.
- (ii) Plan and cross-section of tube well with pumphouse.
- (iii) Plan, cross-section and L-section of a distributory fall with details of wing wall, pitching, flooring and tubewell.

PART D :

Reading and interpreting Civil Engg. Drawing.



### 3.8 IRRIGATION ENGINEERING

L T P  
3 - -

#### RATIONALE

Irrigation is an ancient subject in Civil Engineering and its significance to Indian conditions is great. This is specially because of the occurrence of rainfall in about three months of the year requiring in many situations impounding of water for use during dry months of the year, further water for cultivation has to be transported over long distances to help/support crops of different types. India has contributed a great deal in this area and it is only field that diploma holders in Civil Engineering become aware of the knowledge in this area and acquire the skills of understanding the wide variety of irrigation structures. Irrigation engineering acquired a special meaning in the context of development of rural communities and the need to produce more with increasing population. Hence the course in the subject of Irrigation Engineering has been designed so as to cater to the present needs of diploma holders in Civil Engineering.

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Distt. of Periods		
		L	T	P
1.	Introduction	4		
2.	Rainfall and run-off	6		
3.	Water requirement of Crops	8		
4.	Lift Irrigation	8		
5.	Flow Irrigation	10		
6.	Canal Head Works	10		
7.	Regulatory works	5		
8.	Cross drainage works	5		
9.	Dams	5		
10.	Water logging and drainage	4		
11.	Major Irrigation Projects of India	6		
12.	Ground Water recharge	4		
Total		75	-	-

#### DETAILED CONTENTS

1. Introduction
  - 1.1 Definition of irrigation.
  - 1.2 Necessity of irrigation
  - 1.3 History of development of irrigation in India
  - 1.4 Types of irrigation
  - 1.5 Sources of irrigation water

2. Rain Fall & Run - Off
  - 2.1 Definition of rainfall & run-off, catchment area, Dicken's & Ryve's formulae
  - 2.2 Types of rain gauges - Automatic & Non - automatic
  - 2.3 Stream gauging.
3. Water Requirement of Crops
  - 3.1 Definition of crop season
  - 3.2 Duty, Delta and Base Period, their relationship
  - 3.3 Gross command area, culturable command area Intensity of Irrigation, Irrigable area
  - 3.4 Water requirement of different crops-Kharif and Rabi
4. Lift Irrigation
  - 4.1 Types of Wells - shallow & deep well, aquifer types , ground water flow, construction of open wells and tubewells.
  - 4.2 Yield of an open/tube well and problems
  - 4.4 Methods of lifting water - manual and mechanical devices, use of wind mills.
5. Flow Irrigation
  - 5.1 Irrigation canals
  - 5.2 Perennial Irrigation
  - 5.3 Different Parts of irrigation canals and their functions
  - 5.4 Sketches of different canal cross-sections
  - 5.5 Classification of canals according to their alignment
  - 5.6 Design of irrigation canals - Chezy's formula, Mannings formula, Kennedy's and Lacey's silt theorys and equations, comparison of above two silt theorys. equations, critical velocity ratio.
  - 5.7 Use of Garrets and Lacey's charts
  - 5.8 Various types of canal lining - Advantages & disadvantages
6. Canal Head Works
  - 6.1 Definition, object, general layout, functions of different parts
  - 6.2 Difference between Weir and Barrage
7. Regulatory Works

- 7.1 Functions and explanation of terms used
  - 7.2 Cross and Head regulators
  - 7.3 Falls
  - 7.4 Energy dissipaters
  - 7.5 Outlets-Different types
  - 7.6 Escapes
8. Cross Drainage Works
- 8.1 Functions and necessity of the following types:- Aqueduct, Syphon, Superpassage, Level crossing, inlet and outlet.
  - 8.2 Constructional details of the above
9. Dams
- 9.1 Earthen dams-types, causes of failure
  - 9.2 Classification into masonry & concrete dams
  - 9.3 Labelled cross-section of gravity dam.
  - 9.4 Spillways
10. Water Logging and Draingage
- 10.1 Definition, causes and affects,detection, prevention and remedies
  - 10.2 Surface and sub-surface drains and their layout.
11. Major Irrigation Projects in India
- Practice:
- Visits to atleast one of the Irrigation Projects and write specific report about the same.
12. Ground Water Recharge
- Aim, Method and Advantage.

### 3.9 ENVIRONMENTAL POLLUTION & CONTROL

(Common to three year Diploma course in Civil Engg.spl.in Environmental Pollution & Control and Water & Power Resource Management.)

L T P  
2 - -

#### RATIONALE

A Civil Engineering technician must have the knowledge of different types of pollution caused due to industrialisation and construction activities so as he may help in balancing the eco system & control pollution by providing controlling devices.

The contents of this subject have been developed to cater the above needs.

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Ecology of environment	3		
2.	Pollution and its classification	5		
3.	Water pollution	9		
4.	Air pollution	8		
5.	Solid Waste pollution	5		
6.	Noise pollution	5		
7.	Thermal Pollution	5		
8.	Radio Active Pollution	5		
9.	Legislation	5		
TOTAL		50	-	-

#### CONTENTS

##### 1. ECOLOGY OF ENVIRONMENT:-

Elements of environment: Earth, water, air, space and energy. Ecology: Living and non living concept leading to ecology. Ecosystem: Terrestrial, aquatic and marine affect of environmental pollution on ecological balances.

##### 2. POLLUTION AND ITS CLASSIFICATIONS

Definiton, classification, air, water, solid waste, thermal, noise and radio active pollutions. Different parameter of pollution.

##### 3. WATER POLLUTION:-

Sources, transport of pollutants, effect of water pollutants on man, animal, plant and material, various types of pollutants. Mainly discuss various types of wastes from community, general characteristics of domestic & industrial

wastes and their affects on environment, disposal methods on land and water, criteria of disposal by dilution. Stream sanitation. Sampling and monitering instrumentation for water pollution and control.

4. AIR POLLUTION:-

Sources, types of air pollutants, Transport of air pollutants, dispersion by single and multile sources. Control equipment, filter, electrostatic precipitators, wet scrubbers, fume combustion by incineration. Air pollution control in new and old plants.

5. SOLID WASTE POLLUTION:-

Review of various types of solid waste. sources, components of solid waste, city garbage and industrial solid waste handling and disposal equipment . Method of disposal, salvage and recovery. Volume reduction in solid waste.

6. NOISE POLLUTION:-

Sources, measurement of pollution. Degree of noise. Echos and their control. Industrial noise, units characteristics occupational injuries due to noise, criteria and standard for occupational injuries due to noise. Means to control noise in industry.

7. THERMAL POLLUTION:-

Various pollutants. Affects on environment, preventive measures.

8. RADIO ACTIVE POLLUTION:

Sources and affect on human, animals, plants and materials, measurement, means to control, preventive measures.

9. LEGISLATION :

Preliminary knowledge of the following Acts and rules made thereunder-

- The Water (Prevention and Control of Pollution) Act - 1974.
- The Air (Prevention and Control of Pollution) Act - 1981.
- The Environmental Protection (Prevention and Control of Pollution) Act -1986. Rules notified under EP Act - 1986 Viz.
  - # The Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000
  - # The Hazardous Wastes (Management and Handling ) Amendment Rules, 2003.

- # Bio-Medical Waste (Management and Handling) (Amendment) Rules, 2003.
- # The Noise Pollution (Regulation and Control) (Amendment) Rules, 2002.
- # Municipal Solid Wastes (Management and Handling) Rules, 2000.
- # The Recycled Plastics Manufacture and Usage (Amendment) rules, 2003.

### 3.10 EARTHQUAKE ENGINEERING

L T P  
2 - -

RATIONALE

#### TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Toipc 1	6		
2.	Toipc 2	2		
3.	Toipc 3	4		
4.	Toipc 4	3		
5.	Toipc 5	4		
6.	Toipc 6	10		
7.	Toipc 7	10		
8.	Toipc 8	3		
8.	Toipc 9	8		
TOTAL		50	-	-

1. Causes of earthquakes and seismic waves, magnitude, intensity and energy release, Basic terminology, Characteristics of earthquakes, Seismic hazard, vulnerability and risk, Seismic Zoning.
2. Earthquakes performance of structures in past earthquakes.
3. Philosophy of earthquake resistant design and concept of ductility, Short and long period structures, Concept of spectrum, Static force calculations.
4. Architectural considerations : Building simplicity, symmetry. Irregularities, Continuity and Uniformity
5. Effect of soils and liquefaction, Remedial measures, Construction of earth structures.
6. Seismic construction of masonry buildings, provisions of IS:4326.
7. Seismic construction of RC buildings detailing, provisions of IS: 13920.
8. Retrofitting of masonry and reinforced concrete buildings.
9. DISASTER MANAGEMENT :  
  
Definition of disaster - Natural and Manmade, Type of disaster management, How disaster forms, Destructive power, Causes and Hazards, Case study of Tsunami Disaster, National

policy- Its objective and main features, National Environment Policy, Need for central intervention, State Disaster Authority- Duties and powers, Case studies of various Disaster in the country, Meaning and benefit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.

Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.



### 3.11 CIVIL LAB-III (RCC & HIGHWAY)

Details of curriculum are mentioned in theory paper

1. Design of Steel & R.C.C. structure.
2. Highway, Railway & Bridges.

3.12 PROJECT WORK  
DETAILED CONTENTS

6.6.1 Preparation of any such project:

- (i) Survey and soil investigation, planning, designing preparing working drawings, estimation and scheduling of a work for a small building including writing of Technical Report.
- (ii) Planning a water supply and drainage system for a house. Preparation of working drawings for all the sanitary fittings. Estimating quantity of materials and cost including writing of technical report.
- (iii) Preparation of water supply and drainage scheme for a small colony with all working drawings, estimates and schedule of works including writing of technical report.
- (iv) Given topographical sheet of the area, select alignment of a small length of road connecting two stations. Preparation of detailed drawings (L-section, cross-section and plan). Detailed estimate, schedule of work and writing of technical report.
- (v) Selection of type design for a culvert to be proposed over a riverlet crossing a road. Preparation of working drawings, detailed estimate, schedule of work and writing of technical report.
- (vi) Conducting survey, preparation of drawings, Estimate and writing technical report for the improvement and widening of an existing road.
- (vii) Conducting survey work, preparation of plans, making proposals for improvement, preparation of estimate for existing road including writing of technical report.
- (viii) Conducting survey work, preparation of plan, L-section and cross-section of a small distributory making proposals and preparing detailed estimates for earth work including writing of technical report.
- (ix) Conducting survey work of a depression, making proposals for bund, working out capacity of reservoir and design of irrigation system including writing of technical report.
- (x) Planning of small civil engineering work including designs, drawings, estimates and technical report writing.
- (xi) Other problem with in syllabus including survey work, design, drawing, estimate and technical report writing.

### 3.13 FIELD EXPOSURE

#### INDUSTRIAL EXPOSURE AND VISIT

Four Weeks structured and supervised, branch specific, task oriented industrial/field exposure to be organised during summer vacation

The student during the vacation training must undertake training in at least any one of the following.

1. Topographical Map :  
survey work with the help of level & plan table and prepare the map showing contours.
2. Construction of multistory Framed structure:  
The construction of different components of the framed structure foundation (pile, raft etc.) Beams, columns, slab, basement, ducts ( lifts & services).
3. Construction of Water Supply & Sewer Line :  
The process of laying water supply and sewer pipe lines at a proper gradient and different method of pipe joints.
4. Construction of over Head Tanks ;  
construction of different components of over head tank e.g. foundation, columns, beams, ring beams, side walls, circular slab etc.
5. Construction of Irrigation Work ;  
Construction of Irrigation channel at a proper gradient, Canal head works, Regulatory work, Falls, cross drainage work, Tube well Open well, wind mill etc.
6. Construction of Dam :  
Knowledge of the different works involved in construction of dams e.g mass concreting, concrete conveyors, tunneling etc.
7. Construction of culverts & bridges :  
The construction of piers, abutments, deck beam of bridge construction construction of different components of culvert eg. wing wall abutments curtain wall, slab and arch.
8. Construction of Roads :  
The construction of WBM, bituminous, Concrete roads and should know how to provide gradient, camber super elevation in construction of roads.
9. Construction of Breast Wall & retaining Wall :  
The construction of breast wall & retaining wall of stones in construction of hill roads and provision of weep holes. He must also understand the R.C.C. retaining wall its components eg. stem, heel and their reinforcement detail & construction.
10. Entrepreneurial and professional Practice:  
Student should go for training under the Private Architect/ Civil Engg Consultant / Private Contractor/ Construction Agency and see the Civil Engg. performed by them.

FOR Spl. RURAL ENGINEERING

3.14 AGRICULTURE ENGINEERING AND RURAL DEVELOPMENT

L T P  
2 - 1

(A) Agriculture Engineering :

Importance of Agriculture Engineering in the field of agriculture. Objects of tillage, types of tillage and various improved tillage practices in the modern agriculture. Improved method and devices for the crop planting. Miscellaneous agriculture equipments for crop production e.g. fertilizer distributors, ammonia application, harvesting and crop processing equipments, Storage structures, small capacity ferro cement bins. Various farm buildings such as farm houses, farm sanitation, animal shelters (barns, poultry houses) their planning, design and construction suitable for particular area.

Farm water supply. Planning and Layout of farm stead, various sources of farm power, their suitability and adoptability e.g. Tactor, Mechanical engines, Hydraulic power etc.

(b) Rural Development :

1. Community Development and Organisation :

Concept, aims and objectives, Principles and organisational pattern of community development . Importance of a village and its vital role in Nation's growth and life. Conceptual differences in Rural and Community development. Historical background of various Rural development programmes with special reference to I.R.D.P., TRYSEN, Youth Organisation, JRY, IAY, P.M.R.Y.

2. Extension Education :

Concept, definition, objectives, principles, and elements of extension education, importance in the field of Civil engineering. Brief idea of Extension Education in India and abroad. The method of extension approaches-individual, group and mass. Knowledge and preparation of simple audio visual aids, role and duties of an extension agency and extension workers .

2. The Indian Village :

Its growth and existing social conditions. Major social, economic and other problems related to agriculture engineering. Rural institutions like Village schools, Panchayats, Co-operative societies, Rural banks.

3. Elementary Sociology :

Rural society - meaning and characteristics of rural society. Elementary knowledge of social structure and social institutions like village schools, panchayats, co-operative societies, rural banks .

4. Village Survey :

Method and techniques of village survey. Collection of data, tabulation, interpretation, analysis and report writing. Programme planning- meaning, principles, importance and evaluation.

PRACTICAL WORK

To conduct demonstration meetings on use of different equipments e.g. use of smokeless chula, Gobar gas plant, Health centres, Community halls, special features of rural housing, roads, water supply, sanitation. Chains used for area measurement.

To study the rural engg. problems and role of technical personnel in dealing them.

Training in public speaking and conducting group discussions on different rural engineering problems. Importance of traditional technologies, social forestry and its importance.

To conduct a socio-economic survey of a village and report writing.

NOTE :

Students have to do these problems in the surrounding village.

FOR Spl. ENVIRONMENTAL POLLUTION AND CONTROL

3.14 ENVIRONMENTAL MANAGEMENT

L T P  
3 - -

RATIONALE

The study of different types of environmental pollutions has already been dealt in the previous paper. Due to vast Civil Engineering developmental activities, the environment degradation is going on, to assess the impact on the environment as well as to manage the environment, the need of the paper felt necessary. The contents of this paper have been developed to cater the above need.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	Distt. of Periods		
		L	T	P
1.	Environmental Indicators	10		
2.	Environmental Impact Assessment(E.I.A.)	10		
3.	Hazards & Accident Preventions	15		
4.	Disaster Management	10		
5.	Measuring Technologies	10		
6.	Treatment Technologies	10		
7.	Air & Water Pollution Control Acts	10		
Total		75	-	-

DETAILED CONTENTS

1. ENVIRONMENTAL INDICATORS :

Indicator of Ecological Environment, Indicators and Bio diversity, Indicators for Economic, Social and Aesthetic Environment. Uses of the Indicators for Public, Decision Makers, Judicial System, Researchers and other Groups. Development of the Indicators using procedure like basic data gathering identifying the critical factor and data distribution.

2. ENVIRONMENT IMPACT ASSESSMENT (E. I. A.):

Impact of Environmental Management Processes on Biological System including man. EIA of developmental projects like residential and commercial complexes, dams, reservoirs, canals, railways, tunnels, bridges, etc.

3. HAZARDS AND ACCIDENT PREVENTIONS :

Terminology relating to chemical hazards, classification of

chemicals, hazards and hazardous chemicals, Hazards associated with manufacturing storage and handling of chemicals, Hazards associated with particulate matter specially from cement, metallurgical industries and thermal power station, I.S. and other codes of safety for operational hazards in laboratories and industries.

Hazardous chemical manufacturing, storage and impact rules 1989, Hazardous waste management and handling rules 1989.

4. DISASTER MANAGEMENT :

Disaster, Risk assessment studies, Examples of disasters such as Bhopal Gas (MIC) leakage episode and other, formulation of crises group, Disaster management of dams, Reservoirs, High rise building in earthquake prone areas, bridges, etc.

5. MEASURING TECHNOLOGIES :

Measuring sampling techniques for quantification of various parameters under various conditions of air, water and land systems; Physical, chemical and biological parameters.

6. TREATMENT TECHNOLOGIES :

Standards based on B.I.S./Pollution Control Board, Water Treatment for domestic use, Industrial water treatment, Domestic waste water treatment, Industrial waste water treatment, Radio active waste control and Air pollution control.

7. AIR AND WATER POLLUTION CONTROL ACTS :

Classification of polluting/Non polluting Agencies. Procedure for getting N.O.C. and Consent. Calculation of Cess on industrial water consumption, Environmental Audit/Statement. Rules and regulations related to starting any new industry and undertaking and new developmental projects by government and non-government agencies.

Ministries of environment at central and state levels. Constitution, composition and functions of Central Board and State Boards for the prevention of pollution

The Water (Prevention and Control of pollution) Act, 1974. The Air (Prevention and Control of Pollution) Act, 1981, The Environmental Protection Act (1986).

FOR Spl. WATER RESOURCE

3.14 WATER & POWER RESOURCE MANAGEMENT

L T P  
3 - -

Rationale

Natural resources are limited in the nature and their optimum use for maximum period at an economic budget will enhance the developmental activities of the nation. A student having knowledge of Water & Power Resource Management as a subject in the field of Civil Engg. will prove useful for accepting the challenges of the world of work. The contents of the subject have been designed to familiarise the students with knowledge and skills of Water & Power Resource Management.

TOPIC WISE DISTRIBUTION OF PERIODS

Sr. No.	Units	Coverage Time		
		L	T	P
1.	Introduction	3	-	-
2.	Hydrology	4	-	-
3.	Meteorology	8	-	-
4.	Ground & Surface Water	6	-	-
5.	Water Quality	8	-	-
6.	Planning For Water Resources Development	10	-	-
7.	Water Power Development	12	-	-
8.	River Training	8	-	-
9.	Inland Navigation	8	-	-
10.	Flood Control	8	-	-
		75	-	-

DETAILED CONTENTS

1. INTRODUCTION:

History, Background, Distribution and use of water, Functions of various department and organisation involved in Water & Power Resource Management such as Ministry of Water Resources, Govt. Of India, Central Board of Irrigation and Power, Central Water Commission, National Institute of Hydrology, Central Water & Power Research Station, Central Electricity Authority, National Hydro-Power Corporation, Flood Control, Power, Irrigation, Irrigation Research Station, Command Authorities, Soil Conservation, Minor Irrigation etc.

2. HYDROLOGY:

Definition, History, Hydrologic cycle, Precipitation, Stream flow, evaporation and transpiration from free Water surface,



Soil surface, Vegetation. Necessity of Hydrologic data, Water Balance, Role of Hydrology in water resources development.

3. METEOROLOGY:

The weather and the atmosphere, temperature in the Atmosphere, Pressure and Winds, Wind measurement, Air masses and Fronts, Warm and Cold Fronts, Life history of cyclone, Atmospheric humidity- Absolute, Relative and Specific, Measurement of humidity, Change in climate, Indian Monsoon and its salient features.

4. GROUND & SURFACE WATER:

Ground water occurrence, ground water hydraulics, Ground water fluctuations, Artificial recharge of ground water, Characteristics of the hydrograph, Effect of rainfall distribution on shape of hydrograph, Unit hydrograph analysis, Hydrographs of base flow, Conjunctive use of surface and ground water.

5. WATER QUALITY:

General water quality requirement for domestic, industries and irrigation, Sources of salinity in ground water, units of expression, various methods, cost aspect of desalination, Re-use of water, Need for control of industrial and municipal effluents discharged in to water sources used for Irrigation, Injurious salts, Malaria Control.

6. PLANNING FOR WATER RESOURCES DEVELOPMENT:

Objective data and requirements, Project formulation, Single purpose and multipurpose projects, Reservoir capacity, Factors affecting reservoir capacity, Mass curve of flow, Economic return from projects, Cost allocation, Odra-bandi, System of Levying Irrigation Charges from canals and tubewells, Different types of multipurpose projects - Hydro electric power, Public water supply, Flood control, Navigation etc. Study of some important multi-valley projects of India. National Water Policy, National Water Grids, Interstate Problems/Disputes, State/Central Government Acts on development of Water and Power Resources.

7. WATER POWER DEVELOPMENT:

Sources of energy, Power plant, types of power schemes, Importance of electric power, Power development in India, Water power schemes their types and layout, Water power potential and electric power. Installed capacity of power station synchronous speed of generator, Economics of water power development. Advantage of Water Power over thermal and nuclear power

8. RIVER TRAINING:

Types of rivers, Meandering of rivers, Cut-off, Objects of river training, Types of river training works- Guide banks (Bell's Bank), Marginal embankments (Dykes), revetment, groynes, bank pitching, launching apron, pitched island etc.

9. INLAND NAVIGATION:

Navigable inland water ways, Methods of achieving navigability in river, Requirements of navigation canal, Navigation works - A lock weir, A canal lock, Fender piles, Tow path, Bridges etc.

10. FLOOD CONTROL:

Methods of estimation of flood discharge, Flood control reservoirs, Deterministic and statical methods of flow estimation. Flood routing, Flood management, Flood walls and embankments, Channel improvements, Evacuation and Flood zoning, Economics and Flood control, Flood warning and forecasting, Flood management in India.

NOTE:

Field visits to atleast two of the following Water & Power Resource Management Projects/Institutes and write specific report about the same :-

Field Visit:

1. National Institute of Hydrology, Roorkee.
2. Ganga Discharge site at Varanasi/Patna.
3. Irrigation Research Institute, Roorkee.
4. Irrigation Research Station, Bahadrabad
5. Department of Hydrology, University of Roorkee, Roorkee.
6. Bheem Goda Head Works, Hardwar.
7. G. B. Pant University of Agriculture and Technology.
8. Narora Head Works, Nuclear Power Station, Narora
9. Rihand Dam/Matatila Dam/Kalagarh Dam.

STAFF STRUCTURE

DIPLOMA IN CIVIL ENGG.

Intake of the Course 30  
 Pattern of the Course Annual Pattern

Sl. No.	Name of Post	No.
1.	Principal	1
2.	H.O.D.	1
3.	Lecturer Civil Engineering	4
4.	Lecturer in Mech. Engg.	1
5.	Lecturer in Maths	1
6.	Lecturer in Chemistry	1
7.	Lecturer in Physics	1 Parttime
8.	Lecturer in Comm. Tech.	1
9.	Lecturer in Elect. Engg.	1
10.	Computer Programmer	1
11.	Steno Typist	1
12.	Accountant / Cashier	1
13.	Student / Library Clerk	1
14.	Store Keeper	1
15.	Class IV	6
16.	Sweeper	Part time as per requirement
17.	Chaukidar & Mali	as per justification

Note :

1. Services of other disiepline staff of the Institute may be utilized if possible
2. Qualifications of Staff : as per service rule
3. The post of "Computer Programmer" in not needed in the institutions where diploma in "Computer Application" is running.

DIPLOMA IN CIVIL ENGINEERING  
SPACE STRUCTURE

[A] ADMINISTRATIVE BLOCK

Sl. No.	Details of Space	Floor Area Sq. metres	Remark
1.	Principal's Room	30	
2.	Confidential Room	10	
3.	Steno's Room	6	
4.(a)	Office including Drawing Office	80	
(b)	Record Room	20	
5.	Staff Room		
	(a) Head 1	15	
	(b) Lecturer 10 sq.m./ Lect. for 8 Lecturers	80	
6.	Library and Reading room	150	
7.	Store	100	
8.	Students Common room	80	
9.	Model Room	90	

[B] Academic Block

Sl.No.	Detail of Space	No.	@ Sq.m	Floor Area Sq.m.
1.	Class Room	2	75	150
2.	Drawing Hall	1	120	120
3.	Physics Lab			75
4.	Chemistry Lab			120
5.	Mechanics & S.O.M Lab			120
6.	Survey Lab			40
7.	Civil Lab I			75
8.	P.H.E. Lab			75
9.	Highway Engg. Lab.			75
10.	Hydraulics and Irrigation Engg. Lab			120
	Over Head Tank 2000 Litre Cap;			
	Under Ground Tank 600 Litre Cap;			
11.	Computer Lab (Air Cond.Glass Partition and Special type pvc flooring and false ceiling )			60
12.	Rural Development and Agricultural Engg. LAB			60
13.	CAD LAB (Air Conditioned with glass Partiation, PVC Flooring and False Ceiling)			60

[C] Work shop

I	Workshop Supdt. Room	12
II	Store	20
III	Shops	
(a)	Carpentry Shop	50
(b)	Smithy Shop	70
(c)	Fitting Shop	50
(d)	Welding Shop	50
(e)	Painting Shop	50
(f)	Sheet Metal ,Soldering & Brazing shop	50
(g)	Plumbing shop	50
(h)	Machine Shop	150
(i)	Foundry	75

[D] Student's Aminities

1.	Hostel	40	%	of Strength of Students
2.	Cycle Stand	50	%	of Strength of Students
3.	Canteen and Tuck shop	50		
4.	N.C.C. Room	70		
5.	Dispensary	40		
6.	Guest Room(Attached Bath) including kitchen & store	45		

[E] STAFF RESIDENCES

1.	Principal	1	100	100
2.	Head od Department	1	100	100
3.	Lecturer	4	80	320
4.	Non teaching & Supporting staff	8	60	480
5.	Class IV	6	30	180

Priority to be given in following order

(1)

- a. Administrative Building
- b. Labs
- c. Workshop
- d. Over head Tank
- e. Boundary Wall
- f. Principal Residence
- g. Fourth Class Quarters (2/3)

(2)

- a. Hostel
- b. Students Aminities

(3)

Residences of employee

LIST OF EQUIPMENTS

Only those of the equipments given below which are essentially required for the conduction of practicals mentioned in the curriculum are to be procured by the institutions.

"Machine/Equipments/Instruments of old BTE list which are not included below are to be retained in the Lab/Shop for Demonstration purpose but not to be demanded fresh for purchase."

NOTE : Equipment for different shop and lab of latest version should be purchased.

I. APPLIED PHYSICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Brass ball with hook 2 cm. dia	2	20	40
2.	Stop clock least count 0.1 Sec	2	500	1000
3.	Wall bracket with clamping arrangement	2	50	100
4.	Meter scale	5	20	100
5.	Convex lences of focal length 10 cm., 20 cm., 50 cm. and 100 cm. 2 nos. of each	8	10	80
6.	Optical bench steel with pin and lence holders	2	500	1000
7.	Anstronomical telescope	1	500	500
8.	Searl's conductivity apparatus with copper & steel rods 25 X 4 cm. diameter with all accessories	1 set	1000	1000
9.	Lea's conductivity app. complete with all accessories	1 set	1000	1000
10.	Constant water flow arrangement	2	400	800
11.	Boiler made of copper 2 lt. cap.	4	200	800
12.	Platinum resistance thermometer	2	800	1600
13.	Potentiometer - 10 wires with jocky	1	500	500
14.	Meter bridge complete	1	250	250
15.	Lead accumulator 2.2 V. and 20 amp. hour capacity	2	250	500
16.	Moving coil galvenometer	3	200	600
17.	Moving coil ammeter 0-1 amp., 0-5 amp., 0-10 amp., 1 no of each	3	250	750
18.	Moving coil voltmeter 0-1 V. 0-5 V., 0-10 V. 1 No of each	3	250	750
19.	Lechlanchi cell complete	3	100	300
20.	Resonance col. of steel tube with tuning forcs and other accessories	1	500	500
21.	Tuning forcs set of different frequencies	1 set	1000	1000
22.	App. for determining coefficient of friction on a horrizontal plane	1 set	1000	1000
23.	Appratus for determining characteristics of P-N junction diode complete with all accessories	1 set	1500	1500
24.	Post office box dial type	1	1200	1200

S.No.	Name of Equipment	No.	@ Rs.	Amt. in Rs.
25.	Resistance box 0-10 ohm., 0-100 ohm. 2 nos. each	4	400	1600
26.	Rehostat of different ohm.capacity	8	250	2000
27.	Physical balance with weight box	2	800	1600
28.	Set of fractional weights	10	20	200
29.	Fortin's barometer with mercury	1	2500	2500
30.	Battery eleminator 6 V. & 3 amp.	1	250	250
31.	Lab tables	3	8000	24000
32.	Lab stools	10	100	1000
33.	Anemometer cup type	1	1000	1000
34.	Anemometer hand held	1	1000	1000
35.	Suryamapi	1	1500	1500
36.	Insolation meter	1	1500	1500
	Misc.	Lum Sum		5000

## II. APPLIED CHEMISTRY LAB

1.	Test tube stand	15	10	150
2.	Funnel stand	15	10	150
3.	Burette stand	15	30	450
4.	Pipette stand	15	10	150
5.	Chemical balances with analytical weights 1gm -200gms	5	1500	7500
6.	Fractional weights set with rider	5sets	25	125
7.	Kipp's apparatus 1000 ml. polythen	2	500	1000
8.	Reagents bottles			
	250ml	120	10	1200
	500ml	5	15	75
	1000ml	5	25	125
9.	Wide mouth bottle 250 ml	15	15	225
10.	Winchester bottle 2.5 litre	15	30	450
11.	Test tubes 1/4" x 6"	75	1	75
12.	Boiling tube 1" x 6" hard glass	24	10	240
13.	Pestle and mortar 10 cms	2	30	60
14.	Watch glass 7.5 cms	15	5	75
15.	Beakers			
	100 ml.	10	15	150
	250 ml.	24	20	480
	400 ml.	12	25	300
	1000 ml.	5	30	150
16.	Weighing bottle 10 ml with lid	15	10	150
17.	Wash bottles	15	15	225
18.	Conical flask 250 ml.	15	30	450
19.	Flat bottom flask 500 ml.	6	40	240
20.	Flat bottom flask 250 ml.	15	25	375
21.	Burette 50 ml.	15	60	900
22.	Pipette 25 ml.	15	20	300
23.	Measuring flask 250 ml. with stopper	15	50	750
24.	Measuring cylinder of various sizes (250 ml, 500 ml, 1000 ml) 3 no. of each	9	LS	250
25.	Bunsen's burner of brass	15	50	750

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
26.	Gas plant petrol 10 to 20 burners automatic	1	5000	5000
27.	Spirit lamp	15	30	450
28.	Tripod stand	15	10	150
29.	Wire gauge 15 X 15 cm. with asbestos	15	15	225
30.	Test tube holder	15	10	150
31.	Porcelain plates	15	20	300
32.	Funnel 15 cm.	15	16	240
33.	Blow pipe & work tools with electric blower for glass blowing	1 set	10000	10000
34.	Cork borers with sharpn	2 set	100	200
35.	Cork pressure	1 set	250	250
36.	Glass cutting knife	1	75	75
37.	Spatula hard & nickel/steel	2 each	50	100
38.	Water tapes with gooseneek	6	200	1200
39.	Gas taps two way	10	150	1500
40.	Pinch cock & screw	15	20	300
41.	Distilled water units (electrical)	1	5000	5000
42.	Distilled water units (solar)	1	5000	5000
43.	Open balance 1000 gms./10 mg.	1	600	600
44.	Platinum wire	5	25	125
45.	Brush for cleaning various type	40	10	400
46.	Jars 20 Lit. for keeping distilled water	5	100	500
47.	Lab table 2 m. x 1.2 m. x 1 m. hight with central sink and cup boards (Teak wood) with drawers and two built in almira on each side with reagent racks, better tile top	4	8000	32000
48.	Exhaust fans 18"	4	2000	8000
49.	Side racks and selves for bench reagents made of teak wood for 24 bottels each set	4	2000	8000
50.	Digital balance electronic	1	10000	10000
51.	Hot plates 7-1/2", 3" dia controled 2000 watts	1	1000	1000
52.	Hot air oven thermostatically controled with selves and rotary switches 350 x 350 x 25 high	1	8000	8000
53.	pH Meter	1	1000	1000
54.	Glass Electrode	2		
55.	Reference Electro	2		
	Miscellaneous	LS		10000



APPLIED MECHANICS LAB

Sl.No.	Name of Equipment	No.	Rate	Amount
1.	Polygon of Forces Apparatus	1	700	700
2.	Universal Force Table	1	1500	1500
3.	Principle of Moment Apparatus			
	Bell Crank lever	1	500	500
4.	Combined Inclined plane & Friction apparatus	1	900	900
5.	Simple wheel and axle	1	800	800
6.	Differential wheel and axle	1	1200	1200
7.	Double sleeve Pulley Block	1	400	400
8.	Simple Screw Jack	1	200	200
9.	System of pulleys (Any I,II,III)	1	1200	1200
10.	Worm & Worm wheel	1	1200	1200
11.	Apparatus for Reaction at support	1	1000	1000
12.	Jib Crane	1	500	500
13.	Jointed Roof Truss Apparatus	1	500	500
	Misc.	Lum Sum		2000

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 III. WORKSHOP PRACTICE

CARPENTRY SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	60 cm.rule	10	15	150
2.	Flexible steel rule 2 metre	2	20	40
3.	T square 23 cm. steel	10	20	200
4.	Bevel square 23 cm. steel	2	30	60
5.	Marking knife 25 cm. steel	10	30	300
6.	Marking gauge wooden & brass 25 cm.	10	30	300
7.	Mortise gauge wooden & brass 25 cm.	10	50	500
8.	Caliper inside, steel 20 cm.	2	50	100
9.	Caliper outside , steel 20 cm.	2	50	100
10.	Compass steel 20cm.	2	40	80
11.	Devider steel 20 cm.	2	40	80
12.	Plumb	2	20	40
13.	Wooden bench vice steel 20 cm.	10	200	2000
14.	Bench hold fast steel 30 cm.	10	40	400
15.	Bar clamp 2 m.	2	300	600
16.	G clamp of flat spring steel 20x30 cm.	4	60	240
17.	Rip saw 40-45 cm.	10	80	800
18.	Cross cut saw 40-45 cm.	2	80	160
19.	Tennon saw 30-35 cm.	10	50	500
20.	Dovetail saw 30-35 cm.	2	60	120
21.	Compass saw 35 cm.	4	60	240
22.	Key hole saw or pad saw 30-35 cm.	2	25	50
23.	Bow saw	2	25	50
24.	Frame saw	2	25	50
25.	Chisel fish brand 1" to 1/8"			

	firmer	3 set	100	300
	Dovetail	3 set	100	300
	Mortise	3 set	100	300
26.	Gauge or Golchi 1" to 1/8"	3 set	150	450
27.	Wooden jack plane complete	10	100	1000
28.	Wooden smoothing plane	10	80	800
29.	Iron jack plane complete	10	200	2000
30.	Iron rebate plane complete	3	80	240
31.	Iron grooving plane complete	3	120	360
32.	Iron compass plane complete	3	200	600
33.	Wooden moulding plane complete	3	200	600
34.	Bradawl	3	150	450
35.	Gimlet drills set	1 set	150	150
36.	Center bit	2	120	240
37.	Twist bit	2	80	160
38.	Auger bit	2	40	80
39.	Dovetail bit	2	15	30
40.	Counter shank bit	2	20	40
41.	Ratchet brace machine	2	175	350
42.	Grand drill machine 1/4"	2	200	400
43.	Wooden hand drill burmi	5	200	1000
44.	Wooden mallet	10	25	250
45.	Claw hammer	3	30	90
46.	Carpenters hammer	10	30	300
47.	Cutting tool for Universal wood working machine	3 set	800	2400
48.	Screw driver 18" & 15"	6	50	300
49.	Adze 500 gm.	10	50	500
50.	Pincer 175 mm.	6	75	750
51.	Plier 150 mm.	4	90	360
52.	Oil stone 8"	4	75	300
53.	Rasp file 12"	4	100	400
54.	Half round file 12"	4	80	320
55.	Round file 12"	4	80	320
56.	Triangular file 5", 4"	8	60	480
57.	Water stone	4	20	80
58.	Carpentry work benches	4	2000	8000
59.	Band saw machine complete	1	30000	30000
60.	Circular saw machine	1	15000	15000
61.	Double Ended Electric Bench grinder	1	6000	6000
62.	Universal wood working machine	1	15000	15000
	misc. for foundation of machines	LS		10000

#### SMITHY SHOP

1.	Anvil 150 Kg. with stand	5	2500	12500
2.	Swage block 50x30x8cm.&45x45x10cm.	2	1250	2500
3.	Hammers			
	Ball peen 0.8 Kg. (Approx.)	10	150	1500
	Cross peen 0.8 Kg. (Approx.)	10	150	1500
4.	Beak iron 25 Kg.	1	500	500
5.	Swages different types	6	40	240
6.	Fullers different types	6	30	180
7.	Leg vice 15 cms. opening	1	150	150
8.	Electric blower with motor	1	5000	5000
9.	Furnace chmney with exhaust pipe	5	5000	25000

10.	Sledge hammer - 5 Kg.	2	200	400
	Misc. tools		LS	2500

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S.No.Name of Equipment No. @ Rs. Amt.in  
Rs.  
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SHEET METAL, SOLDERING & BRAZING

1.	Dividers - 15cm.	5	60	300
2.	Trammel 1 m.	1		
3.	Angle protector	5	60	300
4.	Try square 30 cm.	5	40	200
5.	Centre punch	5	20	100
6.	Steel rule 30 cm. , 60 cm.,	5	25	125
7.	Sheet metal gauge	1	120	120
8.	Straight snips 30 cm.	2	250	500
9.	Curved snips 30 cm.	2	300	600
10.	Bench shear cutter 40 cm.	1	5000	5000
11.	Chisel 10 cm.	5	100	500
12.	Hammer	5	150	750
13.	Bench vice 13 cm.	5	1000	5000
14.	Plier	5	50	250
15.	Nose plier	5	60	300
16.	Sheet metal anvil/stakes	5	2000	10000
17.	Shearing machine 120 cm.	1	2500	2500
18.	Solder electric	2	500	1000
19.	Solder furnace type	2	250	500
20.	Brazing equipments and accessories	1	5000	5000
21.	Blow lamp	2	250	500
22.	Sheet bending machine	1	10000	10000
	Misc.		LS	5000

FITTING SHOP

1.	Bench vice jaw 10 cm.	10	300	3600
2.	Surface plate 45x45 cm.	2	2000	4000
3.	V. Block 10x7x4 cm.	5	350	1650
4.	Try square	10	40	400
5.	Bevel protractor 30 cm.	1	2100	2100
6.	Combination set	1	2500	2500
7.	Divider	5	60	300
8.	Centre punch	5	20	100
9.	Calipers (Different sizes)	12	20	240
10.	Vernier calipers 30 cm.	2	600	1200
11.	Micrometer 0-25, 25-50 m.m.	4	500	2000
12.	Vernier depth gauge	1	350	350
13.	Feeler gauge--15 blades	1	30	30
14.	Radius gauge	1	100	100
15.	Angle gauge	1	100	100
16.	Thread gauge	1	100	100
17.	Bench drilling machine 13 mm.	1	5000	5000
18.	Double ended electric grinder	1	4000	4000
19.	Drill set	1set	1000	1000
20.	Reamer set	1set	2000	2000
21.	Tap set	1set	2000	2000
22.	Adjustable wrenches (15 cm., 20cm. 30 cm.)	1set	500	500
23.	Allen key set	1set	350	350

24.	Spanners	6	60	360
25.	Work benches	6	2000	12000
26.	Power hacksaw	1	4000	4000
	Misc. Files, Dieset, Hexa frames etc.		LS	10000

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S.No.Name of Equipment No. @ Rs. Amt.in  
Rs.  
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WELDING SHOP

1.	Ellectric welding set oil cooled	1	10000	10000
2.	Industrial regulator type oil cooled arc welder	1	12000	12000
3.	Air cooled spot welder 7.5 KVA	1	15000	15000
4.	General accssories for air cooled spot welder of 7.5 KVA			8000
5.	Gas welding set with gas cutting torch and complete with all accessories	1	15000	15000
6.	Misc. work benches		LS	20000

PAINTING & POLISHING SHOP

1.	Air compressor complete with 2 HP motor	1set	12000	12000
2.	Spray gun with hose pipe	1	1000	1000
3.	Stoving oven	1	3000	3000
4.	Buffing machine with leather and cotton wheels	1	4000	4000
5.	Electroplating Equipment for cromium Nikle plating.	1	10000	10000
	Misc.		LS	2000

PLUMBING SHOP

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S.No.Name of Equipment No. @ Rs. Amt.in  
Rs.  
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1.	Pipe vice 5 cm.	4	250	1000
2.	Chain wrenches	5	250	1250
3.	Ring spanner Set	5	125	625
4.	Wheel pipe cutter	2	300	600
5.	Water pump plier	4	50	200
6.	Pipe die set 2" set	2 set	600	1200
7.	Pipe bending device	1	5000	5000
8.	Work benches	4	4000	16000
9.	Set of various types of plumbing fittings e.g. Bib cock, Cistern, Stop cock, Wheel volve, Gat volve etc.		LS	2000
10.	Misc. Hacksaw frame and others		LS	2000

FOUNDRY SHOP

1.	Moulding boxes	25		6000
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2.	Laddles	5	1000
3.	Tool kits	10 sets	2500
4.	Quenching tanks water or oil	2	1000
5.	Permiability tester	1	1000
6.	Mould hardness tester	1	6000
7.	Sand tensile testing equipment	1	7500
8.	Portable grinders	1	3000
9.	Temperature recorders/controllers	LS	5000
10.	Pit furnace with Blower	1	5000

#### MACHINE SHOP

1.	Lathe machine 4.5 feet "V" bed. Height of centres 8.5 inch. Dog chuck 8 inch complete 1 H.P. motor 440v, push button starter with coolent pump, tray and with standard accessories.	2	25000	50000
2.	Shaper machine 12 inch stroke with 2 H.P. motor 440 volts push button starter with vice 6 inch (Swivel base)	1	20000	200000

#### NOTE:-

The institutes running mechanical engg. course need not purchase these two items sepreately because they will have one complete machine shop for the course

V. BUILDING MATERIAL TESTING LAB/ CIVIL LAB I

1.	Kit of specimens of stones ( at least 10 types) kept in a wooden box labelled	2 set	1000	2000
2.	Kit of specimen of timber of size 15x10x5 cm kept in wooden box labeled ( at least 10 types)	2 set	1000	2000
3.	Vicat's needle apparatus complete with all accessories.	4	800	3200
4.	Air permeability apparatus blain type as per IS 5536 for finness of cement	1	1600	1600
5.	Compression Testing Machine Electrically cum manually operated with pumping unit up to 100 Tonnes Capacity.	1	70000	70000
6.	Lechatlier's apparatus for determining soundness of cement IS 5514 & 4031	4	250	1000
7.	Single pan Balance Dial Type 10 Kg. Capacity.	1	1000	1000
8.	Pan Balance 1 Kg Capacity Dial Type	2	500	1000
9.	Plate form weighing machine 100 Kg Capacity	1	4000	4000

VI. STRENGTH OF MATERIALS LAB

1.	Shear force apparatus for determining shear force at different sections of a freely supported beam with point load.	1	1000	1000
2.	Bending moment apparatus for determining bending moment at different section of a freely supported beam with different loading. complete with all accessories.	1	1000	1000
3.	Deflection beam apparatus consisting of two knife edge and supports, a hanger with knife edge, and a pointer moving over a graduated scale. Complete with scale pan and			

	two beams of different metals each beam 120 cm long.	1	500	500
4.	Universal testing machine capacity 40 tonnes, digital type with standard accessories and XY recorder ( Range 0 to 40 t, 0 to 20 t and 0 to 2 t with least count of 80, 40 and 8 Kg. respectively).	1	350000	35000
5.	Torsion tesfting machine for rods and flats electrically operated with all accessories and recorder.  Capacity : 200 Kgm Ranges :0 to 20,0 to 50,0 to 150 & 0 to 200 Kgm respectively.	1	30000	30000
6.	Helical spring appratus for determining axial deflection of a spring and stiffness.	1	1500	1500
7.	Hardness testing machine as per I.S. Brinnal and rockwell load range -in stages of 2.5 KN up to 30 KN with optical microscope 25 fold magnification with light arrangement complete with all accessories and motors of HP 0.25 to 0.33 .	1	8000	8000
8.	Impact testing machine.	1	15000	15000
9.	Misc. for Pan Balance weights,scales,spanner set,wrinch set, screw driver etc.		L.S.	5000

#### VII. CIVIL ENGG. LAB -II

##### Building Construction & Maintenance Lab

1.	Trowel			
	(a) Big size	6	20	120
	(b) Small size	6	15	90
2.	Tasla steel	6	50	300
3.	Plump bob for mason	6	16	96
4.	Hand showl ( Phawra)	3	100	100
5.	Pick axe	3	60	180
6.	Prismatic Compass	1	500	500

7.	G.I. sheet drum capacity 100 lit.	2	250	500
8.	Ladder Aluminium/steel	1	2000	2000
9.	Spirit Level	2	100	200
10.	Mason's Tool Kit	2	500	1000
11.	Steek Tapes 30m, 15m & 5 Nos each	15	LS	2000
	Misc.		LS	1000

## II. Concrete Technology Lab

1.	Thickness gauge for determining flakiness index as per IS 2386 Part - I	2	800	1600
2.	Length gauge for determining elongation index as per IS 2386 Part I	2	700	1400
3.	Pycnometer 900 ml	2	200	400
4.	Measuring cylinder 1000,500,100 ml	3		1000
5.	Pan Balance with weights 5 Kg	1	1000	1000
6.	Slump cone apparatus complete with all accessories.	2	1500	3000
7.	Gun Metal moulds set consisting of 150 mm cube 12 Nos. 100 mm cube 3 Nos. 150 mm dia x 300 mm long 3 Nos. Tamping rod 3 Nos	1 set	5000	5000
8.	Tripple Beam balance 3 Kg cap 0.1 gm accuracy.	1	2000	2000
9.	Set of sieves 150 micron, 300 micron, 600 micron, 1.12 mm, 2.36 mm, 4.75 mm with receiving pan and lid.	2 set	1500	3000
10.	Vee Bee Consistometer as per IS-1199	1	15000	15000
11.	Compaction Factor apparatus as per IS-1199 & IS-5515	1	5000	5000
12.	Vaccum pump air displacement 50 to 75 lit. / min., Vibration less rotary type with oil seal, pump			



	machnaism in metal case with oil level and drain plug and base Cap. 0.5 mm of Hg single phase 50 Hz 0.25 HP	1	3000	3000
14.	Misc.	LS		5000
III. Soil Mechanics & Foundation Engg. Lab				
1.	Electric heated oven thermosttically controlled double walled chamber size 600 mm x 600 mm, 3 shelevs temp. ambient to 150 Deg. C	1	5000	5000
2.	Tripple Beam Balance 111 gm. , 0.1 gm accuracy	2	1000	2000
3.	Standard fine test sieves 200 mm dia - spun brass frame without any joint stainless steel / phosphor bronze standard seive closed with lid and receiver.  4.75, 2.0, 1.0 mm, 600, 300, 150 & 75 microns with square opening as per IS 460	1 set	3000	3000
4.	Standard course test sieves with perforated round or square openings made of GI frame/spun brass frame 200 or 300 mm dia of following size with lid and receiver 4.75, 9.5 mm 19.25, 57 and 100 mm as per IS 460	1 set	2000	2000
5.	Sieve Shaker motorized Gytratory type to carry 7 sieves of 200 mm or 300 dia with adopter and time switch for 0-60 minutes single phase 1/4 HP	1	7500	7500
6.	Liquid Limit Device motorized with counter set, rubber block, Cassagrande & ASTM tools gauge block, spatula & bowl.	1	1800	1800
7.	Plastic Limit Apparatus consisting of brass rod 3.0 mm dia (IS 2720 part v) and 150 mm long, glass plate 200 x 150 x 3 mm thick, porcelain evaporating 120 mm dia, flexible spatula with 80 mm long 20 mm wide blade,moisture can - set	2	200	400
8.	42.5 micron sieve	1	200	200

9.	Permeability test apparatus for constant and variable heads as per IS 2720 part (17)	1 set	4000	4000
10.	Proctor compaction apparatus as per IS 2720 part 7 & 8	1 set	3000	3000
11.	Soil Sample Extractor	1 set	1500	1500
12.	Direct Shear Test Apparatus as per IS 2720 part 13	1 set	15000	15000
13.	Raffle sample divider	1 set	500	500
14.	Cylindrical core cutter field density kit IS 2720 part 29	1 set	800	800
15.	Appratus for determining dry density by sand replacement method as per IS 2720 part 28	1 set	1500	1500
16.	Unconfined compression test appratus with all accessories ( compaction device, sample ejector, strain dial indicator, proving ring, jack etc.	1 set	6000	6000
17.	Standard penitration test apparatus with all accessories.	1 set	1500	1500
18.	Sampling Auger out fit blade type (post hole type) of following dia 50, 100 & 150 mm each with one meter extension rod, steel handle & T piece.	1 set	1000	1000
19.	Sampling Auger out screw type of following dia 38 mm, 50 mm with one meter extension rod and T piece	1 set	600	600
20.	Sample container of aluminium 50 mm dia and 25 mm high.	5		250
21.	Misc. for glass wares, porcelain wares dial gauges,proving ring ,brushes, water bath,density bottle etc.	LS		10000

#### VIII. HYDRAULICS LAB

1.	Apparatus to verify Bernoulli's Thorem	1 set	12000	12000
2.	Apparatus for conducting experiments on venturimeter with collecting and supplying tank	1 set	12000	12000

3.	Reynold's apparatus with storage tank and flow steadying arrangement with 1/2 HP pump and accessories	1 set	8000	8000
4.	Apparatus for determining Cc, Cv and Cd	1 set	12000	12000
5.	Apparatus for determining various head losses in pipes	1 set	8000	8000
6.	Current meter Propeller type	1	3000	3000
7.	Current meter Bucket type	1	3000	3000
8.	Notch apparatus with set of notches	1 set	9000	9000
9.	Model of Pelton Wheel	1	2000	2000
10.	Model of Recprocating pump	1	2000	2000
11.	Model of Centifugal pump	1	2000	2000
12.	Model of Impulse turbine	1	2000	2000
13.	Model of reaction turbine	1	2000	2000
14.	Pressure gauge Borden's type	1	2000	2000
15.	Water meter	1	2000	2000
16.	Mechanical flow meter	1	2000	2000
17.	In place of item no. 1,2,4,5,6 & 8 Hydraulic bench may be purchased with all accessories or such institution if already have above items may purchase one unit, Otherwise 6 units			
	One Unit cost			15000
	Six units cost			90000
18.	Misc. for tools, Manometer Pitot's tube, Differential manometer and minor equipments			10000

#### IX. SURVEYING LAB

1.	Measuring Chain Is 492 30 m long	8	150	1200
2.	Measuring Chain Is 492 20 m	2	100	200
3.	Gunter's Chain	1	100	100
4.	Arrows	50	10	500
5.	Tape Metallic ( free man ) 30 m	15	100	1500

6.	Ranging rods of MS Conduits	60	50	3000
7.	Optical Square	8	100	800
8.	Cross Staff	8	50	400
9.	Offset rods	8	50	400
10.	Line Ranger	8	125	1000
11.	Octagonal Cross Staff	8	80	640
12.	Prismatic Compass 100 mm dia	8	400	3200
13.	I.O.P. Level 230 mm with stand	8	1200	9600
14.	Quick Setting Dumpy Level 300 mm with stand	8	1200	6000
15.	Dumpy level 350 mm with stand	5	1000	5000
16.	Levelling Staves telescopic 4 m	6	250	1500
17.	Leveling Staves 4 m folding type	2	250	500
18.	Leveling Staves 3 m Single length	8	150	1200
19.	Plane Table complete set with all accessories	8	1000	8000
20.	Transit Vernier Theodolite 175 mm	8	7000	56000
21.	Transit Vernier Theodolite with optical plummet ( Tacheo meter)	2	10000	20000
22.	White Clad Steel Tape Freeman 30 m	4	150	600
23.	Surveyor's Compass 100 mm dia	3	250	750
24.	Telescopic Alidade 175 mm	3	1000	3000
25.	Planimeter	5	500	4000
26.	Pentagraph 750 mm	3	750	2250
27.	Ediograph 750 mm	1	750	750
28.	Abney's level	3	200	600
29.	Hand level	3	60	180
30.	Indian Pattern Tangent Clinometer	3	600	1800
31.	Cylone Ghat Tracer	1	1000	1000
32.	Trough Compass	2	60	180

33.	Mallet	8	75	600
34.	Wooden pegs	100	10	1000
35.	Box sextant	1	800	800
36.	Garden Umbrella	4	500	200
37.	Steel folding Chairs	20	150	3000
38.	Steel folding Tables	4	300	1200
39.	Binocular	1	2000	2000
40.	Le-Desly Clinometer	1	1000	1000
41.	Boning rod set	1 set	600	600
42.	Target Staff	2	250	500
43.	Desk Calculator	2	1000	2000
44.	Invar tape	1	1500	1500
45.	Substance bar	1	3500	3500
46.	Steel Band	1	250	250
47.	Fibre glass tape 20 meter long	2	150	300
48.	Misc.	L.S.		2000
49.	Total Station	1		250000
50.	Auto Level	1		60000

X. PUBLIC HEALTH ENGINEERING LAB/ENVIRONMENTAL ENGG. LAB

1.	Colourimeter photoelectric type with matching filters	1	6500	7000
2.	Centrifuge electrically operated accomodating 4 to 6 tubes for symultaneous centrifugation	1	3000	3000
3.	Jackson's Turbidity meter	1	1000	1000
4.	Digital turbidity meter with 3 filters and 3 matching test tubes	1	5000	5000
5.	pH meter Digital battery cum mains operated ( 0 - 14 pH range)	1	4000	4000
6.	Jar test apparatus ( Flocculator ) with 6 jars of 1 ltr. capacity speed 20 to 120 r.p.m and 6			

	stirrers complete with motor	1	6000	6000
7.	Dissolved oxygen meter Digital display type, range 0 to 20 mg/ltr automatic temp. compensation 0 - 45 degree selcious.	1	7000	7000
8.	B.O.D. Incubator 450 mm x 300 mm x 600 mm made of stainless steel, temp. range 0 - 45 degree selcious	1	16000	16000
9.	Water bath thermostatically controled 400 mm x 300 mm x 100 mm size range 5 degree to 50 degree sel. accuracy 0.5 degree sel.	1	2500	2500
10.	Hot air oven 355 mmx355mmx355mm	1	6000	6000
11.	Hot plate with regulator	2	1000	2000
12.	Water sampler standerd kit	1	1000	1000
13.	Water analysing kit	1	5000	5000
14.	Mechanical stirrer	1	5000	5000
15.	Soxhlet apparatus for COD experiment	1	9000	9000
16.	Water distillation apparatus (solar ) 2 lit. / hour	1	3000	3000
17.	L.P.G. cylinder with regulator and burner(5kg.capacity)	1	1000	1000
18.	Chloroscope digital for residual chlorine	1	3000	3000
19.	Chemical balance with weight box & rider	2	2000	4000
20.	Soap Bubble Meter for hardness range 0 - 500 ppm	1	5000	5000
21.	Wind speed and direction recorder	1	5000	5000
22.	Model boards of water supply fittings	1	3000	3000
23.	Model boards of sanitary fittings	1	3000	3000
24.	Auto Clave	1	10000	15000
25.	Misc. for porcelain bowls, glass wares and other minor tools etc.	L.S.		5000

XI. CIVIL LAB - III ( HIGHWAY AND STRUCTURE LAB )

1.	Bar bending cutter apparatus	1	2000	2000
2.	Ring and ball apparatus IS 1205	1	1000	1000
3.	C.B.R. apparatus with leading machine as per IS 2720 part XVI	1	13000	13000
4.	Flash point and fire point apparatus electrically / gas heated as per IS 1448 and 1209	1	2000	2000
5.	Los Angle's Abrasion testing machine as per IS 2386 part IV	1	14000	14000
6.	Aggregate Impact testing machine with automatic blow counter as per IS 2386 part IV	1	4000	4000
7.	Penetration value apparatus as per IS 1448 and 1203	1	4000	4000
8.	Tar Viscometer as per IS 1206	1	4000	4000
9.	Ductility Test apparatus as per IS 1208/19/8 with motor and other accessories	1	10000	10000
10.	Aggregate crushing strength testing apparatus as per IS 9376	1	10000	10000
11.	Bitumen sampling apparatus as per IS 1201	1	600	600
12.	Misc. for hammer, anvil, chisel scale, tapes, stop watch etc.		L.S.	5000

COMPUTER AIDED DESIGN LAB

S.NO.	DISCRIPTION	QTY.	APPROX.COST (Rs.)
1	PENTIUM-IV 2.4 Ghz or latest RAM-256 MB or latest HDD-80 GB latest MONITOR COLOUR 17" AGP 16 MB 52X MM KIT( 52x CD Drive, Speaker,sound card) FDD - 1.44 MB Key Board - 107 Keys Multimedia Mouse - Optical Fibre Mouse 32 Bit PCI ETHERNET CARD(10/100) Mbps Pre loaded Windows XP OR WINDOWS 2000	16 (15+1Server)	8,000,00=00