STUDY AND EVALUATION SCHEME FOR THREE YEARS DIPLOMA COURSE IN :-

1. Mechanical Engg.(Production)
2. Mechanical Engg.(Automobile)
3. Mechanical Engg.(Referigeration & Air Conditioning)
4. Mechanical Engg.(Repair & Maintenance)
5. Mechanical Engg.(Computer Aided Design)

(Effective From)

I YEAR

Curriculum							Scheme of Examination							
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Sess. Marks	Total Marks	
3	-	-	2	-	5	1.1 Professional Communication	2.5	50	20	70	3	20	10	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	130
3	-	-	2	-	5	1.4 Applied Chemistry	2.5	50	20	70	3	40	20	130
-	-	8	-	-	8	1.5 Engineering Drawing	3.0	50	20	70	-	-	-	70
2	2/2	2/2	-	-	4	1.6 Applied Mechanics	2.5	50	20	70	3	40	20	130
3	-	-	2	-	5	1.7 Elements of Mech. Engg.	2.5	50	20	70	3	40	20	130
3	-	-	-	-	3	1.8 Elementary Workshop Tech.	2.5	50	20	70	-	--	--	70
-	-	-	-	8	8	1.9 Workshop Practice	--	--	--	--	4	60	30	90
						1.10Field Exposure-I (Assessment at Instt. Level)	--	--	--	--	2	--	30	30
20	3	8	9	8	48	<---------TOTAL---------->	--	400	160	560		240	150	390	950
						Games/NCC/Social and Cultural Activities + Discipline (30 + 20)									50
													TOTAL		1000

NOTE:-
(1) Each period will be 50 minutes duration.
(2) Each session will be of 32 weeks.
(3) Effective teaching will be at least 25 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) After the Annual Exam.Student of I year Mecanical Engg will go for a two week visit of a small/medium size industry. It will be structured and supervised by the institution. Purpose of the visit is to give students an exposure of industrial setup and that of simple tools, instruments and the skill there in day to day use. Every student will submit the institution a report of his visit. The report will invaribly contain the discription of his observations about (1) Products/Work (2) Tools and Equipments Used. He will be evaluated at the institution level for 30 marks--20 for viva and 10 for the reprot presented. See Annexure -I.

STUDY AND EVALUATION SCHEME FOR THREE YEARS DIPLOMA COURSE IN :-

1. Mechanical Engg.(Production)
2. Mechanical Engg.(Automobile)
3. Mechanical Engg.(Referigeration & Air Conditioning)
4. Mechanical Engg.(Repair & Maintenance)
5. Mechanical Engg.(Computer Aided Design)

(Effective From)

II YEAR

Curriculum							Scheme of Examination								
Periods Per Week						S U B J E C T	Theory				Practical				Grand Total
Lec.	Tutorial	Draw		Lab	Work Shop	Total		Examination Dur.	Marks	Sess. Marks	Total Marks	Examination Dur.	Marks	Sess. Marks	Total Marks	
3	1	-		-	-	4	2.1 Applied Mathematics-II	2.5	50	20	70	--	--	--	--	70
3	1	-		-	-	4	2.2 Mechanics of Solids	2.5	50	20	70	--	--	--	--	70
2	1	-		-	-	3	2.3 Materials & Material Science	2.5	50	20	70	--	--	--	--	70
2	1	-		-	-	3	2.4 Hydraulics & Hydraulic Machines	2.5	50	20	70	--	--	--	--	70
2	1	-		-	-	3	2.5 Thermal Engineering	2.5	50	20	70	--	--	--	--	70
2	1	-		-	-	3	2.6 Manufacturing Processes	2.5	50	20	70	--	--	--	--	70
2	-	-		-	-	2	2.7 Electrical Technology & Electronics	2.5	50	20	70	--	--	--	--	70
1	-	-	3	-	-	1	2.8 Computer Application For Engineering Lab	--	--	--	--	3	60	30	90	90
-	-	8		-	-	8	2.9 Mechanical Engg. Drawing Practicals	3.0	50	20	70		--	--	--	70
-	-	-	2	-	-	2	2.10 Mechanics of Solid Lab	--	--	--	--	3	40	20	60	60
-	-	-	1	-	-	1	2.11 Thermal Engineering Lab	--	--	--	--	3	20	10	30	30
-	-	-	1	-	-	1	2.12 Hydraulics Lab	--	--	--	--	3	20	10	30	30
-	-	-	2	-	-	2	2.13 Electrical Technology & Electronics Lab	--	--	--	--	3	40	20	60	60
-	-	-	-	8	-	8	2.14 Manufacturing Processes (W/S Practice)	--	--	--	--	6	80	40	120	120
17	6	8		9	8	48	<---------TOTAL---------->	--	400	160	560		260	130	390	950
Games/NCC/Social and Cultural Activities + Discipline (30 + 20)																50
TOTAL																1000

NOTE:-
(1) Each period will be 50 minutes duration.
(2) Each session will be of 32 weeks.
(3) Effective teaching will be at least 25 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) S. I. system of units shall be used in each subject.
(6) 4 week structured and supervised branch specific, task oriented industrial/field exposure to be organised during summer vacation. Student will submit a report. There will be 60 marks for this exposure. These marks will be awarded by the project examinier in final year (Examination Marks :40, Sessional Marks: 20). See Annexure-II
(6) Field visits and Extension lectures at institute level as per need be arranged.

STUDY AND EVALUATION SCHEME FOR THREE YEARS DIPLOMA COURSE IN :-

1. Mechanical Engg.(Production)
2. Mechanical Engg.(Automobile)
3. Mechanical Engg.(Referigeration & Air Conditioning)
4. Mechanical Engg.(Repair & Maintenance)
5. Mechanical Engg.(Computer Aided Design)

(Effective From)

III YEAR

Curriculum						S U B J E C T	Scheme of Examination								
Periods Per Week							Theory			Practical				Grand Total
Lec.	Tutorial	Practical	Lab	Workshop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	
2	1	-	-	-	3	3.1 Industrial Management and Entrepreneurship Development	2.5	50	20	70	--	--	--	--	70
3	1	-	-	-	4	3.2 Industrial Engg.& Safety	2.5	50	20	70	--	--	--	--	70
3	1	-	-	-	4	3.3 Theory of Machines	2.5	50	20	70	--	--	--	--	70
3	1	-	-	-	4	3.4 M/c Tool Tech.& Maintenance	2.5	50	20	70	--	--	--	--	70
2	1	-	-	-	3	3.5 Design & Estimation	2.5	50	20	70	--	--	--	--	70
3	1		-	-	4	3.6 Metrology & Measuring Instruments	2.5	50	20	70	--	--	--	--	70
2	-	-	-	-	2	3.7 Environmental Education * and Disaster Management Practicals	2.5	50	--	--	-	--	--	--	--
-	-	-	3	-	3	3.8 Metrology Lab	--	--	--	--	3	50	30	80	80
-	-	-	-	8	8	3.9 Mechanical Workshop / * Autoshop	--	--	--	--	6	100	50	150	150
						GROUP(Any One)									
						(A) Production Group									
2	1	-	-	-	3	3.10 Production Technology-I	2.5	50	20	70	--	--	--	--	70
2	1	-	-	-	3	3.11 Production Technology-II	2.5	50	20	70	--	--	--	--	70
2	1	-	-	-	3	3.12 Production Automation	2.5	50	20	70	--	--	--	--	70
-	-	-	-	3	3	3.13 Production Tech. Lab.	--	--	--	--	3	50	30	80	80
-	-	1	-	-	1	3.14 Project	--	--	--	--	3	100	50	150	150
-	-	-	-	-	-	3.15 Field Exposure II	--	--	--	--	-	40	20	60	60
24	9	1	3	11	48	<---------TOTAL---------->	--	450	180	630	--	340	180	520	1150
						(B) Auto Group									
2	1	-	-	-	3	3.10 Automobile Engine	2.5	50	20	70	-	--	--	--	70
2	1	-	-	-	3	3.11 Automobile Technology	2.5	50	20	70	-	--	--	--	70
2	1	-	-	-	3	3.12 Automobile Maintenance, Servicing & Repair	2.5	50	20	70	-	--	--	--	70
-	-	-	3	-	3	3.13 Automobile Engg. Lab	--	--	--	--	3	50	30	80	80
-	-	1	-	-	1	3.14 Project	--	--	--	--	3	100	50	150	150
-	-	-	-	-	-	3.15 Field Exposure II	--	--	--	--	-	40	20	60	60
24	9	1	6	8	48	<---------TOTAL---------->	--	450	180	630	--	340	180	520	1150

Curriculum						S U B J E C T	Scheme of Examination								
Periods Per Week							Theory			Practical				Grand Total
Lec.	Tutorial	Practical	Lab	Workshop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	
						(C) R.A.C. Group									
2	1	-	-	-	3	3.10 Refrigeration	2.5	50	20	70	-	--	--	--	70
2	1	-	-	-	3	3.11 Air Conditioning	2.5	50	20	70	-	--	--	--	70
2	1	-	-	-	3	3.12 R.A.C. Plant Erection, performance & maintenance	2.5	50	20	70	-	--	--	--	70
-	-	-	3	-	3	3.13 Refgn. & Aircondn. Lab	--	--	--	--	3	50	30	80	80
-	-	1	-	-	1	3.14 Project	--	--	--	--	3	100	50	150	150
-	-	-	-	-	-	3.15 Field Exposure II	--	--	--	--	-	40	20	60	60
24	9	1	6	8	48	<---------TOTAL---------->	--	450	180	630	--	340	180	520	1150
						(D) Repair & Maint. Group									
3	1	-	-	-	4	3.10 Repair & Maintenance I	2.5	50	20	70	-	--	--	--	70
3	1	-	-	-	4	3.11 Repair & Maintenane II	2.5	50	20	70	-	--	--	--	70
-	-	-	-	4	4	3.12 Maintenance Practice	-	-	-	-	3	50	30	80	80
-		1	-	-	1	3.13 Project	-	-	-	-	3	140	60	200	200
-	-	-	-	-	-	3.14 Field Exposure II	-	-	-	-	-	50	30	80	80
24	8	1	3	12	48	<---------TOTAL---------->	--	400	160	560	--	390	200	590	1150

						(E)	Computer Aided Design Group									
3	1	-|	-	-	4	3.10	Computer Graphics	2.5	50	20	70	-	--	--	--	70
3	1	-|	-	-	4	3.11	Computer Aided Design	2.5	50	20	70	-	--	--	--	70
-	-	-|	-	4	4	3.12	Computer Aided Graphics and Design Lab.	-	-	-	-	3	50	30	80	80
-		1-|	-	-	1	3.13	Project	-	-	-	-	3	140	60	200	200
-	-	-|	-	-	-	3.14	Field Exposure II	-	-	-	-	-	50	30	80	80
24	8	1	3	12	48	<---------TOTAL---------->		--	400	160	560	--	390	200	590	1150
						Games/NCC/Social and Cultural Activities + Discipline (30 + 20)										50
															TOTAL	1200

NOTE:-
(1) Each period will of be 50 minutes duration. 30% Carry Over of I Year 300
(2) Each session will be of 32 weeks. 70% Carry Over of II Year 700
(3) Effective teaching will be at least 25 weeks. 100% of Final Year 1200
(4) Remaining periods will be utilised for revision etc.
(5) Each group of 2 to 3 students may choose one problem from the project paper. Aggegate 2200
(6) Field visits and Extension lectures at institute level as per need be arranged.
(7) The students of production Engg. will opt group (a) Automobile Engg. students will opt group (b) and Ref. & Airconditioning students will opt group (c) Repair and Maintenance students will opt. group (d), Computer Aided Design student will opt. group (e)depending upon spacific branch running in an institution.
(8) *- Student of Automobile engineering elective group will do Autoshop in place of Mechanical Workshop
(9) (*) It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

Curriculum							Scheme of Examination							
Periods Per Week							S U B J E C T	Theory			Practical			Grand Total
Lec.	Tut/oral	Prje ct	Lab	Work Shop	Total			Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Sess. Marks	Total Marks	
						(C)	R.A.C. Group							
2	1	-|	-	-	3	3.10	Refrigeration	2.5	50	20	70	-	--	--	--	70
2	1	-|	-	-	3	3.11	Air Conditioning	2.5	50	20	70	-	--	--	--	70
2	1	-|	-	-	3	3.12	R.A.C. Plant Erection, performance & maintenance	2.5	50	20	70	-	--	--	--	70
-	-	-|	3	-	3	3.13	Refgn. & Aircondn. Lab	--	--	--	--	3	50	30	80	80
-	-	1|	-	-	1	3.14	Project	--	--	--	--	3	100	50	150	150
-	-	-|	-	-	-	3.15	Field Exposure II	--	--	--	--	-	40	20	60	60
24	9	1	6	8	48	<---------TOTAL---------->		--	450	180	630	--	340	180	520	1150
						(D)	Repair & Maint. Group							
3	1	-|	-	-	4	3.10	Repair & Maintenance I	2.5	50	20	70	-	--	--	--	70
3	1	-|	-	-	4	3.11	Repair & Maintenane II	2.5	50	20	70	-	--	--	--	70
-	-	-|	-	4	4	3.12	Maintenance Practice	-	-	-	-	3	50	30	80	80
-		1|	-	-	1	3.13	Project	-	-	-	-	3	140	60	200	200
-	-	-|	-	-	-	3.14	Field Exposure II	-	-	-	-	-	50	30	80	80
24	8	1	3	12	48	<---------TOTAL---------->		--	400	160	560	--	390	200	590	1150
						(E)	Computer Aided Design Group							
3	1	-|	-	-	4	3.10	Computer Graphics	2.5	50	20	70	-	--	--	--	70
3	1	-|	-	-	4	3.11	Computer Aided Design	2.5	50	20	70	-	--	--	--	70
-	-	-|	-	4	4	3.12	Computer Aided Graphics and Design Lab.	-	-	-	-	3	50	30	80	80
-		1-|	-	-	1	3.13	Project	-	-	-	-	3	140	60	200	200
-	-	-|	-	-	-	3.14	Field Exposure II	-	-	-	-	-	50	30	80	80
24	8	1	3	12	48	<---------TOTAL---------->		--	400	160	560	--	390	200	590	1150
						Games/NCC/Social and Cultural Activities + Discipline (30 + 20)										50
															TOTAL	1200

NOTE:-
(1) Each period will of be 50 minutes duration. 30% Carry Over of I Year 300
(2) Each session will be of 32 weeks. 70% Carry Over of II Year 700
(3) Effective teaching will be at least 25 weeks. 100% of Final Year 1200
(4) Remaining periods will be utilised for revision etc.
(5) Each group of 2 to 3 students may choose one problem from the project paper. Aggegate 2200
(6) Field visits and Extension lectures at institute level as per need be arranged.
(7) The students of production Engg. will opt group (a) Automobile Engg. students will opt group (b) and Ref. & Airconditioning students will opt group (c) Repair and Maintenance students will opt. group (d), Computer Aided Design student will opt. group (e)depending upon spacific branch running in an institution.
(8) *- Student of Automobile engineering elective group will do Autoshop in place of Mechanical Workshop
(9) (*) It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

C O N T E N T S

II- MAIN FEATURES OF THE CURRICULUM

Title of the course	1. Mechanical Engg.(Production) 2. Mechanical Engg.(Automobile) 3. Mechanical Engg.(Referigeration & Air Conditioning) 4. Mechanical Engg.(Repair & Maintenance) 5. Mechanical Engg.(Computer Aided Design)
Duration	Three Years
Pattern of the course	Annual System
Intake	30
Type of course	Full Time
Entry qualification	10+ with science & mathematics (Not Elementary)
Mode of admission	Through Joint Entrance Examination

III- LIST OF EXPERTS

On dated 16-12-96 the following experts whose contribution and support in the revision of this curriculum is a matter of obligation to I.R.D.T.

1.	Dr. S. K. Chaudhry Professor Mech. Engg. Deptt.	I. I. T., Kanpur
2.	Dr. P. K. Misra Reader Mech. Engg. Deptt.	M. N. R. Engg. College Allahabad
3.	Dr. S. J. Pandey Professor & Head Mech. Engg. Deptt.	H.B.T.I., Kanpur
4.	Dr. A. P. Verma Professor Mech. Engg. Deptt.	H. B. T. I., Kanpur
5.	Shri D. R. Mehrotra Dy. General Manager	Track Parts of India, Kanpur
6.	Shri M. K. Tiwari Principal	Govt. Poly., Lucknow
7.	Shri B. K. Puri Principal	Govt. Poly., Etawah
8.	Shri A. K. Verma Asstt. Director	A. T. I., Kanpur
9.	Shri Rahul Gupta Lecturer Mech. Engg. Deptt.	H. B. T. I., Kanpur
10.	Shri R. K. Saxena Lecturer	Govt. Poly.,Ghatampur
11.	Shri S. P. Varshney Lecturer	Govt. Poly., Lucknow
12.	Shri S. P. Verma Workshop Sup.	Govt. Poly., Lucknow
13.	Shri B. R. Pandey Principal	F. G. Poly., Raibaralli
14.	Shri Y. K. Agrawal Lecturer	Govt. Poly., Kanpur
15.	Shri V. N. Verma Lecturer	S.G.S.J. Poly., Khurja

16.	Shri J. P. Yadav Dy. Director	I.R.D.T., Kanpur
17.	Shri M. R. Khurana Asstt. Professor	I. R. D. T., Kanpur
18.	Shri K. M. Gupta Asstt. Professor	I. R. D. T., Kanpur
19.	Shri M. P. Singh Asstt. Professor	I. R. D. T., Kanpur

LIST OF EXPERTS (Semester System)

On dated 05-03-99, 09-03-99 and 29-04-99, the following experts contribution and suggestions in revision/review for semester system of the curriculum is a matter of obligation to I. R. D. T., U.P., Kanpur

1.	Dr. A. P. Verma Professor Mech. Engg. Deptt.	H. B. T. I., Kanpur
2.	Dr. H. C. Upadhaya Workshop Suptd.	H. B. T. I., Kanpur
3.	Shri R. C. Trivedi Retd. HOD (Mechanical Engg.)	I. R. D. T.,U. P., Kanpur
4.	Shri A. K. Gosh Senior Manager	Kaliash Motors, Kanpur
5.	Shri T. R. Verma Asstt. Regional Manager	U.P.S.R.T.C. Work shop Kanpur
6.	Shri Amit Dixit Executive	TELCO, Lucknow
7.	Shri D. R. Malhotra Dy. General Manager	Track Part of India, Kanpur
8.	Shri R. S. K. Sinha Asstt. Professor	Board of Technical Education, Lucknow
9.	Smt. Kalpana Gaur HOD(Mechanical Engg.)	Government Polytechnic, Kanpur
10.	Shri Raja Ram Verma Lecturer(Mech. Engg.)	Government Polytechnic, Kanpur
11.	Shri M. P. Singh Bhadauria Lecturer(Mech. Engg.)	Government Polytechnic, Kanpur
12.	Shri J. P. Yadav Dy. Director	I.R.D.T., Kanpur

13. Shri M. P. Singh — I. R. D. T., Kanpur
Asstt. Professor

14. Dr. Anita Bajpai — I. R. D. T., Kanpur
Asstt. Professor

15. Shri K. M. Gupta — I. R. D. T., Kanpur
Asstt. Professor

On dated 22-12-05 the following experts whose contribution and support in the revision of this curriculum is a matter of obligation to I.R.D.T.

1.Shri Abid Husain	Asstt. Director	S.I.S.S.,Kanpur
2.Shri A. K. Verma	Asstt. Director	A.T.I., Kanpur
3.Shri B. K. Misra	Prof. & Head	H.B.T.I., Kanpur
4.Shri K.S. Gandhi	H.O.D.	G. P., Lucknow
5.Shri K. N. Gupta	H.O.D.	G. P., Ghaziabad
6.Shri M.P. Singh	Asst.Director	D.T.E.,U.P.,Kanpur
7.Shri S. Sinha	Lecturer	I.E.T., Lucknow
8.Shri Ram Subhag	Asstt. Sec.	B. T. E., Lucknow
9.Shri Ashraf Ali	Professor	I. R. D. T., Kanpur
10.Shri Y. Singh	T. B. O.	I. R. D. T., Kanpur
11.Shri K. M. Gupta	Asstt. Prof.	I. R. D. T., Kanpur

Suggestion recevied from the following experts:

1.Dr. A. Ghosh	Professor Deptt. of Mech. Engg.	I. I. T., Kanpur
2.Dr. S.K.Chaudhary	Professor Deptt. of Mech. Engg.	I. I.T., Kanpur
3.Dr. Rajeev Gupta	Asstt. Prof.	H.B.T.I., Kanpur

NEED ANALYSIS AND CURRICULUM PROFILE

Due to ever expanding universe of knowledge the need for revision of a curriculum in any system of education always exists. A revision is vital to accommodate new idias, to make it more systematic by reordering the idias and to make it more suitable to the need of the time. With these points in view it was decided to revise the curriculum for three year (Six Semester) diploma course in Mech. Engg. with Specialisation in Production Engg., Automobile Engg., Refrigeration and Air Conditioning, Repair and Maintenance and Computer Aided Design.

As a first renovating step a paper " Introduction to Computer" has been introduced in the course. It is the need of the time. The portion of the syllabus common for Production, Auto & Refrigeration Air conditioning, Repair and Maintenance and Computer Aided Design sections has been restructured so as the students specialising in any one of the five sides may not remain totaly ignorant of the other four. So the basic concepts of these sections of specialisaion has been covered in common portion of the syllabus. The specific and comparatively advanced knowledge has been kept for specialisation parts. Thus the number of papers in specialisation is reduced to two from four. This change in the end will necessarily develop more confidence in the students. He will able to inhance his knowledge in the other fields of specialisation with little effort and can with stand the responsibility.

Also the subject Engg. Drawing has been limited to second year of the course by suitably rearranging the topic contents. The paper "Elements of Mechanical Engineering" has been redesigned with emphasis on study of vital machine components and thermal engineering primary concepts. It will help the students in pursuing their studies in later years of the course. The topic materials and materials science has been given a new light and some lab work has been introduced there in. This is only the tip of the iceberg in the sea of change spotted here. The care has been taken in choosing topics for development of knowledge and skills wanted for various jobs available to diploma holders. The Continuity and consistency in the development of the subject matter spreading over the period of the course has been carefully assured.

Besides this, the subjects of present obsessions of the society such as environment pollution ,ecological imbalance and need of development of entrepreneurship in the youth due to growing unemployment too have been duely introduced for the awarenesss of the students.

of the experts in the workshops held at the institute or availed by personal contacts. A list of their names appears in following pages. Sufficient provision for practical experience has been made in the syllabus by providing a good number of lab/shop expercises in almost every topic. Further provision for exposure to industry twice during the period of course, first after first year exam. for two weeks and second after second year exam. for four weeks will give an extra impetus to sharpening of the students talent.

V- JOB OPPORTUNITIES & CURRICULUM DESIGN

S.No	Job Opportunity Areas	Position/ Designation	Job Activities/ Skill Required	Subject/Matter In Curricilum
1.	State Electricity Bords, P.W.Ds & Irrigation Deptts.	J.E./Section Officers/ Foreman	Wear evaluation Preparing repair schedule & repair supervision or Mechanical Store keeping & verification of items.	WorkShop Technology & WorkShop Practices, Measuring & testing, Metrology, Mechanics of solids.
2.	Plainning & Extension	A.D.O., Minor Irrigation	Deciding Loans for mechanical items-engine, pumps, tractors etc.	Thermal Engg. Electrical Technology Estimating & Hydraulics
3.	Indian Railways	Chargeman Mecahnical	Supervising & Maintenance of refrigeration & air conditioning systems and other mech. equipments.	Thermal Engg. workshop practice, machine tool technology welding.
4.	Civil Aviation	Technician/ Store Incharge	Up keep of mech. appliances/Store keeping	Workshop Practice, Machine tool Technology, entreprenurship, Inventory Control.
5.	E.M.E. Core defence	Superintendent Grade-II	Rearline checking & maintenance & holding stores	Workshop Practice, Machine tool Technology, entreprenurship, Inventory Control.
6.	N.T.P.C, N.B.C.C, N.H.P.C., Nuclear Power Station, Food Corp. of India, Shipping Corp., Oil & Natural Gas Commission	Supervising Foreman, Tech. Assistant, Mechanical Store Incharge	Knowledge of hand tools & M/C tools, welding, work estimation, engineering components, Installation of M/C	Workshop Practice, Machine tool Tech., entreprenurship, Inventory Control. Industrial Engg., Engg. Drawing
7.	Vocational & Junior Technical Schools	Vocational Master/ Tech. Teachers.	Knowledge & capability of using hand & M/C tools studying & preparing drawing of engg. Components & assembly	WOrkshop Practice & technology Engg. Drawing.

S.No	Job Opportunity Areas	Position/ Designation	Job Activities/ Skill Required	Subject/Matter In Curricilum
8.	Banks & Gen. Insurance Comp.	Technical Asstt. or Field Super-visors	Preparing Survey reports, checking & verification of mechanical items, estami-nation of damages of mechanical appliances.	Checking, Testing by use of various instruments. (Metrology & Measuring Instruments) Material Scie-nce Lab.
9.	Engineering Industries like B.H.E.L, H.A.L, I.T.I., H.M.T etc or private sector under-takings.	Maintenance Foreman/ Production Supervisor, Inspector or Quality Controller. or Service Centre Incharge of Public Undertaking	Maintenance job, production planning, schedul-ing & Inpection for quality control.	Workshop techno-logy,Welding, M/C tool technology, Industrial Engg. Metrology & Engg. Drawing.
10.	Process Industries	Maintenance Foreman	Assembly & Deass-embly of mechani-cal units, Pipe work, Overhauling of units	Mechanical Engg. Drawing Metrology, Workshop Practice, Plumbing etc.
11.	Research Laboratories	Technical Asstt. or Reaserch Asstt. or Design Asstt.	Drawing, Data collection & analysis, Investigating Survey	MathematicsI,II Engg. Drawing, Communication Techniques
12.	State Road Transport, Corp.	Workshop Foreman,	Repair & Mainten-ance of automobi-les	I.C. Engines, Workshop Techno. & W/S Pract., Automo-bile Technology
13.	R.T.O Office	R.I (T)	Checking for road worthiness for driving licence	Thermal Engg. Automobile Technology
14.	Industries Department	Factory Inspector, Rate Contract Item Inspector	Knowledge of Industrial Safety & Quality Checking	Industrial Engg. & Safety. Metro-logy, Mechnics of Materials & Material Sc. Lab

S.No	Job Opportunity Areas	Position/ Designation	Job Activities/ Skill Required	Subject/Matter In Curricilum
15.	Technical Education Institutions (Polytechnics & I.T.I.s)	Instructors & Demonstrators	Knowledge of all labs & shops relating to mechanical engg.	All Practical Labs.
16.	Sale & Service of machines & parts.	Sales repre-sentative or service technician	Sales dealing Use of hand tools.	Workshop practice, Entrepreneur-ship, Indust-rial Management
17.	Self Employment	Partnership or Ownership	Over all knowle-dge of curriculum	
i.	Repair Shop			
ii.	Manufacture of Ancillaries for big unit			
iii.	Contact of Mechanical repair, Erection, Instal-lation of plants & machine.			

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)	10	-	-
	B. Report writing (English) Note making and minutes writing	10	-	-
4.	Composition	10	-	-
5.	Grammer	20	-	-
		75	-	50

1. PART I : COMMUNICATION IN ENGLISH

1.1 Concept of communication, importance of effective communication, types of communucation, formal, informal, verbal and nonverbal, spoken and written. Techniques of communication, Listening, reading, writting 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
Pratices : 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 expresed 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 Noune 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 abbrevation, 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 ceteria 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 x2=4ay, y2=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 crossing and 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 x2 + y2 + z2 + 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, Logaritimic 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 Tangants, 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 homogenity of dimensions and applications of homogenity 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 measuremnts, accuracy and precision, random and systematic errors, estimation of probable errors in the results of measurement(Combination of erros in addition, substraction, multipication and powers). Significant figures, and order of accuracy in resprect 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, Geo-stationary 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 (A1V1=A2V2), 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. Coeffi- cients 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 , characterstics 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, Wein's displacement and raleigh-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). Accoustics of building defects and remedy.

Ultra-Sonic :

Generation, Magnetostriction, Piezoelectric effect, Application in new technology

11.A Optics

Quantum nature of light, Coherrence (Spatial and temporal), Duality of wave and particle, Concept of Interference, Biprism, Fraunhoffer 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 changed capacitor. fleming left hand rule, torque on a current loop, Moving coil, Galvano meter. Charging/discharging of capacitors, Ballistic galvonometer, 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 magentic 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 soldis, classification of solids into conductors, insulators and semiconductors on the basis of energy band structure. Intrinsic and extrinsic semi conductors, 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 emmission, radiation damage, Nuclear fission and fusion, Nuclear reactors (PHWR-type and fast breader) and their application, Mass-energy relation, Automatic 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 velocty 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 T2 verses l and using the formula g=4n2/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 E1/E2 by potentio meter.

10. Determination of specific resistance by Carry Foster bridge.

11. Determination of resitivity by P.O.Box.

12. Verification of Kirchoff's Law.

13. To observe Characteristics of p-n Junction diode on oscillscope.

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 blcok elements), Periodic properties : Ionisation potential electro negativity, 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 it 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, Electro chemical series and its application.

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

6. CHEMICAL KINETICS :

Introduction, order and molecularity of rection. Activation energy, Rate loss, rate constants, Ist order reactions and 2nd order reactions.

7. CATALYSIS :

Definition Characteristics of catalytic reactions, Catalytic promotors and poison , Autocatalysis and Negative catalysis, Actvation 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 collidal and its types, Different system of colloids, Dispersed phase and dispersion medium.
Methods of preparation of colloidal solutions, Dialysis and electrodialysis. Properties of colloidal solution with special reference to absorption, Brownian Movement, tyndal effect, Electro phoresis and coagulation. relative stability of hydrophillic and hydrophobie 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 embritlement, 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, Disel and Petrol), Benzol and Power alchol.

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

Cracking and its type, Gasoling from hydrogenation of coal (Bergius process and Fischer tropsch'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 constitutents, 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. Steroisomerism (a) Geometrical (b) Optical

- Definition of chiral, achiral stereogenic centre, plane of symmetry.

- Types of steroisomers-

    1. Conformers or Rotamers (Only ethanes)
    2. Configurational isomers

a. Enantiomers
b. Diastereoisomers

17. ORGANIC REACTIONS :

1. Fundamental auspects -

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 (Markonicove's Rule, Cyanohydrin and Peroxide effect),
B. Mechanism of Substitution reactions (Nucleophillic-hydrolysis of alkyle halide, electrophillic substitution halogenation, Sulphonation, Niration and friedel-Craft reaction.
C. Mechanism of Elimination reaction - Dehydration of primary alcohol, Dehyrohalogenation 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 :

NH4+, Pb++, Cu++, Bi+++, Cd++, As+++, Sb+++,

Sn++, Al+++, Fe+++, Cr+++, Mn++, Zn++, Co++

Ni++, Ba++, Sr++, Ca++, Mg++

B. Acid Radicals :

CO3--, S--, SO3--, CH3COO-, NO2-,

No3- , Cl-, Br_ , I- , So4--

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 CaCo3 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 hard ness of water sample by O-hener's method.

1.5 ENGINEERING DRAWING

[Common to Three years Diploma Course in Civil 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 craftmen 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 perosonnel 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 acqures 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

C O N T E N T S

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

1. Drawing, instruments and their uses.

1.1 Introduction to various drawing, instruments. 1

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 referance 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 prependicular to the others.

Cases involving cutting plane perpendicular to one of the reference planes and inclind 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
Screw and form of screw thread

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 commonds and osnap commands (two dimensional drawing only)

NOTE :
The drawiang should include dimension with tolerence whereever 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

1.6 APPLIED MECHANICS

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

[Also Common to 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 scaler 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 praticle,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 eqilibrium of a body resting on a rough inclined plane, simple problems on friction. Conditions of sliding and toppling.

6. Machines:

Definition of a machine. Mechancial 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 meterials 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 cylinderical and spherical shells:

Differentiation between thick and thin shells, cylinderical and spherical shells, thin spherical and cylinedrical shells subjected to internal pressure, lognitudinal stresses,circumferential or hoop stresses. longitudinal, circumefrential 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).

1.7 ELEMENTS OF MECHANICAL ENGINEERING

L	T	P
3	-	2

Rationale :

As the name implies, this paper is to give beginner a ready and rough perception of mechanical engineering just to facititate his grasp of studies in the later years.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Thermal Engineering			
A.	Sources of Energy	4	-	-
B.	Fuels and Combustion	6	-	-
2.	Machine Components			
i.	Pins, Cotter & Knuckle Joints	6		
ii.	Keys, Key Ways, Splines On Shafts	6	-	-
iii.	Shafts, Collars, Cranks & Eccentrics	8	-	-
iv.	Couplings & Cluches	8	-	-
v.	Bearings	8	-	-
vi.	Gears	8	-	-
vii.	Springs	5	-	-
viii.	Transmission of Motion	6	-	-
3.	Mechanisms	6	-	-
4.	Lubrication	4	-	
		75	-	50

DETAILED CONTENTS

1. Thermal Engg.

A. SOURCES OF ENERGY:

Basic ideas, conventional and nonconventional forms- Thermal, Hydel, Tidal, wind, Solar, Biomass and Neuclear and their uses.

B. FUELS & COMBUSTION:

Introduction to common fuels - solid, liquid and gases and their composition. Combustion of fuels- their higher and lower calorific values. Combustion equations for carbon, sulphur, hydrogen and their simple compounds. Calculation of minimum amount of air required for complete combustion. Combustion analysis on mass basis and on volume basis. Concept of excess

air in a boiler furnace combustion. Heat carried away by flue gases. Analysis of flue gases by Orsat apparatus. Simple numerical problems

Idea of specific properties of liquid fuels such as detonation, knock resistance (cetane and octane numbers), viscosity, solidification point, flash point and flame point.

2. MACHINE COMPONENTS:

Brief Idea of loading on machine components.

(i) Pins, Cottor and Knuckle Joints.

(ii) Keys, Key ways and spline on the shaft.

(iii) Shafts, Collars, Cranks, Eccentrics.

(vi) Couplings and Clutches.

(v) Bearings-Plane, Bushed, Split-step, ball, Roller bearing, Journal bearing, Foot step bearing, thrust bearing, collar bearing and Special type bearings and their applications. Selection of ball bearing and roller bearing for given application using design data book.

(vi) Gears :

Different types of gears, gear trains and their use for transmission of motion. Determination of velocity ratio for spur gear trains; spur gear, single and double helical gears, Bevel gears, Mitre wheel, worms, Rack and Pinion. Simple and compound and epicyclic gear trains and their use. Definition of pitch and pitch circle & module.

(vii) Springs:

Compression, Tension, Helical springs,Torsion springs, Leaf and Laminated springs. Their use and material. Selection of spring by design data book, simple numerical problem.

(viii) Transmission of Motion By Belts, Ropes & Pulleys, Chain & Sporckets :

Open and cross belt drive, determination of velocity ratio. Effect of thickness and slip on the velocity ratio (Concept only, No mathematical treatment), Method of prevention of slip. Determination of velocity ratio in compound belt drive, use of stepped pulley. Classification and uses of ropes in transmission operation. Chains and their classifications, their application in power transmission, their comparison

with other drive systems

3. MECHANISMS:

Definition of link, Frame and mechanism. Difference between machine and machanism, kinematic pairs, lower and higher pairs. Velocity diagram for four bar mechanism, slider crank mechanism, quick return mechanism. Introduction to Cam and its use.

4. LUBRICATION:

Different lubrication system for lubricating the components of machines.

Principle of working of wet sump and dry sump system of lubrication. (Explain with simple line diagram). Selection of lubricant bsed on different application (Requirement with the help of manufacturer catalogue).

NOTE: While teaching theory it is important to bring and show the machine components to the students.

ELEMENTS OF MECHNICAL ENGINEERING-LAB

A. Study and demonstration of the following

1. (a) Bio Gas Plant.
   (b) Wind Mill.
   (c) Solar Cooker.
   (e) Voltaic Cell Type Soalr Energy Converter.

2. Key's, Key ways and Splined shaft e.g. Jib head key, Flat key, Saddle key, Woodruff key, Feather key, Pin key, Splined shaft.

3. Pins- Split pin, Taper cotter type split pin, Cottor pin, Foundations Bolts- Lewis rag bolt, Fish tail bolt and Square head bolt.

4. Friction clutch and Coupling- Cone cluch, Plate cluch (Single Pair); Muff coupling, Flange coupling, Universal or Hook's joint coupling. Flexible coupling- Belt and Pin Type, Coil spring type.

5. Bearings- Plane, Bush, Split step bearings, Ball Roller bearings, Thrust bearings.

6. Gears- Spur gear, Single and Double herical gears, Bevel gears.

7. Gear Trains- Simple spur gear train, Compound gear train, Epicyclic gear train.

8. Compressor and Tension helical springs.

9. Slider Crank Mechanism.

   Performance Practicals:

10. Determine the angle covered in forward and return stroke of Quick Return Mechanism of available shaper in machine shop.

11. Estimate the amount of ash and moisture in given sample of coal or coke
12. Deterimination of velocity ratio of a spur gear train.

13. Velocity diagram of a four bar chain mechanism.

14. Performance evaluation of solar cooker.

    NOTE:-

    Field visits are recomended for equipments not available in the institution such as biogas plant, wind mill. No need to purchase them. No actual installation of this lab in a separate room wanted. Equipment of this lab can be accommodated in applied mechanics lab or else where.

1.8 ELEMENTARY WORKSHOP TECHNOLOGY

L	T	P
3	-	-

Rationale :

The knowledge of " Workshop Technology " is very basis of mechanical engineering practice. For a beginner to technician course, familiarity with hand tools is a matter of utmost importance. The classroom teaching and a practice in shop will meet this need well.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	General Introduction	3	-	-
2.	Carpentry			
a.	Fundamentals of Wood Working Operations.	3	-	-
b.	Common Carpentry Tools	6	-	-
c.	Joining of timber Components	3	-	
3.	Metal Fabrication			
A.	Metal Shaping			
1.	Smithy	9	-	-
2.	Sheet Metal Working	9	-	-
B.	Metal Joining			
1.	Permanent Jointing	9	-	-
2.	Temporary Jointing	6	-	-
C.	Familiarity With Tools	6	-	-
4.	Protection of Fabricated Structure from Weather			
1.	Painting	6	-	-
2.	Varnishing & Polishing	3	-	-
5.	Foundry Work	6	-	-
6.	Machine Shop	6	-	-
		75	-	-

DETAILED CONTENTS

1. GENERAL INTRODUCTION:

(a) Scope of subject "Workshop Technology" in engineering.

(b) Different shop activities and broad division of the shops on the basis of nature of work done such as

(i) Wooden Fabrication (Carpentry)

(ii) Metal Fabrication (shaping and Forming, Smithy, Sheet metal and Joining-welding, Rivetting,Fitting

and Plumbing.

2. CARPENTRY :

(a) Fundamental of wood working operations:

- Marking & Measuring.
- Holding & Supporting.
- Cutting & Sawing.
- Drilling & Boring.
- Turning.
- Jointing.

(b) Common Carpentry Tools:

Their classification, size, specification (name of the parts and use only).

(1) Marking and measuring tools:

Rules, try square, Bevel Square, Marking gauge, Mortise gauge, Scriber (marking knife). Combination set

(2) Holding and supproting Tools:

Carpentary vice, Bench hold fast, Bar clamp, Bench hook, Hand clamp C and G clamp.

(3) Cutting and Sawing Tools:

Saws: (Grip or Hand, panel, cross cut, Tenon, dove tail, compass, key hole and bow saw),

Chisel: (Firmer, dovetail, mortise and gauge),

Planes: (Wooden & Iron plane. Jack plane, Smoothing plane).

(4) Drilling and Boring tools: Auger, Gimlet, Hand drill, Brace and bits.

(5) Striking Tools: Mallet and Claw hammer.

(6) Turning Tools & Equipments: Wood working lathe and lathe tools.

(7) Miscellaneous Tools: Screw driver, Rasp, Pincer, Oil stone, Triangular file and Saw set.

(c) Joining of Timber Components For Fabrication Works:

Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet , Groove, Tongue, Dowel, operations in assembly-Simple lap and butt, Mortise, Tenon, Dovetail, Mitre & briddle joints. Uses of glue, dowelpin and screw in preparation of joints. Common

defects likely to occur during and after joining, defects due to wrong use of tools, defects due to wrong operation, defects due to improper seasoning of timber-their identification and remedy. Safety (personal and equipment) to be observed.

3. METAL FABRICATION:

(A) Metal Shaping :

Smithy:

(1) Operations involved (concept only)-Preparation of fire, Supporting and holding the metal, cutting the metal in size, heating, drawing down or fullering, usetting, swaging, bending, punching, blanking, drifting and forge welding,

(2) Tools and equipment used (Names, size, specification for identification only).

(3) Heating and fuel handling equipment-Smithy Forge, Blower, Shovel, Poker.

(4) Holding and supporting tools-Common tongs, anvil, swage block.

(5) Striking Tools-Ball pein, cross pein ,Straight pein double face and sledge hammers .

(6) Cutting tools - Hot and cold chisel and shear set.

(7) Punching & Drifiting Tools - Punch & Drift.

(8) Bending Tools and fixture.

(9) Forming & Finishing Tools - Fullers, Swage Flatters, Set hammers.

(10) Defects likely to Occur during and after operations their Identification and Remedy. Defects due to wrong operation , wrong tool and wrong heating.

(11) Safety of Personnel, Equipment & Tools to be observed.

(2) Sheet metal working:

(I) Tools and Operation:

(1) Operations involved (Names and concept only) Laying out, marking and measuring,cutting, Shearing and blanking, Straightening bending and seaming, Punching and piercing , burring and stamping,

(2) Sheet metal joints - Lap, seam, Locked

seam,hemp,wirededge, cup or circuler, Flange, angular and cap.

(3) Tools and equipments used (Name, size, specification for identification only).

(4) Marking Tools- Scriber, Divider and Trammel, Protractor, Trysquare, Dot punch, Steel Rule, Steel tape, Sheet metal gauge.

(5) Cutting and shearing Tools-hand Shear and lever, Snips, Chisels.

(6) Straightening tool-Straight edge.

(7) Striking Tools-Mallet, Hammer.

(8) Holding Tools-Vice, Plier, C or G clamps, Tongs.

(9) Supporting Tools-Stakes and Anvil.

(10) Bending Tools-Crimpers, Form dies, Roundnose plier, Rails.

(11) Punching-Piercing and Drifting tools.

(12) Burring Tools-Files.

(13) Common defects likely to occur during and after operation-Their identification and remedy. Defects due to wrong operation or wrong tool.

(14) Safety of Personnel, Equipment & Tools to be observed.

(B) Metal Joining During Fabrication:

(1) Permanent Joining:

(a) (1) Welding methods-Forgewelding, gas welding (high and low pressure-oxyacetylene welding, types of flames.

(2) Electric welding- D.C. & A.C., Connected tools, operation, materials and safety measures.

(b) Soldering & Brazing:

For black Galvanised and Tincoated Iron sheet, brass and copper sheets only.

(1) Its concept, comparison with welding as joining method and classification, electric soldering and forge soldering.

(2) Soldering operation- edge preparation of joints, Pickling and degreasing, Fluxing, Tinning and

Soldering.

(3) Materials Used-Common fluxes, soft and hard solder, solder wire (Plain and Resin core) and sticks, spelters and their specifications and discription (For Identification Only), forge soldering bits.

(4) Electric soldering iron.
(5) Common defects likely to occurs during and after soldering.
(6) Safety of Personnel, Equipment & Tools to be observed.

(c) Rivetting:

(1) Its comparison with welding as joining method.

(2) Rivets and Materials.

(3) Operation involved-Marking from given data, edge preparation, drilling and punching arrangements of joint elements (Lap, Butt with single cover plate and double cover plate) upsetting of rievet tail, shaping head and caulking.

(4) Tools and equipments used- (Names, Size, Specification and uses)-Supporting and holding tools (Stakes and Tonqs)-Striking tools-Ball pien, Straight pien and Cross pien hammers and head forming tools (Shapes), drills punches and solid punches, drift, elementary knowledge about working of pneumatic, hydraulic and electric rivetor.

(2) Temporary Joining (Fastners & Their Uses):

Introduction to

(1) Various types of Bolts (Names of prats and specification) and various types of washers and nuts used with them and their uses, material they are made of , studs and foundation bolts.

(2) Screws, keys, pins and cottors-their material and use.

(3) Pipe connectors-Sockets, elbows, tees, cross and bends, unions, volves, glands packing and operation in use of pipe connectors-cutting, marking, threading, pipe bending, joining different pipe line fittings- (Steps of operation only).

Tools and equipment used in their operations (Name, Size, Specification and Discription for Identification).

Supporting and holding tools-Pipe vices (Bench, leg and hand), Pipe wrenches, Spanners.

Cutting Tools- Hack saw and Pipe cutters.

Threading Tools- Pipe dies and Taps.

Materials Used for Joining-White lead, Cotton and Gasket.

Common defects lickely to occur during and after operation and their remedies.

(3) Familiarity with The Use of Various Tools Used In Mechanical Engineering Workshop:

Marking & Measuring:

Steel rule, surface gauge, marking block, protractor, trysquare, scriber, punches, divider and callipers, surface plate, V. block, gauges- (screw, pitch, radius, feeler), Vernier callipers, Micrometer, Vernier height and depth gauge, use of dialgauge.

Holding Tools:

Vices (Bench, leg and hand vice), clamps tongs, pliers,

Cutting Tools:

Hack saw (Fixed and Adjustable framce), chisels-flat, cross cut, diamond, round nose.

Files:

According to section-Knife edge, Flat, Triangular round, Square, Half round,

According to grade - Rough, Bastard, Second cut, Smooth and Dead smooth,

Drills and Allied Tools:

Parallel and taper shank Twist drill,

Thread Cutting Tools:

Taps and Dies,

Miscellaneous Tools:

Wrenches, Keys, Spaners, Pliers, Screw drivers their specification and many others which have not been named for use in various shops. They should be shown physically to each student for famillarity.

4. PROTECTION OF FABRICATED STRUCTURES FROM WEATHER:

1. PAINTING:

Its need, Introduction to methods of paintings (Classification only); Mannual, Machine (spray) and dip painting at room temperature, operations involved-discription of steps only eg. surface preparation method for old and new surface in timber and iron structure-sanding, derusting, deqreasing, filling of pore and dents, paint application- manual, machine (spray and dip painting drying of paint air drying and oven drying under coat and filler material (red oxide, putty, yellow clay), surface preparation materials (sand and emery papers); tools and equipments used (Name, size specification for indification).

Brushes-Round and flat wire brush, scraper, trowel , spray gun, compressor.

Defects likely to occur in painting and their remedies

Safety of Personnel, Equipment & Tools to be observed.

2. VARNISHING & POLISHING:

Its need operation involved (description of step only), surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and sprit polish,copal varnish. Defects likely to occur.

Safety of Personnel, Equipment & Tools to be observed.

5. FOUNDRY WORK:

Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding.

6. MACHINE SHOP:

Introduction to machine tools viz lathe, drilling machine, shaper and planer simple line and block diagram of components and their functions. Brief concept of NC and CNC machines.

1.9 WORKSHOP PRACTICE

[Common with Civil Engg., Civil Engg. (sp. in Rural Engg.), 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 L	T	Time 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 briddle 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 abressive 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) Abrassive cutting by leather wheel.

ii) Pollishing 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 taping the same to creat 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 cupula & 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 ferous (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 metalic handle.
EX-4 To make a square or hexogonalhead 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

1.10 FIELD EXPOSURE-1

The purpose of this course is to train the students to learn working in factory situations under supervision of factory staff and polytechnic staff. The whole department faculty should be deputed for this purpose.

Head of faculty should procure seats for giving summer training for students with the assistance of Director, Board of Apprenticeship Training.

A small project like study of material handling system, Plant layout study, Inventory control, Work study, Process control rejection and rework study, Inspection system and Quality control, etc. may be alloted.

II YEAR

2.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L	T	P
3	1	-

Rationale :

The study of mathematics is an important requirement for the understanding and development of concepts of Engg.The purpose of teaching mathematics to the Diploma Engg. students is to give them basic foundation and understanding of mathematics so that they can use the same for the understanding of engineering subjects and their advancements.

Sl.No.	Units	Coverage Time L	T	P
1.	Matrices	15	5	-
2.	Ordinary Differential Equations	15	5	-
3.	Differential Calculus-II	15	5	-
4.	Integral Calculus-II	15	5	-
5.	Probability & Statistics	15	5	-
		75	25	-

DETAILED CONTENTS

1. MATRICES :

1.1 Algebra of Matrices, Inverse :

Addition, Multiplication of matrices, Null matrix and a unit matrix, Square matrix, Determinant of a matrix, Cofactors, Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation :

Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence, Rank of a Matrix :

Linear dependence/independence of vectors, Definition and computation of a rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vactors,Consistency of equations.

1.4 Types of Matrices :

Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular.

1.5 Eign Pairs, Cayley-Hamilton Theorem :

Definition and evaluation of eign values and eign vectors of a matrix of order two and three, Cayley-Hamilton theorem (without Proof) and its verification, Use in finding inverse and powers of a matrix.

2. ORDINARY DIFFERENTIAL EQUATION :

2.1 Formation, Order, Degree, Types, Solution :

Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree and Meaning of solution of a differential equation, Linear, Nonlinear equation.

2.2 First Order Equations :

Variable seperable, equations reducible to seperable forms, Linear and Bernoulli form exact equation and their solutions.

2.3 Second Order Linear Equation :

Property of solution, Linear equation with constant coefficients, canchy type equation. Homogeneous and Non-homogeneous equations, equations reducible to linear form with constant coefficients.

2.4 Simple Applications :

LCR circuit, Motion under gravity, Newton's law of cooling, radioactive decay, Population growth, Force vibration of a mass point attached to spring with and without damping effect. Equivalence of electrical and mechanical system

3. DIFFERENTIAL CALCULUS-II :

3.1 Function of two variables, identification of surfaces in space

$$z=x2 + y2,\quad x2 + y2 =a2\ ,\ x + y = 2$$

$$\frac{x2}{a2} + \frac{y2}{b2} + \frac{z2}{c2} = 1 \qquad \frac{x2}{a2} - \frac{y2}{b2} + \frac{z2}{c2} = 1$$

3.2 Partial Derivatives :

Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Eulens

theorem for homogeneous functions, Jacobians.

3.3 Vector Calculus :

Vector function, derivatives, gradient, divergence and curl Some indentities among these.Five integrals, double and triple integral, surface integral, Grean, Gauss and stokes theorem and application

4. INTEGRAL CALCULUS - II

4.1 Laplace Transform :

Definition, Basic theorem and properties, Unit step and Periodic functions, Solution of ordinary differential equations.

4.2 Beta and Gamma Functions :

Definition, Use, Relation between the two, their use in evaluating integrals.

4.3 Fourier Series :

Fourier series of f(n)-n<x<n, Odd and even function, Meaning of the sum of the series at various pairs.

5. PROBABILITY AND STATISTICS :

5.1 Probability :

Laws and Conditional probability

5.2 Distribution :

Discrete and continuous distribution.

5.3 Binomial Distribution :

Properties and application through problems.

5.4 Poisson Distribution :

Properties and application through problems

5.5 Normal Distribution :

Properties and applications through problems

5.6 Method of Lease-quare.

2.2 MECHANICS OF SOLIDS

L	T	P
3	1	2

Rationale :

The subject gives the sight for selection of materials for engineering use and helps in deciding dimensions of the components in design work.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Stress, Strain & Properties of Materials	9	3	- -
2.	Complex Stresses	12	4	-
3.	Shear Force & Bending Moment	12	4	-
4.	Theory of Simple Bending	9	3	-
5.	Strain Energy	9	3	-
6.	Torsion	9	3	-
7.	Slope & Deflection of Beam	6	2	-
8.	Columns & Struts	9	3	-
		75	25	50

DETAILED CONTENTS

NOTE:

The treatment of subject is limited to simple numerical problems. This subject previously known as "Strength of Materials" has been renamed as "Mechanics of Solids" .

1. STRESS STRAIN AND PROPERTIES OF MATERIALS:

Mechanical properties of materials Ductility, Tenacity, Brittleness, Toughness, Hardness, Factor of safety. Different types of loads and stresses, strain in a stepped bar. Determination of stress and elongation of a bolt in a bolted joint when subjected to direct external load only, stresses in compound bars and columns. Equivalent modulus of a compound bar, temperature stresses. Shrinkage of a tyre on a wheel. Temperature stress in compound bar, stress-stain curves for mild steel, Aluminium, cast iron & rubber.

2. COMPLEX STRESSES:

Stresses on an oblique plane in a body subjected to direct load, concept of compound stresses. Principal stress and Principl planes under direct and shear stresses. Graphical determination by Mohr's circle.

3. SHEAR FORCE AND BENDING MOMENT:

Shear force and bending moment for concentrated and uniformly distributed loads on simply supported beams,

cantileveer and overhanging beam. Shear force and bending moment diagrams.Relationship between shear force and bending moment. Point of contra flexure, calculations for finding the position of contra flexure.Condition for maximum bending moment.

4. THEORY OF SIMPLE BENDING:

Simple bending, examples of components subjected to bending such as beam, axle, carriage spring etc.. Assumptions made in the theory of simple bending in the derivation of bending formula. Section Modulus Definition of neutral surface and neutral axis and calculation of bending stressess at different layers from the neutral surface for beam of different sections, Pure bending, Concept of Moment of Inertia and case study

5. STRAIN ENERGY:

Meaning of strain energy and resilience. Derivation of formula for resilience of a uniform bar in tension. Proof resilience, modulus of resilience, suddenly applied load, Impact or shock load. Strain energy in a material subjected to uniaxial tension and uniform shear stress. General expression for total strain energy of simple beam subjected to simple bending.

6. TORSION:

Strength of solid and hollow circular shafts. Derivation of torsion equation. Polar modulus of section. Advantages of a hollow shafts over 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.

7. 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.
Cantelever having point load at any point of the span.
Cantitilever with uniformly distributed load over the entire span
Cantilever having U.D.L. over part of the span from free end
Cantelever 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.

8. COLUMNS AND STRUTS:

Definition of long column, short column and slenderness ratio. Equivalent length, Critical load, Collasping load, End conditions of columns. Application of Euler's and Rankines formule (No Derivation). Simple numerical problems.

2.3 MATERIALS & MATERIAL SCIENCE

L	T	P
2	1	2

Rationale :

All industrial products but services and power are material forms. They achieve their final form by going through series of operations in the industries. So the knowledge of behaviour science of materials in very essential for engineers and technologist. The importance of the subjects is also due to the reason of increasing efficient use of materials in todays industries and progress in the development of new materials of the desired properties. Class room instructions along with the lab work will do well to generate a confidence in the student.

Note:-

The arrangement for practicals is to be made in the lab previously known as Strength of Material Lab now renamed as "Material Science Lab".

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P	
1.	General Introduction	2	1		Mate-
2.	Structure of Metals & Their Deformation	4	2		rial Scie-
3.	Properties & Usage of Metals				nce
1. (a)	Ferrous Metals	10	5		Lab.
(b)	Nonferrous Metals	8	4		-
2.	Nonmetallic Materials	14	4		-
4.	Identification & Testing of Metal Alloys	2	2		- -
5.	Heat Treatment of Metals	4	3		-
6.	Miscellaneous Materials	6	4		-
		50	25	50	

DETAILED CONTENTS

1. GENERAL:

Brief introduction to the subject metallurgy and its scope in engineering field, classification of materials of industrial importance. Their chemical thermal, electrical, magnetic, mechanical and technogical properties and their selection criteria for use in industry.

2. STRUCTURE OF METALS AND THEIR DEFORMATION:

Structure of metals and its relation to their physical, mechanical and technological properties. Elementary idea of arrangement of atoms in metals, molecular structures crystal structures and crystal imperfactions. Deformation of metals, effects of cold and hot working operations over them. Recovery recrystallisation and grain growth, solid solutions, alloys and inter metallic compounds, alotropy of metals, effect of grain size on properties of metals. Corrosion its causes and prevention.

3. PROPERTIES AND USAGE OF METALS:

(1) (a) Ferrous Metals.

(b) Non Ferrous Metals.

(2) Nonmetallic Materials.

1. METALS:

(a) Ferrous Metals:

(i) Classification of iron and steel. Sources of iron ores and places of availability. Outline of manufacture of pig iron, wrought iron, cast iron and steel. (Flow diagram only)

(ii) Cast iron: Types as per I.S. - White, malleable, grey mottled, modular and alloy, properties and common uses.

(iii) Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Name and places of steel plant in India. Availability of various section of steel in market, its forms and specifications.

(iv) Alloy Steel : Effect of alloying various elements, viz Cr, Ni, Co, V, W, Mo, Si and Mn on mechanical properties of steel, Common alloy steels, viz,
(a) Ni-Steel

(b) Ni-Cr-steel

(c) Tungsten Steel

(d) Cobalt steel

(e) Stainless steel

(f) Tool steel- High Carbon Steel, High Speed tool Steel, Satellite Metal, Tungsten Carbide Diamonds.

(g) Silicon magnese steel

(h) Spring steel

(i) Heat resisting alloy steels (Nimonic steels).

(j) Impact hardening steel

(B) Non-ferrous Materials:

(i) Important ores and their metal content, outline of manufacturing methods, trade names, properties (Phy/Mech./Elect.) and use of the following metals: Aluminium, Zinc, Copper, Tin, Silver, Lead.

(ii) Base metal with principle alloying elements (I.S.I. specification). Improtant properties and use of the following alloys:

(a) Aluminium Alloys:

Aluminium-Copper alloy, Al, Zn alloy, Aluminium-Silica Alloy-Al-Ni-Alloy, Duralumnium-derived alloys (R.R. and Y-alloy).

(b) Copper Alloys:

Brass, Bronze, Gun metal, Phosphor Bronze, Aluminium Bronze, Ni Bronze.

(c) Nickel Silver:

Nickel-Copper Alloy (monel metal) inconel, Nickel, Silver.

(d) Bearing Metals:

Lead base alloys, tin base alloys. (White metals or babbit metals) Copper base alloys.

(e) Solders:

Solders-(Lead, Tin solder, Plumber solder, Tinman's solder or Tin solder) Silver solder, Brazing alloys (spelter), Inconel alloys.

2. NON-METALIC MATERIALS:

(a) Timber:

Conversion of Timber: Its meaning necessity, Seasoning of timber, Preservation of Timber : Types of preservation, Methods of application, Defects in timber, Surface treatment, Soaking treatment, Hot and Cold treatment; Common Indian timber specilic uses,

properties identification, units of purchase. Brief study of produces of Timber, Plywood, Hard board, Batten Board, Veneer board.

(b) Plastic and Other Synthetic Materials:

Plastics-Improtant sources-Natural and Synthetic, Classification, thermoset and thermoplastic, Various trade names, Important Properties and engineering use of plastics. Market forms-Pallets, Granules, Powder and Liquid forms; Uses of Sungloss rexin, Linoleum, Plastic coated paper, Fibres-Important sources. Inorganic fibres, Natural Organic Fibres and Synthetic organic fibre and their use.

(c) Paints, Enamels, Varnishes and Lacquers:

Paints and Enamels-types, its purpose, essential ingredients and their role, characteristics of a good paints and enamel, Selection of different types of paints, varnishes from manufacture catalouge.

(d) Heat Insulating Materials:

Classification of heat: Insulating material, properties and uses of China clay, Cork, Slagwool, Glass wool, Thermocole,Puf, Properties and uses of asbestos as filler material.

(e) Electrical Insulating Materials:

Classification of electrical insulating materials, properties and use of-China clay, Leather, Prespan paper, empire cloth masonite, Bakelite, Ebonite, Fibre, Mica, Wood Wool, Glass wool, Rubber, Felt, Insulating oil and Varnish and Enamel paint. Electrical resistance and fuse materials.

(f) Hardwares:

General specification, uses and methods of storage of G.I. and C.I. steel, Copper, A.C. pressure conduits, R.C.C. spun, P.V.C. pipes and their uses. General sheets specification (I.S.) and uses. Method of storage of G.I. sheets, M.S. sheets, General specification of pipe fittings viz. Elbow, Tee, Bend, Crosses and Sockets. General specification and use of wire nails, wood screws and door hinges, toggle bolts, sliding bolts.

4. IDENTIFICATION AND TESTING OF METAL ALLOYS:

Selection, specification forms and availability of materials. Testing of materials(Destrictive and non-destrictive), Identification of metal by giving mini project.

5. HEAT TREATMENT OF METALS:

Elementary concept,purpose, Iron-carbon equilibrium diagram. T.T.T. or 'S' curve in steels and its significance, micro structure of steels and martensitic transformation (elementary idea). Hardening, Tempering, Annealing, Normalising and case hardening. Ageing, Various temperature ranges for different metals and alloy (From heat treatment hand book)

6. MISCELLANEOUS MATERIALS:

Important properties, characteristics and use of the following materials.

(a) Abrasives-Natural and Manufactured, sand stone, emery and corrundum, diamond, garnet, silicon carbide, Boron carbide, aluminum oxide, anyother abrasives qualities of good abrasive.

(b) Celluloid or Xylomite

(c) Felt

(d) Magnetic Materials

(e) Mica

(f) Refrctory Materials-Fire clay, Dolomite, Magnesite, Poreclain, Fire bricks and their uses

(g) Jointing Materials-Glues and Adhesives, Cements Pyroxylene cement, Rubber cement, Magnestic cement.

(h) Composite Materials : Introduction to polymers of metal matrix composite, Carbon fibre, Glass fibre

(i) Germenium alloys (metal glasses)

(j) Source of procurement of various Ferrous and non-ferrous and composite materials

2.4 HYDRAULICS & HYDRAULIC MACHINES

(Common With Dairy Engineering)

L	T	P
2	1	1

Rationale :

The mechanical behaviour of liquid in static as well as in dynamic conditions has always been the subject of interest for engineers. A mechanical engineer working in food or some chemical industry dealing with fluids frequently comes across problems of liquid flow, their static storage and disposal of liquid wastes. Also use of hydraulic in automation and power generation is well known to us all.

The subject gives an adequate insight to understand and face such situations related to working with liquids.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction	1	-	-
2.	Hydrostatics	5	3	-
3.	Buoyancy	2	1	-
4.	Fluid Flow	4	2	-
5.	Energy & Momentum Equation	8	4	-
6.	Orifices	6	3	-
7.	Notches & Weirs	6	3	-
8.	Flow Through Pipes	4	2	-
9.	Flow Through Channels	6	3	-
10.	Hydraulic Machines	8	4	-
		50	25	25

DETAILED CONTENTS

1. INTRODUCATION:

Fluid, Fluid Mechanics, Hydraulics, Hydro-statics, Hydro dynamics, Ideal fluid.

2. HYDROSTATICS:

Properties of fluids, Pressure and depth relationship, Hydrostatic pressure, pascal's law, total pressure on flat surfaces, Centre of pressure on flat surfaces. (Simple Numerical Problems)

3. BUOYANCY :

Bouyancy, Condition of equilibrium of a floating body, Meta centre and Meta centric height. (Simple Numerical Problems)

4. FLUID FLOW:

Different types of flow, Reynold's number, Equation of continuity and its applications. (Simple Numerical Problems)

5. ENERGY AND MOMENTUM EQUATION:

Types of energies, Energy equation and its application. Bernoulle'stheorem flow measurement instruments where energy equation is used e.g. Venturimeter, Orifice meter, Flow nozzle, pitot tube, Prandtle tube. (Simple Numerical Problems)

6. ORIFICES:

Flow through orifices, Co-efficient of contraction, Co-efficient of velocity, Co-efficient of discharge, Large vertical orifices, Drowned orifice, time of emptying a rectangular and circular tanks with flat bottoms. (Simple Numerical Problems)

7. NOTCHES & WEIRS:

Different types of notches, Measurement of discharge over rectangular notch, V-notch, Francis and Brazin's formula for rectangular weirs. Submerged weirs, Broad crested weirs. (Simple Numerical Problems)

8. FLOW THROUGH PIPES:

Losses in pipe flow due to friction, sudden enlargement, contraction and bends, Elbow & Tee. (Simple Numerical Problems)

9. CHANNELS:

Characteristics of flow, Uniform flow through channels. Rectangular and Trapezoidal channels, Application of Chezy's, Manning and Kutter's formula. Most economical channel sections of retangular and trepozoidal shapes. (Simple Numerical Problems)

10. HYDRAULIC MACHINES:

Impulse and reaction turbines, Principle of working of Pelton wheel, Francis and Kaplan turbines with simple line diagrams, their classification, construction, working, operational problems. Centrifugal and reciprocating pumps, Hydraulic press and Hydraulic Jack.

2.5 THERMAL ENGINEERING

L	T	P
2	1	1

Rationale :

The heat energy is still a major means of power in the world. Knowledge of thermal contrivances and related principles is very essential for mechanical enginers. The paper presents an introduction to Sources of heat, Thermodynamic principles and their application to thermal contrivances.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Fundamental of thermodynamics	4	1	-
2.	Properties of Steam	4	2	-
3.	Steam Generator	5	3	-
4. A.	Steam Turbines	5	3	-
B.	Steam Condensers	2	1	-
5.	Gas Turbine	5	1	-
6.	Air Compressors	6	3	-
7.	Thermal Power Plant	8	4	-
8.	Nuclear Power Plant	6	3	-
9.	Internal Combustion Plant	5	4	-
		50	25	25

DETAILED CONTENTS

1. FUNDAMENTAL OF THERMODYNAMICS :

Definition, concept of thermodynamic system and surroundings. Closed system, open system, isolated system, thermodynamics definition of work. Zeroth low of thermodynamics.

First law of thermodynamics for cyclic and noncyclic processes. Idea of internal energy and enthalpy. Thermodynamic processes - constant volume, constant pressure, constant temperature (Isothermal) processes, adiavatic process polytropic process, their representation on P-V diagram and calculation of work done. Application of the first law of these process. Simple numerical problems.

Second law of thermodynamic concept of perpetual motion

machine of first order and that of second order. Concept of heat engine, heat pump and refrigerator. Carnot cycle efficiency for heat engine and cop for refrigeratr and heat pump.

ENTROPY - its physical concept and signidicance, reversibility and efficency, Irreversibility and entropy. Expression for change of entropy in various thermodynamic processes.

Simple numerical problems concerning the above.

2. PROPERTIES OF STEAM :

Idea of steam generation begining from heating of water at 0oC to its complete fromation into saturated steam. Pressure temperature curve for steam. Idea of dry saturated steam, wet steam and its dryness fraction, super heated steam and its degree of super heat. Enthalpy, entropy, specific volume and saturation pressure and temperature of steam. Use of steam table and mollier chart. Simple numerical problems.

3. STEAM GENERATORS:

Types of steam generators - Low pressure and High pressure boilers, Modern high pressure high discharge boiler - Stirling boiler, Lamont, Loefflor, Benson, Velox, ramsin and Schmidi-Hartmann boiler, Computer controlled accessories, Equivalent evaporation, Boiler performance efficiency.

4.A STEAM TURBINE :

Classification, details of turbine, working principle of impluse and reaction turebine, compounding methods of steam turbine, efficiency bleeding, concept of steam bozzles, governing of turbine.

B. STEAM CONDENSER :

Principle of operation, classification, A brief concept of condenser details.

5. GAS TURBINE :

Elements of gas turbine, working principle, fuel and fuel system, open and close cycle, methods of testing, operating characteristics, Atkinson cycle, Brayton cycle, Heat exchanger, Inter cooler, Reheater, Applications, Performance. Brief concept of heat exhanger.

6. AIR COMPRESSOR :

Definition and their use, Difference between reciprocating and rotary compressor, their types and working workdone during compression in single stage and two stage, Heat rejected and inter cooling in tow stage compression,

volumetric efficiency, compressor lubrication.

7. THERMAL POWER PLANT :

Main parts and working of plant, Thermodunamics cycle, Fuel handling, Combustion and combustion equipments, Problem of ash disposal, Circulating of water schemes and supply of make up water, Selection of economiser, Super heater, Pre-heater, Feed water heater and dust collector, Steam power plant, Heat balance and efficiency.

8. NUCLEAR POWER PLANT :

Elements of nuclear power plant, Types of nuclear reactor, Fuel moderators, Coolants, Controls, Disposal of nuclear wastes, Classification of nuclear power plant, Cost of nuclear power, Nuclear fuels.

9. INTEGRAL COMBUSTION PLANT :

Engine classification, Engine cycle, C.I. engine combustion, S.I. engine combustion, Engine structure, Fuel admission system, Air intake system, Engine cooling system, Lubrication system, Engine starting system, I.C. engine in steam plant-Features and working.

2.6 MANUFACTURING PROCESS

L	T	P
2	1	8

Rationale :

Manufacturing involves variety of operations over the raw material. For mechanical engineers it is matter of utmost improtance to have complete knowledge of such operations. The present paper aims to initiate the students into the matters.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1. A.	General Processes	8	4	-
B.	Welding			
i.	Weld edge Preperation & Various Welding Processes	6	3	-
ii.	Welding Arcs	2	1	-
iii.	Welding Special Materials	6	3	-
iv.	Testing of Welds & Relevent Welding Codes.	2	1	-
2.	Foundary Practice			
A.	Patterns & Moulding	6	3	-
B.	Melting & Pourng	6	3	-
C.	Special Castings	6	3	-
3.	Powder Metallurgy	8	4	-
		50	25	200

DETAILED CONTENTS

1. (A)-GENERAL FORMING PROCESSES:

Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity), fusibility and divisibility Viz Rolling, Forging, Drawing, Extruding, Spining, Pressing, Punching, Blanking.

(B)-WELDING:

(I) Weldedge prepration, Introduction to various welding processes with procedure equipments and applications such as
(i) Electric arc welding.

(ii) Resistance welding-Spot welding, Flash butt, Percussion welding.
(iii) Thermit welding.
(iv) Carbon arc welding
(v) Metal-Inert-Gas welding (MIG).
(vi) Tungsten arc welding (TIG).
(vii) Atomic Hydrogen arc welding.
(viii) Stud welding.
(ix) Laser Beam, Electrom Beam Welding, Exploison Welding, Ultrasonic Welding.
(x) Under water welding
(xi) Submerged Arc welding

(II) WELDING:

Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes. Selection of electrode from catalogue, current and voltage setting from welder's hand book.

(III) WELDING OF SPECIAL MATERIALS:

(i) Welding of plastics, equipment, filler, rods, weldability, procedures and precautions.

(ii) Welding of Grey Cast Iron, shelded metal arc gas welding procedures.

(iii) Welding of Aluminium, Argon arc and gas welding procedures.

(iv) Welding of copper, Brass and Bronzc, Gas shielded metallic arc welding, TIG., Oxyaccetylene method.

(v) Welding of Alloy steels welding, Stainless steel, welding by oxyacetylene process, MIG, TIG. Specification of electrode as per latest I.S. code.

(IV) TESTING OF WELDS & RELEVENT WELDING CODES:

(a) Destructive methods.

(b) Non destructive methods-visual, X-ray, Gamma-ray, Magnetic particles, flaw detection, flourescent, dye penetrant and ultrasonic testing.

(V) COST ESTIMATION OF WELDING :

Meterial cost, Fabrication cost, Preparation cost, Welding cost and Finishing cost, Over head cost, Cummulative effect of poor practices on cost, Calculation of cost of welding gas consumption and welding electrodes.

2. FOUNDRY PRACTICE:

(A) PATTERN AND MOULDING:

The pattern materials used, Types of patterns, Allowances and pattern layout, Colour scheme pattern defects, Types of cores and their utility.

Moulding Processes:

Classification of mould materials according to characteristics, Types of sands and their important test, parting powders and liquids. Sand mixing and preparation, Moulding defects.

(B) MELTING AND POURING:

Fuels and metallic materials used in foundary. Melting furnaces used in foundary such as pit furnace, Tilting and cupola furnaces, metals and alloys. Additions to molten metal, Closing and pouring of the moulds. Coring-up, venting and closing, use of ladles, spur and risers, Defects due to closing and spuring. Basic idea of fettling operations. Surface treatment, Salvaging of castings, Factors determining soundness of casting. Handling of molten metal from furnace to mould.

(C) SPECIAL CASTING:

Elementary idea of speceal casting processes-Shell mould casting, die casting, investment mould casting, centrifugal and continuous casting full mould casting.

Elementary idea of mechanisation of foundries.

(D) ESTIMATING AND COSTING :

Calcultion of material cost for casting and Forging.

3. POWDER METALLURGY:

Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing. Self lubricated bearings. Advantages of the process and its limitations. (Elementary concept only).

2.7 ELECTRICAL TECHNOLOGY & ELECTRONICS

(Common With Dairy Engineering)

L	T	P
2	-	2

Rationale :

The superiority of electricity as power over other means in use in home or industry can not be denied. So it is imperative to introuce the mechanical engineering students with electrical machines and their various uses.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Electric Induction	2	-	-
2.	A. C. Theory	4	-	-
3.	Three Phase Circuits	4	-	-
4.	Measurement & Measuring Instruments	10	-	
5.	Electronics	8	-	-
6.	D. C. Machines	6	-	-
7.	Transformers	4	-	-
8.	Synchronous Machines	4	-	-
9.	Induction Motors	4	-	-
10.	Electro Heating	2	-	-
11.	Electro Plating	2	-	-
		50	-	50

DETAILED CONTENTS

1. ELECTRIC INDUCTION:

Faraday's Laws of electromagnetic induction. Self and mutual induction. Statically and Dynamically induced e.m.f., Lenz's law. Fleming's left hand and right hand rule.

2. A. C. THEORY:

Production of alternating e.m.f. Definition of cycle, Frequency, Amplitude, Time period, Instantneous, Average, R.M.S. maximum values of sinosoidal wave. Form factor, peak factor.

Representation of a sinosoidal quantity by a mathematical expression and phasor, phase and phase difference, Relationship of voltage and current for pure resistance, pure inductance and pure capacitive reactance,impedance. Solution and phasor diagrams of simple R.L.C. series and

parallel circuits. Active and reactive power. Significance of P.F.

3. THREE PHASE CIRCUITS:

Production of Three phase voltage, advantages of three phase supply. Concept of star and delta connections. Relationship between phase and line values of currents and voltages, Power in three phase circuits, simple numerical problems.

4. MEASUREMENT & MEASURING INSTRUMENTS:

(i) Primary and secondary instruments-Indicating, Recording and Integrated instruments.

(ii) Working principle and construction of the following instruments.

(a) Ammeter & Voltmeter (Moving coil & Moving Iron). Extension of their ranges.

(b) Dynamometer type wattmeter.

(c) Single Phase A. C. Engery Meter.

(iii) Measurement of power in a single phase and three phase circuits by wattmeter, Use fo digital multimeter for measurement of voltage, Current and testing of devices.

5. ELECTRONICS:

Basic idea of semi conductors P & N type. Semi conductor diodes, Zener diodes and their applications in rectifiers. Transistors-PNP and NPN-their characteristics and uses at an amplifier (Brief description only). Prniciple characteristics and application of SCR. Devices like UJT, FET, DIAC, TRIAC (Brief introduction, Introduction to operational amplifier, Introduction to basic logic gates and microprocessors.

6. D. C. MACHINES:

D. C. Generator:

Working principle, Constructional details, e.m.f. equation, Types of generators and their applications.

D. C. Motor:

Working principle, Back e.m.f., Types of D. C. motor and elementary idea of their characteristics. Torque equation, Methods of speed control (Description Only).

7. TRANSFORMERS:

Working principle and constructional details of a single phase and 3 phase transformers, e.m.f. equation, Losses and efficiency, Cooling of transformers, Elementry idea of auto transformers and welding transformers.

8. SYNCHRONOUS MACHINES:

(a) Alternators:

Working principle, Types of alternators, Constructional details, E.M.F. equation, Condition for parallel operation.

(b) Synchronous MOtors:

Working principle, Constructional details, Vector diagram, Effect of excitation on armature current and power factor, Synchronous condenser.

9. INDUCTION MOTORS:

(a) Three Phase Induction Motors:

Working principle and constructional details-Types of induction motors-Slipring and Squirrel cage. Slip in induction motors. Speed torque characteristic, Starting and speed control. Application of induction motors in industry. General faults and their remedies.

(b) Single Phase Induction Motors:

Working principle and constructional details and

application of single phase motors (Split phase, Capacitor start and Run Motor). A. C. series motors, General faults and their remedies.

10. ELECTRO HEATING:

Types of electro heating. Brief description of resistance ovens and induction furnace and core furnaces.

11. ELECTROPLATING:

Importance of electroplating, Principle of electroplating and equipement used. Processes used in electroplating, Anodising.

2.8 COMPUTER APLICATION FOR ENGINEERING

[Common with Civil Engg., Civil (Spl. With Rural), Mechanical Engg.,(Specialisation in Production, Automobile, Refrigeration and Air conditioning), Electronics Engg.,Instumentation and Control Engg., Dairy Engg., Leather Technology, Footwear and Leather Goods Tech., Cermics, Chemical Engg.(Four year Sandwitch), 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.

2.9 MECHANICAL ENGINEERING DRAWING

L	T	P
-	-	8

Rationale :

" Drawing Is The Language of Engineers " goes the maxim. So it is indispensible for engineers. It is the most precise, accurate and concise way of communicating about object forms and their dimensions.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time Pds.	P
1.	General concept of Machine Drawing	8	2 Sheets
2.	Familiarization with Auto Cad(Latest V.)	40	4 Sheets
3.	Sectional view Drawing	16	2 Sheets
4.	Assembly Drawing (2 Sheet Manual, 2 Sheet Use of CAD)	40	4 Sheets
5.	Assembly Drawing From Details & Vice-Versa	40	3 Sheets
6.	Spur Gear Profile Drawing (1 Sheet Manual, 1 Sheet Use of CAD)	12	2 Sheet
7.	Free Hand Sketching of		
i.	Pipe Fitting	8	1 Sheet
ii.	I.C. Engine Piston & Flywheel (1 Sheet Manual, 1 Sheet Use of CAD)	12	2 Sheets
iii.	Cutting Tools of Machine Tools (1 Sheet Manual, 1 Sheet Use of CAD)	8	2 Sheet
iv.	Gear Puller & C-Clamp (1 Sheet Manual, 1 Sheet Use of CAD)	8	2 Sheet
v.	Sketching of orthographic view	8	2 Sheet
		200	25 Sheets

DETAILED CONTENTS

1. GENERAL CONCEPT OF MACHINE DRAWING

(a) Views and sections (Full and half), dimensioning Technique -Unidirection and aligned practice conventions as per latest code of practice for general engineering drawing.

(b) General concept of IS working drawing symbols for

(i) Welding & Rivetting

(ii) Serews & Screw threads

(iii) Surface Finish Marks

(iv) Limits, Fits & Tolerances

2. FAMILIARIZATION WITH AUTO CAD COMMOANDS:

- What is CAD, Different type of CAD software available, Advantages of using CAD, AUTOCAD graphical user interface.

- Setting up drawing environment : Setting units, Drawing limits, Snap, Opening and Saving a drawing, Setting drafting properties, Different co-ordinate system used.

- Commands and their aliases, Different methods to start a command.

- Selecting object, removing object from selection set, Editing with grips, Editing object properties.

- Use of draw commands - Line, Arc, Circle, Polygon, Polygon, Polyline, rectangle, Ellipse, construction line, Spline.

- Use of modify commands - erase offset, Move, Copy, Mirror, Fillet, Chamfer, Array, Scale, Stretch, rotate, Explode, Lengthen.

- Creating 2D objects using Draw and Modify commands, Use of Hatch commands.

- Controlling the drawings display; Zoom, PAN, view ports, Aerial view.

- Drawing with precision : Adjusting snap and Grid alignment.

- Use of Tools Menu bar for calculating distance, angle, area, ID points, Mass using inquiry command, Quick select.

- Adding text to drawing, Creating dimension.

- Use of UCS, Alignment of UCS, Move UCS, Orthographic UCS.

- Creating 3 D objects using region, boundary, 3D Polyline, Extrude, revolve feature.

- Use of solid 3D edit features, Shell, Imprint, Separate, Section, Boolean functions like Union, Subtract and Intersect, Extrude faces, Move faces, Delete face, Offset faces, Copy faces and colour faces commands.

- To show the section - Use of slice, Section commands.

- Rendering and imaging, Produce hard copies.

3. Sectioned View of

(i)) Foundation bolts

(ii) Pipe Joints - Flanged, Socket, Hydraulic joint and Union joint.

4. Assembly Drawing of

(i) Knuckle joint- Part drawing, Solid Modeling, Assembly and Sectioning.

(ii) Protective type flange coupling- Part drawing, Solid Modeling, Assembly and Sectioning.

(iii) Bench vice - Part drawing, Solid Modeling, Assembly and Sectioning.

5. Assembly drawing from detail and vice versa.

(i) Tail stock of Lathe machine

(ii) Screw jack

(iii) Drilling Jig

6. Spur gear profile drawing from given data

7. Free hand sketching of

(i) Pipe fittings-Such as-Elbows-Reducers, T-Cross and Bibcock.

(ii) I. C. engine piston, Simple bearing, Cottor and Knuckle joint, pulleys and flywheel-Sectioned views.

(iii) Cutting tools of Lathe machine, shaper and common milling cutters.

(iv) Gear puller and C-clamp

(v) Sketching of ortho graphics views from isometric views be practiced.

NOTE :

All the sheets should be working drawing complete with tolerances, type of fits and surface finish symbols and material list according to I.S.I. code. 25% drawing sheet should be drawn in first angle projection and rest 75% drawing sheet should be in third angle projection.

2.10 MECHANICS OF SOLID LAB

1. To find the shear force at a given section of simply supported beam for different loading.

2. To find the value of 'E' for a steel beam by method of deflection for different loads.

3. To determine the Max-Fibre stress in X-section of simply supported beam with concentrated loads and to find the neutral axis of the section.

4. To determine the ultimate tensile strength, its modulus of Elasticity, Stress at yield point,% Elongation and contraction in x-sectional area of a specimen by U.T.M. through necking phenomenon.

5. To determine the ultimate crushing strength of materials like steel and copper and compare their strength.

6. To determine Rock Well Hardness No. Brinell Hardness No. of a sample.

7. To estimate the Shock Resistance of different qualities of materials by Izod's test and charpy test.

8. To determine the bending moment at a given section of a simply supported beam for different loading.

9. To determine the various parameters of Helical coil spring

10. To determine the angle of twist for a given torque by Torsion appratus and to plot a graph between torque and angle of twist.

11. Study of diamond polishing apparatus.

12. Study metallurgical microscope.

13. (a) To prepare specimens for microscope examination (For Polishing andetching).

    (b) To examine the microstructure of the above specimens under metallurgical microscope.

    (c) To know composition of alloy steel by spebber steeloscope

    (d) To know carbon in steel by carbon steel estimation apparatus

14. Perparation of specimens and study of microstructure of eight given metals and alloys on metallurgical microscope.
    i. Brass.
    ii. Bronze.

iii. Grey Cast Iron.
iv. Malleable Cast Iron.
v. Low Carbon Steel.
vi. High Carbon Steel.
vii. High Speed Steel.
viii.Bearing Steel.

15. To perform heat treatment process on materials of known carbon percentage -
1. Annealins 2. Normalising 3. Case Hardening

16. Mini Project

i. Collect samples of heat insulating materials

ii. Collect samples of various steels and cast iron.

iii. Collect sample of Non-Ferrous alloys.

iv. Collect samples of Non-Metalic enginering materials

2.11 THERMAL ENGINEERING LAB

1. Determination of temperature by
   i. Thermo couple
   ii. Pyrometer

2. Study of constructional details and specification of high pressure bioler and sketch (through field visit)

3. Demonstration of mounting and accessories on a boiler for study and sketch (field visit).

4. Performance testing of steam boiler.

5. Study of steam turbines through models and visits.

6. Determination of dryness fraction of wet steam sample.

7. Study and understanding of various types of furnance and their use through available furnaces/visits.

8. Study and sketching of various hand tools, Lifting tackes, Gadgets used in plant.

9. Study of fuel sypply and lubrication system in I.C. engine.

10. Study of battery ignition system of a multi-cylinder petrol engine stressing on ignition timing, setting fixing order and contact breaker gap adjustment.

11. Determination of B.H.P. for diesel and petrol engine by dynamometer.

12. Morse test on multi-cylinder petrol engine

13. To prepare heat balance sheet for diesel/petrol engine.

2.12 HYDRAULICS LAB

A. Demonstration of the following for study & sketch.

1. Piezometer tube, Mechanical flow meter, Manometers, Pressure gauge.

2. Hydraulic ram, press and jack.

3. Pelton wheel and Francis turbine or their model.

4. Centifugal and Reciprocating pumps.

B. Performance Experiments :-

5. Measurement of discharge over notches and its verification.

6. To verify Bernaulli's theorem.

7. To determine coefficient of discharge of a Venturimeter.

9. To determine coefficient of contraction, coefficient of velocity and coefficient of discharge for a given orifice.

9. To determine the loss of head of water due to friction in a water pipe line.

10. To study performance

    i. Pelton Wheel
    ii. Francis Turbine.

11. To study the performance of a

    i. Centrifugal Pump
    ii. Reciprocating Pump.
    iii. Gear Pump

12. To measure the velocity of water flow in a open channel by a current meter

2.13 ELECTRICAL TECHNOLOGY & ELECTRONICS LAB
(Common With Dairy Engineering)

1. To change the speed and direction of rotation of d.c. shunt motor by

   (a) Armature control method.
   (b) Field control method.

2. To change the speed and direction of rotation of d.c. compound motor by

   (a) Armature control method.
   (b) Field control method.

3. To measure the terminal voltage with variation of load current of

   (a) D.C. shunt generator.
   (b) D.C. compound generator.

4. To perform load test on a single phase transformer and determine its efficiency.

5. To start and run a induction motor by

   (a) Star Delta Starter.
   (b) Auto Transformer Starter.

6. To measure slip of an induction motor by direct loading.

7. To start and change the direction of rotation of an induction motor.

8. To measure transformation ratio of a single phase transformer.

9. To measure power and P.F. in a single phase circuit by Ammeter, Voltmeter and Wattmeter.

10. To measure power and P.F. in a 3 phase/A.C. circuit by two wattmeter method.

11. To calibrate a single phase energy meter at different P.F.'s and different loads.

12. To locate the faults in an electrical machine by a megger.
13. To connect a fluorescent tube and note its starting and running current.
14. To draw characteristics od Silicon Controled Rectifier (SCR).
15. Testing of electrical devices - Zenor, Diode, Transistor, FET, UJT, SCR.

16. Use of operational amplifier as adder, substractor, comparator, differentiator and integrators.

2.14 MANUFACTURING PROCESSES (WORKSHOP PRACTICE)

I. FOUNDRY PRACTICE (WORKSHOP):

Minimum work in each section is indicated against that

1. PATTERN MAKING:

(a) Making Patterns (At least two).

(i) Solid one piece pattern.
(ii) Split two piece pattern.
(iii) Split three piece pattern.
(iv) Gated pattern.
(v) Four Piece pattern.
(vi) Sweep pattern.
(vii) Skeleton pattern.
(viii) Segmental pattern.

(b) MAKING CORE BOXES (At Least 2) For:

(i) Straight Core Box.
(ii) Bent Core Box.
(iii)Unbalanced Cores.

2. SAND PREPARATION AND TESTING:

(a) Sand Testing (At Least 2 Experiments).

(i) Grading (Grain Size).
(ii) Determination of Moisture content
(iii) Determination of Clay content.
(iv) Determination of Permeability for gases.

(b) Preparation of :

(i) Green Sand Composition.
(ii) Dry Sand Composition.
(iii) Loam Sand Composition.
(iv) Oil Sand For Cores.

3. MOULDING:

(a) Making at least 8 sands moulds of different forms with different types of pattern using.

(i) Floor Moulding.
(ii) Two Box Moulding.
(iii)Three Box (or more) Moulding.

(b) At least one of the following :

(i) Making and setting of cores of different types.
(ii) Making one shell mould apparatus.

4. MELTING AND POURING:

(Each to be Demonstrated at least once in the session).

(a) Demonstration of Melting of cast iron in

(i) Pit Furnace.
(ii) Cupola.

(b) Demonstration of melting a Non-Ferrous metal in :
(i) Pit Furnace.
(ii) Tilting Furnace.

(c) Pouring of Metals in Moulds (Ferrous and Non Ferrous).

5. CLEANING, INSPECTION AND NON DESTRUCHIVE TESTING:

(a) Shaking,cleaning and fettling of casting (At least 2 Casting).

(b) (i) Inspection of cast component (visual) and perparing inspection report (At least one report).
(ii) Establishing cause of Defects seen (At least one cause).

(iii)Dye penetration test for casting
(iv) Magnetic flw detection test/Ultra sound flaw detection test for castings.

6. CASE STUDY OF:

At least 2 sand casting products from sand preparation, pattern layout to final finished casting by shell moulding, centrifugal casting, investment casting and continuous casting.

7. ADVANCE WELDING SHOP :

(a) Study of various Gas cutting and welding equipments :- Welding transformer, Generator/rectifier, Gas cylinder, Gas cutting machines, Cutting torches etc., Various electrondes and filler metals and fluxes.

Practice of welding and cutting of different metals by making suitable jobs by different methods :-

1. Arc Welding practice of mild steel (M.S.) and Spot welding on stainless steel jobs.

2. Tig Welding practice of Non-Ferrous metals, like Copper, Brass and Aluminium.

3. Practice of Gas cutting manually.

4. Practice of Gas cutting by cutting machine.

5. Practice of Arc cutting.

6. Study of Welding defects.

7. Inspection and Tests of welded joints.

8. Practice of Spot and Seam welding.

9. Practice of Welding pipe joints, Pipes and Pressure vessels.

2.15 COMPUTER APPLICATION FOR ENGINEERING LAB

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.

III YEAR

3.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
2	2/2	-

Rationale:

The knowledge of this subject is required for all engineering technicians, but it becomes more important for those technicians who wish to choose industry as their career. This course is designed to develope understanding of various functions of management, role of workers, and engineers, industrial safety, trade unions, wages and incentives, marketing, entrepreneurship, inventory control and industrial legislation.

Sl.No.	Units	Coverage Time L	T	P
1.	Principles of Management	10	4	-
2.	Human Resource Management	3	2	-
3.	Human and Industrial Relations	4	3	-
4.	Personnel Management	6	3	-
5.	Financial Management	6	3	-
6.	Material Management	4	3	-
7.	Labour, Industrial and Tax Laws	4	2	-
8.	Entrepreneurship Development	8	4	-
9.	Intellectual Property Rights	5	1	-
		50	25	-

DETAILED CONTENTS

1. PRINCIPLES OF MANAGEMENT :

Definition of management, Administration organisation, Functions management, Planning, Organizing, Co-ordination and control, Structure and function of industrial organisations, Leadership- Need for ledership, Factors to be considered for accomplishing effective leadership, Communication -Importance, Processes, Barriers to communication, Making communication, Effective, formal and informal communication, Motivation - Factors determining motivation, Positive and negative motivation, Methods for imporving motivation, Incentives, Pay promotion and rewards, Controlling - Just in time, Total quality management, Quality circle, Zero defect concept. Concept of Stress Management

2. HUMAN RESOURCE DEVELOPMENT :

Introduction, Staff development and career development, Training strategies and methods.

3. HUMAN AND INDUSTRIAL RELATIONS :

Human relations and performance in organisation, Understand

self and others for effective behaviour, Industrial relatios and disputes, Charcteristics of group behaviour and Trade unionism, Mob psychology, Labour welfare, Workers participation in management.

4. PERSONNEL MANAGEMENT :

Responsibilities of human resource management - Policies and functions, Selection - Mode of selection - Procedure - training of workers, Job evalution and Merit rating - Objectives and importance wage and salary administration - Classification of wage, Payment schemes, Components of wage, Wage fixation.

5. FINANCIAL MANAGEMENT :

Fixed and working capital - resource of capital, Shares, types preference and equity shares, Debentureptypes, Public deposits, Factory costing, Direct cost, Indirect cost, Factory over head, Fixation of selling price of product, Depreciation- Causes, Methods.

6. MATERIAL MANAGEMENT :

Objective of a good stock control system - ABC analysis of inventory, Procurement and conumption cycle, Reorder level, Lead time, Economic order quantity, Pruchasing procedure, Stock keeping, Bin card.

7. LABOUR, INDUSTRIAL AND TAX LAWS :

Importance and necessity of industrial legistation, Types of labour laws and dispute, Factory Act 1948, Payment of Wages Act 1947, Employee State Insurance Act 1948, Various types of taxes - Production Tax, Local Tax, Trade tax, Excise duty, Imcome Tax.

8. ENTREPRENEURSHIP DEVELOPMENT :

Concept of entrepreneurship, need of entrepreneurship in context of prevailing employment conditions of the country. Sucessful entrepreneurship and training for entrepreneurship development. Idea of project report preparation.

9. 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.

NOTE : Entrepreneurship Awareness camp to be organised at a stretch for Two or Three days. Lectures will be delivered on Entrepreneurship by industries experts at institute level.

3.2 INDUSTRIAL ENGINEERING AND SAFETY

L	T	P
3	1	-

Rationale :

Industrial engineering is a subject related to production activities in the industry. It deals with problems such as how to minimise production cost and produce better quality. The concepts developed for managing and mointoring production activities are of interest for any production engineer. Besides this industrial safety pollution and ecological disturbances are also obsession of present day industrial society.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Inspection	6	2	-
2.	Work Study	8	3	-
3.	Production Planning & Control	9	3	-
4.	Material Handling & Material Handling Equipments	6	2	-
5.	Plant Layout	6	2	-
6.	Standardisation	6	2	-
7.	Quality Control	9	3	-
8.	Cost Estimation	9	3	-
9.	Value Engineering	12	4	-
10.	Accidents and Safety	4	1	-
		75	25	-

DETAILED CONTENTS

1. INSPECTION :

Inspection, Need and its planning, objective. Types of inspection. Inspection standards. Duties of inspector in inspection. Inspection needs.

2. WORK STUDY:

Method Study-Process chart, Flow process chart, Flow diagram, Man and Machine chart, Gang process Chart. Work Measurement-Time study, Tools used in time study, Performance rating, Allownace and use of time standard, Time and Motion study. Principle of human motion economy, Micromotion study, Memomotion study, Therbligs, left hand and right hand chart.

3. PRODUCTION, PLANNING AND CONTROL:

Methods of production-Unit, Batch,mass. Sales forecasting and its use. Planning-Products, process parts, materials, Optimum Batch quantityfor production and Inventory, Theory and Analysis of M/C capacity, Batch quantity, Loading and balancing-Scheduling M/C loading. Preplanning activities, Routing, Despatching, Follow up activities.

4. MATERIAL HANDLING AND MATERIAL HANDLING EQUIPMENT:

Factors in material handling problems, Cost reduction through improved material handling, Reduction in time of material handling, Material handling equipments -Lifting lowering devices, Transporting devices, Combination devices, Maintenance of material handling equipments.

5. PLANT LAYOUT:

General plant location factors, Influance of location on plant layout, selection of plant site, Product layout, Process layout. Advantages and disadvantage of process layout

6. STANDARD AND CODE:

National and International code, value of standardisation. Standardisation programme, Role of Standardisation department, standardisation techniques and problems.ISO-9000 - Concept and its evaolution and implications

7. QUALITY CONTROL:

Concept of quality control, Quality assurance elements of quality control, Statistical quality control, Acceptance sampling, control chart for variable and attributes, Uses of X, R, "P" and "C" chart - O.C. curve, Concept of Total Quality Management

8. COST ESTIMATION :

Introduction and function of cost estimation, estimation procedure, elements of cost, depreciation - methods of calculating depreciation, overhead expences, distribution of over head expences, calculation of cost for machining and metal forming process and break even analyzer.

9. VALUE ENGINEERING :

Concept of value engineering and technique.

10. ACCIDENTS AND SAFETY :

Classification of accidents, causes of accidents, Effects of accidents, Action to be taken in case different types of accidents, Safety - needs, consciousness, prodecures, measures. General safety devices used on machines, Safe working condition and productivity.

3.3 THEORY OF MACHINES:

L	T	P
3	1	-

Rationale :

As the name implies the subject deals with the principles related the working of machine so for the successful design of machines and mechanism a through understanding of this subject is essential.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Mechanisms and Machines	6	2	-
2.	Kinematic Analysis & Synthesis	10	4	-
3.	Dynamics of Machines	10	4	-
4.	Governors	8	2	-
5.	Unbalance in Machines & Engine & Balancing	10	4	-
6.	Cam & Cam Follower Mechanisms	12	3	-
7.	Gear & Gear Drives	9	2	-
8.	Vibration	10	4	-
		75	25	-

DETAILED CONTENTS

1. MECHANISMS AND MACHINES :

   Drfinition, Kinematic pairs, types of mechanism, Special types of mechanism, Space mechanisms.

2. KINEMATIC ANALYSIS & SYNTHESIS :

   Displacement, Volocity and Acceleration of plane mechanism, Graphical and analytical techniques, Synthesis of mechanisms - Crank Rockers, Four Bar Mechanisms, Slider Crank Mechanisms.

3. DYNAMICS OF MACHINES :

   Static and dynamic force analysis, Graphical and analytical approaches, Engine mechanisms, Turning moment diagram, Flywheel analysis, Gyroscopic action in mechines.

4. GOVERNORS :

Types and classification, Principle of working of gravity controlled and spring controlled governors, Stability, Isochronism, Sensitivity and capacity.

5. UNBALANCE IN MACHINES, ENGINES AND BALANCING :

Origin of unbalanced forces and moments and effects of unbalance, Unbalance in rotating bodies and balancing of discs and rotors, Balancing machines, Field balancing of discs and rotors, Unbalance in reciprocating machines - engine, Compressor, Presses. Unbalance force and moment in a single cylinder engine and balancing, Multi cylinder engine balancing in Line engine, V and Radial engines, Lanchestor balancing techniques.

6. CAMS AND CAM FOLLOWER MECHANISMS :

Purpose of using cam- Follower mechanisms, types of cams and cam follower mechanisms, Nomenclature synthesis of disc cam profiles for prescribed follower motion, determination of basic dimension, Graphical and analytical approaches for different types of followers, Dynamics of cam - follower systems - Jump and crossover stock.

7. GEARS AND GEAR DRIVES :

Power transmission by gears and fundamental law of gearing, Involute profile and conjugate action, Characteristics of involute tooth gear - Pinon to system, Under cutting and interference, Minimum number teeth, types of gears, Various gear drives - Spur, Helical, worm and Bevel gear, Gear train - Simple compound and epicyclic gear trains, Differential gears.

8. VIBRATION :

Vibration of single degree of freedom, Systems, Free forced, Damped and undamped vibration, Frequency response and resonance, Bare excitation - Transmissibility and Isolation, Free vibration 2 DOF system - Concept of normal mode, vibration absorber, Multidegree of freedom systems, Free vibration of bars, Shafts and beams, Energy methods and approximate methods.

3.4 MACHINE TOOL TECHNOLOGY & MAINTENANCE

(Common With Dairy Engineering)

L	T	P
3	1	-

Rationale :

A mechanical engineer whether working as design, maintenance or production engineer can not go without knowledge of machine tools. The paper provides useful insight of principles and working of machine tools.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Basic features & Kinematics	9	3	-
2.	Centre Lathe	12	4	-
3.	Shaping, Planing & Slotting Machines	6	2	-
4.	Drilling & Boring Machines	6	2	-
5.	Milling Machines	15	5	-
6.	Grinding Machines	6	2	-
7.	Broaching Machines	6	2	-
8.	Jigs & Fixtures	6	2	-
9.	Cooling Process	3	1	-
10.	Automatic Machining Centres	6	2	-
		75	25	-

DETAILED CONTENTS

1. BASIC FEATURES AND KINEMATICS:

Various types of machining operations and machine tools. Common features of all basic machine tools, work holding and tool holding devices, Drive systems, sources of power, Bed, body or frame. Mechainaical drive system for providing reciprocating, oscillating and rotational movement. Systems of stepped and stepless, friction and positive drives. Principle of setting upper, Lower and Intermediate speeds. Mechanical methods of providing automaticity in machine tools.

2. CENTRE LATHE:

The centre lathe and its principle of working. Types of lathes, Lathe specification and size, Features of lathe bed. Head stock and tail stock. Feed mechanism and change-gears,

carriage saddle, Cross slide, Compound rest, Tools post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe dogs, mandrils, Steady rest, Lathe attachements. Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, Under cutting, Relieving. Types of lathe tools and their uses.

Brief description of semi automatic and automatic lathes such as capstan and turret lathes, their advantages and disadvantages over centre lathe, types of job done on them. General and periodic maintance of a centre lathe.

3. SHAPING, PLANING & SLOTTING MACHINES:

Working principles of planer, shaper and slotter. Differences and similarties among them, quick return mechanism applied to the machines. Types of work done on them, types of tools used, their geometry . General and periodic maintenance of a shaper.

4. DRILLING & BORING MACHINES:

Types of tools used in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.

5. MILLING MACHINES:

Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling, Negative rack milling, cutting speed and speed for different tools in up and down milling. Simple compound and Differential indexing, milling of spur gears and racks.General and periodic maintenance of milling machine.

6. GRINDING MACHINES:

Common abrasive grinding wheel materials, Bonds, Grain or grits of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding. Types of grinding machines, precision finishing operations like honing.

7. BROACHING MACHINES:

Broaching- internal and external surface Types of work done on broaching machine. Simple types of broaches and their uses, Types of broaching machines.Comparision of broaching with others processes.

8. JIGS AND FIXTURES:

Object of Jigs and Fixture. Difference between jigs and fixtures. Principle of location. Principle of clamping. Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs- Bushes (Fixed liner, Renewal slip). Template. Plate jigs. Channel jigs, Leaf jigs. Simple example of milling, turnning, grinding, horijontal boring fixtures and broaching fixtures. Welding fixtures. devices.

9. COOLING PROCESS:

Coolants and cutting fluids difference between coolant and cutting fluid, Function and action of cutting fluids. Requirement of good cutting fluids, their selection for different materials and operations.

10. AUTOMATION OF MACHINING CENTRES :

Introduction to CNC Machine tools (Computer Numerical Control Lathe) and FMS (Flexible Manufacturing System) Introduction only.

3.5 DESIGN AND ESTIMATION

L	T	P
2	1	-

Rationale :

Designing is a creative activity. It requires coordiantion of various aspect of engineering knowledge. So it provides the students an opportunity to utilise their learning. Estiamtion is a process of deciding the production cost and material requirements. When coupled together it offers a self sufficient base for manufacturing. The paper aims to develop such capacity in the student.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
	Part A			
1.	Introduction To Design	2	1	-
2.	Machine Parts Subjected To Direct Load & Shear Loads	4	2	-
3.	Riveted & welded Joints	4	2	-
4.	Machine Parts Subjected To Bending Moments.	4	2	-
5.	Machine Parts Subjected to Twisting Moment	4	2	-
6.	Machine Parts Subjected To Combined Bending & Twisting Moment	4	2	-
7.	Machine Parts subjected to Combined Direct & Bending Stresses	4	2	-
8.	Design of Gear	8	4	-
	Part B			
1.	Estimation of Material Requirement	4	2	-
2.	Estimation of Time For different Machining Operations	8	4	-
		50	25	-

DETAILED CONTENTS

NOTE:

1. Treatment of the subject is limited to elementary situations only.

2. Standard data required for the design problems are to be

given in the question paper.

PART A:

1. INTRODUCTION TO DESIGN:

General design consideration in machine parts. Mechanical properties of materials of construction, steps in machine design. Factor of safety, Selection of materials.

2. MACHINE PARTS SUBJECTED TO DIRECT LOADS AND SHEAR LOADS:

Threaded connections, core and nominal diameter of screw, boiler-Stay. Design for number of studs or bolts and their diameter for cylinder covers due to external forces. Punching and shearing. Design of cotter and Knuckle joints.

3. RIVETED AND WELDED JOINTS:

Types of riveted joints, possible failure of riveted joints. Strength and efficiency of riveted joint. Unwins formula. Determination of safe load and pitch of rivets. Design of lap and butt joints.

Common type of welded joints, definition of leg length, throat thickness and size of weld. Simple design for 'V' butt welded joint, Transverse fillet and parallel fillet welded joints.

4. MACHINE PARTS SUBJECTED TO BENDING MOMENT:

Design for the diameter of railway-Wagon axle, axle used in road-vehicles.

Semi-elliptic Laminated spring-Proof load and proof stress stiffness. Expression for max. stress and deflection. determination of different dimensions number of Laminations, Central deflection in a Laminated spring.

5. MACHINE PARTS SUBJECTED TO TWISTING MOMENT:

Design of solid and hollow shafts. Close-coiled helical spring. Maximum shear stress induced for given axial load. Expression for axial deflection, spring index, solid length and stiffness. Calcualtion for number of coils, mean coil dia and dia of spring wire for axial gradual loads. Simple cases of composite springs. Design of keys and coupling bolts for a rigid flanged coupling.

6. MACHINE PARTS SUBJECTED TO COMBINED BENDING AND TWISTING MOMENT:

Theory of failures

(i) Maxm. Principal stress theory.
(ii) Maxm. shear stress theory concept of equivalent bending moment, equivalent torque,Design of over hung crank pin. Design of shaft dia for over hung pulley in a belt

drive.

7. MACHINE PARTS SUBJECTED TO COMBINED DIRECT AND BENDING STRESS:

Eccentric load and eccentricity. Max. and minimum stress intensities. Reversal of stress. Design for safe load on small columns. Design of brackets and clamps for eccentric loading.

8. DESIGN OF GEAR:

Selection of material, Design analysing, Lewis equation, Stress concentration, Dynamic load, Surface compressive stress, Beam strength, Bending stress, check or plastic deformation, Design procedure for Spur gear and Helical gear.

PART-B:

1. ESTIMATION OF MATERIAL REQUIREMENT:

Estimation of weight of simple machine parts. Review of the area/volume of triangle, equilateral triangle, Hexagon, rectangle, Square rhomboid, parallelogram, Octagen, circle, Hollow circle, Sector of circle, Sector of Hollow circle circular, Semi circle, Cube prism, Square prism, general prism, Cylinders, Sphere, Hollow sphere segment of sphere, Zone of a sphere, Cones pyramids, Frustum of a pyramid, Frustum of a cone.

2. ESTIMATION OF TIME FOR DIFFERENT MACHINING OPERATIONS:

Turning, Facing, Chamfering, Knurling, Taper Turning, Threading, Drilling, Boring, Shaping and planing, Milling, Broaching, Simple problems pertaining to above.

3.6 METROLOGY AND MEASURING INSTRUMENTS

L	T	P
3	1	3

Rationale :

Measuring is the very basis of every decision making activity. How should we measure is a matter of still more importance. Metrology is the philosphy of subject and measuring instruments are means. Both are equally improtant for engineer's at every stage of their work pursuit. The paper aims to enable the student to envisage such aspecets of the job at hand.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction	6	-	-
2.	Principle & Classifications of Measuring Instruments	9	3	-
3.	Transducers	6	2	-
4.	Comparators	9	3	-
5.	Surface Finish	6	2	-
6.	Various Types of Instruments Used For	12	4	-
i. a.	Physical Measurement			
b.	Liquid Level & Viscosity			
ii.	Mechanical Quantities			
7.	Temperature Measurement	6	2	-
8.	Special Measuring Devivces	6	2	-
9.	Measurement of Vibrations	6	2	-
10.	Inspection of Geometrical Errors	9	3	-
		75	25	75

DETAILED CONTENTS

1. INTRODUCTION:

Meaining and scope of metrology in field of engineering. standards and types of mesaurements (Line and Wave length, Primary, Secondary and Tertiary measurement concept only). Limits, Fits and Tolerances. Interchangeability, precision and accuracy, Sources of error.

2. PRINCIPLES AND CLASSIFICATIONS OF MEASURING INSTRUMENTS:

(A) Principle of Mechanical Measuring Instruments:

Lever method, vernier method, screw and screwnut method, compound gearing and helical spring methods.

(B) Principles of Optical Instruments:

Reflection, Refraction, Interference, Polarisation, Optical prisms, Lenses and Optical projection (Magnification)

(C) Principle of Electrical measuring instruments

(D) Principle of Hydraulic and Pneumatic Instruments.

3. TRANSDUCERS:

Definition, various types of transducers such as resistive, capacitive, inductive, electromagnetic, photo electric, piezo electric and their use in instrumentation.

4. COMPARATORS:

General principles of constructions, balancing and graduation of measuring instruments, characteristics of comparators, use of comparators, difference between comparators, limit gauges and measuring instruments. Classification of comprators, construction and working of dial indicator, johanssen "Mikrokator", read type mechanical comparator, mechnical-optical, zeiss optotest, electro limit, electromechanical, electronics, penumatic comparators, gauges, tool makers microscope.

5. SURFACE FINISH:

Geometrical characteristics of surface roughness- Wavyness. Lay, flaws. Effect of surface quality on its functional properties. Factor affecting the surface finish. Drafting symbols for surface roughness.Evaluation of surface finish. RMS and CLA values. Methods of measuring surface roughness. Qualitative and quantitative methods. Comparison of surfaces produced by common production methods.

6 VARIOUS TYPES OF INSTRUMENTS USED FOR:

(i) (a) Physical Measurements such as - Length, Depth height, Thickness, Gaps, Curvature , Angle, Taper, Area, Undulations, Surface finish, Thread and Gear measurement.

(b) Liquid Level & Viscosity - Liquid level measuring methods and devices Viscometer - Plate and Cone viscometer, Two float viscometer, Rheo viscometer.

(ii) Mechanical Quantities :

(a) Displacement, velocity, acceleration, speed, torque-Use of transducers and electronic counters, stroboscope, vibrating reeds and technometers.

(b) Pressure and Vacuum - Idea of atmospheric pressure, Gauge pressure and vacuum - Use of instruments such as manometers and pressure gauge using elastic elements such as diaphragm, Capsule, Bellows, Bourdon tube and various transducers and thermo couple, vacuum gauges.

(c) Strain Gauge - Use of strain gauge and loadcells.

7. TEMPERATURE MEASUREMENT:

Various types of thermometers, thermocouples, pyrometers (Radiation and optical type both).

8. SPECIAL MEASURING DEVICES:

Computerised 3-D measuring machine (Working Only).

9. MEASUREMENT OF VIBRATIONS:

Use of siesmic Accelerometer, Potentio metric type and L. V. D. T. type, Piezoelectric type accelerometer.

10. INSPECTION OF GEOMETRICAL ERRORS:

Construction and working of auto collimeter, checking of straightness, flatness, squareness and parallelism, circularity (By dialgauge and telerod).

3.7 ENVIRONMENTAL EDUCATION & DISASTER MANAGEMENT

L	T	P
2	-	-

RATIONALE:

A diplima student must have the knowledge of different types of pollution caused due to industrialisation and construction activities, so as he may help in balancing of eco-system and control pollution by providing controlling measures. They should be also aware of the environmental laws for effectively controlling the pollution of environment. The topics are to be taught in light of legislation Para-3.

TOPIC WISE DISTRIBUTION OF PERIODS:

SL. NO.	TOPIC	L	T	P
1.	Introduction	6		
2.	Pollution	3		
2.1	Water Pollution	8		
2.2	Air Pollution	8		
2.3	Noise Pollution	3		
2.4	Radio Active Pollution	4		
2.5	Solid Waste Management	5		
3.	Legislations	3		
4.	Environmental Impact Assessment	4		
5.	Disaster Management	6		
	TOTAL	50	-	-

DETAILED CONTENTS

1. INTRODUCTION :

- Basics of ecology, Ecosystem, Biodiversity Human activities and its effect on ecology and eco system, different development i.e. irrigration, urbanization, road development and other engineering activities and their effects on ecology and eco system, Mining and deforestation and their effects.

- Lowering of water level , Urbanization.

- Biodegradation and Biodegradibility, composting, bio remediation, Microbes .Use of biopesticidies and biofungicides.

- Global warning concerns, Ozone layer depletion, Green house effect, Acid rain,etc.

2. POLLUTION :
Sources of pollution, natural and man made, their effects on living environments and related legislation.

2.1 WATER POLLUTION :

- Factors contributing water pollution and their effect.

- Domestic waste water and industrial waste water. Heavy metals, microbes and leaching metal.

- Physical, Chemical and Biological Characteristics of waste water.

- Indian Standards for qulity of drinking water.

- Indian Standards for quality of treated waste water.

- Treatment methods of effluent (domestic waste water and industrial/ mining waste water), its reuse/safe disposal.

2.2 AIR POLLUTION :

Definition of Air pollution, types of air pollutants i.e. SPM, NOX, SOX, GO, CO2, NH3, F, CL, causes and its effects on the environment.

- Monitoring and control of air pollutants, Control measures techniques. Introductory Idea of control equipment in industries i.e.

A. Settling chambers
B. Cyclones
C. Scrubbers (Dry and Wet)
D. Multi Clones
E. Electro Static Precipitations
F. Bog Fillers.

- Ambient air qulaity measurement and their standards.

- Process and domestic emission control

- Vehicular Pollution and Its control with special emphasis of Euro-I, Euro-II, Euro-III and Euro IV.

2.3 NOISE POLLUTION :

Sources of noise pollution, its effect and control.

2.4 RADISACTIVE POLLUTION :

Sources and its effect on human, animal, plant and material, means to control and preventive measures.

2.5 SOLID WASTE MANAGEMENT :

Municipal solid waste, Biomedical waste, Industrial and Hazardous waste, Plastic waste and its management.

3. 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.

4. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) :

- Basic concepts, objective and methodology of EIA.

- Objectives and requirement of Environmental Management System (ISO-14000) (An Introduction).

5. 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 benifit 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.

3.8 METROLOGY LAB

1. Measurement of angle with the help of sine bar/vernier Bevel protractor.

2. Study and sketch of various types of optical projectors.

3. Use of comparators for measurement

4. To measure the diameter of a hole with the help of precision balls.

5. Measurement of Taper by standard balls and rollers.

6. To test the squareness of a component with autocollimeter.

7. To measure the pitch, angle and form of thread of a screw.

8. Measurement of gear elements by using gear tooth vernier.

9. To measure the straightness of the edge of a component with the help of autocollimeter.

10. Use of linear measuring instrument such as vernior calliper and micrometer.

11. Use of height gauge and vernier collipers.

12. Calibration of vernier callipers/micrometers with slip gauge.

13. Calibration of height gauge/depth gauge with slip gauge.

14. Measurement of Thread Parameter by using tool maker's microscope.

15. Use of slip gauge in measurement of centre distance between two pin.

16. Checking of accuracy of a plug gauge with micrometer.

17. Measurement of surface roughness of a surface.

18. Use of feeler, wire, radius and fillet gauges for checking of standard parameters.

NOTE:
Institute is at liverty to develop and conduct practical according availability of items to be measured by the instrument. Every year the items to be measured, shall be chage to perform practical so that the repeatation may be avioded. The student shall conduct and tabulate the experiments individually and teachers will evaluate each student.

3.9 MECHANICAL WORKSHOP (WORKSHOP PRACTICE)

ONLY FOR SPECILIZATION IN PRODUCTION, REPAIR AND MAINTENANCE, REFRIGERATION AND AIR CONDITIONING AND COMPUTER AIDED DESIGN

NOTE:

At least Four jobs against jobs at No. 1. Two jobs against jobs at No. 2A and 2 jobs against jobs at No 2B. Four jobs against at No. 3.

1. MAKING UTILITY JOBS ON LATHE INVOLVING:

(a)	Step turning, Parallel Turning, Taper turning and Knurling	2 jobs
(b)	Drilling, Boring, Counter boring and Internal taper turning under cutting, Chamfering & Facing.	2 jobs
(c)	V. thread cutting (Internal and External)	2 jobs
(d)	Square thread Cutting (internal and external)	1 jobs
(e)	Multistart thread cutting	1 jobs
(f)	Eccentric Turning.	2 jobs
(g)	Study & Operate CNC trainer lathe & prepare a stud of given specification.	1 job
(h)	Study & operate Turret/Capstan lathe to prepare a plug gauge & finish it to given specification on cylindrical grinder.	2 jobs

Note:

Students be giving opportunity to try their hands for these exercises on capstan/turret & CNC trainer lathe also.

2A. MAKING UTILITY JOBS ON :

(i)	Planer - Planing of C.I Block & finish it on suface grinder to given specification.	1 job
(ii)	Shaper - 'V' Block of different size	1 job
(iii)	Slotter- Key Way Cutting	1 job
(iv)	Tool & Cutter Grinder	
	(a) To Grind Lathe Tools (All Angles)	1 job
	(b) To Grind A Shaper/Planer Tools	1 job
	(c) To Grind A Drill Bit	1 job

B. GROUP WORK ON MILLING MACHINE INVOLVING DOWN AND CLIMB MILLING:

(a)	Slab Milling	
(b)	Straddle Milling	2 job.
(c)	Gang Milling.	1 job.
(d)	Spur Gear Cutting	1 job.
(e)	Groove Cutting(Dovetail,Square,T-slot and Radious)	1 Job

3. FITTING SHOP:

(a)	To make different types of keys	3 job.
(b)	To make template gauge	2 job.
(c)	To make limit gauge (Plate shape)	2 job.
(d)	Making male and female fitting jobs	3 job.

NOTE:
For examination student should be allowed to pickup a job from any of the three groups by lottory system and be examined orally for all the three groups

3.9 AUTOMOBILE SHOP

ONLY FOR SPECILIZATION IN AUTOMOBILE ENGINEERING

1. Study and sketch of hand tools different gauges and their use.

2. Automobile engine cylinder boring practice.

3. Valve face grinding, tapping and reaming of valve guide.

4. Light vechile brake drum turning practice.

5. Nozzle cleaning, testing and adruotment.

6. Assemble and deassemble of petrol and diesel engine of an automobile vechile.

7. Setting a regulator of cut out and testing of dynamo and rectify its minor repairs.

8. Phasing and calibrotion of diesel fuel injection pump.

9. Engine tuning of an automobile engine.

10. Checking and adjusting a clutch pedal play and brake pedal play, tightness of fan belt and brake shoe.

11. Checking and overhandling of car radiator.

12. Automobile engine cylinder honing practice.

13. Overhandling of hydraulic brake system.

14. Measuring spark plug gap, valve clearance and ring clearance, grinding and lapping operation for adjustment.

15. Care and servicing of following Air conditioning components for automibile vehicle

    i. Autocontrol unit
    ii. Temperature control unit
    iii. Soleniod valve
    iv. Expansion valve
    v. Relays

Elective Group A

3.10PRODUCTION TECHNOLOGY-I

L	T	P
2	1	-

Rationale :

The developments in manufacturing processes can not be ignored in the context of all around developments. An engineer must update himself to stand the demand of the time. the paper aims to introduce the students with such developments.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Introduction	1	-	-
2.	Metal Forming Processes	12	6	-
a.	Forging			
b.	Rolling			
c.	Press Forming			
d.	Drawing, Extrusion			
e.	Energy Forming Techniques			
3.	Conventional Metal Cutting Processes	12	6	-
4.	Metal Finishing Processes	5	3	-
5.	Surface Treatment and Finishing	2	1	-
6.	Plant maintenance			
	(a) Maintenance	14	7	
	(b) Organisation	4	2	
		50	25	-

DETAILED CONTENTS

1. INTRODUCTION:

Concept of manufacturing processes, classification and application.

2. METAL FORMING PROCESSES:

(a) FORGING:

Hammer forging, drop-forging, dies for drop-forging, drop hammers, press forging, forging machines or up setters, forging tools, forging defects and remedies. Concept of losses in forging operation, estimation of

stock required for hand forging considering scale and shear losses

(b) ROLLING:

Elementary theory of rolling, hot and cold rolling, types of rolling mills, rolling defects and remedies.

(c) PRESS FORMING:

Types of presses, working, selection of press dies, die-material. Press operation-Shearing, piercing trimming, shaving, notching guering or rubber forming, embossing, stamping, punching.

(d) Drawing, extrusion, pipe and tube drawing.

(e) Energy forming technique - Explosive forming, electromagnetic forming.

3. CONVENTIONAL METAL CUTTING PROCESSES:

(a) Gear manufacturing process- Gear hobbing, gear shaping gear shaving, gear generating, gear burnishing, forming 'V' generator, straight bevel gear manufacturing, spiral bevel gear manufacturing.

(b) External threading process-Roll threads,thread milling, thread grinding, thread rolling, thread chasing, Die heads.

(c) Machining of cylinderical holes - Multiple spindle drill press, gang drill press, drilling deep holes and small diameter holes, boring, coordiante method of locating holes, Jig boring machine.

4. METAL FINISHING PROCESS:

Grinding Process, Diamond machining, Honing, Lapping, Super finishing, Polishing and buffing.

5. SURFACE TREATMENT & FINISHING:

Meaning of the terms surface treatment and its purpose. Elecments of surface treatment cleaning protecting, Colouring, Altering surface properties.

Surface Treatment Processes- Wire brushing. Belt sanding. Alkaline cleaning, Vapour degreasing. Pickling. Ultrasonic cleaning. Solvent cleaning. Painting application by dipping. Hand spraying. Automatic spraying. Electrostatic spray finishing. Electrocoating. Hot dip coating. Phosphate coating- Packerising and Bondersing. Buffing. Blackening, Anodising. Electro Nickle Plating. Nickle carbide plating. Sputtering.

6. Plant Maintenance

(A) Maintenance: maintenance definition, scope of maintenance, maintenance strategies, economics and performance measures, objective of maintenance, concepts of general approach to eliminate Losses, classification of maintenance-corrective, scheduled, preventive, predictive and productive maintenance. common techniques to monitor the conditions of systems-vibration based, radiographic, thermographic, ferro graphic, computer based diagnosis etc, forms of wear, wear on guide surfaces, breakdown and remedies of machine tools, repair cycle, installation and maintenance of machine tools, PERTin maintenance.

(B) Organisation-Objective of maintenance organisation,function and duties of maintenance department,inspections and scheduling,routine-servicing and scheduled repair,maintenance planning,concepts of maintenance mainagement.

3.11 PRODUCTION TECHNOLOGY-II

L	T	P
2	1	3

Rationale :

Knowledge of Production Technology for a production engineer is like water to a fish. The paper aims to initiate the student to its primary level.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Production Machine Tools	6	3	Prod-
2.	Unconventional Machining Processes	14	7	ucti-
3.	Production of Plastics	6	3	lab
4.	Cutting Tools For Machining	6	3	Prac-
5.	Press Tools	6	3	toce
6.	Modern Concept of Quality Control	6	3	-
		50	25	75

DETAILED CONTENTS

1. PRODUCTION MACHINE TOOLS:

Machine tools used for quantity production. Semi automatic multitools centre lathe. Autolathes: Single spindle automatics. Slilding head types. Single spindle automatics. Multispindle automatics, Ultra high speed machining. External centrelss grinding. Internal centerless grinding. Machinical copying systems. Hydraulic servo copying systems for lathe. Electric copying systems, special purpose machines - Brake Drum Turning Lathe

2. Unconventional Machining Processes-

(A) MECHANICAL PROCESS-

(i) Abrasive Jet Machining (A.J.M.):Fundamental principles,basic mechanisms of material removal,application & process.

(ii) Ultrasonic machining(U.S.M):Fundamental Principles,basic mechanism of material removal application,uses & its limitations.

(B) CHEMICAL MACHINING: Introduction, fundamental principles, process & its advantages & limitations.

(C) ELECTRO CHEMICAL PROCESS:

(i) Electrochemical machining(E.C.M.):Fundamental, principles,

basic mechanism of material removal, application, uses and its limitations.

(D) ELECTRIC DISCHARGE MACHINING (E.D.M.):Fundamental principles, basic mechanism of metal removal,application & its limitations.

(E) LASER BEAM MACHINING(L.B.M.):Fundamental principles, basic mechanism of material removal,uses & its applications.

(F) ELECTRON BEAM MACHINING(E.B.M.)Fundamental principles,basic mechanism of material removal,uses & its applications.

(G) PLASMA ARC MACHINING(P.A.M):Fundamental,principle,badic mechanism of material removal.uses and its application.

3. PRODUCTION OF PLASTICS:

Polymers. Thermo plastics. Moulding of thermoplastic. Extrusion process. Sheet forming process. Machining of thermoplastics. Thermosetting Plastics. Moulding of Thermosetting plastics. Machining of thermosetting plastics. Other processing methods for plastics. Plastic component design. Mould design.

4. CUTTING TOOLS FOR MACHINING:

Elementtry theory of metal cutting, Single point tools- Basic angles. Chip formation and their classification,basic mechanism of chip formation,geometry of chip formation,forces on chip. Effect of manipulating factors such as velocity, size of cut, effect of tool geometry, Specific power consumption. Tool material. Tool wear and Tool life. Tailor's tool life equation. Machining economics.

Properties of tool materials. Tool materials. Tool steels. High speed steel. Cast cobalt alloys. Carbides or cintered carbide. Ceramics. UCON.

Surface treatment of cutting tools- Its advantage. Tin coated high speed steel, diamonds, Cubic boron nitrides.

5. PRESS TOOLS:

Elements of Press tools, Factors affecting press tool design. Shearing. Bending. and Drawing operation. Combiniation. Progression and compound die. Rubber die forming.

6. MODERN CONCEPT OF QUALITY CONTROL :

Do it right first time, Just in time (JIT), Process Control, ZD production (Zero Defect Production).

3.12 PRODUCTION AUTOMATION

L	T	P
2	1	-

Rationale :

The automation in industrial manufacturing has always been a dream to the persons involved since the very onset of the process of industrialisation. The progess has been so fast that today almost every process is automatic or can be made so. Advent of computers has added another dimension to the process. It will not ne inappropriate if we call it "Computer Era". So it is imperative to give young engineers some awareness of the situation. Hence the paper.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	General	4	2	-
2.	Fundamentals of Manufacturing & Automation	10	5	- -
3.	Production Economics	4	2	-
4.	High volume Production System	12	6	-
5.	Assembly System & Line Balancing	4	2	-
6.	Automated Assembly System	8	4	-
7.	Numerical Control Production System	4	2	-
8.	N.C. Part Programming	4	2	-
		50	25	-

DETAILED CONTENTS

1. GENERAL:

Automation-Definition, Scope, its types and their merits, Reasons for automation. Its appreciation and crticism. Introductory Idea and meaning of the terms CNC, DNC, Adaptive control, FMS & CIM and machining centre. Current trends in NC, CAD, CAM. Introduction to Robotics.

2. FUNDAMENTALS OF MANUFACTURING AND AUTOMATION:

Types of Industries- Manufacturing, Processing; Basic producers, Converter, Fabricators.

Manufacturing-Functions- Processing- Basic processing, Secondary processing; Operations enhancing physical properties and finishing operations; Assembly, Material

handling and Storage; Inspection and test and control, their meaning with automation point of view.

Manufacturing Process Inputs- Raw materials, Equipments (Machine tools), Tooling and fixtures, Energy and Labour. Outputs- Finished product and Scrap/Waste. Plant Layout- Its meaning and concept of fixed position layout, Process layout, Product layout and Group technology layout. Organisation and Information Processing Business functions, Product design, Manufacturing planning and Manufacturing control.

Production Concept- Such as-Manufacturing Lead Time (MLT), Prodcution rate, Components of Operation Time, Production Capacity (PC), Utilisation and availability, Work in Process (WIP), Time in Plant (Tip), WIP Ratio, Tip ratio, their meaning and significance. Simple numerical problems.

Automation Strategies and Their Effect- Specification of operation, Combined operations, Simultaneous operations, Integration operations, Increase flexibility, Improved materal handling and storage, on-line inspection, process control and optimization, Plant operation control, Computer integrated manufacturing.

3. PRODUCTION ECONOMICS:

Methods evaluating investment alternatives, Constraints in manufacturing, Break Even Analyis, Unit Cost of Production, Cost of manufacturing lead time and work in process.

4. HIGH VOLUME PRODUCTION SYSTEMS:

Type of production,types of layout, economic justification of transfer machines, Detroit type automation meaning, concepts of different flow lines for automatic loading and transferring, buffer storage, automatic inspection, tools servicing, design and fabrication considerations, auto sizing, mechanical calipers for turning operation,pneumatic sizing of external cylindrical ground work, in process gauging of internal cylindrical ground work, pneumatic slide position measuring device, digital slide position measuring device, autosizing for centre less grinding, friction roller, optical measurment. Methods of work part transport, Transfer mechanism, Buffer storage, Automation for manufacturing operations, Design of fabrication considerations.

5. ASSEMBLY SYSTEM AND LINE BALANCING:

The assembly process, Assembly system, Manual assembly lines, Line balancing problems. Computerised line balancing methods. Other ways to improve the line balancing, flexible manual assembly line, Partial Automation.

6. AUTOMATED ASSEMBLY SYSTEMS:

Design for automated assembly, Types of automated assembly systems, Parts feeding devices, Part orienting devices, Feed tracks, Escapements and Part placing mechanism, Role of industrial robot in automatic assembly.

7. NUMERICAL CONTROL PRODUCTION SYSTEM:

Numerical machine Tool, Binary System, Coordinate system and Machine motions, Types of N.C. systems, Machine tool applications, Economics of NCS.

8. N.C. PART PROGRAMMING:

Tape and Tape format, Methods of N. C. part porgramming, Computer assisted part programming, The APT Language, Manual data inputs, N. C. part programming using CAD/CAM,use of computer as support in design and manufacturing, Case study.

3.13 PRODUCTION TECHNOLOGY LAB

1. Inspection of casting

   (a) Flange of pipe
   (b) Pulley
   (c) Gear blank
   (d) Bush

2. Turning, boring, internal threading of cost iron flange.
3. Marking and drilling holes in cost iron flange 75 mm. size pipe.

4. Boring hole in cast iron pully and cutting key way slot.

5. Turning bottom shaft of cycle and milling cotter slot.

6. Turning hub axle of cycles.

7. Turning and internal threading of cone of cycle.

8. Turning bearing races and cups of cycle.

9. Turning plug gauge.

10. Case hardening of

    (a) Plug gauge
    (b) Bottom saft of cycle
    (c) Gear

11. Gear milling, internal hole boring, key way slot cutting for auto (scooter/jeep/truck/gear box).

12. Milling of snap gauge plate.

13. Inspection practices

    (a) Flange after each operation.
    (b) Pully after each operation.
    (c) Gear after each operation.
    (d) Gauges after each operation.
    (e) Cycle parts after each operation.

14. Hardness testing.

15. Cr, Plating.

16. Packing practices.

17. Few examples as case study such as schedule for complete overhaul of centre lathe,reciprocal or centrifugal pumps and compressor etc giving work distribution,planning repair estimate.

18. Heat treatment of small tools, coining tools and forgining dies.

3.14 PROJECT

The project paper will be of two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and invironmental pollution control.

PART-A(For Spl. in Production Engineering Only):

Four problems on design and drawing of simple machine/machine parts and preparing project report for loan to establish small scale industry to fabricate the item designed. A few examples of such items are given below. Bench Vice, Small centrifugal pump, Screw jack, Hand Shearing Machine, Hand blower, Main Switch outer casing (Cost Iron), Stepped Motor Pulley, Biogas Plant, Smoke Less Chulha, Hand Operated Grinder/Juicer, Agricultural Implements, Material Handling Equipments for small scale industry. Solar Cooker or any other simple items of general utility or industrial use.

PART-B:

The student Will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygenic conditions, Education facilities and various programmes/projects running for the development and the personnels and agencies involved in the work. He will also make observation on environmental pollution and ecological disturbunces and will make a mention of that in his report with its reason, suggesting remedies or ways to minimise it. Without it the project will not be taken as complete. The student will also do some constructive work for pollution control as advised by the guiding teacher

Student will choose any one of the problems from Part(A) and Part(B) is compulsary for all students. The students can be divided into groups of threes to do one problem. The students will be examined for 100 marks by an examiner appointed by B.T.E, U.P.

1.	Examination Marks		100
	Part A:-		
	Project Work	50	
	Viva Voce	25	
	Part B:-		
	Project Work	15	
	Viva Voce	10	
	Sessional Marks	50	50
	Total	150	150

3.15 FIELD EXPOSURE- II

Industrial Training

(See Annexure-II)

Elective Group B

3.10 AUTOMOBILE ENGINE

L	T	P
2	1	3

Rationale :

The development of automobile industry and direct or indirect dependence of the present day society on the services of its products has made the knowledge of this technology imperative. The paper deals with power unit part of automotive need.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P	
1.	General Concept of Automobile	5	2		Auto-
2.	Choice of Power Unit For An Automobile	6	3		mobi-le
3.	I.C. Engine	8	4		Engg.
4.	Fuel Supply & Ignition System				Lab.
i.	Petrol Engine	8	4	-	
ii.	Diesel Engine	8	4	-	
5.	Cooling System	7	4	-	
6.	Lubrication System of Automobile Engines	8	4	-	
		50	25	75	

DETAILED CONTENTS

1. GENERAL CONCEPT OF AUTOMOBILES:

Their classification name and make of some India made automobiles. Layout of chasis. Meaning of the terms : Front wheel drive, Rear wheel drive, Four wheel drive, Front and Rear wheeled vechicles. Basic requirements of an automobile.study of specifications of different engines used in Indian vehicles.

2. CHOICE OF POWER UNIT FOR AN AUTOMOBILE:

Torque and power requirements of an automobile in various conditious. Torque characteristics of some power units such as Gas turbine, Electric motor and I.C. engine; their suitability to automobile needs. Draw back of I.C. engine to

meet these needs. Measures taken to make it sutiable to these needs.

3. I.C. ENGINE:

Multicylinder engine, Construction and materical of its Piston and Connecting rod Assembly; Crank shaft, Fly wheel and Bearings; Engine volve and Valve operating mechanism (Cam shaft, Valve timing gears, Tappet, Push rod, Rocker and Valve springs).
Advantage of multicylinder engine for automobiles use, Firing order, Arrangment of cylinders. Volve positions and disign of combustion chamber cylinder head and gasket.

Wankle rotary engine. Idea of super charging, its advantages phenominon of knocking or detonation, its cause and effect on engine. Octane number and cetane number.

4. FUEL SUPPLY AND IGNITION SYSTEM:

(i) PETROL ENGINE:

Fuel supply circuit components (fuel tank to engine), their function. Exhaust pipe and silencer. Construction and working of mechanical and electrical fuel pumps, curburettor, its function. Simple carburettor, its limitations. Modified carburettor-Zenith, Carter, Solex and S.U. carburettors, their construction and working. Curburettor Controls-Throttle, Choke (Conventional, Automatic). Airfuel ratio, its variation with speed. Magneto and Coil Ignition Systems-Working of coil ignition system for multicylinder engine and electornic ignition system, Ignition timing, Ignition advance and retard-Their need and factors on which they depend.

Spark Plugs-their types as used in automobile engines. Location of spark plug.

(ii) DIESEL ENGINE:

Fuel supply circuit for Diesel engine, Primary and secondary fuel filter, their positioning in the circuit. Construction and working of fuel pump and fuel injection pump. Governer and injector, Solid and Air injection in Diesel engine. Distributor types of diesel injection pump. Turbulence in filters wet and dry types. Inlet and exhaust mani folds arrangement. Exhaust pipe and silencer.Concept of fuel energy saving.

(iii)MULTI POINT FUEL SUPPLY FOR PETROL ENGINE :

Construction, Fuel Supply system and working

(iv) Introduction to other fuels - CNG, Battery, etc.

5. COOLING SYSTEM:

Necessity for cooling the engine Air cooling, Shapes of cooling fins. Field of application for air cooling. Water Cooling- Thermosyphon system, Pump circulated water cooling system. Details of water cooling system-Water jackets, Hose, radiators and fans. Thermostat, Water pump and pressure type radiator cap, Anti freeze and anti corrosive additives. Engine cooling liquids other than water and their characteristics.

6. LUBRICATION SYSTEM OF AUTOMOBILE ENGINES:

Principle of lubrication on multicylinder petrol/diesel engine. Types of lubrication systems-Splash type, Pressure type and Combined. Types of lubrication pumps, pump drive, Relief volves, Oil pressure, Oil filters and their location in lubrication system, Crank case ventilation, Crank case dilution.

3.11 AUTOMOBILE TECHNOLOGY

L	T	P
2	1	-

Rationale :

The development of automobile industry and direct or indirect dependence of the present day society on the services of its products has made the knowledge of this technology imperative. The paper deals with automotive needs other than power unit.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
	Automobile technology.			
1.	Auto Transmission System	10	5	
2.	Steering System	4	2	
3.	Braking System	6	3	
4.	Suspension System	4	2	
	Automobile Electrical systems			
5.	Storage Battery	3	1	
6.	Dynamo & Alternator	4	2	
7.	Engine Starting System	4	2	
8.	Automobile Wiring & Lighting System	6	3	
9.	Vehicle Airconditioning	5	3	
10.	Study of specification for different units	4	2	
		50	25	--

DETAILED CONTENTS

1. AUTO TRANSMISSION SYSTEM:

(a) CLUTCH:

Function of clutch in an auto mobile, Construction delail of single plate and multi plate friction clutches, Centrifugal and semicentriufugal clutch. Construction and working of fluid flywheel.

(b) GEAR BOX:

Its function, Assembly detail and working of sliding Mesh, constant mesh, Synchromesh and epicyclic gear boxes. Simple concept of over drive,overrunning clutch,transfer case and torque converter.

(c) PROPELLER SHAFT:

Its function, Universal joint and slip joint, Hotchkiss drive and Torque tube drive.

(d) FINAL DRIVES:

Concept of tail pinion, Crown wheel, Differential type rear axle.

(e) WHEELS AND TYRES:

Sizes of tyres used in Indian vehicles, over inflation, under inflation and their effect. Causes of tyre wear, Tyre retreading, idea of Toe in, Toe out,Camber, Caster, King pin inclination. Advantages of tube less tyres over tyres with tubes. Wheel alignment and balancing, Tyre rotation, Difference between radial and cross ply.

2. STEERING SYSTEM:

Its function, Principle of steering. Ackerman and Devis steering gears, Steering gear types, Worm and nut, Worm and wheel, Worm and roller, Rack and pinion type. Concept of steering system commonly used in Indian Vehicles.Concept of steering locking assembly,introduction to power steering.

3. BRAKING SYSTEM:

Construction details and working of mechanical, Hydraulic and Vaccum brakes,disc brake,air brake,Introduction to power brake. Details of master cylinder, Wheel cylinders , Conceptof brake drum and brake linings and brake adjustment.

4. SUSPENSION SYSTEM:

Function of suspension system. Types of suspension systems, Working of leaf springs, Coil springs. Shock absorbers, Tortion bar suspension and stabilisers. Mac phersion system.

5. Storage Battery:

Storage Battery constructional detail of lead acid cell battery. Specific gravity preparation of electrolyte, effect of temperature, Charging and discharging on specific gravity of electrolyte. Capacity and efficiency of battery. Battery charging from D.C. mains, A.C. mains, Battery charger-Charging circuit, care and maintenance of batteries. Checking of cells for voltage and specific gravity of electrolyte.

6. DYNAMO AND ALTERNATOR:

Introduction to Dynamo and its details, Regulators-Voltage, current and compensated types. Cutout Construction working and their adjustment. Alternators-Construction and working, charging of battery from alternator. Use of battery, dynamo/alternator in an automobile.

7. ENGINE STARTING:

Engine starting circuit, Drive motor and its characteristics, Conditons of starting and behaviour of motor at starting. Starter Drive-Bendix pinion, Torsion, compression, Clutch and sliding armature type. Starter Switch-Mannual, over running, solenoid and vaccum switches. Turbo chrging and inter-cooling.

8. AUTOMOBILE WIRING & LIGHTING SYSTEM:

Earth return and insulated return systems-6 volts, 12 volts and 24 volts systems, Positive and negative earthing,Fuse in circuit, Automobile cabbles-Specifications and colour code.Diagram of a typical wiring systems.

Principle of auto illumination, Lighting requirement-Head lamp mounting and construction, sealed beam lamp, Assymetrical head lights, dip and full beam type bulb, auxillary type lights. Polarised head light, Flesher unit, Warning lights and panel lights. Fore head lamp systems. Other lamps-Pass lamps, Fog lamp, reversing lamps. Switching of lamps. Parking brake,Direction indicators. Electric horns, Revolution counter, Speedometer, Fuel gauge, Pressure gauge, Temperature gauge, Wind screen wipers,stereo system and speaker,introduction to remote sensing devices. Microprocessor control of automoble.

9. Vehicle Airconditioning

Meaning of airconditioning and its applications,brief idea of various type heat loads in vehicles,concepts of room air conditioner,fundamental of comfort air conditioning and its conditions,brief idea of airconditioning cycle and its layout,fundamental and working of compressor magnet clutch,condenser,evaporator,expansion valve, thermo switch, three way solenoid valve, chech valve, fan assembly and air conditioners relay, H.V.A.C.

10. STUDY OF SPECIFICATION FOR DIFFERENT UNITS :

Cluch, Gear Box, Propeller Shaft, Final Drive, Wheel and tyre manufactured in India

3.12 AUTOMOBILE MAINTENANCE, SERVICING & REPAIR

L	T	P
2	1	-

Rationale :

The development of automobile industry and direct or indirect dependence of the present day society on the services of its products has made the knowledge of this technology imperative. The paper deals with automotive needs other than power unit.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Engine Maintenance & Repair	8	4	
2.	Repairing Processes	4	2	
3.	Repair & Maintenance of Radiaor & Lubricating system	4	2	
4.	Chasis repair & Maintenance	6	3	
5.	Electrical System Repair & Maintenance	6	3	
6.	Accessories of Electrical System & their service	6	3	
7.	Tools & Equipment	6	3	
8.	Automobile Pollution & Control	4	2	
9.	Repair and maintenance of Vehicle Air conditioning system.	6	3	
		50	25	-

DETAILED CONTENTS

1. ENGINE MAINTENANCE & REPAIRING :

Maintenance, Maintenance schedule,Routine Maintenance schedule for petrol engine and diesel engine,lubricating chart,cleaning and adjustment,preventive maintenance, trouble shooting for faults in engines. Overhauling of engines, Adjusting the engine timing, Maintenance and adjustment of carburettor and fuel injection pump. Checking the valve clearance and adjustment, valve grinding and lapping, engine tuning, detection and rectfication of faults using compression gauge and vaccum gauge,general methods of predelivery inspection of vehicle.

2. REPAIRING PROCESSES :

Cylinder reboring and resleeving, Removal of liners and fitting, inspection; Repair and fitting of valve and valve guides, checking the connecting rod for bending and connecting rod alignment, inspection of crank shaft for ovality and regrinding, Phasing and calibration of fuel injection pump, nozzle testing, cleaning and grinding.

3. REPAIR AND MAINTENANCE OF RADITOR AND LUBRICATING SYSTEM:

Radiator repair and maintenance, Maintenance of lubricating system, Flushing the lubricating system, Change of used lubricating oils, clearing and fitting of oil filter lubrication of water pump, grades of oils, multi grade oil, additives for improving the quality of oil.

4. CHASIS REPAIR AND MAINTENANCE :

Grease and greasing points requiring greasing, specifications of greases to be used for different parts, repair of tyres and tubes, greasing of wheel bearing, rotating schedule for front and rear tyres, bleeding of brakes, pedal play adjustment in clutch and brakes, adjustment, change of brake lining, testing of brakes, dissembly greasing and recambering of leaf spring.

5. ELECTRICAL SYSTEM REPAIR AND MAINTENANCE :

Starter trouble, shooting and suggesting remedies, removal of starter from engine, repairing the starter, bushes and bushes replacement, checking of armature for short circuit, cleaning of commutators, checking, repairing of starter drive reassembly and testing of starter, dynamo, lubricating the dynamo, changing the bushes, checking and turning the electrical horn.

6. ACCESSORIES OF ELECTRICAL SYSTEM AND THEIR SERVICE :

Wind screen, wiper, electrical horn and relay, cigrette lighter, growler, spark plug cleaner and tester, electrical test bench.

7. TOOLS AND EQUIPMENTS :

Cylinder reboring machine, surface grinder, arbor press, valve seat cutter and grinder, valve refacer crank shaft grinder, engine tune up instruments, feeler gauge, Timing light (Neon light), Tachometer, Spark Plug cleaner micrometer, vernier callipers, cylinder gauge, dial gauge, hydraulic hoist specification and working, car washer specification and working, air compressor specification and utility, screw jack, bearing puller, fuel pump testing and calibration machine, nozzle testing machine, grease guns.

8. AUTOMOBILE POLLUTION & CONTROL :

Source and control of automobile air pollution, causes of automobile pollution and their remedies monitoring and analysis of autoexhaust emission, legislative action, judical response.Introduction to energy conservation.

9. REPAIR AND MAINTENANCE OF VEHICLE AIR CONDITIONING SYSTEM :

Testing and Charging of Air Conditionar, care & maintenance-

electrical components, noise level system, fresh air allowance, primary & secondary circuit, heat exchanger, cooling & dehumidifying coil. Care & servicing-Air control unit, temperature control unit, magnet clutch, condenser,fan assembly, Evaporator, relays, expansion valve, filters and three way solenoid valve. Checking of harness of air conditioning.

3.13 AUTOMOBILE ENGINEERING LAB

1. Study and sketch of

   i. Battery Ignition System
   ii. Magnetic Ignition System

2. Study and sketch of

   i. Head Light Model
   ii. Wiper and Indicator

3. Study and Sketch of

   i. Radiator
   ii. Water Pump
   iii. Oil Pump
   iv. Shock Absorber

4. Study and sketch of

   i. A. C. Pump
   ii. S. V. Pump
   iii. Master Cylinder

5. Study and sketch of

   i. Rear axle
   ii. Differential
   iii. Stearing System
   iv. Bendix Drive

6. Checking and setting of ignition on timing useing timing light for advance and retard

7. Fault finding practice of an automibile vechile foru wheelers(Petrol and Diesel vechile)

8. Driving practice of four wheeler

9. Charging of Automobile battery and measuring cell voltage and specific gravity of electolyte.

10. Determination on of gear ratio of an auto engine tachometer/stroboscope

11. Cleaning and adjustment a carburettor

12. Changing of wheels and checking the alignment of wheels.

AUTOMOBILE SHOP

1. Study and sketch of hand tools different gauges and their use.

2. Automobile engine cylinder boring practice.

3. Valve face grinding, tapping and reaming of valve guide.

4. Light vechile brake drum turning practice.

5. Nozzle cleaning, testing and adruotment.

6. Assemble and deassemble of petrol and diesel engine of an automobile vechile.

7. Setting a regulator of cut out and testing of dynamo and rectify its minor repairs.

8. Phasing and calibrotion of diesel fuel injection pump.

9. Engine tuning of an automobile engine.

10. Checking and adjusting a clutch pedal play and brake pedal play, tightness of fan belt and brake shoe.

11. Checking and overhandling of car radiator.

12. Automobile engine cylinder honing practice.

13. Overhandling of hydraulic brake system.

14. Measuring spark plug gap, valve clearance and ring clearance, grinding and lapping operation for adjustment.

15. Care and servicing of following Air conditioning components for automibile vehicle

    i. Autocontrol unit
    ii. Temperature control unit
    iii. Soleniod valve
    iv. Expansion valve
    v. Relays

3.14 PROJECT

The project paper will be of two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and invironmental pollution control.

For Spl. in Automobile Engineering Only) :

Part-A

Choose any one problem to establish auto workshop. Servicing and repairing of Auto engines (Diesel/Petrol). Reconditioning and overhauling of Diesel and Petrol engine, Phasing and calibration of fuel injection pump and Adjustment of injector, Tyre retreading, Adjustment and repairing of Auto electrical system - Self starter, Dynamo & Cutout, Charging of Battery (Old/New), Cylinder Boring, Turning of Brake Drum, Valve Grinding,remote sensing devices in vehicle,airconditioning installation in vehicles.

PART-B:

The student Will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygenic conditions, Education facilities and various programmes/projects running for the development and the personnels and agencies involved in the work. He will also make observation on environmental pollution and ecological disturbunces and will make a mention of that in his report with its reason, suggesting remedies or ways to minimise it. Without it the project will not be taken as complete. The student will also do some constructive work for pollution control as advised by the guiding teacher

Student will choose any one of the problems from Part(A) and Part(B) is compulsary for all students. The students can be divided into groups of threes to do one problem. The students will be examined for 100 marks by an examiner appointed by B.T.E, U.P.

1.	Examination Marks		100
	Part A:-		
	Project Work	50	
	Viva Voce	25	
	Part B:-		
	Project Work	15	
	Viva Voce	10	
	Sessional Marks	50	50
	Total	150	150

3.15 FIELD EXPOSURE- II

Industrial Training

(See Annexure-II)

ELECTIVE GROUP C

3.10 REFRIGERATION

L	T	P
2	1	3

Rationale :

Refrigeration and Airconditioning is one of the needs of modren society and industry. It is already recognised so as it is futile here to say anything about its improtance or utility. For mechanical engineers this knowledge is an extra gem. The subject has been devided in two papers. This paper covers Refrigeration Plant, Erection and its maintenance.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P	
1.	Refrigeration	3	1	Refri-	
2.	Absorption Refrigeration	4	2	gerat	
3.	Vapour Compression System	4	2	gerat	
4.	Production of Low Temperature(Cryogenics)	4	2	ion &	
5.	Air Cycle Refrigeration	4	2	ion &	
6.	Centrifugal & Steam Jet System	6	3	Air	
7.	Compressors	8	4	itio-	
8.	Condensors	5	3	Lab.	
9.	Refrigerant Flow Controls	6	3	-	
10.	Evaporators & Coolers	6	3	ning	
		50	25	75	

DETAILED CONTENTS

1. REFRIGERATION :

Its meaning and application, Unit of refrigeration, Various methods of refrigeration.

2. ABSORPTION REFERIGERATION:

Basic system, Ammonia system, Improved absorption system, Electrolux refrigerator. Simple problems on basic and improved system.

3. VAPOUR COMPRESSION SYSTEM:

Simple saturated vapour compression cycle, Standard vapour compression cycle, Study of P-h chart and T-S chart, Numerical analysis of vapour compression cycle with P-h and T-S chart, Wet and dry compression, Factor effects the COP of system, Departure of actual vapour compression cycle from Theoritical cycle of vapour compression, By passing of evaporator, Flash chamber, Accumulator, Pre cooler and Sub

cooler, System modification by multi compression and expression, System modification by compound compression with inter cooling, Dual and multi effect compression, Multi load system of refrigeration.

4. PRODUCTION OF LOW TEMPERATURE (CRYOGENICS) :

Methods of low production of low temperature - By vapour compression, By evaporation of liquidified gaes, By expresion gases, By dry ice, By magnetic cooling, Method of production of dry ice, Cascade (Multistage) system, Linde and Claude system for liquidification of different gases, Application of low temperature refrigeration.

5. AIR CYCLE REFERIGERATION:

Ideal air cycle, boot strap system, application. Revered carnot cycle, Bell coleman cycle.Simple numerical problems.

6. CENTRIFUGAL AND STEAM JET SYSTEMS:

Ejectior refrigeration system, Steam jet cycle, Function of basic components of the system-Flash chamber, Pumps, steam nozzles, Float valve with throttle valve, diffuser condenser boiler, Secondary ejectors, Vent analysis of ejector cycle, Nozzle efficiency, Entrainment efficiency, Compression efficiency. Performance, advantages and disadvantages of the system, centrigugal refrigeration. Rotor construction, Stator construction, efficiency of centrifugal compression, capacity control, compressor laws (single impeller efficiency of centrifugal compressor).

7. COMPRESSORS:

Introduction types and classification of compressors.

(a) RECIPROCATING COMPRESSORS:

Construction and arrangement of cylinders, types and construction of piston, Suction and discharge valve (types and construction), Poppet valves, ring plate valves, flexing valves, valve location, Bore and strke relation of a compressor. Construction of cranks, connecting rod, crank shaft seal and gaskets, lubricants, their properties, Lubrication recommendations (Small systems, industrial refrigeration, miscellaneous equipment) methods of lubrication, Liquid refrigerant in compressor crank case. Method of reducing oil foaming at the compressor start.

(b) ROTARY COMPRESSORS:

Construction and working, cylinder construction and fitting rotar construction, blade construction, crank shaft construction, valve construction, crank shaft seal and gaskets. Lubrication of rotary compressors.

(c) CENTRIFUGAL COMPRESSORS:

Construction and working of compressor, sealed unit rufflers and their advantages, hermatic rotary compressors, Regulation of compressor capacity, Starting of compressor, shutting down of a compressor.

(d) COMPRESSOR DRIVES:

Reciprocating compressor Drives, open and hermatic compressor drives, Compressor speed, centrifugal compressors drive. Compressor performance.

8. CONDENSORS:

Definition, type of condensors, air cooled, water cooled and evaporator type.

Air cooled condensors- Natural convection, Mechanically cooled finned tube, Plate type, Wire mesh, induced and forced type, Chesis mounted and remote type, air quantity and velocity for an air cooled condenser and rating and selection of air cooled condensers.

WATER COOLED CONDENSERS:

Waste water system, recirculated water system, Effect of fouling on condensers. Types of water cooled condenser, Double tube, shell and coil and shell and tube. Rating and selection of water cooled condensers, simplfied rating, Blead "Off" and "Drift" make up water. Classification and design of cooling tower. tower efficiency of a cooling tower. Cooling tower rating and selection.

EVAPORATIVE CONDENSERS:

Induced and forced type rating and selection of evaporative condenser. By pass and its advantages, water regulating valves, condenser controls, winter starts, condenser and tower maintenance.

9. REFERIGERANT FLOW CONTROLS:

Type of expansion valves, hand expansion valve, automatic expansion valves, Pressure limiting valve gas charge expansion valve multioutlet valves and distributors, multi out let thermostatic expansion valve, venturi type distributor, pressure drop type.

10. EVAPORATORS AND COOLERS:

Definition, design, over all heat transfer co-efficient, L.M.T.D., Evaporator T.D., Effect of evaporator T.D. on space humidity, other factors of evaporator selection. Types of evaporators, Flooded and dry expansion evaporators. Classification according to type of construction, Bare tube,

Plate surface and finned, Natural convection evaporators. Rating and selection of natural convection evaporators. Forced Convection evaporators rating and selection of unit coolers, liquid chilling evaporators (Chillers), double pipe coolers, advantage, disadvantage, application.

COOLERS(Chillers):

Baudelot coolers, Advantages, Application, Tank type coolers, Advantages, Application, Shells and coil coolers, Advantages, Disadvantages, Application shell and tube chillers, Advantages, Application. A comparative analysis of dry expansion and flooded chillers, chiller selection procedure.

3.11 AIR CONDITIONING

L	T	P
2	1	3

Rationale :

Refrigeration and Airconditioning is one of the needs of modren society and industry. It is already recognised so as it is futile here to say anything about its improtance or utility. For mechanical engineers this knowledge is an extra gem. The subject has been devided in three papers. This paper covers Air Conditioning.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Psychrometry	10	5	-
2.	Comfort Airconditioning	6	3	-
3.	Air conditioning load calculation	8	4	-
4.	Air conditioning system	6	3	-
5.	Heat recovery system and heat pump	4	2	-
6.	Duct design and airdistribution	5	2	-
7.	Air conditioning equipments	7	4	-
8.	Evaporative Cooling	4	2	-
		50	25	75

DETAILED CONTENTS

1. PSYCHOMETRY :

Definition, composition of air, Daltons Law of partial pressure, Gas and vapour mixture, Dry and wet bulb temperature, Wet bulb depression, Dew point, Dew point depression, Salurated air, Humidity (Specific humidity, Absalite humidity, Degree salurated, Relative humidity), Humid specific volume and Humid specific heat, Enthaephy of moist air, Study and use of Psychrometric chart and tables.

Psychrometric Process and Their Methods :

Sensible heating and cooling, Abiabatic cooling, Humidification and Dehumidification, Cooling and Humidification, Colling and Dehumidification, Heating and Humidification, Heat and Dehumidification, Humidificating Effiuency.

Mixing of air streans, Mass fraction of air adually comming in contact with the coils, L.M.T.D., Room sensible, Heat factor, Grand sensible heat factor and effective sinsible

heat factor, Simple numerical problems concering above.

2. COMFORT AIRCONDITIONING :

Fundamentals of confort conditioning, Thermodynamics of a human body, Comfort chart, Effective temperature, Factors governing optimum, Effective temperature, Economic consideration for selecting the comfort point, comfert air conditions recommended far inside design conditions for air conditioning.

3. AIRCONDITIONING LOAD CALCULATIONS :

A. COLLING LOAD CALCULATIONS :

Design conditions for colling space, sensible heat gains in the space - (i) Heat transmission load through building structure in through wall door and windows, Roof and Floor, (ii) Solar radiation heat lock (iii) Infiltration heat load (iv) Occupants heat load (v) Electric appliances heat load (vi) Product cooling load above freezing and below freezing (vii) Outside ventilation air load (viii) Other internal heat soruces. Latent heat gain in the space - (i) Infiltration heat load (ii) Occupants heat load (iii) Product freezing load (iv) Respiration load (v) Miscellaneous items for latent heat load.

B. HEATING LOAD CALCULATIONS :

Sensible heat loss- (i) Heat Transmission loss through building structure (ii) Intiltration heat loss (iii) Product heat loss (iv) Other materials heat loss. Latent Heat loss - (i) Infiltration heat loss (ii) Miscellaneouw items for latent heat loss.

Auxillary heat soruce, Net heating capacity, Intermittently heat building.

4. AIR CONDITIONING SYSTEM :

1. Unit airconditoning system (Window air conditioning system), Remote and split air conditioners.

2. Package air conditioning system

i. Package A.C. with water cooled condenser
ii. Package A.C. with air cooled condenser

3. Central Air conditioning system

i. D.X system with air handling unit
ii. Chilled and Hot water system with fan coil unit.

5. HEAT RECOVERY SYSTEM AND HEAT PUMP :

1. Hot gas heat reclaim with desuperheter
2. Heat recovery with parallel condensers

3. Heat well, Basic principle of heat pumb, Heat saurce and sink, Handling of peak heating loads. Application of heat pump, co-efficient of performance of heat.

6. FLUID FLOW, DUCT DESIGN AND AIR DISTRIBUTION SYSTEM :

Pressure drop through duct, conversion from circular section to rectangular section duct design - Equal friction loss (Pressure drop) method, Tthe Static Regain Method, Velocity Reduction Method, Advantages and disadvantages of the above methods.

AIR DISTRIBUTION SYSTEM :

Duct System - the perimeter system, Perimeter loops system and radial perimeter system.

EXTENDED PLENUM SYSTEM :

Different methods of air distribution

7. AIR CONDITIONING EQUIPMENTS :

Air condaninants, Purpose and methods of air cleaning, Different types of air filters and humidifiers, Fans and Blowers, grills and registers.

AIR FILTERS :

Dry filter, Viscous filter, Wet filters, Contrifugal dust callector, Electric filter.

HUMIDIFIERS :

Steam humidifier, Atomization, Type humidifiers , Forced Evaporation humidifier, Air washer humidifier capillary type humidifier

FAN AND BLOWERS :

(i) Axil flow (ii) Radial flow fan, Fan laws, Selection of fan.

8. EVAPORATICE COOLING :

Evaporature colling - Thermodynamics of evaporative cooling, Types of evaparative collers - Spray type, Pad type, Rotating type, Efficiency of evaporative cooling, Limitation of evaporative cooling, Indirector, Modified evaporative cooling system.

3.12 REFRIGERATION PLANT, ERRECTION AND SERVICING

L	T	P
2	1	-

Rationale :

Refrigeration and Airconditioning is one of the needs of modren society and industry. It is already recognised so as it is futile here to say anything about its improtance or utility. For mechanical engineers this knowledge is an extra gem. The subject has been devided in three papers. This paper covers service and maintenance of Refrigeration and Air conditioning Plant.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage Time L	T	P
1.	Study and sketch of important servicing tools and equipment	6	3	-
2.	Refrigerant and water piping	3	2	-
3.	Installation of Refrigeration and A.C Machine	3	1	-
4.	Errection Refrigeeration Plant	4	2	-
5.	Commissioning of Plant	6	3	-
6.	Operation and Routine Maintenance	4	2	-
7.	Preventiue Maintenance, Service and Trouble Shooting	12	6	-
8.	Maintenance, servicing and Over Handling Refrigeration Plants Equipment	12	6	-
		50	25	

DETAILED CONTENTS

1. IMPORTANT SERVICING TOOLS AND EQUIPMENTS :

A. Tube Cutter
B. Flaring Tools
C. Bending Tool
D. Swaging Tool
E. Pinching Tool
F. Pressure Guage
G. Ratchet Valve Key
H. Electronic - Leak Detector
I. Gauage Maine Fald
J. Refrigerant Charging Station.

2. REFRIGERANT AND WATER PIPING :

Refrigerant piping, Refrigerant tubing, Different flare fitting and their use water piping and different pipe fitting, Pipe and Tube joints - Permanent Joint and

temparary Joint in Pipe work and Tube work.

3. INSTALLATION OF REFRIGERATION AND AC MACHINE :

Refrigerator, Water Coolers, Window A.C. (Split Type), Package A.C. (Water cooled and Air Cooled), Air handling, Unit (A.H.U.), Fan Coil Unit (F.C.U.)

4. ERRECTION OF REFRIGERATION PLANT :

Need based layout of refrigeration plant, Installation of different compounts of the refrigeration plant, Errection of the plant, Errection of duct and grills, Precaution in installation and errection.

5. COMMISSIONING OF PLANT :

Testing of refrigerating and Air conditioning, Domestic machines such as refrigerator water cooler, Window A.C. and Plackage unit. Evacuation, Dehydration and Reftigerant charging of above machines. Testing of commercial refrigeration plant, Evacuation, Dehydration and charging (refrigerant and Oil) of the plant.

6. OPERATION AND ROUTINE MAINTENACE :

Operating procedures, Starting sequences and impartance/significance of each step, Stopping sequence, Routine maintenance, Some toutines service operations - Pumping down, Pumping out the refrigerant, reprigerint charging, purging of non condensable gases.

7. PREVENTIUE MAINTENANCE, SERVICE AND TROUBLE SHOOTING :

Preventure maintenance - Anticipation of failure, operating, Plant at design efficiency. Reduction of valumetric efficiency of compressor, Reasons for increase in discharge pressure, Preventive steps, Reasons far reduction in suction pressure, Preventive steps, Increase of clearance valume of compressor, Preventive maintenance suction vapour super heating, Checking efficiency of condenser, Descaling of condenser water tubes, Evaporator- Preventive steps, Reduction in heat tromster effiency, Excess oil in the system, Electrical circuits and control trouble shooting.

8. MAINTENANCE, SERVICING AND OVERHAULING OF REFRIGERATION PLANTS EQUIPMENTS :

Servicing and overhauling of compressor sych as - Reciprocating, rotory, Centrifugal and hermateic sealed compressor unit. Maintenance of reciver, Humiclifier pump, Fan and filters, repair and maintenance of electrical machines related to the trade (Electric motor Testing), Repair and maintenance of - system controlls such as - Relay (Current and Potential) OLP, Thermostat, High and Low pressure controls, Solenoid valve.

3.13 REFRIGERATION AND AIR CONDITIONING LAB

1. Study and use of different refrigeration tools and equipments.

2. Practice in cutting, Bending, Flaring, Swedging and Brazing, soldering of copper tubes.

3. Study of open type reciprocating compressor used in a refrigeration system.

4. To determine the capacity for window type air conditioner

5 Proper method of setting and adjusting
   i. thermostate
   ii. low pressure and high pressure cutout
   iii. thermostate expersion ball

6. Wiring of refrigerator, water cooler, desert cooler, room air conditioner, packed air conditioner, pannel board.

7. Study of a reciprocating Hermatically Sealed Compressor.

8. Study of electric controls such as - Over Lead Protector, Starting Relay, Potential Relay, thermostat, Solenoil Valve, Humidistat, High Pressure Control and Low Pressure Control.

9. Leat testing, Evacuation, Dehydration and Charging of a Refrigerating machine (Sealed Unit and Open Unit).

10. Study of Refrigerator (Vapour compression and Vapour absorption type).

11. Study of water cooler and calculation of water cooling rate.

12. Study of different refrigerant flow controls.

13. Study of refrigeration trainer and determine its C.O.P.

14. To Find out air properties such as Dry Bulb Temperature, Wet Bulb Temperature, D. P. T., Relative Humidity, Specific Humidity, Specific Valume and Enthapy of air with the half of sling Psychrometer and Psychrometric chart and compare the results thus ontained.

15. Study of window type air conditioner.

16. To find out bypass factor of cooling coil, heating coil.

17. Study of desert cooler and findout its humidifying or cooling efficiency.

18. Study of airconditioning trainer and findout its C.O.P.

19. Out Door Visit :

A. Cold Storage
B. Ice Plant
C. Milk Clilling Plant
D. Cinema Hall
E. Hotel or restaurent
F. Railway A.C. compartment
G. Automobile A.C. System.pa

3.14 PROJECT

The project paper will be of two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and invironmental pollution control.

For Spl. in Refrigeration & Air-conditioning Only :

Part-A

Design a vapor compression refrigeration system (i.e Compressor, Condenser & Evaporator & Control.

To Establish a workshop for repair & maintenance of refrigerators and air-conditioners.

Design air conditioning system for a cinema hall of 2000 persons capacity assume suitable data

Design air conditioning system for a nursing home for 30 beds.

Design air conditioning system for a car.

PART-B:

The student Will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygenic conditions, Education facilities and various programmes/projects running for the development and the personnels and agencies involved in the work. He will also make observation on environmental pollution and ecological disturbunces and will make a mention of that in his report with its reason, suggesting remedies or ways to minimise it. Without it the project will not be taken as complete. The student will also do some constructive work for pollution control as advised by the guiding teacher

Student will choose any one of the problems from Part(A) and Part(B) is compulsary for all students. The students can be divided into groups of threes to do one problem. The students will be examined for 100 marks by an examiner appointed by B.T.E, U.P.

1.	Examination Marks		100
	Part A:-		
	Project Work	50	
	Viva Voce	25	
	Part B:-		
	Project Work	15	
	Viva Voce	10	
	Sessional Marks	50	50
	Total	150	150

3.15 FIELD EXPOSURE- II

Industrial Training

(See Annexure-II)

ELECTIVE GROUP D

3.10 REPAIR & MAINTENANCE - I

L	T	P
3	1	4

Rationale:

Mechanical engineer is need of every industry and in majority of cases he is made responsible for day to day repair and maintenance of parts and over all up keep of the plant for its smooth running. This paper aims to furish them with certain basic considerations related to their work and responsiblity.

TOPIC WISE DISTRIBUTION OF PERIODS

S.No.	UNITS	COVERAGE L	T	TIME P
1.	Introduction	4	2	-
2.	Preventive Maintenance	12	4	-
3.	Maintenance Stages	6	2	-
4.	Sequence of maintenance Operation	8	2	_
5.	Planning & Scheduling of Maintenance work	8	2	_
6.	Materials & Standerd Spares Store	8	2	_
7.	Application of CPM to Maintenance work	12	4	_
8.	Maintenance Personnel Management	6	2	_
9.	Maintenance Mannuals & Reports	6	2	_
10.	Fitters Common Tools	2	1	_
11.	Lubrication & Lubricants	3	2	_
		75	25	100

DETAILED CONTENTS

INTRODUCTION:

Maintenance definition , maintenance department and its functions. Importance of maintenance for productivity and profitability. Maintenance cost, Economic norms for maintenance.

PREVENTIVE MAINTENANCE :

General concept of predictive maintenance , corrective Maintenance, preventive maintenance and their application and work approach - Condition checking , repair cycle, maintenance stages, classification of equipments for repair and their repair complixity (resources wanted in terms of size of maintenance department staff workers, meterialsand spaces, annual repair cost of mechines and percentagebreak downs and resulting effciency etc.), annual and monthly maintenance schedules, man power planning , norms for machine stoppages during preventive maintenance, percentage of equipment to be taken for preventive maintenance of one

go . Norms for Maintenance cost , economic effect of preventive maintenance.

MAINTENANCE STAGES :

Details of work in each stage for diffrent equipments Metal cutting and metail working machine wood working machines, meterial bandling and equipments, Foundary furnaces and various electrical equipments on machines. pumps and air compressores etc.

SEQUENCE OF MAINTENANCE OPRATIONS :

Condition checking, resetting and adjusting with minor repair. Dismentaling its work sequence and rules (Instructions) some examples.cleaning of parts and determinind faults and comparing them with permissible limits by use of suitable instruments and selection of repair method. Prepartion of assembly fitting in, balance of parts , assembly of mechinisms and machines.

PLANNING AND SCHEDULING OF MAINTENANCE WORK :

Work authorisation and control, standard time for maintenance work, work measurement, work simplefication,concept of break down maintenance.

MATERIALS AND STANDARD SPARES STORE

Idea of specfication, use and precurement of Copper/Brass bars tubes, Sheets and wire mech, Babbit, Solder , steel and Bronze wires, Springs steels wires and tapes , Crane rails, pipes and Pipe fittings, bearings, Belts, Chains, Steel balls, Rollers and needles, Hoses and (flexible pipes, Leather and Rubber Sheets, Hylam Sheets, Asbestor Cords and Sheets, Felt, Brake Linings (Farado), Conveyor belts, Asbestos graphite rope packings, Permanite and card board packings multipurpose adhesives Resins and anaerobic compounds for sealing, jointing, fixing locking and filling etc. A few popular commercial names to mentionsuch as Araldite, Stellon compounds Fevicols, Specfit, Specinstabond, Loctites, Silastics, M-seal etc., their properties and usage. Grinding paste Kerosene, Cotton waste and cloth, welding rods and fluxes, welding electrodes, Common Sizes of fastners, Lubricants, Steel wire and ropes, Chains and mamila ropes, Carbon Steels. Alloy Steels, C I casting, Bronze casting and steels castingsetc. Various types of fasteners and fastening procedures.

Classification of spares, permissible stock as percentage of capital cost. Stock of electrical spares.

APPLICATION OF CMP TO MAINTENANCE WORK :

A few examples as case study such as schedule for complete overbaul of centre lathe, reciprocal or centrifugal pump, A Compressor etc. giving work distribution, planning and

repair estimate.

MAINTENANCE PERSONNEL MANAGEMENT :

Maintenance trade training, Maintenance supervisory training, Evaluation of maintenance job. Incentive payment to maintenance workers.

MAINTENANCE MANUALS AND REPORTS:

Types of manuals, Need for maintenance, contents of manuals, Maintenance manual topices. Manual writing and repoting.

FITTERS COMMON TOOLS : Appliances and devices, handling facilities and measauring instrumants.

LUBRICATION AND LUBRICANTS :

Importance of Lubrication, Kind of Lubricants solid, liquids general purpose lubricants their properties and method of use, Lubricating instruction for machine operators. Duration of topping and replacement of Lubricants in reservoirs. Typical Lubricant charts. Annual or Monthly Lubricant replacement schedule. Paints marks for Lubricating point on the machines. Regeneration of used oil.

3.11 REPAIR & MAINTENANCE -II

L	T	P
3	1	-

RATIONALE

Mechanical engineer is need of every industry and in majority of cases he is made responsible for day to day repair and maintenances of parts and over all upkeep of the plant for its smooth running this paper is meant to those who want to take mechanical engineering maintenance and repair work as their carrier. It exposes them to repair and maintenance ideas for various common machine components.

TOPIC WISE DISTRIBUTION OF PERIODS

S.No.	UNITS	COVERAGE L	COVERAGE T	TIME P
1.	I. S. I. Standards	4	2	_
2.	Guide Surfaces of Machines	12	4	_
3.	Gears	8	2	_
4.	Transmission	8	2	_
5.	Keys & Splines	6	2	_
6.	Couplings & Clutches	6	2	_
7.	Bearings	8	4	_
8.	Machine Spindles, Lead Screws & Nuts	6	2	_
9.	Restroation of Parts by Welding	6	2	_
10.	Seals & Packings	3	1	_
11.	Pneumatic & Hydraulic Machines	8	2	_
		75	25	100

DETAILED CONTENTS

I. S. I. STANDARDS :

Introduction to latest I. S. I. standards dor fits Tolerances and surface finish.

GUIDE SURFACE OF MACHINES :

Method for determining surface wear straight edge, surface plates, their accurancy measurements and control. Accuracy norms of guide surfaces accuracy measurement. Selection of repair method depending upon the value of wear such as Scraping, Grinding, Machining and subsequent scraping or grinding, Metal spray depositing. Idea of percentage manuallabour and tools needed. Methods of checking of nonlinearity, spiral twist, parallelity, along vertical planes, horizontal planes. Repair of lathe machine guide as

specific case. Looking after rolling guideways like recirculating ball brushing, recircukating roller blocks of high precision machine tools.

GEARS :

Usual defects occuring in gears during use. Checking for correct meshing of gears, wear of teeth, breaking or twisting of teeth. Burrs on interual splines of the gear bore or tooth surface. Crack or damage on the rim or bore of the gear wheel and methods for repair of the defects. method of removal of gears.

TRANSMISSION:

Vee belt drive, Chains and sprocket wheels. Standard sections and lenth of Vee belts. Defect and repair methods of pulley grooves. Installation and assembly of Vee belt, care and maintenance of belts. Looking after and settings right timing belts used in high precedion machines.

Different types of standard size chains. Chain wear and their repair methods. Design tolerances. Repair methods of sprocket wheels. Assembly of chain drive.

KEYS AND SPLINES :

Design and tolerances an key width, shaft and housing keyway and diameter. repair methods of wornout keyways.

Design tolerances on different system of fitting , repair, milling, slotting and broaching of splines.

COUPLING AND CLUTCHES :

Couplings (fixed, bush, Self aligning, Safety claw etc.) and their defects in use, repairing methods and their assembly. Friction clutches(Disc, Cone, Cylindrical/band) Material for their friction surface, general defects, repair/regulating methods and their assembly free wheeling clutch common defects and repair methods.

BEARINGS:

Fits and tolerance, Bush wears and its limits, Repair and assembly of splitted and non splitted bushes. Bimetalling Bronze lining, Babbiting, Use of stellon compound.

Ball and roller bearing Assembly comparison numbers, Defects and repair, fits and tolerances.

Number System for bearings and identifying of various grades of bearings.

MACHINE SPINDLES, LEAD SCREWS AND NUTS :

Design tolerance and limiting wear of threads in lead screws

and nuts, their repair methods, play elimination. General defects in machine spindles (e.g. Lathe) and their repair methods. Care of recirculating ball screws of CNC and high precision mechines.

Maintenance of electrical switchs, starters use with machine tools viz. lathe, shaper, milling , drilling and grinding machines, Electrically operated hand tools.

RESTORATION OF PARTS BY WELDING, METALIZATION, CHROMINUM PLATING :

Welding weldability and welding methods for carbon and alloy steels, cost iron hot , cold . Matalisation and chrominum plating process. Eutectic, plasma coating by spray.

(Short and Practical Instructions only)

SEALS AND PACKINGS :

Defferents of types of and standard sizes of seals their application on fixed joints, reciprocating joints and coating shafts. Making of seals from rubber, PVC and Leather sheets.

PNEUMATIC AND HYDRAULIC MACHINES :

Introduction to working principles of pneumatic and hydraulic systems providing Rotary drive, reciprocating drive, speed changing, clamping, unclamping, feed motion and hydraulic copying with examples. Common troubles in and repair methods of their components such as Valves, Gear vanes, Pistions cylinders, pistions rods, piston rings, "O" rings. Repair of diffrent types of pumps and compessors. Making pistion ring from cast iron and from steel.

NOTE:

Use of special measuring Instruments, wherever applicable, be explained well for checking wear in parts for example gears, lead screws and nuts etc.

3.12 MAINTENANCE PRACTICE SHOP

List of Practicals

BEARINGS: Insprection, Removal, Cleaning, Lubrication and refitting of bearings.

Maintenance, repair and replacement of couplings and aligment of shafitings.

Belts and Chain drives :

(i) Mounting of belts and checking of slip.

(ii) Tighting and replacement of chains.

Removal and replacement of springs and keys.

To do following exercise with the given small subassembly units :

(i) To select tools cor removing sub assembly.
(ii) To remove the sub assembly unit from the equipment/machine.
(iii) To disassemble unit.
(iv) To clean the parts, prepare a list and draw sketches.
(v) To insepct and identify wornouts parts.
(vi) To suggest whether the part deserve replacement, readjustment or recovery. Method of recovery if wanted so.
(vii) To reassemble sub assembly replaceing worn out parts.
(viii) To Lubricate the parts and refit the subassembly on the machine or the equipment and test the assembly after fitting.

Given subassembly units are tailstock of lathe, Head stock of lathe, Lathe chuck three jaw or four jaw, Gear box, Piston assembly with rings, Clutch, Footvalve, Safety valve of the boilors, Hydraulic jack, Mechanical jack, Bench vise, guideways, bed shaft, gear tooth.

Preparing decision tree for fault Location. Locating fault and rectifying that for equipment such as Bicycle, Hydraulic pump, water cooler, Refrigerator, A machine tool and An Air Compressor.

Maintenance of the various system including Lubrications service for system such as I.C. Engine, Pump, centrifugal , Reciprocal, Air compressor Rotary and reciprocating, Refrigerator, Air conditioner, Any machine tools.

Preparation of preventive maintenance schedule for institution machine shop.

Serviceing and operation of protable tools pneumatic and electrical.

Maintenance of meterial handling equipment available in the

institution.

Checking and testing of starter switches used with machine tools.

Small armature winding.

Fault finding and repair of automoble wiring.

Testing of electical installation as per I.S. Battery Charging.

Setting on regulator of cutoun testing of dynamo and its Minor repair.

3.13 PROJECT

The project paper will be two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and invironmental pollution control.

For Spl. in Repair & Maintenance

PART-A

This paper will contain four problems relating to preparation of project report for establishing a repair shop and overhauling and maintenance of a small machine or subassembly of some heavy machine in their institution work shop. e.g. Pump, compressor, Drill and Grinding machine, Sub assembly of machine tools.

PART-B

The student will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygenic conditions, Education facilities and various programmes/projects running for the development and the personnels and agencies involved in the work. He will also make observation on enviromental pollution and ecological disturbunces and will make a mention of that in his report with its reason, suggesting remedies or ways to minimise it. Without it the projectwill not be taken as complete. The student will also do some constructive work for pollution control as advised by the guiding teacher.

Student will choose any one of the problems from Part-A and Part-B is compulsary for all students. The students can be divided into groups of three to do one problem. the student will be examined for 140 Marks by an examiner appointed by B.T.E. U.P.

Examination Marks		140
Part-A :-		
Project Work	60	
Viva Voice	35	
Part B:-		
Project Work	25	
Viva Voice	20	
Sessional Marks	60	60
Total	200	200

3.14 FIELD EXPOSURE- II

Industrial Training

(See Annexure-II)

ELECTIVE GROUP E

3.10 COMPUTER GRAPHICS

L	T	P
3	1	-

TOPIC WISE DISTRIBUTION OF PERIODS

S.NO.	UNITS	COVERAGE TIME L	T	P
1.	Basic Fundamental	4	5	-
2.	Data Structure	8	5	-
3.	Picture structure and Pictrue Transformations	20	4	-
4.	Interpolation & approximation of curves and surfaces	20	4	-
5.	Interaction Handling	3	4	-
6.	Language concepts for Interactive computer graphics	20	4	-
		75	25	

DETAILED CONTENTS

1. BASIC FUNDAMENTAL :

- 1.1 What is Computer Graphics ?
- 1.2 The motivation for interactive Computer Graphics.
- 1.3 Model of interactive Graphics Systems.
- 1.4 The display file.
- 1.5 The necessity of a dual representation of Graphics objects.
- 1.6 The problem of picture transformations.
- 1.7 Taxonomy of display systems.

2.DATA STRUCTURE :

- 2.1 Formal definition of data structures
  - 2.1.1 A data structure definition
  - 2.1.2 Definitions of relations & their properties
  - 2.1.3 Linear lists
  - 2.1.4 Tree structures
  - 2.1.5 Generalized list structures
- 2.2 Representation of data structures in a computer
  - 2.2.1 Sequential or linked memory allocation
  - 2.2.2 Representation of arrays
  - 2.2.3 Representation of trees

2.2.4 Representation of generalized lists (Hierarchical structures)
2.2.5 Representaion of associative structures

2.3 Data models and data base organization

2.3.1 Objectives of data base management systems
2.3.1 Conceptual data models

3. PICTURE STRUCTURE AND PICTURE TRANSFORMATIONS:

3.1 Picture structure
3.2 Domain transformations
3.3 Geometric transformations
3.3.1 Rotation
3.3.2 Translation
3.3.3 Scaling

4. INTERPOLATION AND APPROXIMATION OF CURVES AND SURFACES :

4.1 Introductory remarks
4.2 Classical methods : Lagrange and Hermite Interpolation
4.3 Interpolation with B-splines
4.4 The Hidden surface problem
4.5 Solids

5. INTERACTION HANDLING :
5.1 Interactives input devices
5.1.1 Lightpen
5.1.2 Joystick, control ball, and "mouse"
5.1.3 Tablet lists
5.1.4 Keyboards
5.1.5 Lightpen vs. cursor control devices
5.1.6 A Pen track procedure

6. LANGUAGE CONCEPT FOR INTERACTIVE COMPUTER GRAPHIS :

6.1 High-level graphic programming languages
6.1.1 An example
6.1.2 Language extensions vs. subroutine packages
6.1.3 The "prefabricated-struture" vs. the "building-block" concept
6.2 High-level graphics languages : two cases in point
6.2.1 LEAP-an ALGOL 60 Extension based on the building-block concept.

3.11 COMPUTER AIDED DESIGN

L	T	P
3	1	-

RATIONALE

Diploma holders in mechnical Engineering with specialzation in computer aided design are required to provide professional assistance in design of prototypes, tools jigs and fixtures. For this purpose , it is essential to impart knowledge and skills about computer aided graphics and design for enabling them to perform in this field. Hence this subject.

TOPIC WISE DISTRIBUTION OF PERIODS

S.NO.	UNITS	COVERAGE L	TIME T	P
1.	CAD Hardware	15	5	-
2.	Selection of Appropriate Soft.	5	5	-
3.	Graphic Package	10	5	-
4.	CAD Software	15	5	-
5.	2-D & 3-D transformations	18	5	-
6.	Design process & Role of Computers in design process	10	4	-
7.	Benefits of CAD	2	1	-
		75	25	-

DETAILED CONTENTS

1. CAD Hardware
   - 1.1 Different types of graphics display devices - Stroke writing, Raster, Beam Penetration colour CRT, Shadow mark colour CRT, TFT Monitor.
   - 1.2 Input devics such as mouse , digitiser, light pen, joy stick, thumb wheel, track ball, Scanner.
   - 1.3 Graphics output devices - plotters and printers

2. Selection of an apporopiriate software

3. Graphic Package

   - 3.1 Ground rules for graphics package
   - 3.2 Graphics package

4. CAD Software - Application of CAD Software.

5. 2-D & 3-D transformations

   Translation, scaling, rotation, mirror and share, Zooming, Panning and Clipping.

6. Design process and role of computers in design process

7. Benefits of CAD

3.12 COMPUTER AIDED GRAPHICS & DESIGN LAB

L	T	P
-	-	4

LIST OF PRACTICALS

1. Development of simple graphic package using 2-D and 3-D transformation and algorithms for generation of lines and circles (programming using C)

2. Development of wire frame models of simple 3-D objects like box , cylinder, cone, pyramids, prisms and sphere (programming using C)

3. FEM Mesh generation

4. Stress analysis / heat conduction analysis using standard FEM package.

5. Stress analysis of cantilever using U.D.L.

6. Stress analysis of simply supported beam using point load.

7. Benching of circular plate and analysis of stress and strain.

8. Heat conduction analysis using circular bar.

9. Design and analysis of crank shaft.

3.13 PROJECT

The project paper will be of two parts. Part-A will contain the problems to evaluate students learning. The Part-B will be regarding students awareness of the plans and programmes running for rural development, Ecological balance and invironmental pollution control.

For Spl. in computer Aided Design only

PART-A

Four problems on design and drawing of simple machine/machine parts and preparing project report for loan to establish small scale industry to fabricate the item designed. A few examples of such items are given below.
Bench Vice, Small centrifugal pump, Screw jack, Hand Shearing Machine, Hand blower, Main Switch outer casing (Cost Iron), Stepped Motor Pulley, Biogas Plant, Smoke Less Chulha, Hand Operated Grinder/Jucer, Agricultural Implements, Material Handling Equipments for small scale industry. Solar Cooker or any other simple items of general utility or industrial use. All design and drawing work related to the project shall be done on computer only.

PART-B:

The student Will survey a village and prepare a report giving details of population, Means of lively hood, Health and hygenic conditions, Education facilities and various programmes/projects running for the development and the personnels and agencies involved in the work. He will also make observation on environmental pollution and ecological disturbunces and will make a mention of that in his report with its reason, suggesting remedies or ways to minimise it. Without it the project will not be taken as complete. The student will also do some constructive work for pollution control as advised by the guiding teacher

Student will choose any one of the problems from Part(A) and Part(B) is compulsary for all students. The students can be divided into groups of threes to do one problem. The students will be examined for 100 marks by an examiner appointed by B.T.E, U.P.

1.	Examination Marks		140
	Part A:-		
	Project Work	60	
	Viva Voce	35	
	Part B:-		
	Project Work	25	
	Viva Voce	20	
	Sessional Marks	60	60
	Total	200	200

3.14 FIELD EXPOSURE- II

Industrial Training

(See Annexure-II)

DIPLOMA IN MECHANICAL ENGINEERING
STAFF STRUCTURE

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 Mechanical Engineering	4	
4.	Lecturer in Electrical Engg.	1	Part Time OR Common with other discipline
5.	Lecturer in Maths	1	
6.	Lecturer in Chemistry	1	
7.	Lecturer in Physics	1	
8.	Lecturer in Comm. Tech.	1	
9.	Computer Programmer	1	
10.	Steno Typist	1	
11.	Accountant / Cashier	1	
12.	Student / Library Clerk	1	
13.	Store Keeper	1	
14.	Class IV	6	
15.	Sweeper	Part time or as per requirement	
16.	Chaukidar & Mali	as per justification	
17.	Lecturer in Computer	1(Only for Computer Aided Design Group.	

Note :

1. Services of other discipline 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 "Electronics Engineering" is running.

SPACE STRUCTURE

[A] ADMINISTRATIVE BLOCK

Sl. No.	Details of Space	Floor Area Sq. metres	Remark
1.	Principal's Room	30	
2.	Confidencial Room	10	
3.	Steno's Room	6	
4.(a)	Office Room	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] Acedemic Block

Sl.No.	Detail of Space	No.	@ Sq.m	Floor Area Sq.m.
1.	Class Room	2	60	120
2.	Drawing Hall	1	120	120
3.	Physics Lab			90
4.	Chemistry Lab			120
5.	App. Mechanics Lab./ Elements of Mechanical Engg Lab.			120
6.	Material Science Lab.			120
7.	Thermal Engg. Lab.			120
8.	Hydraulics Lab.			120
9.	Electrical Technology & Electronics Lab or Common with Electrical Engineering.			90
10.	Metrology Lab.			90
11	Computer Lab (Air Cond.Glass Partition and Special type pvc flooring and false ceiling)			60
12.	Automobile Engineering Lab.			90
13.	Refrigeration & Air Conditioning Lab			90
14.	Advance Welding Lab/Shop			90

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

[E] STAFF RESIDENCES

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

Priorty 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 verson 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 lenses 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 lens 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 accessaries	1 set	1000	1000
9.	Lee's conductivity app. complete with all accessaries	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 jockey	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 forks and other accessaries	1	500	500
21.	Tuning forks 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 character-stics of P-N junction diode complete with all accessaries	1 set	1500	1500

24.	Post office box dial type	1	1200	1200
25.	Resistance box 0-10 ohm., 0-100 ohm. 2 nos. each	4	400	1600
26.	Rheostat 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.	LS		5000

II. APPLIED CHEMISTRY LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
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 morter 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.	Measring 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
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.	Platinium wire	5	25	125
45.	Brush for cleaning various type	40	10	400
46.	Jars 20 Lit. for keeping destilled 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 almirah 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 Appratus Bell Crank lever	1	500	500
4.	Combined Inclind plane & Friction apparatus	1	900	900
5.	Simple wheel and axle	1	800	800
6.	Differential wheel and axle	1	1200	1200
7.	Double sleave 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

ELEMENTS OF MECHANICAL ENGINEERING LAB
(Applied Mechanics Lab. Room)

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Biogas Plant	1	By Out door visit	
2.	Windmill	1	By Out door visit	
3.	Experimental Solar Cooker Box Type- Instrumented To Measure Temperature its Performance & Temperature At Various Location.	1	500	500
4.	Photo Voltage Solar Cell	1	10000	10000
5.	Throttling & Separating Colorimeter. (Thermal Engg. Lab)	1	10000	10000
6.	Jib Head Key, Flat Key, Saddle Key, Wood Ruff Key, Feather Key Pinkey & A piece of splined shaft.	1 Set	L.S.	500
7.	Pins- Split Pin, Taper Cottor Type Split Pin, Cottor or Cottor Pin, Cottor Bolts; Lewis or Rag Foundation Bolt, Fish Tail & Square Head Foundation Bolts.	1 Set	L.S.	500
8.	Friction Clutches & Couplings -Cone Clutch, Single Plate Muff Coupling, Flange Coupling Universal Coupling or Hooks Joint. Flexible Coupling- Belt & Pin Type, Coil Spring Type.	1 Set	L.S.	2500
9.	Bearings- Plane, Bushed, Split Step, Ball, Rollar Bearings, Thrust Bearings.	1 Set	L.S.	1000
10.	Spur gear Single & Double Helical Gears, Bevel Gears.	1 Set	L.S.	1000
11.	Simple Spur Gear train	1	1500	1500
12.	Compound Gear Train	1	1500	1500
13.	Epicyclic Gear Train	1	2000	2000
14.	Compression & Tension Helical Springs.	1 Each	200	200
15.	Four Bar Mechanism Fitted on a board.	1	1000	1000
16.	Slider Crank Mechanism	1	1000	1000
17.	Whitworth Quick Return Mechanism Fitted on a board.	1	1000	1000
18.	Steam Boiler Electric Low Pressure, upto 5 psi steam capacity, 8 Kg./ 12 Kg. Per hour, Supply 440V Three Phase	1	20000 (Thermal Engg. Lab.)	20000
19.	Orsat Apparatus	1	2000 (Thermal Engg. Lab.)	2000

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
	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

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

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

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

Additional Equipments For Second Year Mechanical Engg. Only)

1.	Crucibles (10-20 Kg.)	1	2500	2500
2.	Core Boxes	1 Set	4000	4000
3.	Plate form Weighing M/C (100 Kg. Capacity)	1	8000	8000
4.	Drying Oven	1	15000	15000
5.	Sand Sieves	1 Set	600	600
6.	Optical Pyrometer	1	5000	5000
7.	Misc.	LS		3500

THERMAL ENGINEERING LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Simple Verticle Boiler Model	1	1000	1000
2.	Lancashire Boiler Model	1	1000	1000
3.	Babcock Wilcox Bioler	1	1000	1000
4.	Locomotive Boiler	1	1000	1000
5.	Cochran Boiler Model	1	1000	1000
6.	Boiler Safety volve (spring controlled)	1	1000	1000
7.	Boiler Water Level Indicator	1	800	800
8.	Model of Reaction Turbine (Metal cut)	1	4500	4500
9.	Model of Inpulse Turbine (Metal Cut)	1	4500	4500
10.	Model of Surface Steam Condenser (Wodden/Plastic)	1	600	600
11.	Metal working Model of Two Stroke Petrol engine	1	4200	4200
12.	Model of Four Stroke Petrol Engine (Metallic working model)	1	4500	4500
13.	Model of Four Stroke Diesel Engine (Metal working model)	1	4500	4500
14.	Single Cylinder 4 Stroke Petrol Engine Testrig With 5 H.P, Air Cooled, Self Starting Engine and Dynamometer-Brake Drum Type/Electrical Resistance type/Hydraulic & with provision for measuring fuel & Air consumption, BHP & Temperature.	1	30000	30000
	OR			
	Water Cooled Single Cylinder 4 Stroke Diesel Engine Testrig with 5 H.P. Diesel engine, Dynamometer Brake Drum/ /Electrical Resistance/Hydraulic, Water Cooling Arrangement, Fuel Measuring Unit Consisting of fuel, tank, burette, 3 way cock connecting tube, stop watch, thermometers, dial type exhaust gas thermometer. Provision for intake measurement-Reservoir Orifice Plate, Differential Monometer.	1	45000	45000
15.	Steam Boiler Electric Low Pressure, upto 5 psi steam capacity, 8 Kg./ 12 Kg. Per hour, Supply 440V Three Phase	1	20000	20000

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
16.	Steam Separating & Throttling Calorimeter Fully Instrumented To Determine, Quality of Steam of 10-15 Kg/Cm2. Pressure with Steam Condensing Arangement.	1	10000	10000
17.	Thermo Couple	2	1000	2000
18.	Working Model of AirCompressor	1	5000	5000
19.	Misc.	LS	5000	5000
	REFRIGERATION AND AIRCONDITIONING LAB			
1.	Refrigeration Cycle Demonstration Unit-With Condenser & Evaperator Made of toughened glass & Instru-mented to measure Temperature & Pressurse, Refrigerant flow at All Suitable Locations. Arangement for Using Different Expansion Devices.	1	50000	50000
2.	Experimental Air Conditioner Window Type-1 Ton Capacity With Proper Instrumentation For Studying its performance.	1	20000	20000
3.	PSYCHROMETERS			
	Sling Psychrometer.	L S	5000	5000
	Aspiratior Psychrometer.	1		
	Hygrometer	1		
	Dry & Wet bulb wall hygrometer.	1	L.S.	3000
	Dial type hygrometer	1		
	Fortin's barometer	1		
	Manometers	1		
4.	Anemometer Hand Hold	1	1000	1000
5.	Misc.	LS	5000	5000

HYDRAULICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Piezometer Tube 75 cm.	2	100	200
2.	Mechanical Flow Meter			
i.	Turbine Type-Rota Meter	1	1500	1500
ii.	Vane Type	1	1500	1500
iii.	Water Meter Domestic	1	600	600
3.	Manometer	1		
i.	Single 1 Meter Long	1	100	100
ii.	'U' Tube differential Manometer	1	500	500
iii.	Inclined Manometer 1 M. Long	1	200	200
4.i.	Bourdons Pressure Gauge	1	300	300
ii.	Bourdons Vacuum Gauge	1	300	300
5.i.	Hydraulic Ram	1	1500	1500
ii.	Hydraulic Jack 30 cm. Lift	1	4000	4000
iii.	Hydraulic Coupling With Running Motor.	1	4000	4000
iv.	Hydraulic Press 1 Ton	1	4000	4000
6.	Notch Apparatus	1	10000	10000
7.	Bernaulli's Apparatus	1	12000	12000
8.	Ventury Meter Apparatus With differential manometer.	1	12000	12000
9.	Orifice Apparatus With Different Type of Orifices Rectangular 10x10 mm., 20x20 mm. Triangular 15x15x15 mm.	1	10000	10000
10.	Pipe Friction Apparatus	1	10000	10000
11.	Working Model of Pelton wheel	1	30000	30000
12.	Working Model of Francis Turbine	1	30000	30000
13.	Double Acting Reciprocating Pump 25x25 mm. suction & delivery.	1	6000	6000
14.	Single Stage Centifugal Pump With 1 H.P. Electric Motor Drive Discharge 100 lt./min. Head 30 M.	1	3000	3000
15.	Channel Apparatus With Current Meter.	1	20000	20000
16.	Hydraulic test bench	1	65000	65000
17.	General Requirements Such As Tank, Pipeing	1	LS	15000
	Misc. Items Such As Tool Kit, Stop Watches, Notches Wiers, Orifices & Pipe Fittings.		LS	10000

ELECTRICAL TECHNOLOGY & ELCETRONICS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	D.C. Shunt Motor 3 Kw. 1500 RPM with 3 Point Starter.	2	10000	20000
2.	D.C. Compound Motor 3 Kw. 1500 RPM	2	10000	20000
3.	Single Phase Transformer 1 KVA 50 Hz. Primary Voltage 230 with tapping at 50%, 86.6 % Facility	2	6000	12000
4.	3 Phase Induction Motor 415 V., 50 Hz, 440 RPM, 3 KVA Star/Delta/Autotransformer Starter.	2	5000	10000
5.	Loading Drum Spring Balance & Belt Arrnagement.	2 Set	1000	2000
6.	Tachometer (Analog/Digital)	1	2000	2000
7.	3 Phase Inductive Loading of Variable Nature	1	8000	8000
8.	Single Phase Inductive Loading Variable 0-10 Amp., 50 Hz.	1	8000	8000
9.	Moving Coil Ammeter 0-10 Amp.	8	1000	1000
10.	Moving Coil Voltmeter 0-300 V.	8	1000	8000
11.	Moving Iron Ammeter 0-10 Amp.	8	1000	8000
12.	Moving Iron Voltmeter 0-300 V.	8	1000	8000
13.	Wattmeter Single Phase Dynamo Type 75/300/600 V. 2.5/5 Amp.	4	2500	10000
14.	Three Phase Variable Inductive Loading.	1	8000	8000
15.	Single Phase Variable Inductive Loading with Rheostat.	1	8000	8000
16.	Megger 0-20 Mega Ohm, 500 RPM .			
17.	Flouroscent Tube With Choke.	1	100	100
18.	SCR Bread Board	1	1000	1000

19.	Power Supply 230 V.	1	1000	1000
20.	Moving Coil Ammeter 0-500 M.A.	1	1000	1000
21.	Moving Coil Voltmeter 0-250 V.	1	1000	1000
22.	Energy Meter Single Phase 230 V., 5 Amp	1	2000	2000
	Misc.		LS	1500

MECHANICS OF SOLIDS LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Shear Force Apparatus	2	300	600
2.	Young's Modulus Beam Apparatus with Spherometer attachment for measuring deflection	2	350	700
3.	Bending Moment Apparatus	2	400	800
4.	Universal Testing Machine	1	300000	300000
5.	Rockwell Hardness Testing Machines.	1	30000	30000
6.	Brinell Hardness Testing Machine	1	30000	30000
7.	Inpact Testing Machine	1	50000	50000
8.	Helical Spring Apparatus for determining axial deflection	1	1500	1500
9.	Tortion Bar Apparatus	1	1000	1000
10.	Searles Apparatus for Young's Modulus of a wire material with slotted weight set.	1	1000	1000
11.i.	Muffle furnace	1	3000	3000
ii.	Quenching tank	1	500	500
iii.	Saltbath Furnace	1		
12.	Sample Polishing Machine	1	200	200
13.	Pyrometers			
i.	Thermoelectric	1	5000	5000
ii.	Optical	1	5000	5000
14.	Metallurigal Microscope	1	75000	75000
15.	Chemical Balance with Weight Box.	1	1500	1500
16.	Apparatus for carbon estimation in steel sample by microscopic observation	1		
	Misc.	1	LS	5000

ADVANCE WELDING LAB/SHOP

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Portable Gas Cutting Machine	1	25000	25000
2.	Argon Arc Welding Plant	1	30000	30000
3.	AC/DC TIG Welding Set For Welding Nonferous Alloys	1	35000	35000
4.	MIG/CO2 Welding equipment	1	45000	45000
5.	Submerged Arc Welding M/C with Automatic wire Feeder	1	35000	35000
6.	Pedestal grinder	1	4000	4000
7.	Ultra Sonic flaw Delction System.	1 Set	25000	25000
8.	Dye Penetration system	1 Kit	2000	2000
9.	Magnetic Flaw Detection System	1	50000	50000
10.	Reference Charts for Welding defects (Produce by International Institute of Welding)	1 Set	5000	5000
11.	Miscellaneous		LS	500

METROLOGY LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	(i) Sine bar	2	3000	6000
	(ii) Vernier Bevel Protractor	2	2000	4000
	(iii) Universal Bevel Protractor	2	2500	5000
2.	Optical Profile Projector	1	6000	6000
3.	Mechanical Comparator	1	8000	8000
4.	Precision balls of various sizes	1		
5.(i)	Precision Rollers of various sizes	1		
(ii)	Taper gauge set	1	2000	2000
6.	Auto Collimeter with Accessories	1	8000	8000
7.	Screw Pitch gauge set	1	500	500
8.	Micrometers (0-25, 25-50 mm.)	2	500	1000
9.(i)	Hieght gauge	1	1000	1000
(ii)	Vernier Calipers set	1	500	500
10.	Feeler gauge set	1	1000	1000
11.	Tool Makers Microscope	1	10000	10000
12.(i)	Slip gauge set	1	10000	10000
(ii)	Snap gauge Adjustable	1	2000	2000
(iii)	Plug gauge set	1	2000	2000
13.	Polar Planimeter digital	1	5000	5000

14.(i) Radius gauge set	1	500	500
(ii) Wire gauge 0-36 swg	1	1000	1000
(iii) Filet gauge set	1	500	500
15. Surface Roughness tester	1	50000	50000
16. Surface Plate with stand	2	4000	8000
17. Depth Micrometer	2	500	1000
18. Miscellanous	LS	5000	

MECHANICAL WORKSHOP (MACHINE SHOP)

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Centre lathe	8	75000	600000
2.	Allgerared head Lathe	2	200000	400000
3.	C.N.C. Trainer Lathe	2	200000	400000
4.	Planing Machine	1	50000	50000
5.	Shaping Machine	3	40000	120000
6.	Slotting Machine	1	15000	15000
7.	Universal Milling Machine	1	300000	300000
8.	Universal Tool Cutter and Grinder	1	200000	200000
9.	Two Wheel bench Grinder (Wheel size 150x16x12 mm) (Wheel standard Accessories single pahse motor .25 HP highj speed)	1	4000	4000
10.	Bench Drilling Machine 13 mm capacity, 5 HP, AC 230 Volt Single Phase 1400 rpm motor with starter switch 30 mm capacity drill chuck V belt 100 mm machine vice	1	10000	10000
11.	Power Hacksaw motorised with collant pump, vice, lenth gauge, machine drive belt guard, 1 H.P. A.C. 440/3/50/1440 rpm electric motor with starter. Capacity to cut 175 mm. round and 150x150 mm. square rod, Blade size 350x25 mm.	1	8000	8000
12.	Marking off Table Black granite Surface, flat nonmagnetic, nonglaring,	1	4000	4000

	Planing Accurecy as per I.S. size 1000mm x 630mm x 150mm of grade B with slab carbide scriber.			
13.	Surface Plates			
	(a) size 450 x 450 mm	1	4000	4000
	(b) size 450 x 600 mm	1	5000	5000
	cost iron surface plate planed and hand swapped and seasoned, Brown & sharp type ribbing, complete with lifting handles & wooden surface cover. Conforming to I.S. 2285-1963			
14.	Cylindrical granding machine (Plain)	1	75000	75000
15.	Surface grinder table size 12"x8". (Planer type)	1	10000	10000
16.	Turret/Capstan lathe	1	250000	250000
17.	Tools & Instruments-Cutters drill set, taps, dies, drill chucks, milling machine cutters tapper, reamers, micrometers verniers, gear tooth verniers, dial gauges, callipers, steel rules & Hand Tools Such as hammers, chiesels etc.		LS	20000

PRODUCTION TECHNOLOGY LAB

MACHINE SHOP:

Nothing Extra.

AUTOMOBILE ENGINEERING LAB

S.No.	Name of Equipment	No.		@ Rs.	Amt.in Rs.
1.	An automobile for studying & expermenting- 4 wheel drive Diesel Jeep	1		135000	135000
2. *	Model of fluid flywheel	1			
	Torque Convertor	1			
	Gear Box with over drive	1			
3.	Battery Charger 0-12 V, 0-6 Amp.	1	LS	4000	4000
	Cell Tester	1			
	Hydrometer	1			
	Batteries 6 V & 12 V.	1	Each		
4.	Working Model of Battery Ignition System	1			
	Magneto Ignition System Fitted on board.	1			
5.	Gear Box of a vehicle	1			
	Hand Hold Tachometer	1		1000	1000
	One H.P. Motor Single Phase with Starter & coupling.	1		2000	2000
6.	10 H.P Multicylinder Petrol /Diesel engine with testing rig.	1		45000	45000
7.	Fuel Injection Pump	LS		20000	20000
	Calibration Machine with	1			
	Fuel Injection Pump & Coupling	1			
8. *	Electrical Testing Bench	1			
9. *	Cylinder Boring Machine	1			
10.*	Valve Grinding Machine	1			
11.	Nozzle Testing Machine	1		6000	6000
12.	Spray Painting Machine	1			
13.*	Brakedrum Turning Lathe	1			

14.	A.C. Pump	1
	S.U. Pump	1
15.	Dynamo	1
16.*	Bendrix Drive	1
17.	Mechanical Jack	1

NOTE:
Item marked * need not be demanded for purchase if they do not exist in the lab .

MAINTENANCE LAB

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Benchwise 10cm jaw	2	300	600
2.	Centre Punch	2	30	60
3.	Pin Punch	2	30	60
4.	Callipers Inside (spring)	5	100	500
5.	Callipers outside (spring)	5	100	500
6.	V. Callipers 30 Cm.	1	300	300
7.	Micrometer 0-25 Cm.	1	125	125
	25-50 Cm.	1	125	125
8.	V.Depth gauge	1	300	300
9.	Feeler gauge 15 Blades	1	30	30
10.	Radious gauge	1	100	100
11.	Angle Gauge	1	100	100
12.	Thread Gauge	1	100	100
13.	Tap set	1	2000	2000
14.	Allen Key Set	1	350	350
15.	Adjustable Wrench	1	2000	2000
16.	Double Spanners	2	300	600
i.	Size (6x7,8x9,...18x19,20x22 24x27,30x32mm)			
ii.	Size (32x36, 36x41, 41x46, 46x50, 50x55mm)	1	350	350
17.	Misc. Files, Scrapers, Dieset Hexaframe as per need	LS	2000	2000
18.	Pipe Vice 5cm	1	250	250
19.	Chain Rinch	1	250	250
20.	Ring Spanner Set	1	125	125
21.	Ball Peen Hammer	3	30	90
22.	Claw Hammer	1	30	30
23.	Battery Charger 0-12v,6 Amp. Call Tester Hydrometer Lead Acid Battery 12V,6V	1Set	L.S	4000
24.	T-socket wrench Set	1	500	500
25.	Off socket wrench Set	1	500	500
26.	Old Jacks Hydraulic & mechanical	1 Each	LS	3000
27.	Automobile Gear Box Old	1	2500	2500
28.	Refrigerator Old	1	LS	2000
29.	Airconditioner (Window Type) old	1	LS	3500
30.	Water cooler (old)	1	LS	2500
31.	Digital Multimeter Portable 4-5 digits, 0.5 LCD Auto zeroing and Auto Polarity DC Voltage 10MV-1000V DC Currient 0.1MA-10A Ac Voltage 10MV-750V AC Current 0.1MA-10A Batter Operated with connection Leads.	1	1000	1000
32.	Clipon ammeter/Voltmeter	1	1000	1000

	Measuring rang 0-12A, 0-500V Opening 40mm for round conductors Set of spare fuses and connecting Leads.			
33.	Pulley Pullers (One two legged, One three Legged)	2	1000	2000
34.	Bearing Assorted		LS	2000
35.	Couplings Assorted		LS	2000
36.	Air compressor (old unit)			
37.	Portable tools - Pneumatic & Electrical (For Servicing & Repairing Work - Old).	1	2000	
38.	Old lathe Machine/Grinding Machine.	1	5000	
39.	Miscellaneous Needs and for the items ommited hear if any	LS	2000	

NOTE:-

If the items other then tools and instruments mentioned above are available in the institution, they should be used for the purpose alternatively they should be procured from other institutions from where they may be made available for the purpose . For the facilities which cannot be made available in the institution visits of repair and maintenance shops in the vicinity be arranged according to need.

COMPUTER AIDED GRAPHICS AND 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 Pre loaded Norton Anti Virus with licence media and manual OR Computer of latest Specification	16 (15+1Server)	8,000,00=00
2.	Software :		
i.	Noval Netware/NT Latest Version	01	55000
ii	WINDOWS - XP/WINDOWS 2000 /Windows NT	01	6000
iii.	MS OFFICE XP	01	17000
iv.	Dos latest version.	01	5,000
v.	FoxPro 2.5 or Latest Version	01	10000
vi.	AUTOCAD LATEST VERSION	01	40000
vi.	AUTODESK Inventer 10 Profession of latest	01	150000
3.	Hardware		
i.	Internal Modem 56 kbps		
ii.	Hubs-16 port, all accessories related to Networking.		
iii.	Scanner- A4	01	10,000
4.	Plotter 8 Pen,A-4 Size,Plotting speed 10 c.m. per sec. .05 mm minimum mechanical resolution HP-GL, GL emulation commands.	01	30000
5.	132 column 300 CPS or faster 9 Pin dot matrix printer with 500 million character head life.	01	30000
6.	132 column 300 CPS or faster 24 Pin dot matrix printer with 500 million character head life.	01	20000
7.	Laser Printer : 600 DPI ,4/6 PPM 2 MB RAM	01	50000
8.	Digizter A-4 Size 12 x 12 inch +0.5 mm. Point reading accuracy. 0.025 mm. resolution	01	30000

9.	5 KVA on line UPS with minimum 30 miniute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries.	01	150000
10.	Window Air Conditioner 1.5 tons capacity with ISI mark along with electronic voltage stablizer with over voltage and time delay circuit	04	120000
11.	Room preparation and furniture	LS	100000
12.	Vaccume Cleaner	02	

COMPUTER APPLICATION FOR ENGINEERING (Common to all Trades)

COMPUTER CENTRE

S.No.	DESCRIPTION	QTY.	APPROX. COST (in 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 Pre loaded Norton Anti Virus with licence media and manual OR Computer of latest Specification	16 (15+1Server)	8,000,00=00
Software :			
i.	Noval Netware/NT Latest Version	01	55000
ii	WINDOWS - XP/WINDOWS 2000 /Windows NT	01	6000
iii.	MS OFFICE XP	01	17000
iv.	Dos latest version.	01	5,000
v.	FoxPro 2.5 or Latest Version	01	
vi.*	Mechanical DeskTop Power Pack	01	70000
vii*	AutoCad Profession Serives (latest version)	01	300000
	(*->Only For Mechanical Engg.)		
3. Hardware			
i.	Internal Modem 56 kbps		
ii.	Hubs-16 port, all accessories related to Networking.		
iii.	Scanner- A4	01	10,000
4.	132 Column 600 CPS or faster 9 Pin dot matrix printer with 500 million character head life	01	15,000
5.	Laser Jet	01	20,000
6.	5 KVA on line UPS with minimum 30 miniute battery backup along with sealed maintenance free batteries. Provision for connecting external batteries with network connectivity.	01	1,75000
7.	Window Air Conditioner 1.5 tones capctity with ISI mark alongwith electronic voltage stablizer with over viltage and time delay circuit	04	30,000(EACH)
8.	Room preparation and furniture	LS	

7. LEARNING RESOURCE MATERIALS

1.	Overhead Projector with screen	1	--	20000
2.	35 m.m. Slide cum Film Projector	1	--	50000
3.	Audio Cassette Recorder	1	--	15000
4.	V.C.R. with Monitor & Accessories	1	--	35000
5.	Photography Camera for Production of slide and film strips, 35 mm still camera dark room equipment.	1		100000
6.	Mathematical Typewriter	1	--	50000
7.	Cutting, Binding & Stitching equipment.	1	--	30000

ANNEXURE - I

FIELD EXPOSURE - I

Mechanical Engg. students after First year exam. will undergo a two week Industrial Exposure, (in small scale units atleast) aranged and supervised by the iunstitute staff. They may try their hands on simple tools and machines and will incorporate following points in their reports.

1. Name & Address of the unit

2. Date of

   i. Joining.

   ii. Leaving.

3. Nature of Industry

   i. Product.

   ii. Services.

   iii. Working Hrs.

4.
   i. Names of the sections of the unit visited.

   ii. Number of person engaged.

   iii. Activities in the section.

   iv. Name of tools/machines/ instruments used.
   simple sketch of tools & instruments.

   v. Source of power.

5.
   i. What is learnt. (Give on separate field)

   ii. What interested him most. (Give details)

ANNEXURE - II

FIELD EXPOSURE - II

After second exam. in the summer vacation students of mechanical Engg. will have a four week Industrial Training in units not less than small scale industries. It should preferably be arranged in manufacturing (producing machines, equipments or their parts), structural or processing organisations. They will work and focus their attention there on following points to incorporate them in their reports.

1. Name & Address of the unit

2. Date of

   i. Joining.

   ii. Leaving.

3. Nature of Industry

   i. Product.

   ii. Services.

   iii. Working Hrs.

4. Sections of the unit visited and activities there in.

5. Details of machines/Tools & instruments used in working in the section of the unit visited.

6. Work procedure in the section visited.

7. Specifications of the product of the section and materials used.

8. Work of repair and maintenance cell.

9. Details of the shops (welding,

Foundary, Machines shop etc) related to repair and maintenance work.

10. Name of checking and Inspecting Instruments and their details. Quality controls measures taken.

11. Details of hadraulics/pneumatic/ thermal units or appliances used if any.

12. Discripton of any breakdown and its restoring.

13. Use of computer - if any.

14. Visit of units store, Manner of keeping store items, Their receiving & distribution.

15. Safety measures on work place & working conditions in general - comfortable, convenient & hygeinic.

ANNEXURE - III

TRAINEES ASSESSMENT

This Institution invites the comments on the training of its students (work & behaviour) from their immediate supervisors on the following points.

1. Name of the trainee

2. Date of

   i. Joining.

   ii. Leaving.

3.

   i. Regularity & Punctuality

   ii. Sense of responsibility

   iii. Readiness to work/learn

   iv. Obedience

   v. Skill aquired

4. Name of the sections of the unit he attended during his stay.
   His activities/worth of being there.

5. Any thing specific

Sinnature of the Assessor

Date :- Designation

ANNEXURE- IV QUESTIONNAIRE

INSTITUTE OF RESEARCH,DEVELOPMENT AND TRAINING U.P.KANPUR -208024

SUBJECT: Questionnaire for ascertaining the job potential and activities of diploma holder in Mechanical Engg..

PURPOSE: To design and develop Three Year (Six Semester) diploma curriculum in Mechanical Engg.

NOTE: 1.Please answer the questions to the points given in the questionnaire.
2.Any other point or suggestion not covered in this questionnaire may be written on a separate paper and enclosed with the questionnaire.

1.Name of the organisation:_____
_____

2.Name & Designation of the officer filling the questionnaire _____
_____

3.Name of the department/section/ shop _____
_____

4.Important functions of the department/section/shop _____
_____

5.Number of diploma holder employees under your charge in the area of Mechanical Engg.. _____

6.Please give names of modern equipments/machines handled by a diploma holder in Mechanical Engg..

1. 2. 3.

4. 5. 6.

7.What proficiencies are expected from a diploma holder in Mechanical Engg..

1. 2. 3.

4. 5. 6.

8.Mention the approximate percentage of the following desired in Diploma teaching.

1. Theoretical knowledge ----------%
2. Practical knowledge ----------%
3. Skill Development ----------%

9. Do you think " on the job training" / Industrial training should form a part of curriculum. (Yes/ No)
if yes then
(a) Duration of training ----------
(b) Mode of training 1. Spread over different semesters

2. After completion of course

3. Any other mode

10.What mode of recruitment is followed by your organisation.

1. Academic merit
2. Written test
3. Group discussion
4. Interview
5. On the job test.

11. Mention the capabilities/ Qualities looked for while recruiting diploma holder in Mechanical Engg..

(a) Technical knowledge ----------
(b) Practical skill ----------
(c) Etiquettes and behaviour ----------
(d) Aptitude ----------
(e) Health habit and social background ----------
(f) Institution where trained ----------

12. Does your organisation have any system for the survey of Home articles of different countries/States. Yes/No

13. Does your organisation conduct field survey to know users views regarding. Yes/No
1. Home Articles for different age groups and sex.
2. Effect of climatic conditions
3. Any other
If yes ; Please give brief account of each.

14. Which type of assignment do you suggest for an entrepreneur in Mechanical Engg..

15. In which types of organisations can a diploma holder in Mechanical Engg. can work or serve.

1 2 3

4 5 6

16. Job prospects for the diploma holder in Mechanical Engg. (Semester System) the next ten years in the state / country.

17. In your opinion what should be the subjects to be taught to a diploma student in Mechanical Engg..

Theory Practical

18. Kindly mention particulars regarding topics/areas which should be given more emphasisin the curriculum .

Theory Practical

19. Kindly state whether your organisation can contribute towards improvement of curriculum in above field. Yes/ No
If yes : Please give names of experts in your organisation to whom contact.

20. Kindly give your valuable suggestions for being considered at the time of finilisation of curriculum.

21. What changes in technologies are to be incorporated in the development of curriculum in Mechanical Engg. (Semester System)

(Signature)

Kindly mail the above questionnaire duly filled to:-

K. M. Gupta
Asstt. Professor
Institute of Research,Development & Training,U.P.
Govt. Polytechnic Campus
Kanpur-208024

(Please note that all information in this survey is confidential for the use of curriculum design only)

RECOMMENDED BOOKS

List of standard Text Books recommended for diploma level institutions of Uttar Pradesh

1. DISCIPLINE : APPLIED PHYSICS

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	ANUPRAYUKT BHAUTKI	GUPTA & GUPTA	HINDI	1995	75.00	ASIAN PUBLISHERS, 85-C NAI MANDI, MUZAFFAR NAGAR
2.	ENGINEERING BHAUTKI	Dr. BHARGAVA	HINDI	1995	60.00	DHANPAT RAI & SONS
3.	ANUPRAYUKT BHAUTKI	KUMAR & TYAGI	HINDI	1995	75.00	NAV BHARAT PRAKASHAN, BEGUM BRIDGE ROAD,MEERUT
4.	ANUPRAYUKT BHAUTKI	Dr. R.C.PANDEY	HINDI	1994	75.00	NAV BHARAT PRAKASHAN, BEGUM BRIDGE ROAD, MEERUT
5.	APPLIED PHYSICS-I (Vol - I)	Dr. H.H.LAL	ENGLISH	1993	45.00	TATA McGRAW HILL
6.	APPLIED PHYSICS-II(Vol - II)	Dr. H.H.LAL	ENGLISH	1993	54.00	TATA McGRAW HILL
7.	MODERN COLLEGE PHYSICS	WHITE	ENGLISH	1995	110.00	C. B. S.
8.	PHYSICS Vol - I & II	HOLLIDAY AND RESNIC	ENGLISH	1993	100.00	WILEY EASTERN

1. DISCIPLINE : APPLIED MATHEMATICS

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	APPLIED MATHEMATICS (Math-I & Math-II)	KAPOOR & TARAMAN	HINDI	1994	75.00	NAV BHARAT PRAKASHAN, MEERUT
2.	APPLIED MATHEMATICS (Math-I & Math-II)	Dr KAILASH SINHA	HINDI	1994	60.00	BHARAT BHARATI PRAKASHAN, MEERUT
3.	APPLIED MATHEMATICS (I & II)	LUTHERA	HINDI	1994	65.00	B. Tec. PRAKASHAN, LUCKNOW
4.	APPLIED MATHEMATICS (I & II)	P. GUPTA	HINDI	1994	65.00	ASIAN PUBLISHERS, MUZAFFAR NAGAR
5.	ADVANCE Engg. MATHS	H. K. DAS	ENGLISH	1994	125.00	S. CHAND & COo., RAM NAGAR NEW DELHI

1. DISCIPLINE : COMMUNICATION TECHNIQUES

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	ENGLISH FOR COMMUNICATION	V. SHASHIKUMAR M. N. K. BOSE	ENGLISH	1987	21.00	I. R. D. T. U. P., KANPUR
2.	SAMPRESHAN TAKNIK	Prof. R. PAL Dr. Smt NEERAJ SHUKLA Dr.SUBHASH GARG	HINDI	1989	15.00	I. R. D. T. U. P., KANPUR

1. DISCIPLINE : APPLIED CHEMISTRY

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	ANUPRAYUKT RASAYAN	KHANNA & KHANNA & BOUNTRA	HINDI	1994	60.00	BHARAT BAARTI PRAKASHAN, MEERUT
2.	PRAYUKT RASAYAN	MAHENDRA AND SRIVASTAVA	HINDI	1994	58.00	B.TECH. PUBLISHERS,AMMINABAD LUCKNOW
3.	PRAYUKT RASAYAN SHASTRA	S. CHANDRA	HINDI	1994	60.00	NAV BHARAT PRAKASHAN, BEGUM BRIDGE ROAD,MEERUT
4.	APPLIED CHEMISTRY	V. P. MEHITA	HINDI	1993	60.00	ASIAN PUBLISHERS, 85-C NAI MANDI, MUZAFFAR NAGAR
5.	ENGINEERING RASAYAN	Dr. LALIT	HINDI	1994	45.00	DHANPAT RAI & SONS, 1682 NAI SARAK, DELHI
6.	ENGINEERING CHEMISTRY	P. C. JAIN	ENGLISH	1994	100.00	DHANPAT RAI & SONS, 1682 NAI SARAK, DELHI

List of standard Text Books recommended for diploma level institutions of Uttar Pradesh

1. DISCIPLINE : MECHANICAL ENGINEERING

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	MANUFACTURING PROCESS-II	SHARMA & BHATNAGAR	HINDI	LATEST	38.00	NAV BHARAT PRAKASHAN, MEERUT
2.	A TEXT BOOK OF PRODUCTION	P. C. SHARMA	ENGLISH	1992	80.00	S. CHAND & Co., N. DELHI
3.	PRODUCTION TECHNOLOGY	R. K. JAIN & S. C. GUPTA	ENGLISH	LATEST	90.00	KHANNA PUBLISHERS, DELHI
4.	THEORY OF MACHINES	J. K. KAPOOR	HINDI	LATEST	42.00	BHARAT BHARATI PRAKASHAN, MEERUT
5.	THEORY OF MACHINES	R. S. KHURMI & J. K. GUPTA	ENGLISH	LATEST	40.00	EURASIAN PUBLISHING HOUSE, NEW DELHI
6.	THEORY OF MACHINES	R. L. BALLANY	ENGLISH	LATEST	125.00	KHANNA PUBLICATION,2B NORTH MARKET, NAI SARAK, DELHI
7.	MACHINE TOOL TECHNOLOGY VOL I&II	S. K. HAZRA & CHOUDHARY	HINDI	LATEST	90.00	OXFORT & IBH
8.	MACHINE TOOL TECHNOLOGY	J. K. KAPOOR	HINDI	LATEST	60.00	BHARAT BHARATI PRAKASHAN, MEERUT
9.	MACHINE TOOL TECHNOLOGY	S. K. BHATNAGAR	HINDI	1994	70.00	NAV BHARAT PRAKASHAN,MEERUT
10.	INDUSTRIAL MANAGEMENT AND ENTREPRENURSHIP DEVELOPMENT	BHATNAGAR & JAIN	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN, MEERUT
11.	INDUSTRIAL MANAGEMENT AND ENTREPRENURSHIP DEVELOPMENT	D. C. MITTAL	HINDI	LATEST	60.00	ASIAN PUBLICATION,MUZAFFAR NAGAR
12.	INDUSTRIAL MANAGEMENT AND ENTREPRENURSHIP DEVELOPMENT	O. P. KHANNA	ENGLISH	1991	57.00	DHANPAT RAI & SONS.
13.	AUTOMATION PRODUCTION SYSTEM AND C.I.M.	GROVER	ENGLISH	LATEST	140.00	PRINKE HALL OF INDIA,N.DELHI
14.	PRODUCTION AUTOMATION AND C.I.M.	RADHA KRISHNA & S. SUBRAMANYAM	ENGLISH	LATEST	100.00	T.T.T.I., CHANDIGARH
15.	MANUFACTURING TECHNOLOGY	N. RAO	HINDI	1994	72.00	NAV BHARAT PRAKASHAN, MEERUT
16.	MANUFACTURING TECHNOLOGY	M. HASLEYHUEST & M. M. RAO	ENGLISH	LATEST	12.85 (POUND)	LANGUAGE BOOK SOCITY
17.	METROLOGY & MEASURING INSTRUMENT	S. BHATNAGAR & S. C. JAIN	HINDI	1994	70.00	NAV BHARAT PRAKASHAN, MEERUT

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
18.	ENGINEERING METROLOGY	R. K. JAIN	ENGLISH	LATEST	60.00	RAMESH CHAND KHANNA,2-B NATH MARKET, NEW DELHI
19.	ENGINEERING METROLOGY	R. K. RAJPUT	ENGLISH	LATEST	65.00	KATSON PUBLISHING HOUSE, LUDHIYANA
20.	MECHANICAL DESIGN & ESTIMATING	J. K. KAPOOR	HINDI	LATEST	65.00	BHARAT BHARATI PRAKASHAN, MEERUT
21.	MECHANICAL DESIGN & ESTIMATING	R. A. AGRAWAL	HINDI	LATEST	60.00	NAV BHARAT PRAKASHAN,MEERUT
22.	DESIGN AND ESTIMATING	P. C. SHARMA & D. K. AGRAWAL	ENGLISH	LATEST		
23.	A TEXT BOOK OF MACHINE DESIGN	R. S. KHURMI & J. K. GUPTA	ENGLISH	LATEST	55.00	EURASIAN PUBLISHING HOUSE, NEW DELHI
25.	INDUSTRIAL ENGINEERING, SAFETY AND POLLUTION	H. D. SHARMA	HINDI	LATEST	65.00	NAV BHARAT PRAKASHAN, MEERUT
26.	INDUSTRIAL ENGINEERING & SAFETY	J. C. VARSHNEY	HINDI	LATEST	100.00	DEEPAKC PRAKASHAN, GWALIOR
26.	INDUSTRIAL ENGINEERING, SAFETY AND MANAGEMENT	O. P. KHANNA	ENGLISH	LATEST	100.00	DHANPAT RAI & SONS

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	MACHINE DRAWING	P. S. GILLI	ENGLISH	LATEST	75.00	KATARIA, LUDHIANA
2.	ELEMENTARY ENGINEERING DRAWING	N. D. BHATT	ENGLISH	LATEST	90.00	CHAROTER PUBLISHING HOUSE, ANAND
3.	ENGINEERING MECHANICS	J. K. KAPOOR	HINDI	LATEST	60.00	BHARAT BHARATI PRAKASHAN, MEERUT
4.	ENGINEERING MECHANICS	S. K. GUPTA	HINDI	LATEST	55.00	ASIAN PUBLISHING, MUZAFFAR NAGAR
5.	APPLIED MECHANICS	P. GUPTA	HINDI	LATEST	70.00	ASIAN PUBLICATION, MUZAFFAR NAGAR
6.	APPLIED MECHANICS AND STRENGTH	R. S. KHURMI	HINDI	1990	70.00	NERJA CONSTRATIVE AND

	OF MATERIAL						DEVELOPMENT Co.
7.	ELEMENTS OF MECH. ENGG.	KUMAR & MITTAL	HINDI	1993	50.00	ASIAN PUBLICATION, MUZAFFAR NAGAR
8.	ELEMENTS OF MECH. ENGG.	R. A. AGRAWAL	HINDI	1994	50.00	NAV BHARAT PRAKASHAN, MEERUT
9.	ELEMENTS OF MECH. ENGG.	P. C. SONI AND S. RAJAN	HINDI	LATEST	70.00	B. Tech. PUBLICATION,LUCKNOW
10.	KARYASHALA PRODYOGIKI KE MUL TATOYA	HAZRA AND CHOUDHARY	HINDI	LATEST		OXFORD & IBH
11.	PRARAMBHIK KARYASHALA SHILP VIGYAN	D. C. MITTAL	HINDI	LATEST		ASIAN PUBLICATION, MUZAFFAR NAGAR
12.	WORKSHOP W/S TECHNOLOGY (VOL. I & II)	W.A.S. CHAPRMAN	ENGLISH	1989		OXFORD & IBH
13.	AUTOMOBILE ENGINES	G. B. S. NARANG	HINDI	LATEST		
14.	AUTOMOBILE TECHNOLOGY	H. M. SETHI	ENGLISH	LATEST	90.00	TATA McGRAW HILL, N. DELHI
15.	AUTOMATIC MACHINES	JOSEPH HETNER	ENGLISH	1977	30.00	S M BALSARA & USHA, BOMBAY
16.	REFRIGERATION & A/c	SHRADHA NAND	HINDI	LATEST	60.00	ASIAN PUBLISHERS, MUZAFFAR NAGAR
17.	REFRIGERATION & A/c	S. C. ARORA	ENGLISH	LATEST	35.00	TATA Mc GRAW HILL
18.	REFRIGERATION & A/c	D. P. GUPTA	ENGLISH	LATEST	--	
19.	REFRIGERATION & A/c	P. L. BALLONEY	ENGLISH	LATEST	90.00	KHANNA PUBLISHERS
20.	MACHINE TOOL TECHNOLOGY	J. K. KAPOOR	HINDI	LATEST	50.00	BHARAT BHARATI PRAKASHAN
21.	MACHINE TOOL TECHNOLOGY	R. A. AGRAWAL	HINDI	LATEST	65.00	NAV BHARAT PRAKASHAN, MEERUT
22.	STRENGTH OF MATERIALS	Dr. B. C. PUMIA & S. RAMAMURTTY	ENGLISH	LATEST	60.00	LAXMI PUBLICATION, NEW DELHI
23.	MANUFACTURING PROCESS	AGRAWAL AND BHATNAGAR	HINDI	1994	75.00	NAV BHARAT PRAKASHA, MEERUT
24.	MANUFACTURING SCIENCE	GHOSH & MALIK	HINDI	LATEST	60.00	AFFITIATED EAST WESTERN
25.	FUNDAMENTALS OF W/S TECHNOLOGY	HAZRA AND CHOUDHARY	HINDI	LATEST		OXFORD & IBH
26.	THERMAL ENGINEERING	S. K. BHATNAGAR	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN, MEERUT
27.	HEAD ENGINES	PANDEY & SHAH	ENGLISH	LATEST	80.00	CHARSTAL BOOK DEPOT, ANAND
28.	THERMAL ENGINEERING	P. L. BALLANEY	ENGLISH	LATEST	125.00	KHANNA PUBLISHER
29.	DRAW ENGG. AND DRAW CHATIT MACHINES	J. K KAPOOR	HINDI	LATEST	55.00	BHARAT BHARATI PRAKASHAN, NEW DELHI
30.	A TEXT BOOK OF HYDRAULICS	R. S. KHURMI	ENGLISH	LATEST	60.00	S. CHAND & Co.,
31.	FLUID MECHANICS & HYDRAULICS	JAGADESH LAL	ENGLISH	LATEST	50.00	METRO POINT BOOK Co.
32.	MATERIAL & MATERIAL SCIENCE	S. K. BHATNAGAR	HINDI	1994	50.00	NAV BHARAT PRAKSHAN, MEERUT
33.	MATERIAL & MATERIAL SCIENCE	O. P. KHANNA	ENGLISH	LATEST	90.00	DHANPAT RAI & SONS.

List of standard Text Books (Hindi) recommended for diploma level institutions of Uttar Pradesh

1. DISCIPLINE : MECHANICAL ENGINEERING

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
1.	MANUFACTURING PROCESS-II	SHARMA & BHATNAGAR	HINDI	LATEST	38.00	NAV BHARAT PRAKASHAN, MEERUT
2.	THEORY OF MACHINES	J. K. KAPOOR	HINDI	LATEST	42.00	BHARAT BHARATI PRAKASHAN, MEERUT
3.	MACHINE TOOL TECHNOLOGY VOL I&II	S. K. HAZRA & CHOUDHARY	HINDI	LATEST	90.00	OXFORT & IBH
4.	MACHINE TOOL TECHNOLOGY	J. K. KAPOOR	HINDI	LATEST	60.00	BHARAT BHARATI PRAKASHAN, MEERUT
5.	MACHINE TOOL TECHNOLOGY	S. K. BHATNAGAR	HINDI	1994	70.00	NAV BHARAT PRAKASHAN,MEERUT
6.	INDUSTRIAL MANAGEMENT AND ENTREPRENURSHIP DEVELOPMENT	BHATNAGAR & JAIN	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN, MEERUT
7.	INDUSTRIAL MANAGEMENT AND ENTREPRENURSHIP DEVELOPMENT	D. C. MITTAL	HINDI	LATEST	60.00	ASIAN PUBLICATION,MUZAFFAR NAGAR
8.	MANUFACTURING TECHNOLOGY	N. RAO	HINDI	1994	72.00	NAV BHARAT PRAKASHAN, MEERUT
9.	METROLOGY & MEASURING INSTRUMENT	S. BHATNAGAR & S. C. JAIN	HINDI	1994	70.00	NAV BHARAT PRAKASHAN, MEERUT
10.	MECHANICAL DESIGN & ESTIMATING	J. K. KAPOOR	HINDI	LATEST	65.00	BHARAT BHARATI PRAKASHAN, MEERUT
11.	MECHANICAL DESIGN & ESTIMATING	R. A. AGRAWAL	HINDI	LATEST	60.00	NAV BHARAT PRAKASHAN,MEERUT
12.	INDUSTRIAL ENGINEERING, SAFETY AND POLLUTION	H. D. SHARMA	HINDI	LATEST	65.00	NAV BHARAT PRAKASHAN, MEERUT
13.	INDUSTRIAL ENGINEERING & SAFETY	J. C. VARSHNEY	HINDI	LATEST	100.00	DEEPAKC PRAKASHAN, GWALIOR

Sl.No.	TEXT BOOK	AUTHOR	MEDIUM	EDITION YR	COST	FULL ADDRESS OF PUBLICATION
3.	ENGINEERING MECHANICS	J. K. KAPOOR	HINDI	LATEST	60.00	BHARAT BHARATI PRAKASHAN, MEERUT
4.	ENGINEERING MECHANICS	S. K. GUPTA	HINDI	LATEST	55.00	ASIAN PUBLISHING, MUZAFFAR NAGAR
5.	APPLIED MECHANICS	P. GUPTA	HINDI	LATEST	70.00	ASIAN PUBLICATION, MUZAFFAR NAGAR
6.	APPLIED MECHANICS AND STRENGTH OF MATERIAL	R. S. KHURMI	HINDI	1990	70.00	NERJA CONSTRATIVE AND DEVELOPMENT Co.
7.	ELEMENTS OF MECH. ENGG.	KUMAR & MITTAL	HINDI	1993	50.00	ASIAN PUBLICATION, MUZAFFAR NAGAR
8.	ELEMENTS OF MECH. ENGG.	R. A. AGRAWAL	HINDI	1994	50.00	NAV BHARAT PRAKASHAN, MEERUT
9.	ELEMENTS OF MECH. ENGG.	P. C. SONI AND S. RAJAN	HINDI	LATEST	70.00	B. Tech. PUBLICATION,LUCKNOW
10.	KARYASHALA PRODYOGIKI KE MUL TATOYA	HAZRA AND CHOUDHARY	HINDI	LATEST		OXFORD & IBH
11.	PRARAMBHIK KARYASHALA SHILP VIGYAN	D. C. MITTAL	HINDI	LATEST		ASIAN PUBLICATION, MUZAFFAR NAGAR
13.	AUTOMOBILE ENGINES	G. B. S. NARANG	HINDI	LATEST		
16.	REFRIGERATION & A/c	SHRADHA NAND	HINDI	LATEST	60.00	ASIAN PUBLISHERS, MUZAFFAR NAGAR
20.	MACHINE TOOL TECHNOLOGY	J. K. KAPOOR	HINDI	LATEST	50.00	BHARAT BHARATI PRAKASHAN
21.	MACHINE TOOL TECHNOLOGY	R. A. AGRAWAL	HINDI	LATEST	65.00	NAV BHARAT PRAKASHAN, MEERUT
23.	MANUFACTURING PROCESS	AGRAWAL AND BHATNAGAR	HINDI	1994	75.00	NAV BHARAT PRAKASHA, MEERUT
24.	MANUFACTURING SCIENCE	GHOSH & MALIK	HINDI	LATEST	60.00	AFFITIATED EAST WESTERN
25.	FUNDAMENTALS OF W/S TECHNOLOGY	HAZRA AND CHOUDHARY	HINDI	LATEST		OXFORD & IBH
26.	THERMAL ENGINEERING	S. K. BHATNAGAR	HINDI	LATEST	70.00	NAV BHARAT PRAKASHAN, MEERUT
29.	DRAW ENGG. AND DRAW CHATIT MACHINES	J. K KAPOOR	HINDI	LATEST	55.00	BHARAT BHARATI PRAKASHAN, NEW DELHI
32.	MATERIAL & MATERIAL SCIENCE	S. K. BHATNAGAR	HINDI	1994	50.00	NAV BHARAT PRAKSHAN, MEERUT