

**CUSROW WADIA INSTITUTE OF TECHNOLOGY,
PUNE - 411 001.**

MECHANICAL ENGINEERING DEPARTMENT

Multi Point Entry and Credit System

MPECS 2014

CURRICULUM
[w.e.f. June 2014]

CUSROW WADIA INSTITUTE OF TECHNOLOGY, PUNE -1.
CURRICULUM REVISION (2014)

1. Preamble :

- Cusrow Wadia Institute of Technology, Pune was granted Academic Autonomy in the year 1985 by Government of Maharashtra vide letter No. PTI 2483/119915(234)/TE-I (B) dated 27/2/1985.
- Initially the Institute adopted the Model Curriculum prepared by then TTTI, Western Region, Bhopal. Subsequently, the revisions in the curriculum were made as per the needs of the Society.
- The Institute adopted Multi Point Entry and Credit System w.e.f. June 1998.
- The earlier revision was carried out in the year 2010. Subsequently the review of the curriculum was taken in the year 2012-2013. Necessary changes in the contents and detailing of the document as regards to the scope implementation strategy and related processes were done in the year 2013.

The present curriculum will come into force w.e.f. June 2014 .

- The feedback was taken from various stake holders and it was strongly felt that the rapid strides in the field of Information Technology, Computers and Manufacturing Processes , a dynamic curriculum need to adopt the benefits of the fast changing expectations in the contents as well as the Teaching Learning Methodology.
- The Institute has strengthened the hardware and software which is constantly consolidated and upgraded to match the needs of the society in general and the Industries in particular.
- Students should be proficient in the use of computers and related softwares irrespective of the branch of Engineering they are studying. The students shall be made to make maximum use of software packages and use Internet to derive and update their knowledge.
- The contemporary needs of the user system and overall development of the students is the governing factor in the revision of 2014 curriculum.

2. Approach for Curriculum Revision:

- Scientific system approach has been adopted in the revision of curriculum .
- A curriculum revision model showing various steps undergone is presented.
- Analysis of the existing curriculum was done by taking feedback from the faculty implementing the curriculum, Alumni, Industry / Field Personnel, Courses Committee Members and the Experts in the field of Education.
- Entry behaviour of the students was assessed. Basic entry qualification for Diploma is SSC or equivalent .However, higher entry qualification like 12th Science, 12th MCVC, ITI etc. was also considered.
- Curriculum documents of MSBTE, other Boards and other Autonomous Institutions were studied for inclusion of new courses and analysis of contents of existing and newly inducted courses and also the implementation strategy.
- The curriculum is rationalised as per the AICTE and MSBTE norms and guidelines.
- The team members were identified for conducting Search Conference, collecting feedback from stake holders and interviews with Experts for noting the suggestions about the courses and necessary modifications. The Interactive Sessions were arranged through Search Conference attended by the Experts from Industry and Academia. The faculty members were

trained by specialists in Technical Education System as regards to the Curriculum Revision Process.

3. ROLES TO BE PLAYED AND FUNCTIONS TO BE PERFORMED BY A DIPLOMA HOLDER:

- A Diploma holder may be employed in the Industry as a Technician or Supervisor for Production, Installation, Repairs and Maintenance. He also may be employed in drawing, estimation or as an Assistant in IT related activities. He may be an Entrepreneur, be assigned a job of Purchase/ Marketing Department. Diploma holder should have basic knowledge of the various subjects of his branch in Engineering and also the related Inter-disciplinary subjects. He should be aware of the present technologies and be able to adopt the changes in future. He shall acquire the necessary skill sets in the Engineering subjects.
- His role in the Society is that of a responsible individual and should conduct himself as regards the values and cultures. He should acquire the necessary professional, presentation and managerial Skills.

4. ANALYSING JOB FUNCTIONS AND DERIVING CURRICULUM OBJECTIVES:

- The role of a Diploma holder, as a Technician on the job, is analysed in four Domains of Professional Skills, Life Long Learning, Personal Development and Social Development.
- The curriculum should help the students to acquire professional skills and inculcate attitudes in order that the student will be able to discharge the role and functions effectively on the societal and employment front.
- Goals and objectives of each program were framed. The courses common to several programmes and the courses relevant to particular programmes were classified under various categories.
- The overall course structure and Teaching Examination Scheme was prepared.
- The contents of various courses were finalised by considering the feedback from stake holders through interviews, Search Conference and discussions.
- The course structure and the contents were validated by the Board of Studies.
- Study of the Diploma programmes offered by MSBTE , other State Boards and other Autonomous Institutions was done to widen the perspective .

5. Evolving the Teaching Learning Process:

The following points were considered:

- No. of weeks – 16
- Average days per week- 5.5
- No. of contact hours per day – 7
- No. of hours per week for instruction and pre-decided Co-curricular activities – 38.
- Each course shall be taught for sixteen weeks and two weeks shall be utilised for revision in that term.

6. Course Categories:

- Foundation
- Core

- Allied
- Applied
- Specialised
- Number of courses for a programme – 40.
- Number of courses for award of class – 11
- Number of Elective courses - 4
- Number of credits to be earned for obtaining Diploma – 185.
- One credit = one hour of lecture / practical per week for a course.
- Ratio of theory to practical hours per week : approx. 55:45

7. Examination Scheme:

- Theory paper – 80 marks
- Tests – 20 marks
- Term Work – 25-50 marks
- Practicals -25 – 50 marks
- Viva voce- 25 – 50 marks
- Project Work -100 + 50 marks
- Grand total – 4700 marks
- Grand total of marks for award of class – 1600.

8. Course-wise Content detailing:

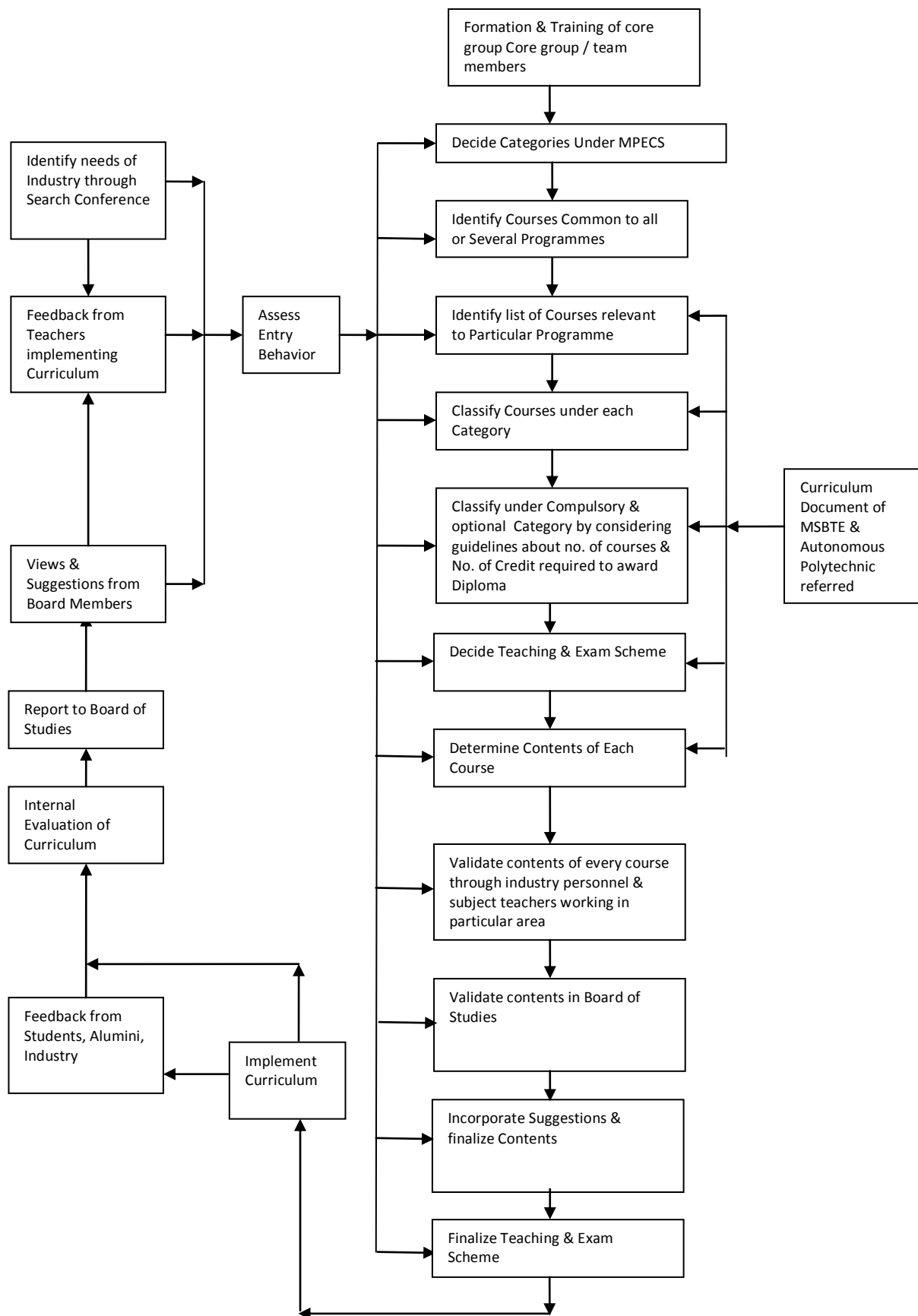
- For finalisation of course structure from Courses Committee, Examination Committee and Board of Studies, various processes in the Curriculum Revision Model were followed. Also the documents of MSBTE and Autonomous Polytechnics were referred.
- Contents were decided by taking into consideration, the expectations of the stake holders, specific needs of Industry, Interviews , Discussions and Experts opinions .
- Every course has a unique code e.g. R14ME4201. ‘R14’ means the course is from the curriculum revised in 2014. ME implies Mechanical Engineering Department will teach this course. ‘4’ indicates that it is Applied Course Category in the programme structure. ‘2’ means the course is to be taught to Mechanical Engineering programme. ‘01’ is the serial number of the course in Applied Courses Category.

The 7th character in the above 9 digit code is assigned for the programme ,e.g. 1 – Civil, 2 – Mechanical, 3 – Electrical, 4 – Computer and 5 – Electronics & Telecommunication Engineering and 7 – Common courses for all programmes taught by Science Department.

- A rationale giving the importance of the course in the curriculum is vividly explained. The course objectives are derived indicating the purpose to teach the course / subject.
- The Practicals, Seminars are spelt out along with assessment technique .
- The input for professional practices and generic skills are included in most of the courses so that the students will be able to learn the contents beyond syllabus.
- The curriculum document prescribes learning resources for students e.g. Reference books, Textbooks, Websites, Handbooks, Printed notes etc.
- Use of Learning Management System, Audio Visual Aids be increased for enhancing the Teaching Learning Process.

9. Curriculum Implementation Strategy:

- Members of the faculty shall continuously undergo Induction Training Programme, Content upgrading programme conducted by ISTE , NITTTR and other Organisations.
- The faculty members will be deputed to attend Refresher courses and Training programmes so as to help them keep abreast with latest developments and technology.
- Faculty members will be trained in respect of various aspects and methods of evaluation systems , Paper setting etc.
- Faculty will be trained for monitoring the curriculum implementation.
- Library will be constantly modernised with additions of latest titles and books .The Library will have open access to the students. Library will be open for extended hours from 10 a.m. to 8.00 p.m. The Books Bank Facility will support the demand of the students.
- The Laboratory and Field Manuals will be structured and standardised so that the students can spend more time for doing practicals, understanding the significance, discussions and result analysis rather than only writing the journals.
- The Examination rules will be revised to suit the curriculum and will have similarity as regards to principles followed by MSBTE and other Examination bodies.
- The Evaluation Systems and marking schemes will be commensurate with the input hours and importance of the topics in the course.
- 24 X 7 Internet connection is available for faculty, staff and students . Also Wi-Fi connectivity provided in all classrooms and laboratories will support the modern methods of teaching.
- Uninterrupted Power Supply and captive power is made available to take over the load shedding .
- The laboratories , equipments and computers be maintained in working conditions. The models, charts and exhibits be displayed to invite attention of the students .
- Industrial visits, Field visits, Study tours shall be arranged regularly in a preplanned and structured manner so as to have focus on technical aspects.
- Guest faculty should be invited to deliver lectures on recent trends, technology, materials and processes . These activities be planned in the beginning of the term .
- The students should imbibe various life skills, generic skills, learn stress management and adjust help and appreciate colleagues especially during group activities, study tours and visits etc.



CURRICULUM REVISION MODEL USED AT CWIT- 2014

What is Mechanical Engineering?

Mechanical engineers are often called the “General practitioners” of engineering because their education is extremely broad and their services span many of interdisciplinary technical, social, environmental and economic problems that face the world today.

Because of their training, mechanical engineers are in demand in practically every type of manufacturing operations as well as in research, academic and governmental organisations. Specific assignments involved research and development, design of equipment or systems, supervision of production, plant engineering, administration, sales engineering, the testing and evaluation of machines and entire plants and teaching. Their educational program also prepares them to address current and future problems in areas such as: energy storage, alternative fuels, waste disposal and management, environmental control, more efficient energy conversion methods and biomedical engineering.

Importance of Mechanical Engineering Programme:

Mechanical Engineers create machines, materials, and system that satisfy a particular function. They deal with problems in areas such as energy conversion, design of mechanical components & systems, man and machine environments, and instrumentation & control of process.

Mechanical engineers are typically involved with such activities as:

- Generation, distribution and use of energy.
- Development and application of manufacturing systems and processes.
- Automation and control of mechanical and thermal systems.
- Design of various products for consumer and commercial markets.

About one-fourth of all engineers practicing today have been educated as mechanical engineers. Their activities include research, development, design, testing, production, technical sales and technical management.

Mechanical engineers are characterized by personal creativity, breadth of knowledge and versatility. For these reasons they are found to function and thrive as valuable members and leaders of multidisciplinary teams. Through clever use of analysis, modeling, design, synthesis, and interpersonal skills they solve important problems to improve our world.

The overall objective of the curriculum in mechanical engineering is to prepare students for lifelong learning and growth in careers as mechanical engineers in the rapidly-changing industrial world.

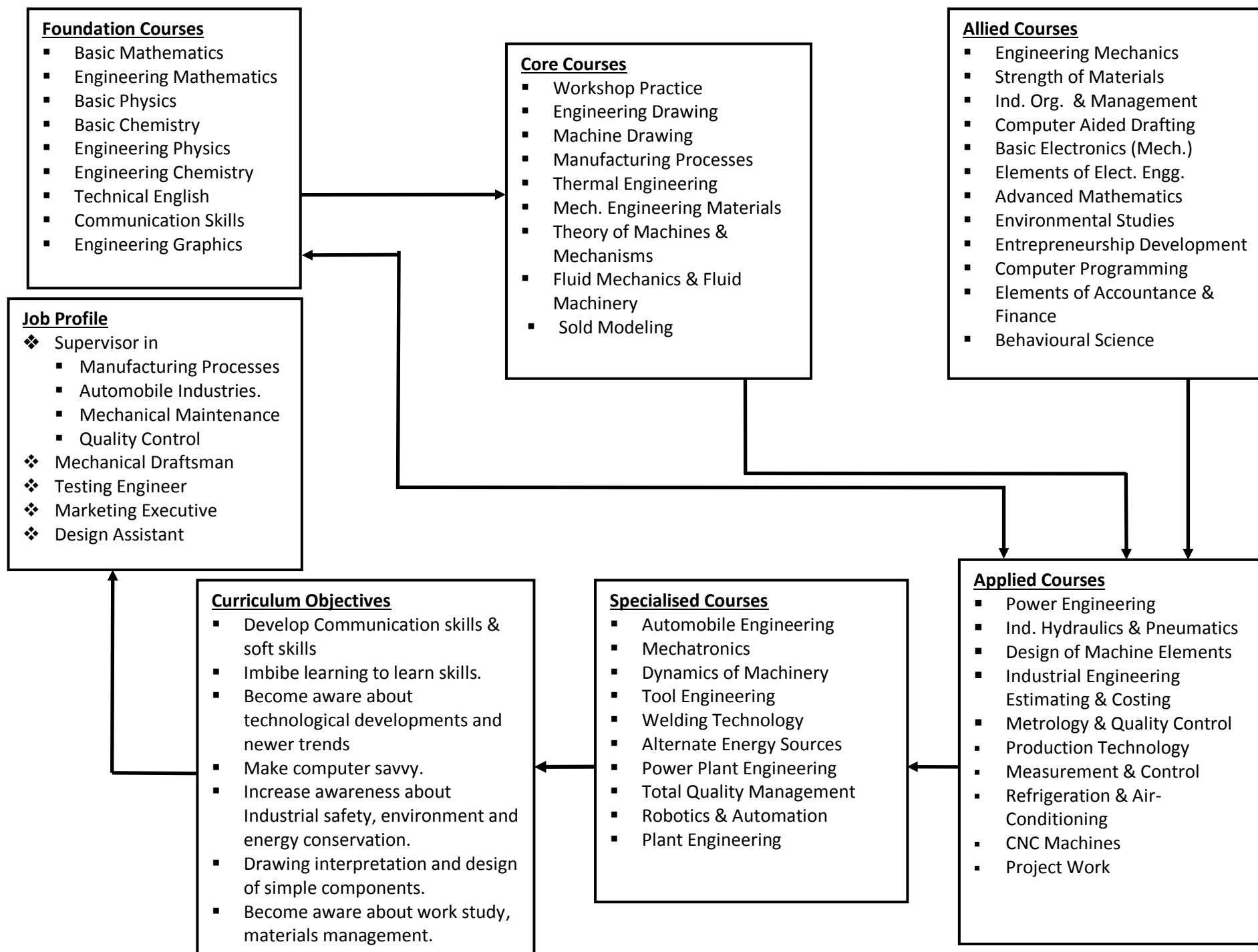
Upon successfully completing the mechanical engineering curriculum, students will be prepared for immediate entry into the field or for further study at the graduate level.

Objectives of Mechanical Engineering Programme:

The Department of Mechanical Engineering intends to provide a firm foundation in mathematics, science, and design methodology applied to the disciplines of mechanical engineering in the areas of mechanical, fluid, thermal and manufacturing systems. It shall offer the most contemporary and essential tools needed in the breadth and depth of mechanical engineering. The curriculum shall incorporate analytical tools, creative thought and communication skills as offered through courses in the department and industrial exchange.

The department shall provide students the opportunities to work effectively as individuals, in teams and provide experience in leadership, management, planning, organization and real world, hands-on engineering that leads to an appreciation of the business and entrepreneurial aspects of mechanical engineering. It shall provide the broad education necessary for engaging in life-long learning.

LINK DIAGRAM FOR MECHANICAL ENGINEERING



PROGRAMME: MECHANICAL ENGINEERING (MPECS 2014)

Sr. No.	Category	Course Code	Course Title	Pre-requisite	Comp. / Opt.	Teaching Scheme		Credits	Examination Scheme					
						L	P			TH	TT	PR	OR	TW
1	FOUND- ATION COURSES (All Compulsory)	R14SC1701	Basic Mathematics	-	C	4	-	4	80	20	-	-	-	100
2		R14SC1702	Engineering Mathematics	-	C	4	-	4	80	20	-	-	-	100
3		R14SC1703	Basic Physics	-	C	2	2	4	40	10	-	-	25	75
4		R14SC1704	Basic Chemistry	-	C	2	2	4	40	10	-	-	25	75
5		R14SC1707	Technical English	-	C	2	2	4	80	20	-	-	25	125
6		R14SC1708	Communication Skills	-	C	1	2	3	-	-	-	25@	25	50
7		R14SC1709	Applied Science	-	C	4	4	8	80	20			50	150
8		R14ME1201	Engineering Graphics \$	-	C	2	4	6	80	20	-	-	50	150
Total					C	21	16	37	480	120	-	25	200	825
9	ALLIED COURSES (8Compulsory & 1 Optional)	R14AM2101	Engineering Mechanics	-	C	3	2	5	80	20	-	-	25	125
10		R14AM2102	Strength of Materials	R14AM2101	C	4	2	6	80	20	-	-	25	125
11		R14ME2203	Ind. Org. & Management	-	C	3	-	3	80	20	-	-	-	100
12		R14ME2204	Computer Aided Drafting	-	C	1	4	5	-	-	50@	-	50	100
13		R14EX2503	Basic Electronics (Mech.)	-	C	4	2	6	80	20	-	-	25	125
14		R14EE2302	Elements of Elect. Engg.	-	C	3	2	5	80	20	-	-	25	125
15		R14SC2701	Advanced Mathematics	-	C	3	-	3	80	20	-	-	-	100
16		R14ME2205	Environmental studies	-	C	2	1	3				25@	25	50
17		R14ME2206	Entrepreneurship Develop.	-	ANY ONE	2	1	3	-	-	-	25@	25	50
18		R14ME2207	Computer Programming	-		1	2	3	-	-	25@	-	25	50
19	R14ME2208	Elements of Accounts & Finance	-	2		1	3	-	-	-	25@	25	50	
20	R14ME2209	Behavioural Science	-	2		1	3	-	-	-	25@	25	50	
Total						25	14	39	480	120	50	50	200	900
21	CORE COURSES (All Compulsory)	R14ME3201	Workshop Practice	-	C	0	4	4	-	-	-	-	50	50
22		R14ME3202	Engineering Drawing \$	R14ME1201	C	2	4	6	80	20	-	-	50	150
23		R14ME3203	Machine Drawing \$	R14ME1201	C	2	4	6	80	20	-	25	25	150
24		R14ME3204	Manufacturing Processes	R14ME3201	C	3	4	7	80	20	25	-	25	150
25		R14ME3205	Thermal Engineering	-	C	4	2	6	80	20	-	25	25	150
26		R14ME3206	Mech. Engg. Materials	-	C	3	-	3	80	20	-	-	-	100
27		R14ME3207	Theory of Machines & Mech.	-	C	4	2	6	80	20	-	-	50	150
28		R14ME3208	Fluid Mechanics & Fluid Machinery	-	C	4	2	6	80	20	-	25	25	150
29		R14ME3209	Solid Modelling	R14ME2204	C	1	2	3	-	-	50		25	75
Total						23	24	47	560	140	75	75	275	1125

Sr. No.	Category	Course Code	Course Title	Pre-requisite	Comp. / Opt.	Teaching Scheme		Cred its	Examination Scheme					
						L	P			TH	TT	PR	OR	TW
30	APPLIED COURSES (All Compulsor y)	R14ME4201	Power Engineering	R14ME3205	C	4	2	6	80	20	-	25	50	175
31		R14ME4202	Ind. Hydraulics & Pneumatics	R14ME3208	C	3	2	5	80	20	-	25	25	150
32		R14ME4203	Design of Machine Elements	R14AM2102	C	4	2	6	80	20	-	25	50	175
33		R14ME4204	Ind. Engg., Estimating & Costing	-	C	3	2	5	80	20	-	-	50	150
34		R14ME4205	Metrology & Quality Control	R14ME3201	C	3	2	5	80	20	25	-	25	150
35		R14ME4206	Production Technology	R14ME3204	C	3	4	7	80	20	-	25	25	150
36		R14ME4207	Measurement and Control		C	3	2	5	80	20	-	-	50	150
37		R14ME4208	Refrigeration & Air-Conditioning	R14ME3205	C	3	2	5	80	20	-	25	25	150
38		R14ME4209	CNC Machines		C	1	2	3			50	-	50	100
39		R14ME4210	Project Work	100CR	C	-	4	4	-	-	-	50	100	150
Total						27	24	51	640	160	75	175	450	1500
40	SPECIAL-ISED COURSES (3Optional)	R14ME5201	Automobile Engineering	R14ME4201	ANY ONE	3	2	5	80	20	-	-	50	150
41		R14ME5202	Mechatronics	R14EX2503		3	2	5	80	20	-	-	50	150
42		R14ME5203	Dynamics of Machinery	R14ME3207		3	2	5	80	20	-	-	50	150
43		R14ME5205	Tool Engineering	R14ME3204	Group “A”	1	2	3	-	-	-	50	50	100
44		R14ME5206	Welding Technology	R14ME3204		1	2	3	-	-	-	50	50	100
45		R14ME5207	Alternate Energy Sources	R14ME3205	ANY ONE	1	2	3	-	-	-	50	50	100
46		R14ME5204	Power Plant Engineering	R14ME4201	Group “B”	1	2	3	-	-	-	50	50	100
47		R14ME5208	Total Quality Management	R14ME4205		1	2	3	-	-	-	50	50	100
48		R14ME5209	Robotics & Automation	R14ME4206	ANY ONE	1	2	3	-	-	-	50	50	100
49		R14ME5210	Plant Engineering	-		1	2	3	-	-	-	50	50	100
Total						5	6	11	80	20	-	100	150	350
Grand Total						101	84	185	2240	560	200	425	-	4700

\$ Theory examination of 4 hours duration

@ Internal Examination

OVERALL SUMMARY

Sr. No.	Category	No. of Courses		Teaching Scheme			Examination Scheme				
		Comp.	Opt.	L	P	Credits	TH+TT	PR	OR	TW	TOTAL
1	Foundation	08	-	21	16	37	600	-	25	200	825
2	Allied	08	01	25	14	39	600	50	50	200	900
3	Core	09	-	23	24	47	700	75	75	275	1125
4	Applied	10	-	27	24	51	800	75	175	450	1500
5	Specialized	-	03	05	06	11	100	-	100	150	350
		35	4	101	84	185	2800	200	425	1275	4700

Total Credits : 185

Total Marks : 4700

Total No. of Courses to complete the Program : 39 (35Comp. +4 Opt.)

Total No. of Theory Exams : 28

Total No. of Practical / Oral exams : (4+1@) + (11+2@) = 18

Theory Credits to Non-Theory Credits Ratio : 55:45

Theory Marks to Non-Theory Marks Ratio : 62 : 38

@ - Internal Examination

FOR CLASS DECLARATION

NO. OF COURSES: 11

COMPULSORY COURSES: 10

OPTIONAL COURSES: 01

Category	Course Code	Course Title	C o m p/ O p t .	Examination Scheme				
				TH	TT	PR	OR	TW
ALLIED COURSES	R14ME2203	Ind. Org. & Management	C	80	20	-	-	-
APPLIED COURSES	R14ME4207	Measurements & Control	C	80	20	-	-	50
	R14ME4201	Power Engineering	C	80	20	-	25	50
	R14ME4202	Industrial Hydraulics & Pneumatics	C	80	20	-	25	25
	R14ME4203	Design of Machine Elements	C	80	20	-	25	50
	R14ME4204	Ind. Engg. Estimating & Costing	C	80	20	-	-	50
	R14ME4205	Metrology & Quality Control	C	80	20	25	-	25
	R14ME4208	Refrigeration & Air-Conditioning	C	80	20	-	25	25
	R14ME4209	CNC Machines	C	-	-	50	-	50
	R14ME4210	Project Work	C	-	-	-	50	100
SPECIALISED COURSES	R14ME5201	Automobile Engineering	AN Y ON E	80	20	-	-	50
	R14ME5202	Mechatronics		80	20	-	-	50
	R14ME5203	Dynamics of Machinery		80	20	-	-	50

MAX. THEORY MARKS

: 900

MAX. ORAL + PRACT MARKS

: 150 + 75 = 225

MAX. TERM WORK MARKS

: 475

GRAND TOTAL

: 1600

THEORY CREDITS TO NON-THEORY CREDITS RATIO : (30+22) 58 : 42

THEORY MARKS TO NON-THEORY MARKS RATIO : (900+700) 56 : 44

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING

Course : Basic Mathematics

Course Code: R14SC1701

Course Category: Foundation

Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	-	3	80	20	-	-	-	100

Rationale:

Mathematics is an important prerequisite for the development and understanding of engineering concepts. The aim of the course is to acquire some essential competencies in Mathematics by the students of diploma in Engineering. The course will help the students to think logically and systematically. The students will develop the attitude of problem solving.

Objectives:

The students will be able to

1. Understand all the basic concepts of Mathematics used in various fields of engineering.
2. Know the methods and procedures of problem solving.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	<u>Trigonometry:</u> 1.1 Trigonometric ratios of an angle Definition of positive and negative angles. Unit of measurement of an angle. Signs of trigonometric ratios of an angle in the four quadrants.(ASTC RULE) Trigonometric ratios of negative angles. 1.2 Trigonometric ratios of compound angles. Trigonometric ratios of allied angles. Trigonometric ratios of multiple and sub-multiple angles. Factorization and de-factorization formulae.	15	16

2	Inverse Circular function 2.1 Definition of inverse circular function. Principal value of inverse circular function. Properties of inverse circular function. Simple problems based on properties. 2.2 Solution of triangle. Sine Rule. Cosine Rule. Solution of the triangle using sine and cosine rule. Determinant: 2.3 Definition of determinants. Problems on expansion of determinants of order 2 & 3. Solution of simultaneous equation in two and three Unknowns (Cramer's Rule).	10	12
3	Matrices: 3.1 Definition of a Matrix. Types of Matrices. Algebra of matrices: Addition, subtraction and multiplication of matrices. 3.2 Transpose of a matrix. Cofactor matrix Adjoint of a matrix. 3.3 Inverse of a matrix and to find inverse by adjoint method. Solution of simultaneous equation by matrix method.	10	16
4	Statistics: 4.1 Measures of central tendency. Mean, Median and Mode for grouped and ungrouped data. 4.2 Measures of dispersion: Mean deviation. Standard deviation. Variance and coefficient of variation	10	12
5	Vector Algebra: 5.1 Definition of Vector. Addition, subtraction of vectors. Direction cosines, direction ratios of line. 5.2 Product of vectors and its properties: Dot product of vectors Cross product of vectors. Scalar triple product of vectors.	09	12
6	The Straight Line: 6.1 Slope and intercept of a line. Parallel and perpendicular lines. 6.2 Intersection of two lines. Acute angle between two lines Perpendicular distance between a point and a line. Distance between two parallel lines. 6.3 Graphs - Graph of linear function. Graph of quadratic equation. Graph of trigonometric function. Graph of exponential function.	10	12
Total		64	80

Teaching Methodology: Chalk board, Discussion, Assignments, Printed notes

Skills to be developed:

Intellectual Skills:

- Memorizing skill will be developed after studying the formulae of all the topics.
- Selection skill will be developed after studying the methods of solving problems during selection of appropriate formula.
- Calculation skill will be developed after studying the topics Trigonometry, Determinants and Matrices
- Skill of drawing graphs will be developed after studying the topic graphs.

Learning Resources:

A) Books :

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Peter V. O'Neil	Advanced Engineering Mathematics	Thomson, Canada.
2	K. A. Stroud, D. J. Booth	Engineering Mathematics	Palgrave, New York, U.S.A.
3	S. L. Loney	Plane Trigonometry	Macmillan Publication

B) Websites for references:

1. www.Wikipedia.com
2. www.Wolfarm.com
3. www.Mathworld.com
4. www.nptel.iitm.ac.in

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING

Course : Engineering Mathematics

Course Code: R14SC1702

Course Category: Foundation

Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	-	3	80	20	-	-	-	100

Rationale:

Mathematics is an important prerequisite for the development and understanding of engineering concepts. The subject intends to teach students basic facts, concepts and principles of Mathematics as a tool to analyze engineering problems. It also aims to teach students to apply the basic facts of Mathematics to solve engineering problem.

Objectives:

The students will be able to:

1. Understand the concept and principles of derivatives, functions, limits.
2. Use the principles of derivatives for the various applications.
3. Understand the principles of complex numbers.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Functions and Limits: 1.1 Definition of functions and Notation. Different types of functions. 1.2 Limits - Concept of limits, Algebra of limits. 1.3 Different methods of finding limits. Limits of algebraic function. Limits of trigonometric function. Limits of exponential functions.	15	16

2	Laws of Derivative: 2.1 Concept and definition of derivative. 2.2 Derivatives of standard functions. 2.3 Laws of derivatives :- Addition law. Subtraction law. Multiplication law. Division law. 2.4 Derivatives of composite functions (Chain rule).	09	12
3	Methods of Derivatives: 3.1 Derivative of parametric functions. Derivative of implicit functions. Logarithmic differentiation. 3.2 Concept of higher order derivative 3.3 Concept of partial derivative.	10	12
4	Application of Derivatives: 4.1 Geometrical meaning of derivative.(slope of tangent and normal to the given curve) 4.2 Radius of curvature. 4.3 Physical application of derivative. 4.4 Maxima and minima using derivative.	9	12
5	Integration: 5.1 Definition of integration as anti-derivative. 5.2 Integration of algebraic functions. 5.3 Integration of trigonometric functions. 5.4 Integration by substitution.	9	12
6	Complex Number: 6.1 Definition of complex number. Algebra of complex number i.e. addition, subtraction, multiplication and division of complex numbers. To express given complex number in $x + iy$ form. 6.2 Representation of complex number in a plane (Argand's diagram). Modulus and amplitude of complex number. Polar form of a complex number. Exponential form of a complex number. 6.3 Powers of a complex number - De - Moivre's theorem. Euler's theorem.	12	16
Total		64	80

Teaching Methodology: Chalk board, Discussion, Assignments, handouts

Skills to be developed:

Intellectual Skills:

- Memorizing skill will be developed after studying the formulae of all the topics.
- Selection skill will be developed after studying the methods of solving problems during selection of appropriate formula.
- Application skill will be developed after studying the topic Application of derivatives.
- Comprehension skill will be developed after studying each and every topic.

Learning Resources:

A) Books :

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	K. A. Stroud, D. J. Booth	Engineering Mathematics	Palgrave, New York, U.S.A.
2	Peter V. O'Neil	Advanced Engineering Mathematics	Thomson, Canada.
3	Shanti Narayan	Engineering Mathematics Vol. I & II	S.Chand & Company, New Delhi.

B) Websites for references:

1. www.wikipedia.com
2. www.wolfarm.com
3. www.mathworld.com
4. www.nptel.iitm.ac.in

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING

Course Name : Basics Physics

Course Code: R14SC1703

Course category: Foundation

Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	2	40	10	-	-	25	75

Rationale:

The development of various engineering topics is primarily based on the fundamental principles. The different principles of physics have a wide range of applications in all the branches of engineering. A reasonably good level of knowledge of physics, therefore, forms sound base for engineering students. Physics can be considered as a basic tool in the hands of an engineer through which he can pursue his studies and research work in technical field. The foundation level of the subject acquired by the student is kept in mind for selection of the topics. To create interest in the students more stress is given on the applications, in engineering field.

Objectives:

The student will be able to

1. Use different types of systems of units.
2. Identify and minimize the errors, Understand significant figures.
3. Study different types of motion and their applications in engineering field.
4. Study molecular forces and explain surface tension and viscosity with applications.
5. Understand different concepts of sound and ultrasonic waves with application.
6. Differentiate between conduction convection and radiation.
7. Use different types of thermometers.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	1.1 Units and measurements: Unit, fundamental units & examples, derived units & examples, system of Fundamental units (C.G.S., M.K.S., S.I. system of units) Rules and Conventions for the use of spacing of symbols in SI system. Table of derived S.I. units. Multiples and sub multiples of units. Significant figures, rules for significant figures. 1.2 Errors. – Types of errors, Minimization of errors, Percentage error, Propagation of errors, Numericals. 1.3 Surface Tension: Molecular forces and their nature, cohesive forces, adhesive forces sphere of influence, definition of	14	16

	surface tension, factors affecting surface tension (Temperature, impurity nature of the liquid), concave and convex meniscus of liquid surfaces and their explanation on the basis of molecular forces, angle of contact, capillary action and its explanation, applications of surface tension. Numericals 1.4 Viscosity: Streamline and turbulent flow of fluids, critical velocity, viscous force in fluid, significance of Reynolds's number, velocity gradient, Newton's law, Stoke's law expression, terminal velocity, Numericals.		
2	2.1 Circular Motion: Circular motion, uniform circular motion, tangential velocity, angular velocity, periodic time, frequency, relation between 1) Angular velocity and frequency, 2) angular velocity and periodic time, 3) linear velocity and angular velocity, radial acceleration expression, centripetal force, centrifugal force, numericals. 2.2 Applications of Circular Motion: Motion of a vehicle round a horizontal curve, banking of roads and tracks, expression for angle of banking and super elevation, centrifuge, Numericals. 2.3 Simple Harmonic Motion: Periodic motion, simple harmonic motion, S.H.M. as a projection of uniform circular motion, equation of S.H.M. graphical representation of S.H.M. concepts of oscillation, periodic time, frequency, amplitude, phase, phase difference. Numericals.	9	12
3	3.1 Modes of Heat Transfer, Temperature Measurement: Difference between heat and temperature, definition of calorie, absolute zero, units of temperature $^{\circ}\text{C}$, $^{\circ}\text{F}$, $^{\circ}\text{K}$ with their conversion a) Conduction – Flow of heat along a bar, steady state and variable state temp. Coefficient of thermal conductivity by Searle's method. (For good conductor) and Lee's method (for bad conductor). b) Convection, c) Radiation - Emissive power, absorptive power, black body, numerical Comparison between conduction, convection and radiation. 3.2 Temperature Measurement: Bimetallic thermometer, resistance thermometer, thermocouple & thermopile, Pyrometers – i) Ferry's total radiation, ii) Optical Pyrometer. 3.3 Sound: Sound waves, propagation of sound, reflection of sound waves, echo, absorption of sound, coefficient of absorption, reverberation, reverberation time, formula for reverberation time (No derivation), methods for controlling reverberation time. Numericals.	9	12
	Total	32	40

Teaching methodology: Chalk board, Group Discussions, Handouts, Question Bank, PPT, Transparency, Seminar, and Guest Lecture.

Term work:

Skills to be developed:

i) Intellectual Skills:

- Identify skill will be developed after studying topics of Temperature measurement.
- Discriminating skill will be developed after studying topics on motion.
- Comprehension skill will be developed after studying concept ,principles laws and rules given in the syllabus.

ii) Motor Skills:

- Measuring skill will be developed after completing practicals.
- Draw graph skill will be developed after studying practicals.
- Observing the result and comparison skill will be developed after competing practicals.

List of Experiments:

1. Measurement of (i) length, breadth and height of a block ,(ii) internal, external diameter and height of a hollow cylinder using vernier calipers of different least counts and digital vernier.
2. Measurement of diameter of sphere, wire and measurement of thickness of a plate by using micrometer screw gauge.
3. Measurement of radii of concave and convex surfaces and thickness of plate using spherometer.
4. To find viscosity of water by Poiseuille's method.
5. To find viscosity of oil by Stoke's method.
6. Calibration of thermocouple and to find unknown temperature.
7. Comparison of different thermometer with respect to mercury Thermometer.
8. To study the effect of length and mass of the bob on periodic time of a simple pendulum.
9. To investigate relation between radius and height of liquid in the capillary tube. (surface tension)
10. Determination of co-efficient of thermal conductivity of a good conductor by Searle's method.
11. Determination of co-efficient of thermal conductivity of a bad conductor by Lee's disc method.

Learning Resources:

A) Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	R.K.Gaur, S.L.Gupta	Engineering Physics	Dhanput Raj Publications.
2	Prof. M. P. Kurian, Prof. R. B. Birlhade, Prof.A.A.Mokashi	Applied Physics	Reliable Publications.
3	Dr.A.P.Saxena & Others	Principles of Physics	J.K.Jain Brothers TTTI, Bhopal.
4	Kamat & Rao	Applied Physics	Jeevan Deep Prakashan.
5	Mrs.V.C.Chinchwadkar	Text Book in Physics	Somaiya Publications, Bombay.
6	Umrani, Joshi	Applied Physics	Nirali Prakashan.

B) Web sites for references:

1. www.physicsclassroom.com
2. www.hyperphysics.com
3. www.physicsinfo.com

C) Video

www.Youtube.com (surface tension, viscosity, sound, ultrasound)

D) PPT

1. www.khanaacademy.com
2. www.slideshare.net

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./E&TC. ENGINEERING

Course : Basic Chemistry Course Code: R14SC1704

Course Category : Foundation Credits 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	2	40	10	-	-	25	75

Rationale:

Basic sciences like Chemistry are the foundation pillar of engineering and technology .It is most essential to learn the basic science to understand the fundamental concepts of engineering and technology.

The topic of Atomic structure and Chemical bonding is helpful to study properties of elements which are required in the engineering field.

In Electrochemistry electrical energy is obtained from the different chemical reactions which are used in different types of batteries. These batteries are widely used in automobiles and in day to day life.

Metallurgy and alloys have importance in various Industries, because metals are the backbone of the Industry. Study of properties of Metals and Alloys is essential.

Non-metallic materials such as plastic and rubber have great importance and application in technology.

Objectives:

The student will be able to

- 1) After studying the atomic structure and chemical bonding student will be able to draw the electronic configuration of various elements with the formation of various types of molecules.
- 2) With the study of electrochemistry student will be able to know electrolysis, Faraday's laws and working of different batteries.
- 3) After study of Metals and alloys student will be understand properties and applications of various Metals and alloys used in engineering industries.
- 4) After studying the non-metallic material student will be able to know the different properties and current applications of plastic and rubber in the engineering field.

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Atomic Structure and Chemical Bonding: 1.1 Atom , Bohr's atomic model (postulates) Fundamental particle of atom, their Mass, Charge, Locations, 1.2 Atomic number, Mass number, Isotopes and Isobars, 1.3 Hund's rule of maximum Multiplicity, Pauli's Exclusion Principle ,Aufbau principle, 1.4 Electronic configuration, Octet rule & Duplet rule. (Electronic configuration upto Atomic number 30). 1.5 Types of Chemical bond, Electrovalent, Covalent, Formation and structure of electrovalent molecules such as NaCl, CaCl ₂ , AlCl ₃ etc. 1.6 Covalent compounds such as H ₂ O, Cl ₂ , O ₂ , NH ₃ , N ₂ etc. 1.7 Distinction between Electrovalent and Covalent compounds.	09	12
2	Electrochemistry 2.1 Definitions of basic terms involved in Electrolysis: Conductors, Nonconductors, Electrolytes: Strong and Weak Electrolyte, Difference between strong and weak electrolyte, Non electrolytes, Electrolysis, Electrolytic cell, Current density. 2.2 Ionization, Electrolytic Dissociation, Arrhenius theory of degree of Ionization /Dissociation and Factors affecting the Degree of Ionization. Definition of electrolytic cell, Electrodes -Cathode and Anode , Electrode potential – Oxidation potential and Reduction potential 2.3 Mechanism of Electrolysis, Electrolysis, Electrochemical series for Cations and Anions , Electrolysis of CuSO ₄ solution using Platinum electrodes & Copper electrodes 2.4 Applications of Electrolysis: Electroplating of Silver, Electro refining of blister Copper , Electrometallurgy 2.5 Electrochemical Processes: Faradays laws of Electrolysis (1 st and 2 nd law), Relation between ECE and CE. Numerical problems , 2.6 Electric Cells and Battery, Types of Cells: Primary and Secondary cells, Construction & Working of dry cell.	10	12
3	A) METALS & ALLOYS Metals 3.1 Introduction , Characteristics of Metals, Definitions –	9	10

	Mineral , ore, Gangue, flux and Slag, Metallurgy 3.2 Metallurgy- flow chart for extraction of metal 3.3 Important Extraction Process- Concentration- Gravity Separation, Electromagnetic separation , Froth flotation Process, Calcinations and Roasting. Reduction – Smelting, Aluminothermic Process, Electrolytic reduction. Refining-Poling, Liquation, Electrolytic refining. 3.4 Mechanical Properties of Metals: Hardness , Ductility, Malleability, Tensile strength, Toughness ,Machinability , Weldability, Forging, Soldering, Brazing, Castability. Alloys 3.5 Definition, Purposes of Making Alloy with examples. Preparation Method – Fusion and Compression Classification of Alloys – Ferrous and Non Ferrous alloys with examples. 3.6 Composition , Properties and Applications of Duralumin , Wood metal, Babbit metal, Monel metal, Brass. B) NON METALLIC ENGINEERING MATERIALS 3.7 Polymers, Definition of polymer (plastic) Polymerization, Types of polymerization with examples. 3.8 Types of Plastic – Thermo-softening and Thermo- setting plastic and their differences , Properties and Applications of Plastic. 3.9 Rubber: Definition ,Types of rubber, Drawbacks of natural rubber, Vulcanization of rubber with chemical reaction , Synthetic rubber- Definition , differences between Natural and synthetic rubber, Examples of synthetic rubber, Properties of synthetic rubber like Elasticity, Tack and Abrasion resistance, Their definition and applications.		
	Total	04	06
		32	40

Teaching Methodology: Chalk board, Discussion, Assignments, Handouts and Question Bank, Moodle.

Term work

Skills to be developed:

i) Intellectual Skills:

- Understand the concept of Construction & working of different batteries.
- Calculation of C.E. and E.C.E

List of Practical's/Experiments

- 1) Know your Chemistry laboratory and prepare sample solutions of different concentrations.
- 2) Drawing of Electronic configuration of atoms from atomic number 1 to 30 & Draw the molecular structure of various electrovalent and covalent compounds.
- 3) To determine Alkalinity of a given Water sample.
- 4) To determine the Neutralization point of weak acid and weak base using Conductivity Meter.
- 5) To determine the ECE of copper by Electrolysis of CuSO_4 solution.
- 6) Determination of percentage purity of Iron from stainless steel alloy
- 7) To determine percentage of Copper from the brass.
- 8) To determine percentage of Nickel from given Monel metal alloy.
- 9) To determine phosphate in a given water sample by using spectrophotometer.
- 10) To draw the Flow sheet of extraction of Metal from its ore.
- 11) Precipitation titration of BaCl_2 with H_2SO_4 using Conductivity meter.
- 12) Prepare Phenol formaldehyde resin used in manufacturing of Bakelite plastic.

Learning Resources

A) Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	V.P .Mehta	Polytechnic Chemistry	Jain brothers , New Delhi
2	Sharma B.K. & Kaur H.	Industrial Chemistry	Goel Publishing House, Meerut.
3	Jain P.C. & Jain Monika	Engineering Chemistry	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
4	S.S. Dara	Engineering Chemistry	S. Chand Publication

B) Web site for references:

1. www.in.wikipedia.org
2. www.nptel.iitm.ac.in
3. www.youtube.com, watch v= KjoQHqzda8 (related to Chemical bonding)

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING**Course : Engineering Physics****Course Code: R14SC1706****Course category: Foundation****Credits : 4****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	2	40	10	-	-	25	75

Rationale:

The development of various engineering topics is primarily based on the fundamental principles. The different principles of physics have a wide range of applications in all the branches of engineering. A reasonably good level of knowledge of physics, therefore, forms sound base for engineering students. Physics can be considered as a basic tool in the hands of an engineer through which he can pursue his studies and research work in technical field. The foundation level of the subject acquired by the student is kept in mind for selection of the topics. To create interest in the students more stress is given on the applications, in engineering field

Objectives:

The student will be able to

1. State the principle and measure the EMF by potentiometer.
2. Understand the concept of resistance and capacitance.
3. Study magnetic effect of electric current and apply right hand thumb rule.
4. Study effect of magnetic field on current carrying conductor and apply Fleming's left hand rule.
5. Differentiate magnetic materials and study their applications in engineering field.
6. Explain different terms related to lasers, its properties and application in engineering field.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	1.1 Measurement of Resistance and EMF : Definition of charge, current, Potential difference ,specific resistance, color code for resistance, types of resistance, resistance in series & parallel combinations (numerical), concept of temperature dependence of resistance, thermister, principle of potentiometer and balancing condition of potentiometer, potential gradient, measurement of EMF by potentiometer (numerical) 1.2 Measurement of Capacitance : Capacitor & capacitance, units, capacitor in series and parallel combinations (numerical), applications of capacitor (air, solid dielectric,	9	12

	electrolytic)		
2	2.1 <u>Magnetic Effect of Electric Current:</u> Magnetic effect of electric current, lines of induction due to a straight conductor; right-hand thumb rule, magnetic induction (direction and magnitude), concept of uniform field 2.2 <u>Effect of Magnetic Field on Current Carrying Conductor:</u> Force of a magnetic field on current carrying conductor, (No derivation) Fleming's left-hand rule, couple acting on a rectangular coil placed in the uniform magnetic field, numerical 2.3 <u>Magnetism:</u> Magnetic materials, permeability, susceptibility, relation between relative permeability and susceptibility, properties of diamagnetic, paramagnetic and ferromagnetic substances, ferrites and their application-antenna cores, television picture tube. 2.4 <u>Electromagnetic Spectrum:</u> Definition, range, applications 2.5 <u>Ultrasonic Waves:</u> Ultrasonic waves, production of ultrasonic waves by magnetostriction transducer, Application – Flaw detection, drilling, welding, cleaning. 2.6 <u>Nanotechnology:</u> Introduction to nanotechnology, principle and applications.	14	16
3	3.1 <u>Lasers:</u> Excitation of particle, optical pumping, types of transitions – non radiative and radiative, spontaneous and stimulated emission, population inversion, resonance cavity, active system, Principle of laser, types of lasers, - ruby laser, Helium-Neon laser, comparison between ruby and He-Ne lasers, Uses of lasers 3.2 <u>Fiber Optics:</u> Principle, structure of optical fibers properties & applications.	9	12
	Total	32	40

Teaching methodology: Chalk board, Group Discussions, handouts, Question Bank, PPT, Transparency, Seminar, and Guest Lecture.

A) Term work:

Skills to be developed:

i) Intellectual Skills:

- Discrimination skill will be developed after studying topics: types of resistor and capacitors, types of lasers.
- Comprehension skill will be developed after studying concept, principles laws and rules given in the syllabus.

ii) Motor Skills:

- Drawing and connecting circuit skill will be developed after completing practicals.
- Measurement skill will be developed after completing practicals.
- Observing the result and comparing skill will be developed after completing practicals.

List of Experiments:

- 1) Specific resistance by voltmeter ammeter method.
- 2) Measurement of EMF by potentiometer.
- 3) Measurement of resistance in series and parallel.
- 4) To study the effect of temperature on the resistance of – thermister.
- 5) To study the effect of temperature on the resistance of - copper coil.
- 6) Measurement of resistance by using color code and digital multimeter.
- 7) Measurement of divergence of light beam by laser.

- Term work includes any six practicals (six weeks)& one mini project/seminar(six weeks)

Learning Resources:**A) Books:**

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	R.K.Gaur, S.L.Gupta	Engineering. Physics	Dhanput Raj Publication.
2	Prof.M.P.Kurian, Prof. R. B. Birhade, Prof. A. A. Mokashi	Applied Physics	Reliable Publications.
3	Dr.A.P.Saxena & Others	Principles of Physics	J.K.Jain Brothers TTTI, Bhopal.
4	Mrs.V.C.Chinchwadkar	Text Book in Physics	Somaiya Publications, Bombay.
5	David Halliday Robert Resnik	Physics	Wiley Eastern Limited.

B) Web sites for references:.

1. www.physicsclassroom.com
2. www.hyperphysics.com
3. www.physicsinfo.com

C) Video

www.Youtube.com

D) PPT

www.khanaacademy.com
www.slideshare.net

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING

Course : Technical English

Course Code: R14SC1707

Course Category: Foundation

Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	3	80	20	-	-	25	125

Rationale:

Students need effective writing skill in their academic and professional life. This syllabus is need based and special efforts are taken to improve the writing skills of students. Students admitted to polytechnic come from rural and urban areas. They are from different mediums and backgrounds. As the students are weak in writing correct English, more stress is given on improving their basic concepts of written communication.

Objectives:

The students will be able to

1. Learn the basic concepts of grammar and sentence formation.
2. Express their ideas logically and correctly.
3. Comprehend the given passage and arrange their ideas in sequential order.
4. Improve their presentation skills in oral and written communication.
5. Interact effectively from the industry point of view.
6. Use the various formats of business correspondence.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Grammar: 1.1 Parts of Speech. 1.2 Transformation of sentences. [tenses, prepositions, conjunctions, punctuation, direct-indirect speech, active & passive voice] 1.3 Features of technical writing.	8	16
2	Communication: 2.1 Written and oral communication. 2.2 Barriers in communication. 2.3 Principles of communication	4	12
3	Applied Writing: 3.1 Dialogue writing 3.2 Comprehension. 3.3 Speech writing on : - Farewell speech - Introducing a guest -Vote of thanks	4	12
4	Office Drafting: 4.1 Notice and Circular. 4.2 Memo. 4.3 Email writing.	4	12
5	Business Correspondence: 5.1 Letter of Enquiry, Order and job application. 5.2 Letter of Complaint, resignation, reminder. 5.3 Joining letter, appreciation letter.	8	16
6	Report writing: 6.1 Visit report. 6.2 Accident report. 6.3 Progress report, Investigation report.	4	12
	Total	32	80

Teaching Methodology: Chalkboard, white board, improved lecture method, discussion method, power point Presentations, case study.

Term work: Skills to be developed:

i) Intellectual Skill:

- Speaking and listening skills will be developed on completion of the assignment nos.7-12 of term work.
- Presentation skills will be developed on performance of assignment nos.1-6 of term work.
- Writing skills will be developed by studying topics of applied writing, Office drafting, Business correspondence and Report writing.
- Reading and comprehension skills will be developed by studying the topic of Comprehension.

ii) Skills to be developed in Professional practices are included in these assignments.

List of Practical/Assignment/Experiment:

1. Self introduction. (Professional Practices)
2. Technical presentation. (Professional Practices)
3. Elocution. (Professional Practices)
4. Power Point presentation. (Professional Practices)
5. Email Writing.
6. News Presentation. (Professional Practices)
7. Introduction of Basic English words and their pronunciation.
8. Introduction of friend, guest, visitors.
9. Meeting and greeting people.
10. Talking about the family.
11. Giving directions about places in town.
12. Describing your home, neighbourhood and region.

(Note: Practical no.7 to 12 will be covered by using Linguaphone Language lab machine. In every practical student will solve the assignment based on that unit. Student will learn basic English words, their pronunciation, introducing new situations and rules to keep the conversation going)

Learning Resources:**A) Books:**

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Locker, Stephen Kyo Kaczmarek	Business Communication : Building Critical Skills	Published by McGraw Hill Professionals.
2	Alok Pandey & Deepak Pandey	Advanced English Grammar & Composition	Published by Sahni Publication, Delhi-7.
3	Raymond Murphy	Intermediate English Grammar	Published by Foundation Book 2003 (Second Edition), New Delhi.
4	Raymond Murphy	Essential English Grammar	Published by Foundation Book Pvt. Ltd., 2004 (Second Edition), New Delhi.
5	M.P. Bhatia	Applied Grammar & Composition	Published by M.I. Publications (Eighth Revised Edition), Agra.

B) Web sites for references :

1. www.learn4good.com
2. www.fluentzy.com
3. www.edufind.com
4. www.khake.com
5. www.learnenglish.org.uk
6. www.english4engineer.com
7. www.owl.english.purdue.edu

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING

Course : Communication Skills

Course Code: R14SC1708

Course Category: Foundation

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-		@25	25	50

@ Internal Exam

Rationale:

The old course materials comprising anthologies of prose selections and the old methodology based mainly on the classroom lecture are not conducive to the development of study skills and communicative competence in the students. Therefore, a need to develop an appropriate course in English for students of engineering and technology and to adopt an innovative approach to English language teaching and learning is essential. The aim of this course is to impart to the students the necessary communication skills that they need in their academic and professional life.

This course demands an actual use of the English language by students in the classroom and encourages interaction among them. It is designed to develop the linguistic skills and not to test their memory skills. In this new approach, all the four skills involved in learning a language, namely- 1) Listening 2) Reading 3) Writing 4) Speaking are developed.

Objectives:

The students will be able to

1. Practice the basic skills of speaking, reading, listening and writing.
2. Express their ideas correctly and fluently in English.
3. Interact with others in English and gain confidence in the use of the English language.
4. Realise the importance of effective presentation skill.
5. Improve their communication skill that will lead to their overall personality development.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Presentation Skills: 1.1 Personal grooming. 1.2 Matter of presentation. 1.3 Manner of presentation.	3
2	Interview Techniques: 2.1 Communication skills. 2.2 Stress management. 2.3 Presence of mind.	3

3	Group Discussion Techniques: 3.1 Manners and etiquettes. 3.2 Discussion rules. 3.3 Effective presentation of views.	3
4	Body Language: 4.1 Facial expressions. 4.2 Posture and gesture. 4.3 Eye movements.	3
5	Resume Writing: 5.1 Correct language. 5.2 Strengths and achievements. 5.3 Format of biodata.	2
6	Vocabulary: 6.1 Synonyms. 6.2 Antonyms. 6.3 Homonyms.	2
	Total	16

Teaching Methodology: Chalk board, Whiteboard, Discussion Method, Power Point Presentation, Case study, Improved Lecture Method etc.

Term work:

Skills to be developed:

i) Intellectual Skills :

- Listening and speaking skills will be developed on completion of assignments of Term work & the topic of group discussion techniques.
- Presentation skills will be developed by studying the topic of Presentation skills and after performing the assignments based on it.
- Writing skills will be developed by studying topic of resume writing.

ii) Motor Skills :

Skills to be developed in Professional practices are included in these assignments as presentation and guest lectures.

List of Practical/ Assignment/Experiment

1. Interview of the candidates. **(Professional Practices)**
2. Debate on different topics. **(Professional Practices)**
3. Poster Presentation. **(Professional Practices)**
4. Group discussion. **(Professional Practices)**
5. Role Play. **(Professional Practices)**
6. Power Point Presentation. **(Professional Practices)**
7. Talking about different jobs and types of work.
8. Talking about your hobbies and enquiring about those of other people.

9. Enquire about people's programmes, plans and booking facilities.
10. Telephone etiquettes and information about the postal service.
11. Talking about the public transport system.
12. Talking about accommodation facilities in a hotel & shopping.

(**Note:** Practical no.7 to 12 will be covered by using Linguaphone Language lab machine. In every practical student will solve the assignment based on that unit. Student will learn the conversation techniques, pronunciation, etiquettes, manners and he will develop the ability to speak in different situations).

Learning Resources:

A) Books :

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Dr.B.R.Kishore , D.S.Paul	Kumar's Group Discussions and Interviews	Vee Kumar Publications Private Limited, New Delhi- 110008.
2	Adam B. Cooper	PowerPoint Presentations that Sell	McGraw Hill Professionals.
3	R.C.Bhatia	Business Communication	Ane Books India, New Delhi.
4	Krishna Mohan, Meera Banerji	Developing Communication Skills	Published by Rajiv Beri for Macmillan India Ltd., New Delhi.

B) Web sites for references:

1. www.skillstudio.co.uk
2. www.khake.com
3. www.search4excellence.com
4. www.selfgrowth.com
5. www.mindtools.com

DIPLOMA PROGRAMME IN: CIVIL/MECH./ELECT./E&TC. ENGINEERING

Course : Engineering Chemistry Course Code: R14SC1709

Course category : Foundation Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	2	2	40	10	-	-	25	75

Rationale:

The topic Water has wide application in all branches of Engineering & Technology. In the curriculum topic like Corrosion & its protection is needed for every engineering field. Whereas the study of the Lubricants is needed to know how various types of machines work smoothly and efficiently in various conditions. Students must know the efficiency of various types of Fuels, its calorific value and the importance of chemical analysis of the Fuel in engineering field.

Awareness of the use of CNG on the larger scale in automobile vehicles helps to reduce the automobile pollution

Objectives:

1. After studying the topic Water student will be able to understand the types of impurities present in water, as well as its removal i.e. purification processes such as ion exchange method, permutit method and important analytical tests of drinking water.
2. Student will be able to understand definition of Corrosion, its mechanism and different factors affecting the Corrosion. Protection methods like Cathodic protection and Application of different metal coating.
3. By studying Lubricant student will be able to select proper lubricant for different conditions in various Machines.
4. After studying the topic Fuel, student will be able to understand how conventional as well as non conventional energy is used for mankind.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1.	WATER 1.1 Types of impurities in the Natural water. 1.2 Definition :Soft water, Hard water, Types of hardness of the Water 1.3 Degree of Hardness of the Water in terms of equivalent amount of CaCO_3, Numericals based on degree of hardness of water 1.4 Bad Effects of hard water in Domestic purposes, In Industries like Textile , Paper , Sugar, Dye industry and in Steam generating boiler 1.5 Water treatment for Industrial applications :Principle , Diagram, Working, Chemical reactions , Regeneration ,Advantages – Permutit/zeolite process and Ion Exchange process 1.6 For Domestic Applications: Water quality parameters for potable water, Treatment of water for domestic application by Screening, Sedimentation, Coagulation, Filtration, Sterilization. Chlorination – using chlorine gas , bleaching powder & chloramines 1.7 Desalination of Sea water (brackish) by Reverse Osmosis 1.8 Definition of pH, pH scale, Numerical problem on pH , Industrial application of the pH	10	12
2.	CORROSION 2.1 Definition of Corrosion, Types of corrosion, 2.2 Atmospheric Corrosion-definition, mechanism of oxidation corrosion, Types of oxide films and their significance, factors affecting atmospheric corrosion 2.3 Immersed corrosion- definition, mechanism of immersed corrosion by galvanic cell action-with evolution of hydrogen gas and absorption of oxygen gas, factors affecting immersed corrosion Protection of Metals by : 2.4 Modification of environment , Modification of properties of metal , Electrochemical protection by sacrificial anodic protection and impressed current ,cathodic protection , use of protective coatings 2.5 Applications of metallic coatings by Galvanizing, Tinning, Metal spraying , Electroplating , Metal cladding , Cementation.	10	12
3.	A:-LUBRICANTS 3.1 Lubricant-Definition, Characteristic of a good lubricant. 3.2 Classification of lubricants-Solid lubricants-characteristics and applications Graphite and Molybdenum disulphide. Liquid lubricants – characteristics and applications synthetic fluid (silicon oil) , Water as a lubricant(coolant), Semisolid lubricants- Characteristics and applications of Grease . 3.3 Mechanism of Lubrication – definition of lubrication , Types of	06	8

	mechanism of lubrication : Fluid film lubrication, Boundary lubrication & Extreme pressure lubrication, 3.4 Physical characteristics of lubricants- viscosity, viscosity index , oiliness, volatility, flash and fire point, cloud and pour point, chemical characteristics of lubricants – acid value or neutralization number, emulsification ,saponification value 3.5 Selection of lubricants for Road rollers , Steam engine, Sewing Machine , Concrete mixer, IC engine, Cutting tools and Gears.		
	B:- FUELS 3.6 Fuels- Definition, calorific value and Ignition temperature, characteristics of good fuels with suitable example, advantages and disadvantages of solid , liquid and gases fuels . 3.7 Classification of fuels , Solid fuels-analysis of solid fuel, proximate analysis of Coal for determination of moisture , volatile matter , Ash and Fixed Carbon, Significance of proximate analysis. 3.8 Liquid fuels – origin , fractional distillation of crude petroleum, Boiling range, Carbon composition and applications of petroleum fractions obtained . Composition , properties and applications of Bio- diesel. 3.9 Gaseous fuels – composition, properties , applications of Biogas, LPG & CNG.	06	8
	Total	32	40

Teaching methodology: Chalk board, Group Discussions, handouts, Question Bank, PPT, Transparency, Moodle.

Term work

Skills to be developed:

i) Intellectual Skills:

Comprehension skill will be developed after studying concept, principles laws and rules given in the syllabus

- Comprehension skill will be developed after studying topics: Corrosion and water.
- Selection skill will be developed after studying topics: Lubricants and Fuels.

ii) Motor Skills:

- Measurement skill will be developed after completing practicals.
- Observing the result and comparing skill will be developed after completing practicals.

Term work includes six experiments (six weeks) and mini projects or seminar (six weeks)

List of Practical's/Experiments:

- 1) Determination of Total hardness of water by using EDTA method.
- 2) To determine Moisture contents in a given coal sample by proximate analysis.
- 3) To determine Ash contents in a given coal sample by proximate analysis.
- 4) To determine viscosity of liquid by using Ostwald viscometer.
- 5) To determine Dissolved Oxygen in a given water sample by Winkler's Method.
- 6) To determine pH of different solutions by using pH meter.
- 7) To determine the Acid value of a given oil.(lubricant)

Learning Resources:

A) Books:

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Jain P.C. & Jain Monika	Engineering Chemistry	Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2	Ved Prakash Mehta	Polytechnic Chemistry	Jain brothers, New Delhi.
3	C. V. Agarwal	Chemistry of Engineering Materials	Tara Publications Waranasi
4	B.K. Sharma	Industrial chemistry	Goel Publication
5	S.S.Dara	Engineering Chemistry	S. ChandPublication

B) Web sites for references:

1. www.in.wikipedia.org
2. www.nptel.iitm.ac.in

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Engineering Graphics

Course Code: R14ME1201

Course Category : Foundation

Credits : 6

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
2	4	4	80	20	-	-	50	150

Rationale:

Drawing which is known as the language of engineers is widely used means of communication among the designers, engineers, technicians & craftsmen in an industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus for the effective & efficient communication among all those involved in an industrial system, it becomes necessary for a diploma engineer to acquire the appropriate skills in the use of graphic language. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects.

Objectives:

The students will be able to

1. Understand basic principles of engineering drawing.
2. Draw orthographic projections of different objects.
3. Draw isometric view from given two orthographic views.
4. Understand and Draw various engineering curves and know their applications.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Introduction : 1.1 Use of instruments, types of lines, types of letterings, full, enlarging and reducing scales, dimensioning techniques (As per IS CODE SP-46). 1.2 Geometrical constructions :- To construct a regular polygon of given side. To construct a regular polygon in a given circle. To inscribe a circle in a given polygon. To circumscribe a circle around a given polygon. To draw circles touching each other and sides of a given polygon internally & externally. 1.3 Tangent exercises :- To bisect a given straight line/ arc /angle. To divide a given straight line into given number of equal parts. To draw a normal to a given straight line/ arc from a given point within or outside it.	4	12

	To draw a straight line parallel to a given straight line /arc through point/ at a given distance. To draw an arc touching to two straight lines / two arcs (internally/ externally)/ one line & one arc. To draw an internal/ external tangent to two given arcs apart from each other. 1.4 Redraw figures :- To redraw the given figures (using the knowledge of Geometrical constructions & tangent exercises).		
2	Engineering Curves : 2.1 Construction of curves :- To study the construction of following curves using the method mentioned against them :- Ellipse -directrix focus method, arcs of circle method & concentric circles method. Parabola- directrix focus method, rectangle method. Involute- of a polygon, circle & combination of polygon & circle. Cycloid- epicycloid & hypocycloid. Helix, Spiral. Use of curves in engineering applications. 2.2 Loci of points :- Types of mechanisms- Loci of points with given condition and examples related to it.	4	12
3	Introduction to Orthographic Projections & Isometric Views : 3.1 Simple exercises to draw Orthographic Projections by first & third angle methods (Wooden Models to be used). 3.2 Simple exercises on drawing isometric views from given orthographic views.	7	16
4	Orthographic Projections : Conversion of given pictorial views into orthographic projections using First angle and third angle method of projections. Dimensioning the Views (objects including curves, slots on sloping planes).	7	12
5	Sectional Views : Conversion of given pictorial views into sectional (full sectional) orthographic projections using first angle & third angle method of projections. Dimensioning the views.	5	16
6	Isometric Projection and Views : Construction & use of isometric scale. Conversion of given orthographic views into isometric projections/views (objects including curves, slots on sloping planes).	5	12
Total		32	80

Teaching Methodology: Discussions, Chalk Board, Charts, Models, Transparencies.

Term Work:

Skills to be developed:

i) Intellectual Skills:

- Conversion of given Orthographic views in to Isometric & vice-versa.
- Visualization of an object.

ii) Motor Skills:

- Use of various drawing instruments.

- Drawing of various engineering curves & loci of points.
- Redrawing the given figures.

List of Drawing Sheets / Assignments:

Use half imperial drawing sheets to complete following exercises.

Work book is an integral part of term-work. All assignments must be completed in workbook before submission of corresponding drawing sheet/s. Students must bring sketch book during lectures as well as practical sessions.

Sr. No.	Topic Name	Number of Sheets	Assignments
1	Geometrical constructions and tangent exercise	1	1
2	Redraw Figures and Engineering Curves	2	2
3	Loci of points	1	-
4	Orthographic views	2	2
5	Sectional views	2	2
6	Isometric views	2	2

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	N.D. Bhatt	Engineering Drawing	Charotar Publication, Anand.
2	Mali and Chaudhary	Engineering Drawing	Vrinda Publications, Jalgaon.
3	Kamat & Rao	Engineering Drawing	Jeevandeep Publicatons, Mumbai.
4	N.Y. Prabhu	Geometrical Engineering Drawing	Pune Vidyarthi Griha, Publications, Pune.
5	Ozarkar & Utturkar	Engineering Drawing	Maharashtra Publishing House.
6	K. Venugopal	Engineering Drawing	New Age International Ltd., Delhi.
7	SP 46-1988	Code of practice for general engineering drawing	Bureau of Indian Standards.(BIS)

DIPLOMA PROGRAMME: CIVIL / MECHANICAL ENGINEERING

Course : Engineering Mechanics

Course Code: R14AM2101

Course Category: Allied

Credits: 5

Teaching and Examination scheme:

Teaching Scheme		Examination scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

Rationale :

This is Allied subject which will enable the students to understand the fundamentals of mechanics. The main purpose is to help the students to develop the logical, orderly processes of thinking that characterize an engineer. The relations between a force and its components, Newton's laws of motion applied to a wide variety of practical situations in the field of civil and mechanical engineering.

Objectives :

The students will be able to

1. Understand the force, force system and their effects on the body.
2. Understand various laws and principles in Engg. Mechanics.
3. Apply the concepts and principles in Engg. Mechanics to various problems in different fields of engineering.
4. Build the pre-requisites for higher semester subjects related to Analysis and Design.

Course Contents :

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Composition and Resolution of Forces : 1.1 Concept of force and its unit, system of coplanar forces, concurrent and non-concurrent, like and unlike parallel forces. 1.2 Resultant and equilibrant of forces, composition of forces: triangle, parallelogram and polygon law of forces. Resolution of forces in rectangular components.	8	16
2	Equilibrium of Forces: 2.1 Moment of a force, Equilibrium conditions, Types of Supports, Beam reactions, 2.2 Varignon's theorem, concept of couple. Principle	8	12

	of transmissibility of a force.		
3	Friction : 3.1 Friction as opposing force, advantages and disadvantages of friction, Laws of friction, coefficient of friction, its value for different materials in contact, angle of friction, cone of friction, 3.2 A body resting on rough horizontal plane under applied force of different magnitude. Equilibrium of a body resting on rough inclined plane when Applied force is i) inclined to plane, ii) along the plane and iii) horizontal.	8	12
4	Centre of Gravity : 4.1 Concept of center of gravity and centroid. Standard case: Rectangle, circle, semicircle and Triangle. 4.2 Determination of centroid for sections such as I, T, L and other compound sections.	8	16
5	Kinetics : 5.1 Momentum, impulse, impulsive force, Newton's laws of motion, 5.2 Direct impact, D'Alembert's Principle, Law of conservation of momentum.	8	12
6	Work, Power and Energy : 6.1 Definitions of work, power and energy and their units, graphical representation of work, work done by a torque. 6.2 Definition, forms of energy – kinetic and potential, law of conservation of energy, work energy principle.	8	12
	Total	48	80

Term Work :

Skills to be developed :

i) Intellectual Skills :

- Understand the concept of Resolution, Composition of forces, Work, Power and Energy.
- Apply and use various principles to solve engineering problems.

ii) Motor Skills:

- Calculate the Resultant of force system, Beam reactions, Coefficient of friction, Centre of Gravity, Moment of Inertia of various plane laminas.
- Locate the position of resultant and centroid in the given figure.

List of Practicals:

1. To verify the Lami's Theorem.
2. To verify law of parallelogram of forces.
3. To verify law of triangle.
4. To verify the law of polygon of forces.
5. To determine the value of 'g' the acceleration due to gravity by Atwood's machine.
6. To verify principle of moment.
7. To find the coefficient of friction between wood and glass using a rough horizontal plane.
8. To find the coefficient of friction between wood and glass using a rough inclined plane.
9. To find mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
10. To find mechanical advantage, velocity ratio and efficiency of screw jack.
11. To find the support reactions of a simple beam.
12. To find the forces in jib and tie of a jib crane.

Assignments on:

1. Topic No. 1 and 2.
2. Topic No. 3 and 4.
3. Topic No. 5 and 6.

Text/Reference books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Beer and Johnston	Engineering Mechanics	Tata McGraw Hill
2	S.P. Timoshenko	Engineering Mechanics	Schaum Outline Series
3	Dadhe Jamdar and Walavalkar	Fundamentals of Applied Mechanics	Sarita Prakashan, Pune.
4	S.B.Junnarkar	Elements of Applied Mechanics	Charotor Book Stall, Anand.

DIPLOMA PROGRAMME : CIVIL / MECHANICAL ENGINEERING

Course : Strength of Materials Course Code : R14AM2102

Course Category : Allied Credits : 6

Teaching and Examination scheme :

Teaching Scheme		Examination scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	-	25	125

Rationale :

This is allied subject which will enable the students to understand the fundamentals of solid mechanics and deals with elementary knowledge of stresses, strains, shear forces and bending moments, it's applications in the field of civil and mechanical engineering.

Objectives :

The students will be able to

1. Understand the normal stress, shear stress and their effects on the body.
2. Understand stress-strain diagrams for ductile and brittle materials.
3. Understand the concepts of shear force and bending moment diagrams.
4. Build the pre-requisites for higher semester subjects related to Analysis and Design.

Course Contents :

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1.	Simple Stresses and Strain : 1.1 Concept of stress and strain, direct, tensile, compressive and shear stress and strain, lateral strain, Poisson's ratio. Stresses in composite sections under direct loading only. Temperature stresses for homogeneous bar only. 1.2 Stress strain curve for mild steel and cast iron, Salient points such as limit of proportionality, elastic limit, yield point, ultimate stress and breaking stress, plastic stage, % elongation, % reduction in area, proof stress working stress, and factor of safety. 1.3 Concept of elasticity, Hook's law, Young's modulus of elasticity, modulus of rigidity and bulk modulus, relation between three elastic module and Poisson's ratio.	12	16
2.	Beams and bending:	10	12

	2.1 Concept of beam, Bending moment and shear force diagrams for cantilevers and simply supported beams with and without overhangs subjected to point loads, uniformly distributed loads (u.d.l.), couples, uniformly varying load (u.v.l.). 2.2 Location of point of contra flexure. Relation between bending moment, shear force and rate of loading.		
3.	Bending Stresses and Shear Stresses: 3.1 Theory of simple bending, flexural formula (No derivation), concept of bending stress, assumptions in the theory of bending, moment of resistance, section modulus, neutral axis, comparative strengths of rectangular, circular, I, T, channel section 3.2 Concept of shear stresses in a beam, average shear stress, max shear stress shear stress distribution diagrams for rectangular, circular, I, T, channel sections.	10	12
4.	Combined bending and direct stresses : 4.1 Axial load, eccentric load, eccentricity, direct stress, bending stress, uniaxial bending biaxial bending. Maximum and minimum total stress, no tension condition, limiting eccentricity, core of section, middle third rule, total stress variation diagrams. 4.2 Strain energy, Resilience, proof resilience and modulus of resilience. Stresses due to gradual, sudden and impact loads.	10	12
5.	Principle planes and principle stresses : 5.1 Stresses on inclined planes, planes, planes of max. shear stress, definition of principle plane and principle stresses, location of principle planes, expression for normal and tangential stress, max. shear stress, Mohr's circle of stresses, condition of max. obliquity of resultant stress 5.2 Thin cylindrical shells: Longitudinal and circumferential (hoop) stresses in seamless thin walled cylindrical shells, shear stress.	12	16
6.	Torsion: 6.1 Concepts of torsion, Torsional equation (No derivation) for solid circular shaft, hollow circular shaft, shear stress distribution over cross section. 6.2 Comparison between a solid and hollow shaft for same strength and same weight, power transmitted by shafts, average torque, maximum torque and torsional rigidity.	10	12
	Total	64	80

Term work:

Skills to be developed:

i) Intellectual Skills:

- Understand the procedure of testing the materials.
- Analyse the beam for flexure, shear and torsion.
- Apply the basic knowledge of Engineering Mechanics to solve the problems.
- Apply the principles studied to field situations.

ii) Motor Skills:

- Graphical representation of stress - strain relationship.
- Drawing shear force and bending moment diagrams for various beams.
- Drawing shear and bending stress distribution diagrams.

List of Experiments/Practicals/Assignments:**Any twelve of the following –**

1. Tensile test on mild steel bar (ductile material).
2. Tensile test on tor steel bar (brittle material).
3. Shear test on two different metals under single and double shear.
4. Bending test on a wooden beam.
5. Izod Impact Test.
6. Compression Test on Metals.
7. Bend Rebend Test on Steel bars.
8. Torsion test on mild steel bar (ductile material).
9. Torsion test on cast iron bar (brittle material).
10. Hardness test on metals: Brinell's hardness test.
11. Fatigue Test on metals.
12. Abrasion Test on flooring tiles.
13. Flexural Test on flooring tiles.
14. Flexural Test on plywood.
15. Water Absorption Test on bricks.
16. Compressive Test on Bricks.

Assignments on :

1. Topic No. 1 and 2.
2. Topic No. 3 and 4.
3. Topic No. 5 and 6.

Reference Books :

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	M.V.Panchanadikar	Strength of Materials	Nirali Prakashan,Pune.
2	Sunil Deo	Strength of Materials	Nirali Prakashan, Pune-2.
3	Walavalkar Y.N.	Strength of Materials for Engineer	EPH Pune.

4	Gharpure V. Y. & Panchanadikar M. V.	Strength of Materials S.I.	PVT Pune.
5	Khurmi R. S.	Strength of Materials	S. Chand and Co., Delhi.
6	Adavi H. V.	Strength of Materials	PVG Pune.
7	Timoshako S. P. and Young D. H.	Strength of Materials	Affiliated, Delhi.
8	Patel A. and Singer F.L.	Strength of Materials	New York, Harper and Row.
9	Nash W. A.	Strength of Materials	Schaum's Series.

DIPLOMA PROGRAMME: MECHANICAL/ELECT./COMP./E&TC. ENGINEERING

Course : Industrial Organisation & Management

Course Code: R14ME2203

Course Category : Allied

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	–	3	80	20	–	–	–	100

Rationale:

This course is classified under human sciences and is intended to teach students about structure of organization, types of organization, principles of management, functioning of personnel department, industrial laws, and inventory control methods. It also envisages giving exposure to accountancy principles and various networking methods.

Objectives:

The students will be able to

1. Understand the concept of different business organization.
2. Know activities in the various departments like purchase, marketing, personnel, material etc.
3. Know different acts for execution of factory work.
4. Understand principles of Bookkeeping& accountancy.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Business Organizations : 1.1 Types & their foundations, proprietary, partnership, private and public limited companies, co-operative and public sector organizations. Role of public and private sector in the country and their social obligations towards society. 1.2 Principles of organizations, delegation of authority and responsibility, decentralization, committee. Types of organizations such as line/military, staff, line & staff. 1.3 Marketing Management: Definition, Selling V/s Marketing concept, Functions of Marketing management, Market Research, Definition, functions & agencies of advertising, Types of market.	9	12
2	Human Resource Management : 2.1 Personnel management: Duties and responsibilities of personnel management, Manpower planning, Sources of employment, recruitment, selection. Various methods of testing, training and development of workers and supervisors, duties and authorities of supervisors, morale maintenance, motivation.	9	16

	2.2 Wages and Incentives: Definition of wages, wage payment plans, Concept of incentive. 2.3 Safety management: Causes and effects of accident, Safety programmes. 2.4 Labour Laws: Factory act, Employee's State Insurance act, Workmen's Compensation act, Dispute act.		
3	Material and Stores Management : 3.1 Introduction to the functions of material management, material flow in an industry, purchase functions and systems, purchase procedure. Receipt and Issue of material, Types of stores, centralized & decentralized purchase. 3.2 Inventory Control: Objectives of inventory control, inventory and its classification, EOQ (Economic Order Quantity) its derivation (no numericals), ABC analysis, Material Requirement Planning (MRP).	7	12
4	Management Process: 4.1 Management and its various definitions, Importance of management, Difference between management, organisation and administration, Evolution and development of management, Levels of management scientific management. 4.2 Principles of management (14 principles of Henry Fayol). Functions of management such as planning, organising, directing, controlling etc.	6	12
5	Financial Management: 5.1 Objectives & Functions of Financial management. 5.2 Capital Generation & its Types, Finance (methods of raising capital), Finance from Bank, Capital market, Financial institutions, Shares & its types, Debentures, Loans, Financial Ratios. 5.3 Book Keeping & Accountancy, its objectives, principles of double entry book keeping, Accounting Terminology (Numericals only on Journal & Ledger Account). 5.4 Introduction to Trading account, profit and loss account & Balance Sheet (No Numericals).	9	16
6	Project Management and Quality Management: 6.1 CPM/PERT Technique: CPM terminologies, Definitions in PERT, Comparison of CPM & PERT (No Numericals). 6.2 Quality management, Quality Policy, Quality control, Inspection, Concept of Quality circle, TQM, Quality Audit.	8	12
	Total	48	80

Teaching Methodology: Chalk-Board, Discussions, Transparencies.

Skills to be developed:

Intellectual Skills :

- Understand functions and managerial skills required for various departments.
- Understand the principles of double entry book keeping system.
- Interpret transactions in journal, ledger and balance sheet.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. O.P. Khanna	Industrial Engineering & Management	Dhanpat Rai & Sons.
2	J. R. Batliboi	First Steps in Book Keeping	
3	Dr. B. C. Punmia and K. K. Khandelwal	Project Planning and Control with CPM and PERT	Laxmi Publication.

DIPLOMA PROGRAMME : MECHANICAL ENGINEERING

Course : Computer Aided Drafting

Course Code : R14ME2204

Course Category : Specialized

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	4	-	-	-	50@	-	50	100

@ Internal Examination

Rationale:

Now a day, manual drafting is obsolete in industry. Computers being the inevitable part in an engineer's life due to its inbuilt characteristics which helps him to do various task with acceleration. Using computers and CAD software it is easy to create and modify drawings ultimately it saves time. It also may be useful to generate assembly and manufacturing drawings.

In mechanical industry operating skills are required for computer aided drafting operations of machine components, handling of printers & plotters. This subject is also useful to apply concepts in 3 D modeling.

Objectives:

Students will be able to

- 1) Draw, edit and modify 2D drawings.
- 2) Give dimensions, tolerances and geometrical tolerances.
- 3) Draw isometric drawing.
- 4) Plot a drawing.

Course Details:

Unit	Name of The Topic	Hours
1	1.1 MS-Word : Introduction, Starting of MS-Word. Creating and Editing a document. Formatting a document. Other features: - find and replace, tables, grammar and spell check. 1.2 MS-Excel : Introduction, Starting of MS-Excel. Creating and Formatting a document. Features: - Auto sum, drag and drop, auto fill, insert clipart, row and column. Charts: - Column, bar, pie, line area. Formula and functions - Types, terms like cell address, types of references, values, objects, add ins. 1.3 MS-Power Point : Introduction, Application- presentation and slide show Creating and displaying a presentation.	02
2	Introduction to Computer Aided Drafting 2.1 Introduction to Computer Aided Drafting (CAD) - Applications, Various Softwares for Computer Aided Drafting. 2.2 Co-ordinate system- Cartesian & Polar-Absolute, Relative mode.	02

	2.3CAD initial settings commands - Snap, grid, ortho, osnap, limits, units, filters, itscale, mbuttonpan 2.4Object Selection methods – picking, window, crossing, fence, last, previous etc.	
3	Zoom and formatting Commands 3.1Zoom Commands – all, previous, out, in, extent, realtime, dynamic, window, pan. 3.2Formatting commands - Layers, block, linetype, lineweight, color. Draw and Enquiry commands 3.3Draw Command - Line, arc, circle, rectangle, polygon, ellipse, spline, block, hatch 3.4Enquiry commands - distance, area	02
4	Edit and Modify commands 4.1 Modify Command - Erase, oops, break, trim, copy, move, mirror, offset, fillet, chamfer, array, extend, rotate, scale, lengthen, stretch, measure, divide, explode, align. 4.2 Grips editing- Move, Copy, Stretch.	03
5	Dimensioning, Text and Plot Commands 5.1 Dimensioning commands - Dimension styles, Dimensional Tolerances and Geometrical Tolerances. 5.2 Text commands - dtext, mtext command. 5.3 Plotting a drawing - paper space, model space, creating table, plot commands.	03
6	Isometric Drawings 6.1 3D Edit Commands -Pline, 3Dpoly, pedit, join splinedit commands. 6.2 View Commands - View ports, UCS, WCS commands 6.3 Shade and Enquiry commands – mass property, Shade and render command.	04
	Total	16

Teaching Methodology: Power Point Presentations (PPT), Guest lecturers, Software applications with the help of computer, actual working with AutoCAD.

Skills to be developed:

Intellectual skills:

1. Select and develop coordinate system.
2. Interpret a drawing to draw in CAD software.
3. Select & use appropriate CAD commands for given situation.

Motor Skills:

1. Use pull down menu and their submenu, toolbars
2. Setting the initial drawing setup.
3. Draw, edit and modify drawings.
4. Use printers and plotters for plotting production drawings.

Term work- The term work shall consist of submissions of printout of each exercise done during the practical.

List of Practicals:

1. Introduction to Auto -CAD software, locations of various toolbars, menu bar, title bar, status bar, applications button, use of mouse, opening and saving file & drawing area etc. with exercises.
2. Training and practice on draw commands with at least two exercises of redraw figures.
3. Training and practice on modify commands with at least two exercises.
4. Training and practice on advanced modify commands with at least two exercises.

5. Training on layers and practice on creating layers & layers control etc. with at least two exercise using layers.
6. Training on dimensions and practice on creating dimensions, editing dimensions, creating leaders and editing leaders with at least two exercises.
7. Training on adding text and practice on, single line text, multiline line text, editing single and multiline text etc. with at least two exercises on it.
8. Training on plotting and printing with at least two exercises on it.
9. Training and practice on isometric drawing with at least two exercises on it.
10. Training and practice on orthographic drawing with at least two exercises on it.
11. Training and practice on MS-Word and MS-Excel & MS-Power Point with at least one exercise for each.

Learning Resources:

1. Books:

Sr. No	Author	Title	Publisher / Edition
1	Sham Tickoo	AutoCAD: A Problem-Solving Approach	Thomson Learning EMEA, Limited
2	George Omura	Mastering Auto CAD	BPB Publication
3	George Omura	ABC's of Auto CAD	BPB Publication
4	Gautam Purohit & Gautam Ghosh	M/c Drawing with AutoCAD	Pearson Publication
5	T Jeyapoovan	Engineering Graphics Using AutoCAD	Vikas Publishing House Pvt. Ltd. Fifth Edition
6	-	Various software manuals	-

2. Websites:

1. <http://www.we-r-here.com/cad/tutorials/index.htm>
2. <http://www.cadtutor.net/tutorials/autocad/>
3. http://www.caddprimer.com/AutoCAD_training_tutorial/AutoCAD_training_lessons.htm
4. <http://www.autocadmark.com/>
5. <http://www.autocadtutorials.net/>

DIPLOMA PROGRAMME : MECHANICAL ENGINEERING

Course : Basic Electronics (Mech.)

Course Code : R14EX2503

Course Category : Allied

Credits : 6

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	-	25	125

Rationale :

Every branch of engineering is related in some way or the other with electronics. The course aims at making a student familiar with the works of fundamental electronic devices, operation & use of different amplifiers, use of power supply, multi vibrators and digital electronics.

Objectives :

The students will be able to

1. Understand the symbol, construction & characteristics of Diode, Transistor.
2. Understand the working Diode, Transistor.
3. Understand regulated power supply.
4. Know the specifications and applications of OPAMP.
5. Draw Digital circuits.
6. Draw timing circuits using IC 555.

Course Details :

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Electronic Devices : 1.1 Introduction to electronic devices, symbol, principal of working, testing procedure for Diode, Zener diode, Power diode, Varactor diode. 1.2 Bipolar junction transistor (BJT). Field effect transistor- JFET & MOSFET. Unijunction transistor. 1.3 Power devices – DIAC, TRIAC, SCR. 1.4 Photo devices – Thermistor, LDR, Photo diode, Photo transistor, LED & LED display (7 segment), Liquid crystal diode (LCD).	12	16
2	Power supply : 2.1 Circuit diagram and operation, Half wave, full wave, Bridge, Filter – capacitor input. 2.2 Concept of unregulated power supply, regulated power supply- line regulation & load regulation. 2.3 Principle of operation, block diagram and application of shunt regulated power supply, series regulated power supply, switch mode power supply (SMPS). 2.4 3 pin IC regulated, IC regulated (IC 723) adjustable power supply.	10	12

	2.5 Concept of constant current limiting and fold back current limiting.		
3	Transistor : 3.1 Single stage transistor amplifier CB, CE and CC configuration and their application. 3.2 RC coupled and direct coupled amplifier, their frequency response and application. 3.3 Power amplifier- class A, B, C, class AB, their comparison on operating point, conduction cycle, efficiency, application. 3.4 Oscillator – Requirement of oscillator circuit, Barkhausen's Criteria of oscillator, circuit diagram, working and its application. Phase shift oscillator, Hartley oscillator, Crystal oscillator circuit.	10	12
4	OP AMP : 4.1 Block diagram and working of op amp. 4.2 Inverting OPAMP- circuit diagram, working, applications. 4.3 Non-inverting OPAMP circuit, Summing OPAMP circuit, Circuit diagram and its working. 4.4 Inverting amp, non-inverting amp. Opamp as summing amp, differentiator, comparator, Schmitt trigger, triangular wave generator.	10	12
5	Digital Electronics : 5.1 Conversion of Decimal into Binary and vice versa ,Study of logic gates - Symbol, truth table and IC numbers - NOT, AND, OR, NAND, NOR,XOR and XNOR gates. 5.2 Combinational Circuits – Half and full Adder, subtractor, multiplexor, de multiplexor, decoder and encoder – applications (Only block diagram ,truth table and simple circuits) 5.3 Sequential circuits - Flip Flops – Block diagrams of RS, JK , Master Slave JK, D and T, triggering mechanisms and applications of Flip flops 5.4 Basics of Counter, Asynchronous counter, decade counter, ring counter and shift register (Only circuit diagram and operation, no timing diagrams) 5.5 Seven segment driving circuit (7447) – Encoder, Decoder, Multiplexer, De multiplier.	12	16
6	IC 555 - Block diagram, Multi vibrator : 6.1 Mono stable using IC 555, circuit diagram, working. A stable using IC 555, circuit diagram ,IC555 as AMV, BMV and MMV 6.2 Introduction to Data converter - ADC , DAC (only principle of operation and applications) 6.3 Signal Conditioning – Need and block diagram of AC and DC signal conditioning. Data Acquisition System- single channel and multi channel ,Data Loggers	10	12
	Total	64	80

Teaching Methodology : Chalk-Board, Discussion, Power Point Presentation, Transparency, Expert Lectures.

Term Work :

Skills to be developed :

i) Intellectual Skills :

- Identify various digital and analog Ics and electronic components.
- Selection of appropriate parameter range on measuring instruments.
- Understand working principle of various electronic components

ii) Motor Skills :

- Make proper connection for the circuits.
- Handling various measuring instruments.
- Testing various electronic components.
- Observing Various parameters' values / outputs and comparing them with standard values.

List of Practicals:

1. Use of multimeter (analog and digital) for current, voltage and resistance measurement.
2. Study of front panel of CRO and its applications.
3. Use of CRO (digital storage) for frequency, voltage, phase measurement.
4. Testing of components like diode, triode, FET, LED, MOSFET, SCR, diac, triac, zener, resistor, capacitor using multimeter, LCR meter, CRO.
5. To plot line and load regulation of un-regulated power supply and regulated power supply.
6. Design and verify 4 bit shift register (right to left).
7. To plot characteristics of CE amplifier.
8. Observation and Measurement of wave form of phase shift oscillator.
9. Design of inverting amplifier using OPAMP.
10. Study of inverting operational amplifier.
11. To verify truth tables for the logic gates AND, OR, NOT, NAND, NOR, XOR.
12. Design and verify 4 bit ring counter.
13. Observation and measurement of waveform of astable multivibrator using IC555.

Learning Resources :

A) Books :

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	V.K. Mehta.	Principles of Electronics.	S. Chand & Company Ltd. New Delhi.
2	Paul Malvino.	Electronic Principles.	Tata McGraw Hill Publishers, New Delhi.
3	A. Mottershead.	Electronic Devices & Components.	Prentice Hall of India.
4	R.P. Jain.	Modern Digital Electronics.	Tata McGraw Hill Publishers, New Delhi.

B) Magazines :

1. Electronics for you.
2. Digit.

C) Web sites for references :

www.en.wikipedia.org.

www.electronics-tutorials.com

www.indianscientificinstrument.com

www.alldatasheet.com

DIPLOMA PROGRAMME : MECHANICAL ENGINEERING

Course : Elements of Electrical Engineering

Course Code: R14EE2302

Course Category: Allied

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

Rationale :

Diploma engineers come across machines and equipments involving components and devices based on principles of Electrical Engineering. The course envisages study of principles of DC and AC circuits, construction, working and selection of different types of DC and AC motors and transformers.

Objectives:

The students will be able to

1. Understand the basic laws of electricity and their application.
2. Understand the concept of Inductor, Capacitor, Power factor, and resonance.
3. Understand the concept of alternating quantity and terms relative to it.
4. Understand the principle of operation, construction, working and characteristics of Transformer, Autotransformer and their maintenance schedule.
5. Understand the principle of operation, construction, working and characteristics of DC machines and their applications.
6. Understand the principle of operation, construction, working and characteristics of AC machines and their applications.
7. Know various electrical heating, melting processes used in industries and safety precautions.
8. Know power system, tariff system and various methods of energy conservation in industries.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Fundamentals : Joule's law of electrical heating, concepts of work, power and energy. Concept of capacitor, capacitance, Faraday's law of electromagnetic induction, Lenz's law, induced emf, self inductance, mutual inductance. Effect of temperature on resistance, resistance in series and parallel, Ohm's law and its limitation, Kirchhoff's law, Star-delta and delta-star transformations	9	16
2	AC fundamentals : Generation of alternate voltages and currents, simple waveforms, terms like cycle, frequency, amplitude, phase, RMS value, average value, form factor. Vector representation of alternating quantities, vector diagrams using RMS value, AC through resistance, inductance and capacitance, AC through R-L, R-C and RLC circuits, and resonance in RLC circuits. Concept of power	8	12

	factor Three Phase Systems - Star and Delta Circuit , Line and phase relationship (No derivation , Simple numerical)		
3	Transformer : Working principle, constructional features. Types of Transformer. EMF equation of a transformer, voltage & current ratio, efficiency & voltage regulation, KVA rating of transformer, Autotransformer, concept of three phase transformer. Current and welding transformer Maintenance schedule of three phase transformer.	6	12
4	DC Machines : DC motor- working principle, types, constructional details, characteristics of DC series, shunt & compound motor, speed control of DC motors. Applications, necessity of starter & types of starter. Introduction to stepper motors, classification and applications	8	12
5	AC motors : Classification of AC motors Construction and principle of operation of three phase induction motor. Speed torque characteristics, slip ,speed control of Induction motor by Variable Frequency Drive(VFD)-working principle and block diagram only Starters – Direct ON line starters and Star Delta starters –working principle circuit diagram and application Single phase motors – capacitor start, capacitor start & run, shaded pole Applications of Single and three phase motors. Study of Other Motors with respect to specifications and rating, construction and application – a)Universal motor b)Stepper motor c) synchronous motor d) Servo motor	9	16
6	Utilization of Electrical Energy : Advantages of electrical motors, selection of motor based on characteristics. Motors for different industrial drives. Concept of electrical heating, resistance, induction & dielectric heating, resistance and arc welding equipment. Introduction to different accessories like MCB , ELCB, wires and cables Electrical safety, necessity of earthing, safety tools. Concept of energy conservation and Audit – CFL and LED lamps with their rating and applications, PF improvement methods	8	12
	Total	48	80

Teaching Methodology: Chalk board, discussion, charts, transparencies,

Term Work:

Skills to be developed:

Intellectual Skills :

- Identify types of motors used for pumps and drives.
- Identify types of transformers used for different applications.
- Selection of proper type of motor and transformer for particular application.
- Interpret results of practicals.

- Writing report after performing the practical by comparing obtained data with standard data.

Motor Skills :

- Proper connection of appliances for specific circuit diagram.
- Measurement of indicated value by indicating instrument.
- Observe and control the parameters shown by instrument.

List of Experiments/ Practicals / Assignments :

1. To identify different electrical accessories like switches, socket outlets, ELCB, MCB, ICTP, ICDP, fuses etc
2. Draw, trace and interpret function of fluorescent tube circuit elements.
3. To find out the voltage, current & power for resistive load connected in series.
4. To find out the voltage, current & power for resistive load connected in parallel.
5. Draw and interpret electrical circuits for domestic appliances like refrigerator, ceiling fan, automatic electric iron.
6. Use of energy meter, multi meter, watt meter, merger for measurement of various quantities.
7. Speed control of D.C. shunt motor by armature control method.
8. Speed control of D.C. shunt motor by field control method.
9. Determination of efficiency and regulation of single phase transformer by direct loading method.
10. Determination of efficiency and regulation of single phase transformer by open & short circuit method.
11. Study of single phase induction motor.
12. Study of R.L.C. circuit.
13. Determination of relationship between line and phase values of voltage and currents in case of balanced three phase (i) star connected load, (ii) delta connected load.
14. Study of three phase induction motor starters.

Learning Resources:

A) Books :

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	B. L. Theraja,	Electrical Technology Vol.-I	S. Chand Publishing.
2.	B. L. Theraja	Electrical Technology Vol.-II	S. Chand Publishing.
3.	B. H. Deshmukh	Electrical Engineering	Nirali Prakashan.

B) Web sites for references: www.wikipedia.com

DIPLOMA PROGRAMME IN:MECHANICAL/ELECT./COMP./E&TC. ENGINEERING

Course : Advanced Mathematics

Course Code: R14SC2701

Course Category: Allied

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	-	3	80	20	-	-	-	100

Rationale:

Mathematics is the backbone of all technical courses. Understanding the engineering concepts requires logical approach and thinking. The course aims to give the Diploma students a perfect knowledge of Mathematics which can be used in the Engineering field. They will be able to apply the advanced concepts of Mathematics in solving the varied kinds of engineering problems.

Objectives:

The students will be able to

1. Learn the new concepts of Integration, Laplace transform, Probability and Differential equations.
2. Solve the given mathematical problem with intelligent combination of techniques.
3. Apply the laws and principles of Mathematics to practical situation.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Integration: 1.1 Different methods of integration. Integration by different types. Some general integral. Integration by parts. Integration by partial fraction. 1.2 Definite integral. Properties of definite integral.	12	16
2	Application of Integration: 2.1 Area under the curve. Area between two curves. 2.2 Mean value. 2.3 Root mean square value.	8	12

3	Introduction to Laplace Transform: 3.1 Definition of Laplace transform. First shifting theorem. 3.2 Inverse Laplace transform. Properties of inverse Laplace transform.	6	12
4	Differential Equation: 4.1 Definition of differential equation. Order and degree of differential equation. Formation of differential equation. 4.2 Solution of differential equation of 1 st order and 1 st degree. Variable separable differential equation. Homogenous differential equation. Linear differential equation.	8	16
5	Probability: 5.1 Definition: event, sample space and probability. 5.2 Introduction to permutation and combination. Factorial notation. Meaning of ${}^n P_r$ and ${}^n C_r$. 5.3 Addition theorem for probability. Simple examples on probability. 5.4 Conditional probability.	8	12
6	Probability Distribution: 6.1 Binomial distribution. 6.2 Poisson distribution. 6.3 Normal distribution.	6	12
	Total	48	80

Teaching Methodology: Chalk board, Discussion, Assignments, printed notes.

Skills to be developed:

Intellectual Skills:

- Memorizing skill will be developed after studying the formulae of all the topics.
- Selection skill will be developed after studying the methods of solving problems during selection of appropriate formula.
- Logical thinking will be developed after studying the topic Probability.
- Application skill will be developed after studying the topic Application of Integration

Learning Resources:

A) Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Peter V. O'Neil	Advanced Engineering Mathematics	Thomson, Canada.
2	Joel L.Schiff	The Laplace Transform	Springer Verlag, New York.
3	Shanti Narayan	Engineering Mathematics Vol. I & II	S. Chand & Company, New Delhi.

B) Web sites for references:

1. www.wikipedia.com
2. www.wolfarm.com
3. www.mathworld.com
4. www.nptel.iitm.ac.in

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Environmental Studies

Course Code: R14ME2205

Course Category : Allied

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
2	1	-	-	-	-	25@	25	50

@ - Internal Examination

Rationale:

Environment essentially comprises of our living ambience, which gives us the zest and verve in all our activities. The turn of the twentieth century saw the gradual onset of its degradation by our callous deeds without any concern for the well being of our surrounding we are today facing a grave environmental crisis. The unceasing industrial growth and economic development of the last 300 years or so have resulted in huge ecological problems such as overexploitation of natural resources, degraded land, disappearing forests, endangered species, dangerous toxins, global warming etc.

It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could be possible remedies or precautions which need to be taken to protect the environment.

The curriculum covers the aspects about environment such as Environment and Ecology, Environmental impacts on human activities, Water resources and water quality, Mineral resources and mining, Forests, etc.

Objectives:

The students will be able to

1. Understand importance of environment
2. Know key issues about environment
3. Understands the reasons for environment degradation
4. Know aspects about improvement methods
5. Know initiatives taken by the world bodies to restrict and reduce degradation

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Nature of Environmental Studies • Definition, Scope and Importance of the environmental studies • Importance of the studies irrespective of course • Need for creating public awareness about environmental issues	4
2	Natural Resources and Associated Problems 2.1 Renewable and Nonrenewable resources • Definition • Associated problems 2.2 Forest Resources • General description of forest resources • Functions and benefits of forest resources • Effects on environment due to deforestation, Timber extraction, Building	5

	of dams, waterways etc. 2.3 Water Resources - Hydrosphere: Different sources of water - Use and overexploitation of surface and ground water - Effect of floods, draught, dams etc. on water resources and community 2.4 Mineral Resources: - Categories of mineral resources - Basics of mining activities - Mine safety - Effect of mining on environment 2.5 Food Resources: - Food for all - Effects of modern agriculture - World food problem	
3	Ecosystems - Concept of Ecosystem - Structure and functions of ecosystem - Energy flow in ecosystem - Major ecosystems in the world	5
4	Biodiversity and Its Conservation - Definition of Biodiversity - Levels of biodiversity - Value of biodiversity - Threats to biodiversity - Conservation of biodiversity	5
5	Environmental Pollution - Definition - Air pollution: definition, classification, sources, effects, prevention - Water Pollution: Definition, classification, sources, effects, prevention - Soil Pollution: Definition, sources, effects, prevention - Noise Pollution: Definition, sources, effects, prevention	5
6	Social Issues and Environment - Concept of development, sustainable development - Water conservation, Watershed management, Rain water harvesting: Definition, Methods and Benefits - Climate Change, Global warming, Acid rain, Ozone Layer Depletion, Nuclear Accidents and Holocaust: Basic concepts and their effect on climate - Concept of Carbon Credits and its advantages	4
7	Environmental Protection Brief description of the following acts and their provisions: - Environmental Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and Control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Population Growth: Aspects, importance and effect on environment - Human Health and Human Rights	4
	Total	32

Teaching Methodology: Chalk-Board, Discussions, Transparencies.

Skills to be developed:

Intellectual Skills:

1. Collection of information, data
2. Analysis of data
3. Report writing

Motor Skills:

1. Presentation Skills
2. Use of multi media

List of Projects:

Any one project of the following:

1. Visit to a local area to document environmental assets such as river / forest / grassland / hill / mountain
2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
3. Study of common plants, insects, birds
4. Study of simple ecosystems of ponds, river, hill slopes etc

Prepare a project report on the findings of the visit illustrating environment related facts, analysis and conclusion. Also suggest remedies to improve environment.

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Anindita Basak	Environmental Studies	Pearson Education
2	R. Rajgopalan	Environmental Studies from crises to cure	Oxford University Press
3	Dr. R.J. Ranjit Daniels Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India

DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./ E&TC ENGINEERING

Course : Entrepreneurship Development

Course Code: R14ME2206

Course Category: Allied

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
2	1	-	-	-	-	25@	25	50

@ Internal Examination

Rationale:

This course consists of topics related to the development of entrepreneurial skills and other details such as selection of product lines, site selection, financial aspects, personnel management, quality control and creative thinking. The course includes case studies in the related field. The course emphasizes the development of enterprising qualities among young engineers.

Objectives:

Students will be able to

1. Identify entrepreneurship opportunity.
2. Acquire entrepreneurial values and attitude.
3. Use the information to prepare project report for business venture.
4. Develop awareness about enterprise management.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	1.1 Introduction : Definition of entrepreneur, concept of entrepreneur and entrepreneurship, importance of entrepreneur. Types of entrepreneur: Innovating entrepreneur, imitative entrepreneur, Fabian entrepreneur, drone entrepreneur and according to type of business. Difference between Entrepreneur and Intrapreneur. 1.2 Entrepreneurial Competencies: - Characteristics of an entrepreneur, qualities of an entrepreneur, competencies of entrepreneur. 1.3 Women Entrepreneur: Definition, characteristics of women entrepreneur. Causes of limited growth in India, remedies for limited women entrepreneurship development.	6
2	Motivation : Definition and concept of motivation, types of motivation: affiliation, power, and achievement motivation. Need and importance of achievement motivation, challenges of motivation, Motivating factors. Theories of motivation: a) Maslow Hierarchy theory ,b)Mc Gregor X-Y theory, c)	4

3	Creativity and Innovation : Definition and concept of Innovation, definition and concept of Creativity. Characteristics of creative people. Discussion of various examples with respect to creativity and innovation.	5
4	4.1 Business Opportunity Search and Scanning : Opportunities available in different sectors such as manufacturing, services and trading. Classification of opportunities on the following: - Natural resource based, Demand based, Local industrial based, Service sector based, Export based, Skill based, Off-farm based. 4.2 Business Idea : Search for business idea, sources of business idea, ways of generating ideas, ideas processing & selection (factors affecting product idea). SWOT Analysis. 4.3 Sources of Business Idea : Market survey & techniques, prospective consumers, development in other nation, study of project profile, government organization, trade fair and exhibitions. Checklists for information collection.	6
5	Government and Non-Government Agencies for Promotion and Development : Importance of funds, Types of funds. Various schemes of assistance of government, Government policies and incentives. Registration with various government agencies, definition of SSI and Ancillary.	5
6	Business Plan Preparation : Project identification, project formulation, feasibility analysis, Estimation of cost of production, Cost volume profit relationship at different levels, Interpretation of financial statements, Institutionalized and Non-institutionalized sources of working capital, Funds flow statements, Loan application form for appraisal. Project report preparation.	6
Total		32

Teaching Methodology: Group Discussion, visits, guest lectures.

Term Work:

Skills to be developed:

Intellectual Skills :

- Identify various opportunities in market.
- Identify individual's entrepreneurial competencies.
- Interpret risk to be taken during a task.
- Interpret SWOT of individual.
- Prepare a report of business plan.
- Enhance/Improve presentation and writing skills.

List of Practicals:

1. Biography of any entrepreneur.
2. Self Disclosure Exercise (Who am I?).
3. Self rating questionnaire.
4. Thematic Appreciation Test (TAT).
5. Ring Toss Exercise.
6. Tower Building Exercise.

7. Convince and Crown.
8. Creativity and Problem solving.

Professional Practices:-

9. Walking through Market.
10. Business plan preparation.
11. Interview of a successful entrepreneur.
12. Interview / Biography of a successful women entrepreneur.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Vasant Desai	Dynamics Of Entrepreneurial Development And Management.	Himalaya Publishing House, 1997, Reprint-1999.
2	Dilip M. Sarwate	Entrepreneurial Development Concept and Practices.	Everest Publishing House, 1996.
3	Gupta Srinivasan	Entrepreneurial Development.	Sultan Chand & Sons, 1993.
4	D. D. Mali	Training of Entrepreneurship and Self Employment.	Mittal Publications, 1999.

DIPLOMA PROGRAMME : MECHANICAL/ELECTRICAL ENGINEERING

Course : Computer Programming

Course Code : R14ME2207

Course Category : Allied

Credits : 3

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	25@	-	25	50

@Internal Examination

Rationale:

The course aims at providing exposure to the principles of programming. The student shall be able to write simple algorithms, draw and interpret flow charts and write programs in a high level language like C using sequential, branching & repetitive structures.

Objectives :

The students will be able to

1. Break a given task into subtasks.
2. Enhance logical thinking.
3. Develop 'C' programs for simple applications.

Course Details :

UNIT	NAME OF THE TOPIC	HOURS
1	Introduction : Problem definition and analysis, algorithms, flow charts, tracing and dry running of algorithms and flow charts. Introduction to C programming, sample C program, compilation & execution of C program.	2
2	'C' Fundamental : Character set, constants, symbolic constants, identifiers, keywords, data types, variable declarations, types of operators: unary, binary, arithmetic, relational, logical, assignment, conditional etc. Hierarchy of operators, expressions, library functions, Use of input/output functions namely printf (), scanf (), getch ().	5
3	Control Statement : Use of control statements: if else, while, do while, for, switch, break, continue, comma operator, goto. Writing, compiling, executing and debugging programs.	3
4	Array : Introduction to subscripted variables, arrays, defining arrays (one and two dimensional), processing arrays, passing arrays to functions.	2

5	Function : Defining and accessing functions, passing arguments, function prototypes. Storage classes: automatic, external, static variables.	2
6	String Handling : String handling, string i/o with gets (), puts (), arrays of strings. Introduction to recursion.	2
	Total	16

Teaching Methodology : Chalk-Board, Discussions, Power Point Presentations (PPT)

Term Work :

Skills to be developed :

i) Intellectual Skills :

- Reading of 'C' variables and constants
- Writing a 'C' program.
- Interpretation of 'C' program.
- Understanding of control statements, Array, Pointer, Functions.

ii) Motor Skills :

- Compilation of program in 'C' compiler.
- Execution of program and observe the output.

List of Experiments / Practicals / Assignments :

Term work shall consist of flowcharts, source listing and input/output (minimum one program for each one) of following assignments:

- A program performing **sequential computations**.
- A program using **if else** statements. Example find the largest number among the three numbers.
- A program using **while** statements. Print the Fibonacci series.
- A program using **do while** statements. To reverse the integer number & count its digits.
- A program using **for** statements. Draw the different types of star (*) pattern on screen.
- A program using **break** and **continue** statements. Calculate sum, mean, Variance, Standard deviation.
- A program using **switch** statements. Calculate the volume, circumference, area of circle.
- A program for **input/output formatting** using **scanf** and **printf**. Calculate the roots of quadratic equation.
- A program using **single dimensional array** e.g. Sort the array
- A program for processing a **2 dimensional array** of integers. Addition, Subtraction, Multiplication and Division.
- A program using **user defined functions**. Calculate the simple & compound interest.
- A program for **string handling**. Copy one string into another string and count the number of character.
- Programs to convert mechanical formulas into 'C' Expressions.

Learning Resources :

Books :

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Yashwant Kanitkar	Let us C	BPB publications.
2	Byron Gottfried	Introduction to C programming	Tata Macgraw Hill Publications.
3	Denis Richie and Kernighan	Introduction to C programming	Prentice Hall India Publications.

DIPLOMA PROGRAMME: CIVIL/ MECH./ELECT./COMP/ ELEX. ENGINEERING

Course : Elements of Accounts and Finance

Course Code: R14ME2208

Course Category: Allied

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
2	1	-	-	-	--	25@	25	50

@ Internal Examination

Rationale:

The aim of this course is to provide with the basic level skills and knowledge required by engineers in the accounting and finance. The curriculum envisages the elementary theory and practice of financial accounting. This involves understanding of the concepts and choices that underline measurement and disclosure in financial statements.

Objectives:

The students will be able to

1. acquire knowledge of basic concepts of accounting
2. acquire basic accounting knowledge
3. interpret the financial statements

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Introduction to Book-keeping and Accountancy Meaning & definition, objectives, importance and utility, Difference between Book-keeping and Accountancy. Basis of accounting: Cash basis and accrual basis Branches of accounting: Financial , Cost, management Accounting terminology: Business transactions- Cash, Credit, Non-monetary transactions Types of assets- Fixed, Current, Fictitious Types of liabilities: Fixed, Current, Contingent Net worth, Capital, Debtor, Creditor, Expenditure, Types of Expenditure: Capital, Revenue, Deferred revenue Solvent- insolvent	5
2	Fundamentals of double entry book-keeping: Principles, Comparison between conventional and double entry system, Classification of accounts: Personal, Real, Nominal Meaning of debit and Credit	6

	Basic rules for debit and credit for different accounts	
3	Journal: Definitions, Importance and utility of journal, Specimen of a journal, Journalizing and steps for journalizing Ledger: Meaning, need and contents of ledger, specimen of ledger account, posting of entries in ledger Balancing of ledger accounts	8
4	Trial Balance: Meaning and purpose Specimen of trial balance, preparation of trial balance from given balances of accounts, introduction to errors and their rectification methods Depreciation: causes and need, methods of computing depreciation Provisions and reserves: Meaning and objectives	3
5	Final Accounts: Financial statements, preparation of profit and loss account, trading account, Valuation of stock, provisions for bad debts, Balance sheet: Arrangements of assets and liabilities Accounting standards:	5
6	Cash flow and fund flow statements Difference between cash flow and fund flow statement, advantages and limitations Ratio analysis: current ratio, return on equity, the debt-equity ratio, the dividend payout ratio and the price/earnings (P/E) ratio	5
	Total	32

Teaching Methodology: Discussions, Chalk-Board, Charts, Transparencies.

Term Work :

List of Assignments :

1. Minimum Two exercises on Journalising
2. At least two assignment on posting entries into Ledger
3. Preparation of Trial Balance,
4. Interpreting a Profit and Loss Account / Income and Expenditure statement
5. Reading a Balance Sheet
6. Exercise on Cash flow statement
7. Finding financial ratios from Balance sheet and interpreting them
8. Reading and interpreting financial Statement of a Private/Public Limited Company

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	T.S. Grewal S.C. Gupta	Introduction to accountancy	S. Chand Publications, New Delhi
2	-	Book-keeping and Accountancy For Std XI And XII	Maharashtra State Board Of Secondary And Higher Secondary Education

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**Course : Behavioural Science****Course Code: R14ME2209****Course Category : Allied****Credits : 3****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
2	1	-	-	-	-	25@	25	50

@-Internal examination

Rationale:

With increased globalization and rapid changing business expectations, employers are looking for wide cluster of skills to cater to the changing demand. Personality traits and soft skills are playing a key role in a student's career in this changing scenario. Corporate houses look for soft skills that supplement hard skills.

Addition of behavioural science in curriculum is intended to enhance the efficiency of a person so that he can contribute to overall growth of organisation. It aims at developing insight into leadership, team building, motivation, interpersonal relationship, problem solving, decision making and aspects of personality in a technician's profile. Addition of the topic of organizational culture will further mould him/ her in the organisational role.

The subject of 'Behavioural Science' provides a broad base in which a technician can develop a successful career in the world of work.

Objectives:

The students will be able to

1. Develop him/her as Team leader.
2. Use self-motivation and motivate others.
3. Build a team and develop team spirit among the team members.
4. Improve the interpersonal relationship skills.
5. Learn Problem solving and decision making skills.
6. Discuss a particular topic in a group and face the interview.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Leadership 1.1 Introduction – Importance, examples of different types of leaders. 1.2 Meaning and Definition of Leadership. 1.3 Leadership qualities – Confidence, Vision, Communication Skills, influencing people etc. 1.4 Types of Leadership styles, their advantages and disadvantages – Autocratic, Democratic, Delegative, Bureaucratic and Laissez Fairie.	6
2	Motivation 2.1 Meaning and Definition of motivation. 2.2 Types of motivation. 2.3 Maslow's Motivation theory. 2.4 Job characteristic model to enhance motivation.	6

3	Team Building 3.1 Definition of Team. 3.2 Difference between Group and Team. 3.3 Need for formation of good team (vision, trust, cooperation, initiative, etc.) 3.4 Approach to Team building (Personality based, activity based, skill based, problem solving based, etc.)	5
4	Conflict Resolution 4.1 Definition of Conflict. 4.2 Types of Conflict – Functional and Dysfunctional 4.3 Sources of Conflict – Ego, Authority, Frustration etc. 4.4 Positive and Negative effects of conflicts. 4.5 Methods of Conflict resolution – Compromising, withdrawal, forcing.	5
5	Problem Solving And Decision Making 5.1 Steps in Problem Solving. 5.2 Methods used for solving problems – trial and error method, brain storming, lateral thinking method. 5.3 Techniques used for Decision making- Decision tree, Decision Matrix, Mind Mapping etc.	5
6	Group Discussion And Interview Techniques 6.1 Group Discussion - Objectives of Group Discussion (ability to work in team, speaking and listening skills, leadership, creativity) - Does and Don'ts of Group Discussion. - How to conclude Group Discussion. 6.2 Interview Techniques - Types of Interviews. (patterned, stress, behavioural) - Dress Code, Body Language and Communication Skill. - Probable questions for Interview. - Telephonic or Video Interview.	5
	Total	32

Teaching Methodology: Chalk-Board, Discussions, Transparencies.

Skills to be developed:

Intellectual Skills:

- Develop ability to find his strengths
- Select proper source of information.
- Follow the technique of time and stress management.
- Set the goal.

Motor Skills:

- Follow the presentation of body language.
- Work on internet and search for information.
- Prepare slides / transparencies for presentation.

List of Practicals/activities:

1. Form a group of 4 or 5 students and discuss the topic 'Qualities of an effective leader'. Each group will prepare its list with justification to the entire class and write an assignment under the guidance of subject teacher.
2. Form a pair of student and each one from pair will ask each other questionnaire on motivation, self-motivation, experiences that motivated him or other which him for success in the past and write an assignment under the guidance of subject teacher based on discussion.
3. Form a group of 4 or 5 students and assign them a group activity such as 'making a shape from match stick (50 to 100 match sticks) without guidance and without group discussion.

4. The group as in activity 3 will now perform the same activity. After group discussion and under guidance of subject teacher, each student from a group will write an assignment for both the activities and write their inferences with reference to group discussion, team development, team building, etc.
5. Form a group of 8 to 10 student and arrange a group activity such as;
 - Industrial visit.
 - Visit to any historical place/fort/museum, etc
 - Housekeeping and cleaning of any laboratory/seminar hall for any function.

After the execution of activity student will write an assignment under guidance of teacher keeping in mind individual role, purpose of activity, inter dependency of work or task, coordination of person and task involved and final performance.
6. Write an assignment on interpersonal relationship and conflict management with student's personal experience of solving conflicts.
7. Form a group of 20 students and ask them to prepare a list of 8 to 10 problems affecting the institute. Subject teacher should analyze one such problem on black board using 'Fish bone technique' with the participation of students. Students will write an assignment consisting;
 - Apparent problem statement.
 - Analysis of the causes.
 - Definition of real problem.
8. The subject teacher starts the session with 'Statement of the problem' written on the black board. After ensuring that all the participants are at the same level of understanding the statement of problem, he initiates NGT (Normal Group Technique) to arrive at maximum possible number of creative solutions. Based on ranking matrix the group will arrive at feasible solutions and students will write an assignment consisting of;
 - Problem Statement.
 - Model of problem solving.
 - List of creative solution suggested by participants.
 - Write the most feasible solution based on given criteria.
9. Form a group of 4 to 5 students and give them a topic for GD for 10 to 15 minutes. Teacher should analyse GD on certain parameters and students will write an assignment on aspects of GD and prepare a format (suggested or designed by teacher) which gives details of GD carried out.
10. Arrange a guest lecture of H.R. Person from industry/expert in interview technique and conduct mock interview of each student. Student should write a report on this activity.
11. Arrange a visit to industry and gather information about organisation, product, turnover, work culture, vision/mission statement, quality policy, Corporate social responsibility etc and write a report on it.

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. Kumkum Mukherjee	Principles of management and organisational behaviour	Tata McGraw Hill Education Pvt Ltd.
2	Dr. T. Kalyana Chakravarti Dr. T. Lata Chakravarti	Soft Skills for Managers	Biztantra
3	Barun K. Mitra	Personality Development and soft skills	Oxford University Press
4	Priyadarshani Patnaik	Group discussion and interview skills	Foundation Books

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Workshop Practice

Course Code: R14ME3201

Course Category: Core

Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme							
TH	PR	PAPER	HRS	TH	TEST	PR	OR	TW	TOTAL
-	4	-		-	-	-	-	50	50

Rationale:

Diploma technician often comes across use of various types of tools & materials. He is required to select, operate & control the appropriate tools & materials for specific application in this context it is almost essential & necessary to have the basic knowledge & understanding of tools, materials and workshop processes.

Objectives:

The student will be able to

1. Know basic workshop processes.
2. Read and interpret job drawings.
3. Identify, select and use various marking, measuring and holding, striking and cutting tools & equipments in various shops.
4. Inspect the job for specified dimensions.
5. Produce jobs as per specified dimensions.
6. Adopt safety practices while working on various machines.

Course Details:

UNIT	NAME OF THE TOPIC	PRACTICAL HOURS
1	Safety Precautions in Workshop: Basic rules of safety, General safety guidelines, Welding safety guidelines.	
2	2.1 Wood Working Shop: Types of woods, carpentry tools (chisels, marking gauges, planes, saws), wood working lathe. Students will do a job involving corner lap joint and mortise and tenon joint	14
	2.2 Black Smithy: Black smithy furnaces, tools & operations.	8
	2.3 Plumbing & Sheet Metal Work: Tools & Operations such as cutting, notching, bending, marking. Tools used in plumbing, fittings used in plumbing. Student will perform a job consisting of threading on G.I./PVC PIPE and fitting of bend, elbows, tee, plugs and other pipe fittings	16

	2.4 Fitting: Tools such as vice, hammers, chisels, files, hacksaws. Operations such as marking, filing, sawing. Student will perform a job consisting of cutting by hack- saw, finishing by using various files, drilling and tapping	16
	2.5 Welding: Classification of welding process such as pressure & fusion welding, Introduction to electric arc welding. Types of joints such as lap joints, butt joints. Student will perform a job consisting of any two joints	10
	Total	64

Term Work:

Skill to be developed:

Intellectual Skills:

- Reading of job drawings.
- Identify and select proper material, tools and machines.

Motor Skills:

- Setting tools, work piece and machines for desired operations.
- Preparing a job as per drawing in allotted time.
- Use of safety procedures during operations.
- Inspection of job with the help of measuring instruments.

List of Practicals:

It consists of jobs involving different operations in fitting, black smithy, tin smithy, welding & carpentry shops.

Professional practices:

Student will gather the information through manufacturers' catalogue, websites, magazines, books & submit the report on following in the form of journal -

- 1) Hand tools used in workshop.
- 2) Operations carried out by hand tools in various shop.
- 3) Safety guidelines in workshop.
- 4) Specifications of various hand tools used in workshop.
- 5) Various process mention in the curriculum of workshop practice.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Chapman W.A.	Workshop Technology, Vol.I	London ELBS.
2	Hazara Chaudhari	Workshop Technology Vol.I	Media Promoters & Publishers.
3	Raghuwanshi B.S.	Workshop Technology Vol.I	Dhanpat Rai & Sons , New Delhi.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Engineering Drawing

Course Code : R14ME3202

Course Category : Core

Credits : 6

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
2	4	4	80	20	--	--	50	150

Rationale :

This second course in engineering drawing has been designed to further reinforce & enhance the drafting skills and the ability of spatial visualization acquired in the foundation course in Engineering Graphics. The course envisages learning understanding of basic concepts in solid geometry. Student is also expected to learn about sketching of elementary components like bolts, nuts, keys, rivets, coupling, etc.

Objectives :

The students will be able to:

1. Understand the basic principle and concepts of engineering drawing.
2. Visualize the objects.
3. Draw different views in different position of objects.
4. Draw the different views of machine components.

Course Details :

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Missing Views : 1.1 Types of sections- full, half, revolved, removed, offset. 1.2 Conventional breaks for circular and rectangular sections. 1.3 Interpretation of given orthographic views and addition of non given (missing) view.	6	16
2	Free Hand Sketches : 2.1 Threads and thread profiles. Conventional representation of threads. Types of nuts, bolts, washers, locking arrangements, set screws 2.2 Types of rivet heads and riveted joints. 2.3 Keys, Couplings (Muff, Flanged and Flexible), Pulleys, Bearings, Pipe joints and Fittings.	4	12
3	Projection of Lines and Planes : 3.1 Lines inclined to both the reference planes 3.2 Planes normal to one reference plane and inclined to other reference plane.	6	12
4	Projections and Sections of Solids : 4.1 Right regular solids- Prisms, Cylinders, Pyramids, Cone and their combinations only. For projections- Prism, Cylinder, Pyramids and Cone-axis parallel to one reference plane and inclined to the other reference plane. 4.2 For sections- (sectional views and true shape of sections)	6	16

	Prisms and cylinders- axis parallel to one reference plane and inclined to the other reference plane. Pyramids and cone- resting on their bases on horizontal plane only.		
5	Surface Developments : 5.1 Surface developments of all the solids considered in the topic number four. 5.2 Their applications such as tray, hopper, funnel, pipe bends etc. 5.3 Anti development exercises	5	12
6	Interpenetration of Solids : Interpenetration of Prism with Prism, Cylinder with Cylinder, Prism with Cylinder (Axes of both the solids are perpendicular to each other)	5	12
	Total	32	80

Teaching Methodology : Chalk-Board, Discussions, Charts, Models, Transparencies.

Term Work :

Skills to be developed:

i) Intellectual Skills :

- Understanding sectional & missing views.
- Understanding the projections of lines & planes.
- Understanding the concept of development & penetration of solids.

ii) Motor Skills:

- Drawing of various solids with different positions.
- Free hand sketching of machine components.

List of practicals and Assignments:

Use half imperial drawing sheets to complete following exercises.

Work book is an integral part of term-work. All assignments must be completed in workbook before submission of corresponding drawing sheet/s. Students must bring sketch book during lecture as well as practical sessions.

Sr. No.	Topic Name	Number of sheets	Assignments Equivalent to no. of sheets
1	Missing Views	2	2
2	Free hand sketches	1	1
3	Projection of lines and planes	2	2
4	Projections of solids	1	1
5	Section of solids	1	2
6	Surface developments	2	2
7	Interpenetration of solids	1	2

Learning Resources :**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	N. D. Bhatt	Machine Drawing	Charotar Publication, Anand.
2	Mali and Chaudhary	Machine Drawing	Vrinda Publications, Jalgaon.
3	K.L. Narayana, P. Kannaiah, K. Venkata Reddy	Production Drawing	New Age International Publications, New Delhi.
4	Kamat & Rao	Machine Drawing	Jaydeep Prakashan, Mumabai.
5	P.S. Gill	Machine Drawing	S.K. Kataria & Sons Publications, New Delhi.
6	SP 46-1988	Code of practice for general engineering drawing	Bureau of Indian Standards.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Machine Drawing

Course Code : R14ME3203

Course Category : Core

Credits : 6

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme							
TH	PR	PAPER	HRS	TH	TEST	PR	OR	TW	TOTAL
2	4	4	80	20	--	25	25	150	

Rationale :

Drawing is a graphical language of Engineer. Diploma Technician has to work in different situations like supervision of production, maintenance of machine, inspection, drafting etc. In whatever capacity he/she may be working, diploma technician has to read, interpret & prepare drawing of various types of different machine components, dies, assemblies etc. He/she is required to understand, assimilate & analyze the drawings completely which eventually leads to efficient performance of manufacturing, so basic skills of reading & interpreting drawings is utmost important & involves preparation of sketches of parts using different symbols as fit, tolerance, surface finish.

Objectives :

The students will be able to

1. Understand industrial drawings.
2. Interpret instructions related to manufacturing of components.
3. Visualize the assembly from a given set of details of machine components
4. Relate easily to the use of IS Conventions of representing various machine components.
5. Understand the significance & use of tolerances of size, form and position.

Course Details :

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Advanced Missing Views : 1.1 Types of sections such as full section, half section, offset section, broken section, revolved section, removed section, aligned section. 1.2 Conversion of given orthographic views into sectional views and addition of the third view. (Objects to be studied are advanced in nature than studied in Course Engineering Drawing), change of method of projection.	4	16
2	Auxiliary Views : 2.1 Study of auxiliary planes. Projections of objects on the auxiliary planes. 2.2 Completing the regular views with the help of given auxiliary views.	5	12
3	3.1 General welding symbol- sectional representation and symbols used in engineering practices. Representation of welding symbols in structural drawings. 3.2 Terminology of spur gears, spur gears in mesh. 3.3 Surface roughness: Process capability, Machining symbol, Indication of	6	12

	machining symbol, Symbol for direction of lay, Roughness values (Ra) and CLA , Roughness grade numbers, conventional representation on drawings.		
4	4.1 Conventional Representation as per IS Code: SP46 of the following:- Conventional breaks ,conventional representation of materials, External and internal threads, single & multi start threads, right and left hand threads. Bolts, slotted heads of set screws, bearing in position, serrated shafts, splined shafts, chain wheels, knurling, square ends and flat surfaces, holes on linear and circular pitches, repeated parts, tapers, chamfers, counter sunk & counter bores, springs, pipe fitting and pipe joint, gears, springs (helical, leaf & spiral), abbreviations used in drawing as per IS Code SP46 . 4.2 Limits, Fits and Tolerances: ISO system of tolerances. Tolerance charts, Hole basis & Shaft basis system, Types of fit, Selection of fit, Selection of tolerance value from chart. 4.3 Geometric Tolerances: Form and position tolerances, their types, conventional representation on drawings.	5	12
5	Details to Assembly : To prepare assembly drawings from given details (number of details limited to 6-8 for semester examination) such as- Couplings- Universal coupling (Hooke's joint). Pipe joints & valves -Expansion joint, Non-return valve, steam stop valve. Engine parts- Cross head, Stuffing box. Bearings- Plummer block, Bushed & Foot Step bearing. Pulleys- Fan belt pulley, Pulley with supports. Other parts- Tool post, Screw Jack, Water Tap. Vices- Pipe Vice, Bench Vice.	6	12
6	Assembly to Details and Drawing Reading : To draw details from given assembly drawing and answering questions on it. Number of details should be limited to 6 to 8. List of assemblies in topic 5 should be taken as reference. Interpretation of given drawing and answering questions related to chapter 3 and 4	6	16
Total		32	80

Teaching Methodology : Discussions, Chalk-Board, Models, Charts, Transparencies.

Term Work :

Skills to be developed :

i) Intellectual Skills :

- Understanding sectional & missing views of complicated objects.
- Visualising the auxiliary views.
- Selection of type of fit (for mating parts).
- Reading of industrial drawings.

ii) Motor Skills:

- Drawing of details to assembly and vice-versa of various machine components.
- Free hand sketching of conventional representation as per IS code, welded joints, surface roughness etc.

List of Drawing practicals/ Assignments:

Use half imperial drawing sheets to complete following exercises.

Work book is an integral part of term-work. All assignments must be completed in workbook before submission of corresponding drawing sheet/s. Students must bring sketch book during lecture as well as practical sessions.

Sr. No.	Topic Name	Number of sheets	Assignments Equivalent to no. of sheets
1	Missing Views	2	1
2	Auxiliary Views	2	2
3	Free hand sketches	-	1
4	Welding	1	1
5	Details to assembly	2	2
6	Assembly to details	2	2
7	Tolerances and surface roughness	1	1

Professional Practices:

An assignment based on drawing from industry (single part or assembly of 4 to 8 parts) and interpretation of drawing

Learning Resources:**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	N. D. Bhatt	Machine Drawing	Charotar Publication, Anand.
2	Mali and Chaudhary	Machine Drawing	Vrinda Publications, Jalgaon.
3	K.L. Narayana, P. Kannaiah, K. Venkata Reddy	Production Drawing	New Age International Publications, New Delhi.
4	Kamat & Rao	Machine Drawing	Jaydeep Prakashan, Mumbai.
5	P.S. Gill	Machine Drawing	S.K. Kataria & Sons Publications, New Delhi.
6	IS Code SP46 (1988)	Engineering Drawing Practice for School and Colleges	Bureau of Indian Standard (BIS)

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Manufacturing Processes

Course Code: R14ME3204

Course Category: Core

Credits : 7

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	4	3	80	20	25#	-	25	150

External practical examination of 3 Hrs duration

Rationale:

Diploma Technician often comes across various types of chip forming & non-chip forming manufacturing processes, machines, equipments. He/She is required to select, operate & control the appropriate process for specified application. In this context it has become almost essential to have the basic knowledge & understanding of these processes, machines & equipments. A diploma technician is able to handle & control the practical situation more effectively and confidently if he/she possesses sound understanding of processes, machines, equipments.

Objectives:

The students will be able to

1. Know and identify basic manufacturing processes for manufacturing different components.
2. Operate & control different machines and equipments.
3. Inspect the job for specified dimensions.
4. Produce jobs as per specified dimensions.
5. Select the specific manufacturing process for getting the desired type of output.
6. Adopt safety practices while working on various machines.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	1.1. FUNDAMENTALS OF METAL CUTTING: Basic elements of machining, Principles of metal cutting & forces involved in metal cutting, Chip formation, Types of chips, Oblique & orthogonal cutting, Chip breaker, Cutting tool geometry and tool signature of single point cutting tool, re-sharpening of cutting tool. 1.2 CUTTING TOOL MATERIAL AND CUTTING FLUIDS: Machine ability , factors affecting machinability, requirements of tool material,[cutting tool material such as high carbon steel, high speed steels, carbide tools, ceramics, diamond tools, cemented oxides, abrasives & CBN etc].Cutting fluid: Functions & desirable properties of cutting fluid, types of cutting fluids. 1.3 TOOL LIFE : Definition of tool life, relation between cutting speed & tool life, factors	9	16

	affecting tool life, Tool failure: causes of tool failure, various types of tool wear, methods for improving the tool life, study of cutting parameters like feed , depth of cut , cutting speed.		
2	2.1 GAS WELDING AND ARC WELDING: Advantages, limitations, applications of oxy-acetylene welding, types of gas flames (neutral, oxidizing, carburizing), welding equipments. Arc welding: working principle, electrodes, fluxes, types of electrodes, applications of fluxes, concept of arc blow, various arc welding processes such as TIG, MIG. SMAW, with their working principle, advantages, limitations & application, arc welding equipments. 2.2 RESISTANCE WELDING, OTHER WELDING METHODS: working principle, advantages, limitations, applications of spot, seam, projection, flash welding. Working principle, advantages, limitations, applications of thermit welding ,electron beam welding and plasma arc welding 2.3 Welding defects: causes & remedies, testing of welded joints for quality. 2.4 Introduction to soldering and brazing: Process, fillers, heating methods & applications.	7	12
3	3.1 PLASTIC MOULDING: Plastic moulding methods - compression moulding, injection moulding, blow moulding, extrusion, vacuum forming and calendaring, .[working principle, advantages ,limitation and applications of each process], laminated plastic. 3.2 METAL FORMING PROCESS:[LECTURES:03,MARKS:06] Hot & cold working: definition, advantages, limitations. Difference between hot working & cold working Drop forging: open die & closed die forging, forging operations Rolling: Principle of rolling, hot & cold rolling, Types of rolling mill, application of rolling, wire drawing. Extrusion: Direct and indirect extrusion, Advantages, disadvantages and Applications.	7	12
4	PATTERN MAKING: Basic steps in making casting, Pattern making : types, materials and allowances, tools, colour coding of patterns MOULDING: Types of moulding sands, properties of sand, moulding methods:bench,sand and machine moulding, cores and core prints, elements of gating system, bench moulding, floor moulding, CASTING: Furnaces: Construction and working of cupola furnace, electric arc Furnace, working, Advantages, limitations of casting processes with their applications such as lost wax casting, die casting[hot chamber and cold chamber], centrifugal casting, SAND CASTING Casting defects - Causes & remedies	9	16
5	LATHE: Center lathe: working principle, parts of center lathe Size & specification of lathe, classification of lathes, Lathe accessories: chucks (three jaws, four jaw, and magnetic chuck), mandrels, rests, faceplates, centers, angle plates. Thread cutting: lathe setup for thread cutting operations, thread cutting calculations. Lathe operations such as turning, taper turning, drilling, grooving, facing, knurling, parting, chamfering. Taper turning methods	7	12
6	DRILLING MACHINE:	9	12

	Introduction, classification, basic parts of bench and radial drilling machine and their functions, twist drill nomenclature, drilling machine operations like drilling, reaming, boring, counter sinking, counter boring, spot facing. Calculation of machining time. Construction of sensitive drilling machine, Work holding and tool holding devices. Tapping-purpose and nomenclature of tapping set. MAINTENANCE OF MACHINE TOOLS: Need and importance of maintenance activity, Types of maintenance, Maintenance manual, Maintenance records.		
	Total	48	80

Teaching Methodology: Chalk-Board, Discussions, Power point Presentations, Transparencies, Charts, Models, guest Lecturers.

Term Work:

Skills to be developed:

Intellectual Skills:

- Identify basic manufacturing processes.
- Understand need of pattern allowances.
- Identify joining methods for fabrication.
- Understand types of pattern, materials of patterns and identify casting defects.

Motor Skills:

- Operate lathes, drilling machines.
- Use welding machines and equipment.
- Make simple pattern out of wood/themocole.
- Inspect dimensions of jobs using measuring instruments.

List of Practicals:

Students shall complete the different jobs in machine shop. Different machining operations will be performed on lathe, drilling machine and shaper. Student shall prepare the journal based on assignments.

At the end of semester external Practical examination will be conducted (3 Hrs Duration). During the practical examination the student is expected to do the job on lathe machine. Job will consist of any four operations from following: straight turning, taper turning, parting off, chamfering, knurling, threading, facing, grooving.

Professional Practices:

Two visits will be arranged in following areas / industries for observing various manufacturing processes :

1. Plastic material processing unit.
2. Fabrication Workshop.
3. Extrusion industry or foundry or forging industry

Student shall submit the report of each visit as a part of term work.

Learning Resources:**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Hajara Choudhury	Workshop Technology, Vol-I & II	Media Promoters & Publishers Pvt, Ltd.
2	Chapman W.A.	Workshop Technology, Vol-I & II	London ELBS.
3	Raghuvanshi B.S.	Workshop Technology, Vol-I & II	Dhanpat Rai, Delhi.
4	Jain R.K.	Production Technology	Khanna Publishers, New Delhi.
5	O.P. Khanna & Lal	Production Technology, Vol – I & II	Dhanpat Rai, Delhi.

DIPLOMA PROGRAMME IN : MECHANICAL ENGINEERING

Course : Thermal Engineering

Course Code : R14ME3205

Course Category : Core

Credits : 6

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	25	25	150

Rationale :

Diploma engineers work in different areas of operation like production, maintenance, power generation, etc. In all these areas he/she comes across energy conversion processes and related devices. Mainly energy conversion takes place in the form of conversion of heat energy to other form of energies. It is therefore essential that knowledge and familiarization with basic Laws, sources of energies, processes of energy conversion, various related devices like I.C. Engines, Boilers, Turbines, Gas Turbines, Air Compressor is necessary.

Objectives :

The students will be able to

1. Apply fundamental concepts of thermodynamics to a thermodynamic system.
2. Understand first and second law of thermodynamics.
3. Apply various gas laws to ideal gas pressure in a thermodynamic system.
4. Calculate properties of two phase system by using steam tables / Mollier charts.
5. Explain construction and working of boilers, mountings and accessories.
6. Appreciate various sources of energy and methods to harness them.

Course Details :

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Basic Thermodynamics : Thermodynamics, energy, thermodynamic systems, boundary, surroundings, types of systems. Process, cycle, thermodynamic equilibrium, reversible and irreversible process, factors making process irreversible, thermodynamic work, Pdv work, properties, point and path function, potential energy, kinetic energy, flow energy, internal energy, Zeroth law. Enthalpy. Change in internal energy and enthalpy for ideal gas. Steady flow process. First law of thermodynamics for closed system. Steady flow energy equation (SFEE) & its application to open systems (like nozzle, boiler, turbine & compressor), continuity equation. First law for closed system undergoing a cycle, application of first law to non flow process, cyclic process and steady flow process Limitations of first law, concept of entropy, second law of thermodynamics, Kelvin Plank and Clausius statement, concept of perpetual motion machine 1 and 2, heat engine, heat pump and refrigerator.	13	16

2	Thermodynamic Cycles, Combustion of Fuels: Introduction to Carnot cycle, Rankine cycle & reversed Carnot cycle, limitations of Carnot cycle and reversed Carnot cycle, Determination of efficiency of above cycles. Fuels –Types, Calculation of air requirements, gravimetric and volumetric analysis, conversion of weight analysis to volume analysis and vice versa, air fuel ratio.	9	12
3	Ideal Gases and Gas Processes : Definition of ideal gas laws: - Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law, equation of state or characteristic gas equation, specific and universal gas constant, specific heats, analysis of ideal gas processes assuming constant specific heat, ideal gas processes like isobaric, isochoric, isothermal, reversible adiabatic, irreversible adiabatic, polytropic, Representation on p-V and T-S diagram. Calculation of changes in internal energy, work and heat. Change in entropy for all processes except polytropic. Problems involving analysis of one process only.	10	12
4	Heat Transfer : Modes of heat transfer, conduction, convection and radiation. Conduction heat transfer, Fourier's law of heat conduction, thermal conductivity. Conduction through cylinder, thermal resistance, composite wall's and composite cylinder's heat transfer coefficient, Newton's Law of cooling, free and forced convection, combined conduction and convection. Radiation: Black and grey bodies, Stephan Boltzman Law, heat transfer by radiation, absorptivity, transmissivity, reflectivity, emissivity.	10	12
5	Properties of Steam and Steam Generators : Generation of steam at constant pressure, representation on various charts like T-S, p-h and h-s charts, Dryness fraction of steam, concept of enthalpy, enthalpy of water, evaporation, degree of superheat, specific volume of steam, external work during evaporation, internal energy of steam, entropy of steam, throttling process, isentropic process, representation on T-s & h-s diagram, separating and throttling calorimeter. Steam Generator : Layout of thermal power plant, Classification, description and working of common boilers (Babcock and Wilcox boiler). boiler draught, thermal efficiency of boiler, High pressure boilers, Introduction of supercritical boilers. Provisions in IBR(Indian Boiler Regulation) Study of boiler mountings and accessories - safety valves, water level indicator, pressure gauge, feed water injector, economizer, super heater, air preheater(to be covered during practical session).	13	16
6	Steam Turbine : Steam nozzle, continuity equation, velocity of steam leaving the nozzle. Steam turbines: Principles of working, classification – Impulse and Reaction, compounding of steam turbine. Parson's reaction turbine. Velocity diagrams of simple impulse turbine, calculation of horse power, stage efficiency, diagram efficiency. Governing of steam turbines. Need of condenser, types of condenser, sources of air leakage and condenser efficiency Cooling Towers – Construction and working - Forced draught, Induced draught and Natural draught.	9	12
Total		64	80

Teaching Methodology : Discussions, Chalk-Board, Charts, Transparencies, Visits

Term Work :

Skills to be developed:

Intellectual Skills :

- Understand concepts and laws of ideal gasses.
- Apply steady flow energy equation to simple systems.
- Understand modes of heat transfer and concept of heat exchangers.
- Interpret steam tables, Mollier chart and relationship between different thermodynamic properties.

List of practicals:

1. Application of first law of thermodynamics to various devices.
2. Trace and draw the path of flue gases and water steam circuit with the help of Fire Tube boilers.
3. Trace and draw the path of flue gases and water steam circuit with the help of Water Tube boilers.
4. Draw the Sketches of various types of Boiler Mountings and Describe Their Working.
5. Draw the Sketches of various types of Boiler Accessories and Describe Their Working.
6. Draw the sketches of impulse and reaction turbines, describe their working.
7. Draw the sketches of steam condensers and cooling towers, describe their working.
8. Determination of Stefan Boltzman's constant.
9. Determination of thermal conductivity of metal rod.
10. Draw the sketches of separating and throttling calorimeter and describe their working.

Professional Practices:

11. Understand safety provisions of Indian Boiler Act. and write the provisions.
12. Visit to a process industry involving boiler and turbines such as sugar factory / Dairy / steam power Plant, write the specifications of boiler and turbine.

Learning Resources :**Books :**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Prof. R. C. Patel & Shri. C. J. Karamchandani	Elements of Heat Engines	Volumes I, II, III, Acharya Publications.
2	R. S. Khurmi	Thermal Engineering	S Chand Publications, New Delhi.
3	R.K. Rajput	Thermal Engineering	Laxmi Publications, New Delhi.
4	V.M. Domkundwar	Heat Engines	Dhanpatrai and Sons Publications, New Dehli.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Mechanical Engineering Materials

Course Code: R14ME3206

Course Category: Core

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	-	3	80	20	-	-	-	100

Rationale:

The world of technology is very much depending on various materials especially engineering materials. A mechanical engineering diploma holder deals with various materials required for cutting tools, dies, gears, bearings and other many applications. He should be able to select the proper tool material for machining, heat treatment to be adopted for specific materials, ferrous & nonferrous materials & their alloys for various engineering field applications, as well as insulating, refractory and plastic materials as per the requirements. So it is virtually important to give suitable exposure to various materials.

Objectives:

The students will be able to

1. Know the importance of engineering materials.
2. To understand Iron-Carbon equilibrium diagram and its importance.
3. Know the various heat treatment processes, non destructive tests and their applications.
4. Know the significance of powder metallurgy.
5. To select suitable material for different applications.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Introduction to Engineering Materials and their Properties : Introduction to engineering materials and their Importance, Classification of engineering materials, characteristics and applications of metals, non metals, ferrous metals and non ferrous metals, Properties of metals: Physical properties- structure, density, melting point. Mechanical properties- strength, stiffness, elasticity, plasticity, ductility, malleability, resilience, toughness, hardness, brittleness, fatigue, creep, thermal conductivity, electrical conductivity. Introduction to corrosion, types of corrosion, corrosion control- protective coatings. Introduction to space lattices, unit cell, crystal structures- BCC, FCC, HCP	9	16
2	Ferrous Metals and Alloys : Phase equilibrium diagram for iron and iron carbon alloy. Allotropy of pure iron Flow diagram for the production of iron and steel, classification,	7	12

	composition and uses of cast iron, effect of sulphur, silicon and phosphorous. Classification, composition and uses of low carbon steel, medium carbon steel and high carbon steel. Alloy Steels: Effect of various alloying elements such as aluminium, chromium, nickel, manganese, molybdenum, tungsten, vanadium, sulphur etc. Composition and uses of nickel steel, manganese steel and stainless steel.		
3	Non Ferrous Metals and Alloys : Properties and uses of Copper and Aluminium alloys. Composition, properties and uses of Brass and types of brass (naval brass, muntz metal and gilding brass), composition, properties and uses of Bronze and types of bronzes such as gun metal, aluminium bronze, and phosphor bronze(for journal bearing and gear application). Composition, properties and uses of Duralumin, Y-alloy, Babbitts and Hindalium, Requisite qualities of bearing materials.	7	12
4	Heat Treatment and Cutting Tool Materials : Heat treatment of metals: Introduction to heat treatment, detailed description of processes such as- Annealing, Normalising, Hardening, Tempering. Surface hardening methods such as Case hardening, Flame hardening, Induction hardening and Nitriding. Cutting Tool Materials: Requirements of cutting tool materials, properties of tool steels and die steels, properties and uses of High Speed Steel, Stellite, Tungsten Carbide and Diamond.	10	16
5	Important Non Metallic Materials : Plastic Materials: Introduction to plastic, types of plastic. Characteristics, properties and uses of :- Thermoplastic materials (ABS, Acrylics, Nylons, Vinyls), Thermosetting materials (Polyster, Epoxies, Melamines And Ureas). Insulating Materials - Introduction to heat and sound insulating materials, description, properties and uses of Cork, elastomers, Asbestos, Thermocole and Glass wool. Composite Materials: Properties and uses of Laminated and fiber reinforced composite materials.	8	12
6	Nondestructive Testing & Powder Metallurgy : Importance of nondestructive tests, difference between destructive and nondestructive testing, Radiography (X ray and Gamma ray),Ultrasonic crack detection, Dye penetrant test, Magnaflux test, Sound and Visual test. Powder Metallurgy: Advantages, limitations and applications of powder metallurgy, Powder metallurgy process.	7	12
Total		48	80

Teaching Methodology:- Chalk-Board, Discussions, Transparencies, PPT.

Term Work:

Skills to be developed:

i) Intellectual Skills :

- Identify suitable heat treatment process for particular application.
- Understand various non – destructive tests.
- Select suitable cutting tool material for various applications.

ii) Motor skills:

- Graphical presentation of various microstructures of steel and cast iron.
- Observe the results under electron microscope.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	O. P. Khanna	A Text Book Of Material Science And Metallurgy	Dhanpat Rai and Sons.
2	Dr. Kodgire	Material Science And Metallurgy	Everest Publishing House.
3	R. K. Rajput	Material Science And Engineering	S.K.Kataria and Sons.
4	S. K. Hazra Choudhary	Material Science And Processes	Indian Book Distribution Company.
5	Kenneth G. Budinski and Micheal K. Budinski	Engineering Materials Properties and Selection	Prentice Hall Of India Pvt. Ltd.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Theory of Machines & Mechanisms

Course Code: R14ME3207

Course Category: Core

Credits : 6

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	-	-	50	150

Rationale:

Mechanical Engineering diploma holder often comes across different machines & mechanisms in practice. He should be able to analyze, identify & interpret various mechanisms of machines in day-to-day life. In maintaining various machines a Diploma technician should have sound knowledge of fundamentals of machines & mechanisms. Basic principles of mechanisms will be helpful in understanding the machines, devices & equipments in a better way.

Objectives:

The students will be able to

1. State difference between machines and mechanisms and applications in practice.
2. Study power transmission system, friction, brakes & dynamometers.
3. Analyse velocity & acceleration of different points of four bars mechanism & slider crank mechanism.
4. Draw cam profile & to analyse gear trains in order to transmit relative motion.
5. Analyse fluctuation of speed & its regulation and governing by different types of flywheel & governors.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Fundamentals and Mechanism: Definitions of kinematics and dynamics, kinematic link, kinematic pairs & their types, kinematic chain, constrained motions & their types, mechanisms, inversions, machines, structures. Single slider crank chain & its inversions like hand pump mechanism, oscillating cylinder engine mechanism, quick return mechanism and rotary I.C. Engine mechanism. Double slider crank chain mechanism & its inversions. Four bar chain mechanism & its inversions like coupling of locomotive.	12	12
2	Velocity and Acceleration in Mechanism: Analytical method of determining velocity and acceleration of a slider, concept of relative velocity and relative acceleration of a point on a link, angular velocity, angular acceleration, concept of centripetal & tangential acceleration, drawing of velocity and acceleration diagrams from configuration diagram of simple mechanisms limited to four links.	10	16

3	Flywheel and Governor: Turning moment on crankshaft, Turning moment diagram for I.C.Engines, mechanical press, concept of coefficient of fluctuation of speed & fluctuation of energy. Governor- function, types-centrifugal & inertia, terminology, comparison of governor with flywheel. Cams and Followers: Concept & definition of cam & follower, types, classification, different follower motions, their displacements like uniform velocity, S.H.M., uniform acceleration & retardation. Drawing of cam profile.	10	12
4	Friction: Clutches and Bearings Laws of dry friction, simple pivot & collar bearings, conical pivot, derivations for torque & power absorbed / transmitted by using uniform pressure and uniform wear theory, Single plate clutch, multiplate clutch, cone clutch, centrifugal clutch and their applications.	12	12
5	Brakes and Dynamometers: Functions of brakes, types –Shoe, band & block, derivation of braking torque and braking force, internally expanding shoe brake. Concepts, principles and working of dynamometers such as rope brake, transmission types dynamometer, belt & epicyclic gear train type dynamometer. Vibrations: types, causes, effects and remedies.	10	12
6	Power Transmission Devices : Belts & belt drives, types of belts, velocity ratio, slip & creep, determination of tension ratio in belt drives, power transmitted, initial tension, centrifugal tension & condition for maximum power transmission. Chain drives- construction of sprockets and chain. Rope drives- types, advantages, limitations, applications. Gear & gear trains - types of gears and their applications, Types of gear trains, train value. Comparison between belt, rope, chain and gear drives.	10	16
Total		64	80

Teaching Methodology: - Chalk-board, Discussions, Charts, Models and Transparencies.

Term Work:

Skills to be developed:

i) Intellectual Skills :

- Identify various inversions of mechanisms.
- Select suitable power transmission device for a particular application.

ii) Motor Skills :

- Graphical representation of cam profile,
- Drawing velocity and acceleration diagrams for a given mechanism.

List of Practicals:

1. Draw and explain Link, Pair, Chain, Mechanism and Machine.
2. Draw and explain inversions of four bar chain mechanism.
3. Draw and explain inversions of single slider mechanism.
4. Draw and explain inversions of double slider mechanism.

5. Graphical solutions of problems on velocity by relative velocity (on A3 size sheets)
6. Graphical solutions of problems on acceleration by relative acceleration methods. (on A3 size sheets)
7. Draw the sketches of governors and describe.
8. To draw displacement diagrams & cam profiles with knife-edge follower. (on A3 size sheets)
9. To draw displacement diagrams & cam profiles with roller follower. (on A3 size sheets)
10. To draw the sketches of different types of brakes and describe.
11. To draw the sketches of different types of clutches and describe.

Professional Practices:

12. Procurement of the manufacturers' catalogue for belts, pulleys and rope drives.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	P.L. Ballaney	Theory of Machines	Khanna Publishers, New Delhi.
2	R.S. Khurmi	Theory of Machines	Eurasia Publishing House, New Delhi.
3	S. S. Rattan	Theory of Machines	Tata McGraw Hill Publications.
4	Dr. Jagdish Lal	Theory of Mechanisms & Machines	Metropolitan Book Co.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Fluid Mechanics & Fluid Machinery

Course Code: R14ME3208

Course Category: Core

Credits : 6

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	--	25	25	150

Rationale:

The course aims at imparting basic knowledge in fluid mechanics and fluid machinery. Understanding of fluid properties, fluid statics, principles of conservation of mass and energy, theoretical concepts and operating procedures of turbines and centrifugal pumps is emphasized.

Objectives:

The students will be able to

1. Define & know various properties of fluids.
2. Measure the pressure in various situations.
3. Calculate discharge using various instruments viz. venturimeter, orifice.
4. Determine direction of flow & loss of head.
5. Classify & understand various types of turbines and pumps.
6. Calculate efficiency of pump.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	1.1 Fluid – Definitions and Properties : Ideal Fluid, compressible and incompressible Fluid, Fluid properties – density, specific weight, specific gravity, viscosity (dynamic & kinematic), vapour pressure, surface tension, capillarity, Compressibility, Newton's law of viscosity. 1.2 Pressure and its Measurement : Definition of pressure, Pascal's law, Hydrostatic law, pressure head, Measuring devices-Piezometer, manometer, U-tube manometer, inclined tube manometer, differential- U tube & inverted U tube manometer, Bourdon's pressure gauge, desirable properties and commonly used manometric liquids. Hydrostatics – Total pressure & centre of pressure on an immersed surface, for general case (circular, triangular & rectangular laminas).	14	16
2	Basic Equations of Fluid Flow : 2.1 Types of flow – Laminar & turbulent (concept of Reynolds number), uniform, non-uniform, steady, unsteady flow. 2.2 Continuity Equation.	9	12

	2.3 Various forms of energies present in fluid – Potential energy, Kinetic energy, Pressure energy. 2.4 Bernoulli's theorem –assumptions, Bernoulli's equation. 2.5 Applications of Bernoulli's equation – Venturimeter (derivation of discharge), Orifice plate, Pitot tube, V and Rectangular Notches (derivation of discharge).		
3	3.1 Flow Through Orifices : Vena contracta, Coefficient of contraction, Coefficient of velocity and Coefficient of discharge, Experimental determination of Cc, Cd and Cv. 3.2 Flow through Pipes : Types of losses, Major and Minor head loss, Head losses due to sudden enlargement and sudden contraction (derivation), Pipe friction factors and use of Darcy Wiesbach equation, Equivalent pipe. Concept of Hydraulic Gradient Line & Total Energy Line, Numericals on Series and parallel pipes, equivalent pipes. Power transmission through pipes & transmission efficiency.	9	12
4	Impact of Jet : 4.1 Momentum Equation and application of momentum equation. 4.2 Impact of jet on flat plates (stationary and moving, vertical and inclined), Impact of jet on curved vanes (stationary and moving). Torque exerted and work done by water on a series of curved vanes mounted on a radial runner.	13	16
5	Water Turbines : 5.1 Layout of a hydro electric power plant. 5.2 Classification of turbines, Construction and working of Pelton, Francis and Kaplan turbines. Work done by Pelton wheel runner. 5.3 Specific speed of turbine, Performance characteristics of turbines, Governing of turbines, Water hammer, Cavitation in turbines, Surge tank, Draft tubes. 5.4 Selection of turbines.	10	12
6	Centrifugal and Reciprocating Pumps : 6.1 Principle, construction & working of centrifugal pump, Types of casings and impellers, Velocity diagram, Calculation of manometric, mechanical and overall efficiency, specific speed, NPSH, Performance characteristics of pump, Priming of pump, Cavitation in pump, Multistaging of pumps, Selection of centrifugal pumps, troubleshooting in centrifugal pump. 6.2 Construction and working of reciprocating pump, comparison between centrifugal and reciprocating pump.	9	12
Total		64	80

Teaching Methodology: Discussions, Chalk-Board, Charts, Transparencies.

Term Work:

Skills to be developed:

i) Intellectual Skills :

- Interpret manometer readings.
- Compare different pressure measuring devices and flow measuring devices.
- Analyze the performance of pumps and turbines.

ii) Motor Skills:

- Measuring the discharge through various devices.
- Priming and starting of centrifugal pump.

List of Practicals:

1. Pressure measuring instruments-Principle, working, operating range, advantages and limitations.
2. Verification of modified Bernoulli's theorem.
3. To find coefficient of discharge of venturimeter.
4. Trial on Impact of Jet apparatus.
5. To find Cd, Cv & Cc of sharp edged circular orifice.
6. To determine friction factor for turbulent flow through pipe.
7. Calibration of V-notch.
8. Study & trial on centrifugal pump to plot operating characteristics.
9. Study & trial on Pelton wheel & plotting of operating characteristics.
10. Study & trial on Francis turbine & plotting of operating characteristics.
11. Study & trial on Kaplan turbine.

Professional Practices:

12. Visit to city water supply pumping station and preparing a detailed report.
13. Collecting data about all Hydroelectric Power Installations in Maharashtra and major installations in India.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. P.N. Modi Dr. S.M. Seth	Hydraulics & Fluid Mechanics	Standard Book House, New Delhi.
2	R.K Bansal	Fluid Mechanics & Hydraulic Machines	Laxmi Publications, New Delhi.
3	R.S. Khurmi	Hydraulics & Hydraulic Machines	Standard Book House, New Delhi.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Solid Modeling

Course Code : R14ME3209

Course Category : Core

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	50	-	25	75

Rationale:

Solid modeling is a process of developing a mathematical representation of any 3 dimensional object. 3D models means solid model is usually originated on the computer by engineer using some kind of solid modeling softwares. The solid model may be created using solid modeling softwares. Solid models are often animated for some uses.

Today 3D models are used in wide variety of engineering fields. Three dimensional computer graphics are widely used for product design, assembly design etc. As a diploma engineer he should have the knowledge of solid modeling software to visualize the machine components & assembly like automobile, machine tools, material handling systems and earth movers etc.

Objectives:

After learning this, the students will be able to :

- 1) Understand the importance of CAD, 3D Modeling.
- 2) Understand sketch, edit, and create, modeling and assembly commands and their utilities.
- 3) Develop solid models from 2 D drawing.
- 4) Generate orthographic projections in 3D modeling software.
- 5) Use appropriate commands
- 6) Use of printers / plotters.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Introduction to Solid Modeling: - 1.1 Introduction to solid Modeling. 1.2 Need, Benefits and Applications of solid modeling. 1.3 Hardware Requirements for solid modeling software. 1.4 Introduction to different Software packages used for Solid Modeling like <i>Solid Works, AutoCAD 3D Max, CATIA, Pro – E, NX, UG.</i> 1.5 Software selection requirements and its criteria.	03
2	2D Sketcher Environment: - 2.1 Sketcher Mode – Line, Profile, Circle, Arc, Rectangle and their sub options. 2.2 Constraining – Dimensioning constraint, Geometrical constraint.	02
3	Creation of Solid Models: - 3.1 Working in 3D environment - Creating 3D Solid Models of simple machine parts using <i>AutoCAD 3D Max</i> software package	04

	3.2 Intersection of solids – Intersect two solid components by inserting new body option, Boolean operations – Union, subtract, intersection.	
4	Assembly Drawing: - 4.1 Assembly Drawing - Preparation of Assembly drawing by using assembly features. 4.2 Exploded view – Explode the assembly.	03
5	Drafting and Dimensioning : - 5.1 Orthographic projections – Generate orthographic projections – front view, top view, side view, sectional views, isometric views, auxiliary views. 5.2 Dimensioning Commands – Apply dimensions, dimensional and geometrical tolerances. 5.3 Bill of material – Prepare part list table and name plate	03
6	Plotting of drawing: - 6.1 Setting up Plotter 6.2 Page set up and Plot command.	01
	Total	16

Teaching Methodology: Power Point Presentations (PPT), Guest Lecturers, Software applications with the help of computer, Multimedia projection, actual working with 3D Modeling software.

A) Term Work: The term work shall consist of submission of printout of each exercise done during the practical individually.

B) List of practicals:

1. At least four exercises on sketcher workbench for 2D sketch.
2. At least five exercises on solid modeling work bench for 3D modelling.
3. At least two exercises on assembly workbench for assembly.
4. At least two exercises on drafting workbench for orthographic projection and isometric view.
5. At least one exercises on drafting workbench for sectional views and auxiliary views.
6. At least two exercises on plotting of drafting.

Skills to be developed:

- i) Intellectual Skills :**
 - Design approach
 - Interpretation
 - Use of Command dialogue box.
- ii) Motor Skills :**
 - Graphical Presentation
 - Use printer and plotter

Practical Examination: (2 Hours for each student): -

Creation of 3D Model and their 2D views from the given part drawing followed by oral examination based on above term work. (One candidate on one computer terminal)

(For assembly drawing practical work select any one assembly like oldham's coupling, cotter Joint, knuckle Joint, stop valve, piston and cylinder assembly, lathe tool post, bearing block assembly, screw jack, tail stock etc.)

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher / Edition
1	Sham Tickoo	Autodesk 3D Max.	Softcover, Cadcim Technologies
2	Sham Tickoo , Deepak Maini	NX 4 for Designers	Softcover, Cadcim Technologies
3	Sham Tickoo , Deepak Maini	Solid Edge V19 for Designers	Softcover, Cadcim Technologies
4	Sham Tickoo	CATIA V5R17 for Designers	Softcover, Cadcim Technologies
5	Sham Tickoo	Pro/Engineer Wildfire for Designers	Softcover, Cadcim Technologies
6	Sham Tickoo	SolidWorks For Designers Release 2006	Softcover, Cadcim Technologies
7	Various advance 3D Modeling software manuals		

2. Websites:

1. <http://catiatutor.com/>
2. http://www.cadenv.com/Tutorials/catia_tutorials/Catia.htm
3. <http://www.proetutorials.com/>
4. <http://www.solidworks.com/sw/resources/solidworks-tutorials.htm>
5. http://www.solidengineering.co.nz/solidworks_free_tutorials.htm
6. www.solidedgetutorials.com/
7. <http://appsci.queensu.ca/courses/APSC161/SETutorials.php>
8. http://homepages.cae.wisc.edu/~me232/ug_tutorials/ug_tutorials.htm
9. <http://www.jqoc.com/soft/Unigraphics-Tutorial/>

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Power Engineering

Course Code: R14ME4201

Course Category: Applied

Credits : 6

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	--	25	50	175

Rationale:

Diploma engineers work in different areas of operation like production, maintenance, power generation, etc. In all these areas he/she comes across energy conversion processes and related devices. Mainly energy conversion takes place in the form of conversion of heat energy to other form of energies. It is therefore essential that knowledge and familiarization with basic Laws, various related devices like I.C. Engines, steam power cycles, Gas Turbines, Air Compressor is necessary.

Objectives:

The students will be able to

1. Understand fundamentals of I.C. Engines.
2. Identify different working cycles, different systems, applications & performance testing.
3. Know different applications of Gas Turbines & Air Compressor.
4. Understand heat transfer in heat exchanger

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Air Compressors : 1.1 Introduction. 1.2 Uses of compressed air, Classification of air compressors, Definition of Compression ratio, Compressor capacity, Free Air Delivered, Swept volume. 1.3 Reciprocating air compressor -Construction and working of single stage and two stage compressor , Efficiency- Volumetric , Isothermal & Mechanical (only simple numerical). Advantages of multi staging. 1.4 Rotary Compressor- Construction and working of screw, lobe, vane , centrifugal compressors (No numerical). Comparison and applications of reciprocating and rotary compressors. 1.5 Methods of energy saving in air compressors.	10	12
2	2.1 Steam Power Cycles: Carnot cycle, Basic Rankine cycle (numerical), effect of operating variables on Rankine cycle efficiency Regenerative Rankine cycle: Layout, representation on T-s chart, Advantage and limitations of regenerative Rankine cycle. (numerical)	13	16

	Reheat cycle: Layout, representation on T-s chart 2.2 Heat Exchangers: Introduction, Classification of heat exchangers, construction and working of shell and tube type heat exchangers, Log Mean Temperature Difference (LMTD) for parallel flow and counter flow heat exchangers, Overall heat transfer coefficient (U), (simple numerical on LMTD and U), Plate type heat exchangers: construction, working, advantages and limitations.		
3	Gas Turbine and Jet Propulsion: 3.1 Classification and applications of gas turbine. 3.2 Constant volume and constant pressure gas Turbines. Closed cycle and open cycle gas turbines and Their comparison. 3.3 Methods to improve thermal efficiency of gas turbine- Regeneration, inter-cooling, reheating using T- Ø diagram (no analytical treatment). 3.4 Jet Propulsion - Principles of turbojet, turbo propeller, Ram jet. 3.5 Rocket Propulsion - Solid propellants and liquid propellants, Components of liquid propellant rocket engine.	9	12
4	I. C. Engine Fundamentals : 4.1 Introduction: Heat Engine and classification of heat engine, Classification of I.C. engine, Basic components of I.C. engine Four-stroke diesel engine and two-stroke diesel engine –principle and working Four-stroke petrol engine and two-stroke petrol engine –principle and working Valve timing diagram for four stroke petrol and diesel engine Comparison of four stroke and two stroke engines Comparison of compression ignition and spark ignition engines 4.2 Air standard cycles: Otto cycle, Diesel cycle, Dual cycle, calculations of properties at salient points and air standard efficiency, Comparison of Otto, Diesel and Dual cycle 4.3 Lubrication system used in I.C. engine Functions of lubrication systems, desirable properties of lubricants used Wet sump lubrication system: Splash and pressure feed lubrication system Dry sump lubrication system	13	16
5	Fuel system ,Cooling and Ignition Systems in I.C. Engines : 5.1 Spark ignition engines: Definition of carburetion, air-fuel mixtures, air-fuel mixture requirements at different loads and speeds Simple carburetor: construction, working and limitations Ignition systems: Battery ignition, magneto ignition, electronic ignition system. 5.2 Compression ignition engines: Fuel injection system: Functions of injection system, components of fuel systems. Individual pump system & Common rail system, Description and working of fuel pump, Principles of injectors and atomizers. Knocking in engine Introduction to MPFI system. 5.3 Engine cooling: Air cooling system, Liquid cooling system, Radiator in cooling system	9	12

6	Performance and Testing of I.C. Engines : 6.1 Performance parameters of I.C. engine: Indicated power, brake power, mean effective pressure, specific fuel consumption, indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, and volumetric efficiency. Methods to determine friction power: Willan's line method, Morse test and Motoring test Heat balance sheet for an I.C. engine 6.2 Pollution control: Pollutants in exhaust gases in Petrol and Diesel Engine, un-burnt hydrocarbon and its effect on environment and exhaust gas analyzers for petrol and diesel engine. Broad provisions in Bharat Stage III & IV standards.	10	12
	Total	64	80

Teaching Methodology: Discussions, Chalk-Board, Charts, Transparencies, Visits.

Term Work:

Skills to be developed:

i) Intellectual Skills :

- Understand functions , working of various devices like I.C .Engines, Gas Turbines etc.
- Identifying various energy conservation points in air compressor unit.
- Understand importance of regeneration and reheating in Rankine cycle.

ii) Motor Skills :

- Assembling and Dismantling different components of I.C.Engines.
- Testing of Air Compressor and I.C.Engine performance for different efficiencies.
- Measurement of pressure, temperature, energy meter reading for Air Compressor.
- Measurement of load, speed ,fuel consumption etc for I.C.Engines.

List of Practicals:

1. Identify various important components of two stroke and four stroke cycle petrol engine with their functions
2. Identify various components of four stroke cycle diesel engine and its fuel injection system.
3. Perform a trial on four stroke cycle petrol engine to evaluate performance parameters with different load.
4. Perform a trial on Multi cylinder Petrol/ Gas engine for determination of friction power (Morse Test).
5. Perform trial on diesel engine to determine various efficiencies, SFC and Heat balance sheet.
6. Identify functional components of two stage reciprocating air compressor with intercooler and explain their purposes.
7. Perform a trial on two stage reciprocating air compressor with intercooler and evaluate performance parameters.
8. Draw a neat sketch of simple carburetor and explain modifications required to satisfy different load requirements.
9. Determinations of log mean temperature difference for parallel and counter flow heat exchanger.
10. Draw and explain of CNG kits used in vehicles.
11. Explain exhaust gas analyzer and catalytic convertor (Bharat Stage III).
12. Assemble and dismantle two stroke/ four stroke petrol engine and prepare a trouble shooting chart.

Professional Practices

- 11 Visit website- <http://library.think.quest.org>, <http://www.grc.nasa.gov> and prepare a brief report on gas turbine and jet propulsion.
13. Visit to a Diesel LOCO shed/ PMT/S.T. workshop and prepare a brief report on it.

Learning Resources:

Books:

SR. NO	AUTHOR	TITLE	PUBLISHER
1	Prof. R. C. Patel & C. J. Karamchandani	Elements of heat engines Volume -- I, II, III	Acharya Publications, Vadodara.
2	R.K. Rajput	Thermal Engineering	Laxmi Publications, Delhi
3	M.L. Mathur & R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons, New Delhi.
4	V. Ganeshan	Internal Combustion Engines	Tata McGraw Hill Publishing House, New Delhi.
5	Dr. V. P. Vasandani & Dr. D. S. Kumar	Heat Engineering	Metropolitan Book House, New Delhi.
6	R. S. Khurmi	Thermal Engineering	S. Chand Publications, New Delhi.
7	V. M. Domkundwar	Course in Thermal Engg.	Dhanpat Rai & Co.
8	P.L.Ballaney	Thermal Engineering	Khanna Publishers.
9	R. K. Jain	Automobile Engineering	Tata McGraw Hill.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Industrial Hydraulics & Pneumatics

Course Code: R14ME4202

Course Category: Applied

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	--	25	25	150

Rationale :

Hydraulic and pneumatic controls are widely used in industry due to versatility, compactness and ease for automation. Course aims at making a diploma technician to understand principles, construction and working of various elements in Hydraulic & Pneumatic control systems. At the end of the course, the students will be able to read and interpret the drawings showing different hydraulic and pneumatic circuits and also become familiar with operation, troubleshooting and maintenance of Hydraulic and Pneumatic systems.

Objectives:

The students will be able to

1. Understand basic fluid properties, important principles of fluid mechanics & hydraulic devices used in practice.
2. Identify fluid power components & their functions.
3. Draw & interpret simple hydraulic and pneumatic circuits, with the significance of role of each component.
4. Diagnose probable causes of failure of components in hydraulic & pneumatic circuits.
5. Appreciate the role electrical & electronic systems in automation.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Fluid Power Systems: 1.1 Principles of fluid systems, comparison with conventional systems, comparison of hydraulic and pneumatic transmission. Symbols & Components of fluid power systems and pneumatic systems. 1.2 Types of hydraulic fluids, properties of fluids, selection of fluids, effects of temperature and pressure on hydraulic fluids. Additives, Filters: position of filters and filter rating. Seals, sealing materials, types of pipes, hoses. Quick acting coupling. 1.3 Fluid conditioning through filters, strainers, sources of contamination and contamination control. 1.4 Accumulators: Classification, details of bladder type accumulator, applications of accumulators. Study of intensifier.	9	16
2	2.1 Hydraulic Pumps – Classification, principle of working and constructional details of Gear pump, Gerotor pump, Vane pump, Radial	7	12

	piston pump, Axial piston pump, Bent axis pump. Selection of pump for power transmission. Elementary power and efficiency calculations. 2.2 Hydraulic Actuators: Types and construction of actuators, linear and rotary actuators, hydraulic motors, tandem cylinder, telescopic cylinder, end cushioning of cylinder, mounting of cylinder.		
3	Direction & Pressure Control Valves: 3.1 Necessity of fluid control through Pressure control, Direction control and flow control. 3.2 Control valves – Directional control valves- check valve, pilot operated check valve, two way two position, four way two position / three position valves, open centre, close centre, tandem centre, float centered, manually operated, solenoid operated, pilot operated direction control valve. 3.3 Principles of pressure control valves, direct operated and pilot operated pressure relief valve, pressure reducing valve, sequence valve, counterbalance valve, unloading valve: construction and working	8	12
4	4.1 Flow Control Valves: Principles of flow control valve, pressure compensated, and temperature compensated, flow control valve, deceleration valve. Speed control circuits-Meter in circuit, meter out circuit, bleed off circuit. 4.2 Hydraulic Circuits: Study of simple hydraulic circuits with linear, regeneration and sequence circuits, study of two pump unloading circuit, circuit using counterbalance valve, cylinder synchronization circuits, automatic reciprocating circuit, circuit for hydraulic shaper and milling machine and grinding machine.	10	16
5	Principles of Pneumatics: 5.1 Schematic diagram of compressed air system and air treatment 5.2 Basics of pneumatic systems- FRL units, constructional details of air filter, regulator and lubricator, shuttle valves, dual pressure valve, quick exhaust valve, time delay valve, speed regulation methods in pneumatics. Basic pneumatic circuits involving above valves.	7	12
6	6.1 Electrical Controls: Electrical controls for fluid power circuits, basic electrical devices. Introduction to electro hydraulic circuits and electro pneumatic circuits. Servo valve, Introduction to ladder diagrams. Applications of hydraulic in industry. Applications of Pneumatics in low cost automation. 6.2 Introduction to PLC based & SCADA systems. Introduction to Cartridge valves and proportional control valves. 6.3 Maintenance, troubleshooting and safety precautions of hydraulic circuits.	7	12
	Total	48	80

Teaching Methodology: Discussions, Chalk-Board, Charts, Transparencies, Visits.

Term Work:

Skills to be developed:

i) Intellectual Skills :

- Interpret simple hydraulic & pneumatic circuits.
- Identify the different components in hydraulic & pneumatic circuits.
- Diagnose the faults & suggest remedies in hydraulic & pneumatic circuits.

ii) Motor Skills:

- Build pneumatic circuits using symbols.
- Connect different components as per given drawing.

List of Experiments / Practicals / Assignments:

1. Classify positive displacement pumps . Sketch various Hydraulic pumps and describe them
2. Sketch sectional views of pressure control valves and draw relevant circuits.
3. Understand principles of flow control valves and draw circuits using flow control valve.
4. Study of direction control valve and circuits using direction control valve and pilot operated check valve.
5. Classify Accumulator, write applications with relevant circuits and understand charging procedure of it.
6. Draw a neat sketch of hydraulic power unit and accessories.
7. Study of direction control valve in pneumatic circuits and circuits using manual and pilot operated valve.
8. Sketch symbol and sectional views of shuttle valve, Quick Exhaust Valve, Dual Pressure Valve, Time Delay Valve and related circuits. Build circuits using components and verify the behaviour
9. Study of electro pneumatic valves and circuits.
10. Draw Standardized graphical (ISO / JIC) symbols.
11. Draw simple hydraulic systems used in practice such as shaping, milling, copy turning, dumper, fork lift, etc
12. Draw and describe any one mobile hydraulic system like earth moving equipment with circuit.

Professional Practices:

13. Survey of oils available in market for hydraulic circuits, specifications, manufacturers' names, costs etc.
14. Study of troubleshooting procedures of various hydraulic and pneumatic circuits.

Learning Resources:**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	S.R. Mujumdar	Oil Hydraulic Systems (Principles and Maintenance)	Tata McGraw Hill Publications, New Delhi.
2	S.R. Mujumdar	Pneumatic Systems	Tata McGraw Hill Publications, New Delhi.
3	Vickers	Industrial Hydraulic Manual	Vickers India.
4	Anthony Esposito	Fluid Power with Applications	Pearson Education Inc.
5	J.J. Pippenger & Hicks	Industrial Hydraulics	McGraw Hill Publications.
6	H.L. Stewart	Hydraulics & Pneumatics	Industrial Presss Ltd.
7	M.J.Pinches and J.G.Ashby	Power Hydraulics	Prentice Hall Publications.
8	Festo	Basic Pneumatic Manual	Festo Controls.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Design of Machine Elements

Course Code: R14ME4203

Course Category: Applied

Credits : 6

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	--	25	50	175

Rationale:

The Diploma Engineers in practical field come across the situations involving design and drafting of machine components and assemblies incorporating various aspects of design such as strength, rigidity, functional design, ergonomic considerations, economy etc. This course aims at providing exposure to a student in the design considerations of various mechanical components.

Objectives:

The students will be able to

1. Understand various modes of failures.
2. Identify area resisting different loading conditions.
3. Select suitable material according to requirement.
4. Design various components like levers, cotter joint, knuckle joint etc.
5. Use Design Data Book.
6. Specify tolerances on designed components.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Introduction to Design: 1.1 Machine Design procedure, General considerations in Machine Design, Types of loads. 1.2 Definition of Stress, Strain, Yield Point, Stress- strain diagram for ductile and brittle materials, factor of safety, factors governing the selection of factor of safety, types of stresses such as tensile, compressive, shear, bearing, crushing, Fatigue, Endurance Limit, S_N curve. Factors governing selection of material. 1.3 Designation of materials as per B.I.S., Stress concentration: meaning, causes and remedies, Finding maximum shear stress and principal normal stress analytically and graphically (Mohr's circle), Theories of elastic failures, Preferred Numbers. 1.4 Use of Handbook, Design Data Book, Standardization, 1.5 Basics of product design – Aesthetic and ergonomic considerations in design. Design for manufacturing, reliability, quality, safety.	10	16
2	Design of Simple Machine Parts: 2.1 Design of simple machine parts subjected to direct tension, compression, shear such as cotter joint, knuckle joint and turn buckle.	10	12

	2.2 Forces resulting in bending stresses – Design of cross section of (rectangular and circular only) Levers, Design of Hand & Foot Levers, Bell Crank Lever. 2.3 Design of machine parts subjected to combined Loading such as Direct and Bending, Direct and twisting, Bending and twisting such as design of bracket cross sections, C clamp frames, Offset links, Overhung crank. Stresses in Screwed Fastenings.		
3	Design of Shafts, Keys and Couplings: 3.1 Types of shafts, materials, Standard shafts available, Forces resulting Torsion- Design of Shafts (hollow and solid) on the basis of rigidity and strength, Design as per A.S.M.E. code, Line shafts supported between bearings carrying one or two pulleys in between or one overhung pulley. 3.2 Types of Keys and their applications, Design of Keys (Rectangular and Square keys.) 3.3 Design of Couplings – Muff or Box coupling, Protected flanged coupling, Bushed Pin Type of Flexible Coupling.	12	12
4	Design of Springs (Tension & Compression) 4.1 Classification, Application and Function of Springs, Material selection & Specification of Springs, Spring terminology. Wahl's Correction factor. 4.2 Design of Helical Compression and Tension Spring for I.C. Engine Valves, Weighing Balance, Railway Buffers--- for gradually applied loads. 4.3 Semi elliptical Leaf springs: Construction & applications.	10	12
5	Design of Power Screws: 5.1 Types of thread profiles used in power screws, merits and demerits, Torque required to overcome thread friction while raising and lowering the load. 5.2 Design of Power Screw with consideration of Maximum Principal Stress & Shear Stress theory. 5.3 Condition for self-locking and overhauling, efficiency of screw thread, Torque required to overcome collar friction, overall efficiency. 5.4 Design of Screw Jack, Screw Press, C clamp, Toggle jack.	10	12
6	6.1 Bolted Joints: Design of bolted and riveted joints under eccentric loading about one axis only. Stresses in Screwed Fastenings, bolts of uniform strength, bolts of cylinder cover. 6.2 Welded Joints: Design of parallel and transverse fillet welds. Circular welds subjected to torsion, Axially loaded symmetrical sections, Merits and demerits of screwed joints and welded joints. 6.3 Bearings: Classification of bearings, comparison, advantages and disadvantages of sliding contact bearing and rolling contact bearings. Static and Dynamic load ratings, bearing life, Average life. Load-life relationship. Selection of ball bearings and roller bearings from manufacturers' catalogue. Bearing Mountings & lubrication. 6.4 Oil seals and packing , Gaskets: Materials and applications	12	16
	Total	64	80

Teaching Methodology: Discussions, Chalk-Board, Models (Cut-sections), Transparencies.

Term Work:

Skills to be developed:

Intellectual Skills :

- Apply and use the basic knowledge of earlier courses like mechanical engineering materials, strength of materials and theory of machines.

- Understand types of failures of machine components and decide the design criteria and equations.
- Understand the concept of standardization and selecting standard components.

Motor Skills:

- Draw the components assembly as per the designed dimensions.
- Use of various IS codes (standards) to select standard sizes of components.

Term work shall consist of three design projects viz:

1. Design and draw Cotter Joint.
2. Design and draw bushed pin type flexible Coupling.
3. Design and draw Screw Jack.

The design project consist of half imperial sheets involving assembly drawing with overall dimensions, bill of material and details of individual components with dimensional tolerances, geometrical tolerances, surface finish symbols etc. so as to make it a working drawing. A design report giving all necessary calculations of the design of components along with the sketches shall be submitted in a separate file.

Assignments:

Any six out of following:

1. Assignment on aesthetic and ergonomic considerations in design and design for manufacturing.
2. Design of shaft subjected to combined bending and twisting moments in both axes involving inclined loads (belt tensions).
3. Design of unsymmetrical (I or T) section for C clamp.
4. Design of bell crank lever or lever of safety valve.
5. Design along with derivation for eccentrically loaded bolted joint.
6. Design of knuckle joint.
7. Design of turn buckle.
8. Study of various arrangements of bearing mountings.

Professional Practices:

1. Survey of prime movers- Electric motors/ I.C. engines available in market along with specification suitable for project. Survey report should be prepared with relevant catalogue.
2. Survey of different types of bearings, their availability in market, companies manufacturing them and numbering of them is to be done along with type of bearing used in different application. Survey report should be prepared

Learning Resources:

A) Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	V. B. Bhandari	Introduction to Machine Design	Tata McGraw Hill Pub. Ltd.
2	P. V. Mandke	Text Book of Machine Design	Nirali Prakashan, Pune.
3	R. S. Khurmi	Text Book of Machine Design	S. Chand & Co. Ltd., New Delhi.
4	G.E. Dieter	Engineering Design: A Materials and Processing Approach	Tata McGraw Hill Pub. Ltd.
5	-	Design Data Book	PSG College of Technology, Coimbatore.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Industrial Engineering, Estimating & Costing Course Code: R14ME4204

Course Category : Applied Credits : 5

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	50	150

Rationale:

Diploma Technician is mainly operating in a particular type of production system in which he has to understand & operate the production system. Diploma Technician should have sound knowledge of operational & theoretical aspects of production system like productivity, product design, Various cost & cost estimation, Plan layout, Material handling, process planning , Time & motion study, Jigs & fixtures, Inventory control .Proper understanding & exposure to these aspects will improve the skills & proficiencies of Diploma Technician while dealing & operating with the production systems.

Objectives:

The students will be able to

1. Understand the principles of work study and work measurement.
2. Establish standards with respect to time study.
3. Know the functions of PPC departments.
4. Develop the knowledge about plant equipment layouts and up keeping the machines.
5. Understand the need of estimation of different manufacturing processes and costing for running the factory.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	1.1 Estimation : Objective of cost estimation, functions of estimating department, Functions of estimator. 1.2 Calculation of Machining Time for operations such as lathe work, Milling, operations on shaping or planning and grinding machines. To estimate fabricated and sheet metal jobs. 1.3 Depreciation & Obsolescence: Definition, classification of depreciation, methods of calculating depreciation such as straight line method and reducing installment method (Numericals on both methods). Concept of Obsolescence.	10	16
2	2.1 Productivity and Work Study: Meaning of productivity, three basic ways to increase productivity. concept, basic work content, and excess work content, causes of excess work content, management techniques to reduce work content. 2.2 Introduction to work study, method study and work measurement. 2.3 Method Study:	8	12

	Definition of method study, steps in method study, process chart symbols and conventions. Process charts: OPC, FPC, MAC, Two handed process chart, flow diagram and string diagram. Critical examination for improving a process, governing considerations for critical examination (primary and secondary questions), check list of purpose, person, sequence, place and means. Therbligs and SIMO chart. 2.4 Principles of Motion Economy: Rules concerning use of human body, rules concerning arrangement of work place and rules concerning tools and equipment, design of work place layout.		
3	3.1 Work Measurement : Work measurement concept, work measurement techniques: time study, P.M.T.S., analytical estimating., P.M.T.S.: definition, basic manual motions, brief description of Reach, Move, Turn, Grasp, Position, Disengage, and Release load. 3.2 Analytical Estimating: definition, salient features, and procedure in brief. Time Study: Time study procedure, cumulative timing and snap back timing method. Breaking the task into elements, types of elements, why to break a task into elements? Allowances: definition, Need, Types. Definition of observed time, normal time and standard time. 3.3 Performance Rating & Incentives: Standard time computation (problems to find standard time), Standard data: definition and types of standard data. Concept of Incentives, group incentives, Halsey incentive plan.	8	12
4	4.1 Costing: Introduction to costing, types of cost: fixed and variable cost, material and labour cost, Expenses: direct and indirect expenses. Components of cost, types of overheads: factory, administrative or office, selling & distribution overheads. Selling price. Advantages of efficient costing. 4.2 Break Even Analysis : Break even point, margin of safety, angle of incidence, determination of break even point, application of break even point, problems to find break even point. Make or Buy decision, criteria for make or buy decision. 4.3 Economic Order Quantity and Economic manufacturing (lot) quantity. Simple problems.	8	16
5	5.1 Production, Planning and Control : Definition and objectives of production, planning and control, functions of production planning and control. Concept, necessity and importance of production planning (men, machine and material), routing, scheduling, dispatching, follow up, corrective action, and estimation as functions of production planning and control. 5.2 Process Engineering and Process Planning : Scope and procedure of process planning. Operation planning and sequence of operation planning, preparation of process planning sheet for a simple component. Factors affecting process planning. Gantt chart.	8	12
6	6.1 Plant Layout: Objectives of plant layout, symptoms of good and bad layout. Types of layout: Description, advantages, limitations and applications of product layout, process layout, fixed position layout and combination layout. 6.2 Plant Maintenance: Definition and importance of maintenance. Types of maintenance. Description, advantages, limitations and applications of Preventive maintenance, Breakdown maintenance and Scheduled maintenance. Predictive maintenance and condition monitoring.	6	12
	Total	48	80

Teaching Methodology: Chalk-Board, Discussions, Transparencies.

Term Work:

Skills to be developed:

i) Intellectual Skills :

- Selection of appropriate method of manufacturing.
- Understand the concept of performance rating.
- Know the objectives of estimation and costing.
- Identify machining time and cost of a product.

ii) Motor Skills :

- Enhance presentation skills through case studies.
- Prepare graphical layout of an organisation/department/section.
- Calculation of standard time for completion of a job.

List of Experiments / Practicals / Assignments:

1. Prepare O.P.C. and F.P.C. for existing and proposed method.
2. Prepare M.A.C. and two handed process chart for existing and proposed method.
3. Understand critical examination procedure in method study.
4. Case studies of critical examination (any five cases).
5. Apply principle of motion economy and design of work place layout.
6. Calculate standard time of job by different timing methods.
7. Calculate machining time for a job.
8. Estimate cost of a product or job.
9. Apply different performance scales and techniques.
10. Draw and compare different plant layouts.
11. Draw material handling equipments like trolley, conveyors, trucks & cranes and their uses.

Professional Practice:

12. Visit to Industrial Engineering department of an industry/company.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	L.C. Jhamb	Work Study and Ergonomics	Everest Publishing House, 1990.
2	T.R. Banga and S.C.Sharma	Mechanical Estimating and Costing	Khanna Publishers, 1997.
3	Samuel Eilon	Elements Of Production And Control	Universal Publishing Corporation Bombay, 2001.
4	International Labour Office, Geneva	Introduction To Work Study	1981.
5	K.G.Lockyer	Factory And Production Management	The English Language Book Society and Pitman Publishing, 1978.
6	O.P. Khanna	Industrial Engineering And Management	Dhanpat Rai and Sons, 1992.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Metrology & Quality Control

Course Code: R14ME4205

Course Category: Applied

Credits : 5

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	25	-	25	150

Rationale:

Mechanical engineering diploma holders often come across different measuring instruments. He should be able to select the proper instrument for the measurement of the machined component based on its tolerances. He should be able to use these measuring instruments to measure various quality characteristics. Also he should be able to analyze the data (reading taken) by the instruments from statistical quality control point of view.

Objectives:

Students will be able to

1. Define accuracy, precision, calibration, sensitivity, repeatability and such relevant terms in metrology.
2. Select appropriate instrument/s for specific measurement.
3. Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form, statistical form.
4. Construct and draw the control charts.
5. Understand ISO certification procedure and quality system.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Quality Control : 1.1 Meaning of quality, Elements of quality: quality of design, quality of conformance, quality of performance, Availability, Reliability, Maintainability, Customer service. 1.2 Quality policies. Concept of total quality management, difference between traditional approach and TQM approach, Quality assurance. Economics of quality, cost and value of quality. Elements of quality costs: Failure cost, appraisal cost, prevention cost. Effect of quality of conformance and design on quality cost. Optimum quality of design. Vendor rating & Vendor quality rating. 1.3 Difference between inspection and quality control. Inspection planning, planning of quality through trial lots. Importance of quality mindedness. Quality circle, Quality audit, ISO 9000 series- concept, importance and implication. QS14000, Product certification and Quality system certification.	10	16

2	2.1 Elementary Study of Statistics: Arithmetic mean, median, mode, range, standard deviation, frequency distribution, pictorial representation of statistical data, normal distribution curve. (Numericals on statistics). 2.2 Statistical Quality Control: Process capability study, process capability of machine, statistical limits, different possibilities, rejection areas, capable and incapable process. Control charts: inherent and assignable sources of variation, control charts by variables- X and R chart; control charts by attributes- p, np, c charts (Numericals on Control Charts).	7	12
3	3.1 Acceptance Sampling- Operating characteristic curve, its important characteristics. AQL, process average, RQL (LTPD), producer's risk, consumer's risk, AOQ, AOQL. Advantages and disadvantages of sampling, Types of sampling plans: Single, double and multiple sampling plans. (No numericals) 3.2 Limits, Fits and Gauges: Terminology, designation of hole and shaft, grades of tolerance and fundamental deviation. Clearance, interference and transition fits, guide for selection of fits, interchangeability and selective assembly, push fit, press fit, shrink fit. Limit gauges, plug gauges, ring gauges, and snap gauges, adjustable snap gauge (Numericals on finding the limits of hole & shaft). 3.3 Taylor's principle of gauge design, gauge maker's tolerance and wear allowance. Design of plug gauge, ring gauge and snap gauge.	7	12
4	4.1 Metrology: Definition of metrology, need of inspection in industries, precision, accuracy, sensitivity, readability, calibration, reproducibility, traceability, magnification. Sources of error: - Systematic errors, random errors, precautions while using an instrument for getting higher precision and accuracy, selection of instruments. 4.2 Measuring Instruments: Zero error concept of instruments, Study and use of different types of Vernier callipers and micrometers, vernier height gauge and depth gauge. Standards: - line standard, end standard, wavelength standard. Slip gauges and length bars. (Numericals on setting of slip gauge). 4.3 Comparators: Definition, advantages, limitations and uses of comparators such as Electrical, optical, Sigma comparator and Pneumatic comparator.	7	12
5	5.1 Dial Indicators: Requirement of good dial indicator, working mechanism, advantages, limitations and uses of dial indicator. Precautions while using dial indicator. 5.2 Angular Measurement: Instruments for angular measurement, Working & use of Vernier bevel protractor, sine bar, spirit level, angle gauges (Numericals on setting of angle gauges). Principle of working of autocollimator and angle dekkor. Miscellaneous methods of angle measurement: - Use of precision balls and rollers, checking the angle of a piece tapered on one side, to check angle of a tapered hole, to measure angle of a V block. 5.3 Geometric Features: Definition of straightness, flatness, squareness, parallelism and circularity. Straightness: straightness testing using Straight edge, spirit level or autocollimator. Flatness: Measuring flatness by dial indicator, Autocollimator and Optical flat. Squareness: squareness testing with dial indicator, autocollimator. Parallelism Testing: - Between two axes, two planes, axis to a plane, trajectory and plane, trajectory to an axis, two trajectories. Circularity and Roundness: Types of irregularities such as ovality, lobing and irregularities of no specific form. Roundness testing by dial indicator. Alignment testing on machine tools.	10	16

6	6.1 Measurement of Surface Texture: Primary texture, secondary texture, sampling length, lay, measurement of surface finish, Tomlinson surface meter, Taylor Hobson Talysurf, Ra, Rmax, Rz values. Symbols for designating surface roughness on drawings. 6.2 Metrology of Screw Threads: Screw thread terminology, errors in threads, pitch errors, measurement of effective diameter using two wire and three wire methods. Thread gauges. 6.3 Measurement and Testing of Gears: Terminology of gears, analytical and functional inspection, rolling test, Gear tooth Vernier caliper measurement of tooth thickness (Constant chord method). 6.4 Measuring Machines: - Optical profile projector, CMM (Co-ordinate Measuring Machine).	7	12
	Total	48	80

Teaching Methodology: Chalk Board, Discussions, Power Point Presentations, Transparencies, Visits, Charts.

Term Work:

Skills to be developed:

i) **Intellectual Skills :**

- Select correct instrument for particular measurement.
- Identify different parts of instruments.
- Interpret the data into readings.
- Understand concept, working principle and parts of various instruments.
- Reading of scales of various instruments considering errors.

ii) **Motor skills:**

- Handling various instruments.
- Setting of instruments with accessories.
- Measure various parameters and comparing with standards.

List of Practicals:

1. To measure physical dimensions of given component using vernier caliper, vernier height gauge and depth gauge in combination of non-precision instruments.
2. To measure physical dimensions of given component using inside and outside micrometer, extension rod type micrometer in combination of non-precision instruments.
3. To build the dimension using slip gauges and identify the errors of vernier caliper and micrometer using slip gauges.
4. To verify acceptance or rejection of given components using limit gauges.
5. To compare dimensions of component with standard slip gauge using dial indicator.
6. To compare inner/outer diameter of the given component with standard gauge using pneumatic comparator.
7. To measure unknown angle of the given component using vernier bevel protractor, sine bar and angle gauges.
8. Use of autocollimator and angle dekkor to check straightness and inclination of the surface.
9. To compare flatness of the surface using optical flats.
10. To conduct alignment test on lathe and drilling machine.
11. To measure the screw thread elements using screw pitch gauge, screw thread micrometer and floating carriage micrometer.

12. To measure the gear elements using gear tooth vernier caliper and profile projector.

Assignments:

1. To draw and interpret frequency histogram, frequency polygon and ogive curve for collected data, also to calculate mean, median, mode and standard deviation.
2. To draw and interpret the control charts for variable attributes (X, R, P and C chart).

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	R. K. Jain	Engineering Metrology	Khanna Publisher, 1999, Reprint-2001.
2	I. C. Gupta	Text Book Of Engineering Metrology	Dhanpat Rai Publication.
3	Chintakindi S.R. and S. S. Ganpule	Metrology And Quality Control	Technova Publishing House, 2000.
4	K. J. Hume	Engineering Metrology	Kalyani Publishers, 1970.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Production Technology

Course Code: R14ME4206

Course Category: Applied

Credits : 7

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	4	3	80	20	--	25	25	150

Rationale:

Diploma technician often comes across various types of basic production processes. He/ She is required to select, operate and control the appropriate processes for specific applications. He/ She is also required to know about various cutting tools, latest improvements in production and surface finishing processes.

Objectives:

The students will be able to

1. Use machine tools like lathe, milling, grinding machine.
2. Understand and select the gear cutting processes.
3. Understand the importance of surface finish and related surface finishing methods.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	MILLING PROCESSES: Introduction, classification ,specification of milling machine, basic parts of column & knee type milling machine & their functions, standard milling cutters, milling operations like plain milling, side milling, straddle milling, gang milling, face milling - slot milling, slitting. Up milling & down milling, cutting parameters. work holding and cutter holder devices, accessories and attachments, Introduction and working principle of universal dividing head, indexing, different methods of indexing (simple, compound, differential), numerical based on indexing.	8	12
2	GEAR MANUFACTURING : Gear tooth elements, types of gear, methods of manufacturing form tooth processes as milling & broaching. Generating processes as gear planning, shaping & hobbing. Working principles of gear shaping, gear shaping cutters, Introduction of gear hobbing, hobbing cutters, Working principles of gear hobbing. Gear finishing processes – gear shaving, grinding & lapping	6	12
3	GRINDING PROCESSES: Basic principle of the grinding processes, Kinds of grinding machines(centre less, surface ,internal, external) ,grinding wheel, Abrasives, Grit grade, Structure of grinding wheel, Wheel shapes ,wheel mounting, selection and specifications of grinding wheel, Wheel lasing, loading of grinding wheel Dressing.	10	16

	SURFACE FINISHING OPERATIONS: Introduction, description, advantages, limitations, applications of traditional finishing processes such as Honing Lapping, Super finishing process, Buffing, Polishing. Description of modern finishing methods such as chemo mechanical polishing, magnetic abrasive finishing, magnetic float polishing.		
4	NON CONVENTIONAL MACHINING METHODS: Need and importance, classification of non conventional machining Methods Working principles, advantages, disadvantages, application of following non-conventional processes: - USM, AJM, EDM, wire cut EDM, ECM, EBM, LBM. SURFACE COATING OPERATIONS: Introduction to various surface coating operations like Electro Plating, Anodizing and Electro-Less Plating, Coating on Abrasive grain, Application of Surface Coating	7	12
5	PRESS AND PRESS WORKING PROCESS : Introduction, classification and types of press, press parts and their functions. Tools and accessories, introduction to power press. Press operations such as shearing, punching, blanking, trimming, lancing, perforating, notching, bending, drawing operations. Types of dies (compound, combination, progressive), construction and Working. Types of blanks ,Layout development for different shapes of sheet metal blank ,Introduction to Die ,Cutting operation, cutting action in punch & die, die clearance, Types of die construction, Die design fundamentals. Die materials.	10	16
6	A] BROACHING AND SAWING MACHINES Broaching machines, geometry of broach, pull and push broaches, different shapes produced by broaching. advantages & limitations of broaching Sawing machines - Classification, types, selection of saws. B] JIGS AND FIXTURES : Definition , types and advantages of jigs and fixtures, different types of locators, different types of clamping devices, various types of jigs , 3-2-1 principle of location. Boring Machines – types, tools and operations	7	12
	Total	48	80

Professional Practices:-

Two visits to be arranged in following areas / industries for observing various manufacturing processes: -

1. Fabrication Workshop.
2. Gear manufacturing shop.

List of Practicals:

Practical consists of three jobs involving different machining operations on lathe, milling and grinding machines, along with journal in the form of assignments.

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Hazara Chaudhari S.K. and A.K.	Workshop Technology Vol. II	Media Promoters and Publishers.
2	Jain R.K.	Production Technology	Khanna Publishers, New Delhi.
3	Rajput R.K.	Manufacturing Technology	Laxmi Publications, New Delhi.
4	Khanna O.P. and Lal	ProductionTechnology Vol. I , II	Dhanpat Rai Publications, New Delhi.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Measurement and control

Course Code: R14ME4207

Course Category : Applied

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	–	–	50	150

Rationale:

The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid strides, with many types of instrumentation devices, innovations, refinements. The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress and methods of control systems for engineering applications.

Objectives:

The students will be able to

1. Understand the principle of operation of an instrument.
2. Appreciate the concept of calibration of an instrument.
3. Select Suitable measuring device for a particular application.
4. Identify different types of errors.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Introduction and significance of Measurement 1.1 Types of measurement, classification of instruments Static terms and characteristics- Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. 1.2 Dynamic characteristics- Speed of response, Fidelity and Dynamic errors, Overshoot. 1.3 Measurement of error- Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors. 1.4 Transducers : Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive	9	12
2	Displacement and Pressure measurement 2.1 Displacement Measurement Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, selection & application of displacement transducer. Optical measurement scale and encoders 2.2 Pressure Measurement Low pressure gauges- McLeod Gauge, Thermal conductivity gauge,	9	16

	Ionization gauge, Thermocouple vacuum gauge, Pirani gauge. High Pressure gauge-Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type		
3	Temperature measurement 3.1 Non-electrical methods- Bimetal , Liquid in glass thermometer and Pressure thermometer 3.2 Electrical methods- RTD, Platinum resistance thermometer, Thermistor, Thermoelectric methods - elements of thermocouple, Seebeck series, law of intermediate temperature, law of intermediate metals, thermo emf measurement 3.3 Pyrometers- radiation and optical	7	12
4	Flow measurements 4.1 Variable area meter- Rota meter, Variable velocity meter-Anemometer 4.2 Special flow meter- Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter ,Turbine meter ,Vortex shedding flow meter	6	12
5	Miscellaneous Measurement 5.1 Acoustic measurement – sound characteristics- intensity, frequency ,power –sound level meter piezoelectric crystal type 5.2 Humidity measurement –Hair hygrometer, Sling psychrometer, 5.3 Liquid level measurement – direct and indirect methods. 5.4 Force & Shaft power measurement -Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. 5.5 Speed measurement -Eddy current generation type tachometer, incremental and absolute type, Mechanical	9	16
6	Control systems 6.1 Block diagram of automatic control system, closed loop system, open loop system, feed back control system, feed forward control system, servomotor mechanism 6.2 Comparison of hydraulic, pneumatic, electronic control systems, 6.3 Control action: Proportional, Integral , derivative , PI,PD, PID 6.4 Applications of measurements and control for setup for boilers, air conditioners, motor speed control, Machine tool control	8	12
	Total	48	80

Note- Numerical based on chapter 1,4,5 only

Teaching Methodology: Chalk-Board, Discussions, Transparencies.

Skills to be developed:

Intellectual Skills:

1. Analyze the result of calibration of thermister
2. Interpret calibration curve of a rotameter
3. Evaluate the stress induced in a strain gauge
4. Verify the characteristics of photo transistor and photo diode

Motor Skills:

1. Test and calibration of a thermocouple
2. Handle various instruments
3. Draw the calibration curves of rotameter and thermister
4. Measure various parameters using instruments

List of Practical:

1. Understand the methods of measurements and instrument characteristics with demonstration of any one measuring device.
2. Displacement measurement by inductive transducer (LVDT)
3. Measurement of negative pressure using McLeod gauge / Bourdon tube pressure gauge. Conversion of pressure in different units.
4. Measurement of temperature by using Thermocouple.
5. Measurement of flow by using rotameter.
6. Measurement of strain by using a basic strain gauge and verify the stress induced.
7. Speed Measurement by using Stroboscope / Magnetic / Inductive Pick Up.
8. Measurement of force & weight by using a load cell.
9. Liquid Level Measurement by using Capacitive Transducer system.
10. Study of an actual control system for one suitable application (boiler) arranging industrial visit at sugar factory / paper mill / textiles / food processing industry.
11. Mini project-A group of 4 students shall take a mini project of searching information about advanced instrumentation / control system using internet and submits its report. Use of this knowledge in project(6th Sem) is highly appreciable.
12. Visit various departments/laboratories in own institute and understand how the measurement devices are fitted on machines/equipments, the procedure of measurement and calibration. (viz. Applied mechanics/ Electronics/ Instrumentation dept)

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. D.S. Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi
2	E.O. Dobelin	Measurement Systems	Tata McGraw Hill Publications,
3	R.K. Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi
4	A.K. Sawhney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Refrigeration & Air Conditioning

Course Code: R14ME4208

Course Category: Applied

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	--	25	25	150

Rationale:

Refrigeration and air conditioning and related devices find important position in application areas of Mechanical Engineering field. Various systems and devices like refrigeration systems, ice plants, process coolers, water coolers. Air conditioning systems are commonly used in practical areas. Diploma engineers are expected to operate and maintain these systems and devices. For this purpose it is necessary to incorporate basic concepts and areas of refrigeration and air conditioning.

Objectives:

The students will be able to

1. Know different refrigeration systems, type of refrigerants with characteristics.
2. Identify different components & controls of refrigeration systems.
3. Analyze different psychometric processes.
4. Estimate the cooling load for a given air conditioning system.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	1.1 Introduction Definition of Refrigeration Refrigeration and second law of thermodynamics Applications of Refrigeration Unit of refrigeration (Ton of Refrigeration) and Coefficient of performance (COP) Relative efficiency of refrigeration cycle or relative COP 1.2 Carnot refrigeration cycle Reversed Carnot cycle for refrigerator and heat pump Comparison of heat engine, refrigerator and heat pump Numerical approach based on reversed Carnot cycle 1.3 Air Refrigeration cycle Joule or reversed Brayton cycle or Bell Coleman cycle for gas refrigeration COP for Brayton refrigeration cycle Numericals based on Bell Coleman cycle (consider compressor and turbine efficiencies) Advantages and Limitations of Air Refrigeration Cycle Simple air refrigeration system with evaporative cooling cycle for air craft refrigeration (layout and working only)	10	16

2	2.1 Simple vapour compression refrigeration (VCR) system Layout of components and representation of VCR cycle on p-V and T-s chart (with dry compression and wet compression) Pressure –enthalpy chart and representation of VCR cycle on it Analysis of VCR cycle Numericals based on VCR cycle (dry as well as wet compression, no subcooling) Effect of condenser and evaporator pressure on COP of VCR cycle using p-h chart Effect of subcooling and superheating on COP of VCR cycle using p-h chart Multistage compression, multi-evaporator refrigeration system ((layout, working and representation on p-h chart) Cascade refrigeration system (layout, working and representation on p-h chart) 2.2 Vapour absorption refrigeration system: Components and working of aqua- ammonia (simple & practical) refrigeration system Desirable properties of refrigerant and absorbent pair used in vapour absorption system Comparison between vapour absorption and vapour compression refrigeration systems.	8	12
3	3.1 Refrigerants: Desirable properties of a refrigerant Designation/ nomenclature of refrigerant Global warming potential, Ozone layer potential and Montreal protocol Properties of refrigerants Ammonia, R22 and R134a Secondary refrigerants Leakage detection and charging of refrigerant 3.2 Refrigeration system components: Compressors: Construction and working of hermetically sealed compressor Condenser: Air cooled, water cooled and evaporative condensers Evaporator: Flooded chiller and Dry expansion chiller Expansion valve: Capillary tube and thermostatic expansion valve High pressure cut-out and low pressure cut-out	6	12
4	4.1 Introduction to Air Conditioning: Definition of air conditioning, Applications of air conditioning 4.2 Psychrometry: Composition of air, Dalton's law of partial pressures Dry bulb and wet bulb temperature, Adiabatic saturation and dew point temperatures, Humidity ratio, relative humidity, degree of saturation, enthalpy of moist air. Psychrometric chart (Numerical based on psychrometric properties with and without chart) 4.3 Psychrometric processes: Adiabatic mixing of air streams, Sensible cooling and sensible heating Apparatus dew point (ADP) & Coil bypass factor, Humidification and dehumidification (latent heating and latent cooling) Cooling and dehumidification & cooling and humidification Heating and humidification & Heating and dehumidification (Numericals based on psychrometric processes using chart)	10	16

5	5.1 Human Comfort: Thermodynamics of human body Effective temperature and factors governing effective temperature Comfort chart and comfort conditions for winter and summer 5.2 Cooling Load Estimation: Calculations of loads due to different sources like solar radiation, human beings, appliances, infiltration of air, etc. Sensible heat factor, Fresh supply and recirculated air quantities. Simple numerical on cooling load estimation. 5.3 Air conditioning systems: Classification of air conditioning systems Central air conditioning system and unitary air conditioning system (window and split air conditioning) Summer, winter and year around air conditioning system.	8	12
6	6.1 Air Distribution system: Principles of air distribution system in air conditioning Air handling system: layout and functions of different components Air distribution outlets: supply outlets, return outlets, grills, diffusers Different arrangement of ducts & types of air distribution systems Types of fans used in air condition system Thermal insulation: functions, properties of insulating material and different types of insulating materials used 6.2 Applications of refrigeration and air conditioning (construction and working: Domestic refrigerator, Ice plant, Cold storage, Water coolers Dessert coolers	6	12
Total		48	80

Teaching Methodology: Discussions, Chalk-Board, Charts, Transparencies, Visits

Term Work:

Skills to be developed:

i) Intellectual Skills:

- Reading of different charts & tables.
- Understanding of basic concepts, cycles & RAC systems.
- Comparison of different refrigeration cycles & systems.

ii) Motor Skills:

- To handle components, devices & tools of systems.
- To measure or to record parameters using different gauges and meters.
- To prepare report of visit and tests on the test rigs.

List of Practicals:

1. Handling, use & familiarization with refrigeration tools & accessories like tube cutter, tube bender, flaring tool, service valve, gauges, blow lamp, service cylinder.
2. Perform trial on vapour compression test rig to determine relative COP.
3. Perform trial on air conditioning test rig to find COP of the cycle.
4. Perform trial on air conditioning test rig to study humidification cycle with heating and dehumidification with cooling cycle.
5. Identify the important components of domestic refrigerator with modern features and describe their functions.
6. Identify the functional components of water cooler and write their functions.
7. Perform trial on ICE plant test rig and determine capacity.

8. Identify the functional components of window type room air conditioner, trace the path of refrigerant and air.
9. Classify and draw the different ducting systems for air conditioning.
10. Assignment on cooling load calculations.

Professional Practices :-

11. Visit a central Air Conditioning plant of hotel/auditorium/office to observe working, layout of ducts, equipments, outlets etc. Prepare a report on trouble shooting chart.
12. Visit a refrigeration plant (fabrication / charging of refrigerant / cold storage plant) and prepare a brief report

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	C. P. Arora	Refrigeration & Air Conditioning	Tata McGraw Hill Publications, New Delhi.
2	Roy Dossat	Principles of refrigeration	Wiley Eastern Publication.
3	R.K. Rajput	A Textbook of Refrigeration & Air Conditioning	S.K. Kataria & Sons Publishers , New Delhi.
4	Manohar Prasad	Refrigeration & Air Conditioning	New Age International Publishers, New Delhi
5	V. M. Domkundwar	Refrigeration & Air Conditioning	Dhanpatrai Publications, New Delhi.
6	P. L. Ballaney	Refrigeration & Air Conditioning	Khanna Publications, New Delhi.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : CNC Machines

Course Code: R14ME4209

Course Category: Applied

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	---	---	--	50	--	50	100

Rationale:

With advent of technology there are many improvements & many advances in manufacturing processes & equipments. As a part of these, conventional machine tools and processes have undergone metamorphic changes in their construction, working & control by incorporating CNC controls. Diploma engineers being in direct contact with manufacturing should possess understanding of advances in manufacturing areas & related equipment & processes. To make their working prominent in field it is necessary to give these basic inputs about their advances.

Objectives:

The students will be able to

1. Know different CNC machines.
2. Know the operation and control of different advanced machine tools and equipments.
3. Produce jobs as per specified requirements by selecting the specific machining process.
4. Adopt safety practices while working on various CNC machines.
5. Develop the mindset for modern trends in manufacturing and automation.
6. Write part programming for given component.

Course Details:

UNIT	NAME OF THE TOPIC	HRS
1	Introduction to CNC machines: 1.1 Current manufacturing needs- Production rate, quality, accuracy, repeatability, reliability, flexibility & manufacturing cost etc. 1.2 Historical developments of machine tools- Development of machine tools, advantages and limitations of machine tools like capstan, turret, automates, transfer lines, NC machines, CNC machines & FMS. 1.3 Classification of CNC machines based on – Control loop feedback system, tool motion control system, absolute & incremental control system. 1.4 Construction & working of – CNC turning, milling, drilling & CNC based co-ordinate measuring machine.	4

2	Constructional elements of CNC machines: 2.1 Machine structure- Bed, slideways, column and tables. 2.2 Spindle & feed drives- Stepper motor, servo motor & fluid motor. 2.3 Movements actuators- Recirculating ball screw, linear motion bearings. 2.4 Feedback elements- Positional and velocity feed backs. 2.5 Automatic tool changer- Tool magazine, turret head. 2.6 Pallet changer- Linear and rotary pallet changer. 2.7 Miscellaneous elements- Lubrication system, coolant and swarf removal system. Use of hydraulic and pneumatic system for tool holding and pallet changing.	3
3	CNC manual part programming: 3.1 Fundamental of CNC manual part programming- Definition of CNC programme, CNC programming & CNC programmer & programmer role, CNC machine specifications, various stages in manual part programming, right hand rule for axis identification, terminology used in CNC manual part programming & word address format(WAF). Concept of subroutine call and do loop function. 3.2 CNC lathe manual part programming- Concept of machine zero, work zero and reference point. G & M codes, various canned cycles, calculations of cutting parameters like spindle r.p.m. tool feed rate etc. To write programmes for given components. 3.3 CNC milling manual part programming- Types of CNC milling machines, concept of machine zero, work zero and reference point. G & M codes, tool length compensation, cutter radius compensations, various canned cycles, calculations of cutting parameters like spindle r.p.m. tool feed rate etc, To write programmes for given components. 3.4 CNC Drilling manual part programming - G & M codes for drilling cycle, counter boring cycle, peck drilling cycle. To write programmes for given components.	6
4	Tooling for CNC machine: 4.1 Introduction to – CNC tooling and its importance, CNC tool planning. 4.2 Types of CNC cutting tools- For turning, milling & drilling CNC machines, types of index able inserts with its geometry. 4.3 Tool holding device- Construction, working & hydraulic tool holding system. 4.4 Tool presetting procedure- 4.5 Automatic tool changer (ATC)- Construction, working, types tool magazines. 4.5 Miscellaneous - Safety procedures, alarms, quick stop and fool proof procedure, on line measurement of dimensions, cutting forces etc.	3
Total		16

Teaching Methodology: Chalk Board, Power Point Presentations (PPT), Transparencies, Guest lecturers, Charts, Visits.

Term Work:

Skills to be developed:

i) **Intellectual Skills :**

- Reading of component drawing and understanding the processes sequence for programming.
- Understanding the various basic concepts of CNC programming.
- Writing CNC programme.

ii) **Motor Skills :**

- Selection of work raw material and clamping.
- Testing of CNC programme for correct path by simulation software and make changes if any.
.CNC machine set-up before machining, and execute the programme for machining.

List of Practicals:

CNC Turning:

1. Introduction to CNC lathe, machine set up and work setting before machining (axis identification, work zero, machine zero and reference point, tool presetting procedure).
2. To develop program on lathe for some operations using G00, G01 and M codes, testing it by simulation software & to execute actually on machine.
3. To develop program on lathe for some operations using G02, G03 and M codes, testing it by simulation software & to execute actually on machine.
4. To develop program on lathe for canned cycle operation, testing it by simulation software & to execute actually on machine.
5. To develop program on lathe for “subroutine call”, testing it by simulation software & to execute actually on machine.
6. To develop program on lathe for “Do loop function”, testing it by simulation software & to execute actually on machine.

CNC Milling:

1. Introduction to CNC milling ,machine set up and work setting before machining (axis identification, work zero, machine zero and reference point, tool presetting procedure) before machining.
2. To develop program on milling machine for some operation using G00, G01 and M codes, testing it by simulation software & to execute actually on machine.
3. To develop program on milling machine for some operation using G02, G03 and M codes, testing it by simulation software & to execute actually on machine.
4. To develop program on milling machine for canned cycle, testing it by simulation software & to execute actually on machine.
5. To develop program on milling machine for tool length and cutter radius compensation, testing it by simulation software & to execute actually on machine.
6. To develop program on milling machine for “subroutine call”, testing it by simulation software & to execute actually on machine.
7. To develop program on milling machine for “Do loop function”, testing it by simulation software & to execute actually on machine.
8. To develop program on milling machine (rectangular pocket milling).
9. To develop program on milling machine (circular pocket milling).

Professional Practices:-

- c. Industrial visit & report writing based on subject contents.
- d. Guest lecture from industry expertise based on contents.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Groover M.P. & Zimmers E.W.	Computer Aided Design and Manufacturing	Prentice Hall of India.
2	Ibrahim Zeid	CAD/CAM Theory and Practice	Tata McGraw Hill Publishing Co., New Delhi.
3	Radhakrishna P. & Subramanyam	CAD/CAM/CIM	Wiley Easteen Ltd.
4	Mickell P. Groover	Automation, Production System & CIM	Prentice Hall (I) Pvt. Ltd., New Delhi.
5	Mickell P. Groover, Emory W Zimmers Jr	CAD / CAM	Prentice Hall (I) Pvt. Ltd., New Delhi.
6	Prof.S. R. Deb	Robotics Technology & Flexible Automation	Tata McGraw Hill Pub. Co. Ltd., New Delhi.
7	Prof.R.B.Patil	CAD/CAM & Automation	Tech-Max productions, Pune.
8	Prof. Chougule N.K.	CAD/CAM/CAE	Scitech Publications (India) Pvt. Ltd.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Project Work

Course Code: R14ME4210

Course Category: Applied

Credits : 4

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
-	4	-	-	-	-	50	100	150

Rationale:

The project work should enable the students to integrate the theoretical and practical concepts studied into useful applications. The work should enable students to exhibit their ability to work in a team, develop planning of execution skills and perform analyzing and trouble shooting in successful completion of project. The project report should be a neatly documented record of the principle, applications, detailed and assembly drawings, process sheets, costing and the scope for future development.

Objectives:

The students will be able to

1. Co-relate theory with practical aspects.
2. Involve in day to day problem solving.
3. Observe modern equipment and processes.
4. Develop skills to identify the problem and to take step towards seeking the solution to the problem.
5. Record systematically their work.
6. Prepare a report.

Term Work:

Term work shall consist of fabrication of working models, machines, prototypes based on new ideas, experimental set-ups, material handling devices, measurement and control of parameters, jigs and fixtures, renovation of machines, low cost automation application, energy saving devices, recycling of waste, innovative mechanisms, pollution control equipments, equipment operating on non-conventional energy, biotechnology etc.

Projects to be based on use of appropriate technology, simulation of movement and operation, pick and place robots, automation of a work station, maintenance based projects, etc.

Above work is to be taken up in groups. Each group shall not have more than four (4) students.
Skills to be developed:

i) Intellectual Skills :

- Selection of project.
- Reading of industrial drawing and case study reports.
- Time management.
- Planning of project activity.
- Leadership and responsibility for completion of task.
- Preparing project report.

ii)

Motor Skills :

- Processing/manufacturing different parts of project.
- Assembling different parts of project.
- Testing of project.
- Recording and Interpreting the data after testing.
- Presentation of project and project report.

Guidelines for Preparation of Project Report:

1. Project report shall consist of about 30 to 50 pages.
2. Project Report shall be typed / printed on A-4 size paper with 13 font size (Times New Roman) and single line spacing
3. Each project group shall prepare (N+1) copies of the reports, (N) being the number of students in the group.
4. Figures and tables will be on separate pages and attached at respective places.
5. Front cover shall have the format as shown below with proper spacing.

<i>PROJECT TITLE</i> NAME: ENROLLMENT NO. DIPLOMA PROGRAMME IN MECHANICAL ENGINEERING

6. The Title Sheet shall be the first sheet and shall contain following with proper spacing.

A PROJECT REPORT ON (TITLE) BY NAMES & EN.NO.s.

7. The Project Approval Sheet shall follow the title sheet and shall be as shown below with proper spacing.

This is to certify that the project entitled _____ submitted by _____, Enrollment No. _____ for the partial fulfillment for the award of DIPLOMA IN MECHANICAL ENGINEERING of CUSROW WADIA INSTITUTE OF TECHNOLOGY, PUNE, 411001 is approved.

8. The sequence of the text of the project report shall be as under :
- a) Index page showing content of text, with page numbers.
 - b) Introduction, Project Specifications.
 - c) Design procedure (if any).
 - d) Component drawings with proper dimensioning, machining symbols and tolerances along with the Process Sheets.
 - e) Assembly Procedure with difficulties faced.
 - f) Test results.
 - g) Costing.
 - h) Conclusions and scope for future improvements.
 - i) References shall be mentioned at the end, followed by appendices (if any).
9. An Assembly Drawing in TWO views shall be prepared and be attached at the end.
10. Preferably actual photographs/ video clips showing actual progress of project work be added at the appropriate places in the report.

Learning Resources:

Standard specification tables, websites, etc.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Automobile Engineering

Course Code: R14ME5201

Course Category: Specialised

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	50	150

Rationale:

Automobile is one of the necessities of modern life. Development and progress of the world majority is based upon the development of modern automobiles. Diploma Engineer should know principle of working, construction and various systems of automobile vehicles of different types and sizes. Now a days many advances in automobile technology have been made like Automatic transmission, Control System, Ignition System , Electrical system ,Alternate fuels, Electronics control System etc. A diploma Engineer should be conversant with these modern developments and trends.

Objectives:

The students will be able to

1. Understand the basic structure of an automobile.
2. Know the vehicles performance parameters
3. Understand the detailed construction features of automobile engines
4. Dismantle and assemble the automobile engines and vehicle systems
5. Know various advanced features in modern automobile vehicles
6. Understand and identify various system components with their functions
7. Compare and select the automobile vehicles based on their features

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Introduction to Automobiles. 1.1 Classification of automobile vehicles, types of automobile vehicles. Two and four wheeler chassis layout of an automobile vehicle, automobile body types, Layout of vehicle such as front engine rear wheel drive, front engine front wheel drive, rear engine rear wheel drive, four wheels drive etc.their advantages, comparisons. Aerodynamic body shapes & advantages, transfer box 1.2 Types of automobile power plants such as petrol engine, diesel engine, gas operated (LPG, CNG),electric power plants, hybrid vehicles , alternate fuels.	7	12
2	Transmission Systems: 2.1 Need and Requirements of transmission system. Its components and their functions,tractive effort ,total resistance, stabilized speed 2.2 Clutch: Function and purpose of clutch, Requirement of good clutch types	10	16

	and construction of clutches as coil spring type and diaphragm type, Electromagnetic clutch. 2.3 Gear box- constant mesh and synchromesh gear boxes, Epicyclic gear box their construction and operation. Overdrive, transfer case, Need of gearbox, Torque convertor 2.4 Propeller shaft types and construction, functions of universal and slip Joints. 2.5 Differential - need, construction and working, differential action and Operation, front axle its types & stub axle 2.6 Axle – Hotchkiss and torque tube drives, Rear- full floating axle, semi Floating and three quarter floating axle. Front axle.		
3	Control Systems: 3.1 Steering System: Purpose of steering system, construction and working of - recirculating ball type and rack and pinion, & Steering mechanism. Wheel Geometry- caster, camber, king pin inclination, Toe In and Toe Out. Power steering (introductory). 3.2 Braking System: Need of braking system, types of automotive braking systems for two and four wheeler vehicles – mechanical, hydraulic and air operated Hydraulic braking systems: Layout & components of hydraulic braking systems ,Construction and working of master cylinder and wheel cylinder, Drum braking system, Disc Braking Systems, Air braking system: layout and working.	9	12
4	Suspension Systems, Wheels and Tyres 4.1Necessity and Classification of Suspension System , Front and rear suspension system construction and working of Wishbone type, Mac Pherson type, Trailing link type, coiled springs, leaf spring and Shock absorbers, hydraulic damper & air suspension system. 4.2 Wheel construction, alloy wheel, wheel alignment and balancing, type of tyres, tyre construction, tread design.	6	12
5	Electrical Systems: 5.1 Battery: Automotive battery construction and operation, battery capacity, Battery ratings, Battery tests Charging System : Need of charging system, Construction and operation of charging system, Alternator principle ,construction and working of cut off relay, battery maintenance. 5.2 Starting System : Need of starting system, layout, construction of starting motor, Bendix drive 5.3 Lighting System: Layout of lighting system of two wheeler and four wheeler, Wiring harness, cable color codings. 5.4 Ignition System and their Components Battery, magneto, electronic ignition system & their comparison.	6	12
6	Advanced control systems & Vehicle Performance : Electronic Control system, block diagram, Sensors,Types,Principle of operation, Electronic Control Unit, Actuators, types, Electronic Stability Programme,Need,Component,Principle of working, Traction Control System, component, working. Vehicle performance parameters, road resistance, traction and tractive effort, power requirement for propulsion, road performance curves, Stability of vehicles. SAE vehicle axis system, vehicle body moments, roll over	10	16
	Total	48	80

Teaching Methodology: Chalk Board, Discussions, (PPT), Guest lectures, Transparencies.

Term Work

Skills to be developed:

i) Intellectual Skills :

- Selection of automobile chassis ,transmission components and different controls for various vehicles.
- Understand electrical systems, pollution norms and modern development.
- Enhance learning to learn skills.

ii) Motor Skills:

- Preparation of power point presentation / Transparencies.
- Handling of various automobile components

List of practicals

1. Study of scenario of Automobile manufacturers in India-Two or four wheeler vehicles.
2. Dismantle and assemble single plate-coil and diaphragm type clutch, sketch and state the functions of important component in brief.
3. Dismantle and assemble synchromesh gear box, sketch and state the functions of important component in brief.
4. Dismantle and assemble differential, sketch and state the functions of important component in brief.
5. Dismantle brake system and observe various components of it, sketch and state the functions of important component in brief.
6. Study and observe various steering systems of automobile vehicle and make a systematic record.
7. Observe and draw various suspension systems, describe their advantages and limitations.
8. Inspection of battery like Ah rating, type of battery, no. of cells, vents, charge status by using hydrometer and voltmeter.
9. Conduct PUC test of car on exhaust gas analyzer according to Indian Motor
10. Vehicle act 1989 revised norms (Petrol or diesel) and write a report..
11. Dismantle and assemble alternator and starting motor of a car and write a report.
12. Study of Advanced Control Systems in Automobiles and modern features in car, write brief report.

Professional Practices:-

13. At least two topics from the syllabus have to be selected by group of students and they are supposed to give seminar / presentation.
14. One industrial visit to automobile industry/Service station and student will submit a report of the visit as a part of term work.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. Kripal Singh	Automobile Engineering (Vol. 1 & 2)	Standard Publications, New Delhi.
2	H.M. Sethi	Automotive Technology	Tata McGraw Hill Publications, New Delhi.
3	Joseph Heither	Automobile Mechanics	Williesten Publications.
4	William Crouse	Automobile Mechanics	Tata McGraw Hill Publications, New Delhi.
5	M.L. Mathur & R.P. Sharma	Internal Combustion Engines	Dhanpat Rai & Sons, Delhi.
6	G.B. Narang	Automobile Engineering	Khanna Publications, New Delhi.
7	R.B.Gupta	Automobile Engineering	Satya Prakashan ,New Delhi

CDs, PPTs, Video Clips: On various constructional and operational details of working of different automobile systems based on internet web sites as under, www.tatamotors.com, www.hyundai.co.in, www.india.ford.com, www.marutisuzuki.com, www.auto.howstuffworks. You tube videos for automobile systems. www.wikipedia.com

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Mechatronics

Course Code : R14ME5202

Course Category: Specialised

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	50	150

Rationale:

The integration of electronics engineering, electrical engineering, computer technology and control engineering with mechanical engineering is increasingly forming a crucial part in the design , manufacture and maintenance of wide range of engineering products and processes. A consequence of this is a need for engineers and technicians to adopt an inter disciplinary and integrated approach.

Objectives:

The students will be able to

1. Identify various input and output devices in an automated system.
2. Understand interfacing of input and output devices.
3. Write simple program for PLC's.
4. Understand and draw ladder diagram.
5. Interpret and use operations manual of PLC manufacturer.
6. Use simulation software provided with the PLC.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Introduction to Mechatronics : Measurement systems, control systems, elements of open loop and closed loop system, sequential controllers, microprocessor based controllers. Sensors and transducers- terminology, displacement, position and proximity, velocity and motion, fluid pressures, liquid flow, temperature and light sensors, selection of sensors, inputting data by switches.	8	12
2	Signal Controlling : Signal conditioning processes, operational amplifiers, filter, digital signals, analogue to digital conversion, digital to analogue conversion, multiplexers, data acquisition, digital signal processing, pulse modulation, data presentation system. Drive units: DC drives, Variable frequency drives (VFD), Scalar and vector drives, Stepper motor driver and controller	6	12
3	Pneumatic and Hydraulic Actuation Systems : Direction control valves, pressure control valves, cylinder, process control valves, rotary actuators, electrical activation systems, mechanical switches like relays, solid state switches like diodes, thyristors and triacs, bipolar	10	16

	transistors, panel MOSFETS, solenoids and relays, DC & AC Data acquisition systems (DAQS), data loggers, supervisory control and data acquisition (SCADA), Communication methods Level and communication, I/O operations, Data width, I/O operations Buffers, Handshaking , Polling and interrupt, Digital communication Parallel communication, Serial communication, Peripheral interface device (PIA), Analogue interfacing		
4	PLC : PLC fundamentals, block diagram, programming, ladder diagram, logic function, latching, sequencing, mnemonics, timer, internal relay and counters, analogue input output, selection of a PLC. Extending and retracting a pneumatic piston using latches,Control of two pneumatic piston ,Control of a process motor ,Control of vibrating machine.	10	16
5	SCADA –Introduction , types, D+R+N (development+run+networking) ,R+N (run + networking), Features of SCADA, Architecture (communication,interfacing and scalability), functionality ,application development, evaluation and benefits of SCADA 8085 Microprocessors: Architecture, block diagram, Pin configuration, generation of control signals, demultiplexing address/ data bus, I/O mapped I/O, Memory mapped I/O	6	12
6	8085 Instructions: Data transfer instructions- MOV, MVI, LXI, LHL, LDA, LDAX Arithmetic Instructions- ADD, ADC, ACI, ADI, DAA, DAD, DCX, INX, INR, DCR, SUB, SUI. Logical Instructions- ANA, ANI, ORA, ORI, XRA, XRI Rotate Instructions- RAR, RRC, RLC, RAL.	8	12
	Total	48	80

Teaching Methodology: Chalk Board, Discussions, Power Point Presentations, Transparencies, Visits, Charts

Term Work:

Skills to be developed

i) Intellectual Skills :

- Know various systems of mechatronics.
- Selection of valves for pneumatic and hydraulic systems.
- Selection of different sensors and transducers for various applications.
- Interpretation of program and block diagram.

ii) Motor Skills :

- Measurement of parameters using proper devices.
- Observe the readings.

List of Practicals:

Term work shall consist of detailed report on the following experiments.

1. Identification and demonstration of different sensors and actuators.
2. Stepper motor control using microcontroller.
3. Demonstration of the working of various digital to analog and analog to digital converter.
4. Development of ladder diagram, programming PLC for level control, position control or any other mechanical engineering application.
5. Draw and demonstrate working of at least TWO electro pneumatic systems.
6. Draw and demonstrate working of at least TWO electro hydraulic systems.
7. Sketch of data acquisition systems.
8. Minimum four programs using 8085 microprocessor.

Professional Practices :-

9. Visit to relevant industry & report writing.

Learning Resources:**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1.	Bolton William.	Mechatronics- Electronic Control Systems in Mechanical and Electrical Engineering	Pearson Edu Ltd.
2.	Histand B.H., Alciatore D.G.	Introduction to Mechatronics and Measurement Systems	Tata McGraw Hill Publishing Co.
3.	Kolk R.A., Shetty D	Mechatronic Systems Design	Vikas Publishing, New Delhi.
4.	K.P.Ramchandran, G.k.vijayraghavan, M.S.Balsundaram	Mechantronics –Integrated Mechanical Electronic System	Wiley India
5.	Mahalik M.P.	Mechtronics Principle, Concepts and Applications	Tata McGraw Hill Publishing Co.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Dynamics of Machinery

Course Code: R14ME5203

Course Category: Specialized

Credits : 5

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	50	150

Rationale:

Dynamics of machinery entails study of analysis of the effects of forces and couples due to acceleration of machine members.

Objectives:

The students will be able to:

1. Understand vibration parameters of a single degree of freedom system.
2. Appreciate role of gyroscopic couple in automobiles, ships and planes
3. Analyze the role of spur gears
4. Diagnose cause of unbalance in a machine
5. Appreciate the parameters influencing performance of governors

UNIT	NAME OF THE TOPIC	HOURS	MARKS
1	Vibrations : Definitions , types of vibrations – longitudinal, transverse, torsional , SHM , degrees of freedom , springs in series and parallel , equivalent spring , free undamped vibrations single degree – natural frequency, circular frequency , factors affecting natural frequency , free damped vibrations (with viscous damping), damped frequency , damping factor , damping coefficient, free torsional vibrations	9	16
2	Forced vibrations of Single degree freedom systems – excitation frequency , resonance , frequency response curves ,magnification factor Vibration measuring devices, ill effects of vibrations, methods to reduce vibrations, vibration isolators and absorbers Introduction to Noise – terminology , intensity , unit of measurement, noise source control, absorbers, enclosures	7	12
3	Gyroscope : Angular velocity , angular acceleration, gyroscopic couple, Effect of Gyroscopic couple on Airplane. Effect of Gyroscopic	8	12

	couple on Ship, stability of an automobile – stability of two wheeler, stability of a four wheeler		
4	Kinematics of Spur Gears : Spur Gear terminology, law of gearing, velocity of sliding, conjugate teeth, forms of teeth , path of contact, arc of contact, number of pairs of teeth in contact (contact ratio), pressure angle, interference, undercutting ,methods to avoid interference and undercutting ,effect of centre distance variation , minimum number of teeth	9	16
5	Balancing Introduction to balancing, Need of balancing, Static and dynamic balancing, Balancing of masses rotating in single and several planes, transference of a force from one plane to another Balancing of reciprocating mass in single plane	8	12
6	Governors Introduction to governors , types of centrifugal governor (Watt, porter and Hartnell only) controlling force, governor effort and governor power with numerical treatment, sensitivity, stability, isochronisms and hunting	7	12
	Total	48	80

Teaching Methodology: Chalk Board, Discussions, (PPT), Guest lectures, Transparencies.

Term Work :

List of Practicals:

1. Experimental verification of static and dynamic balancing of rotating masses.
2. Draw a conjugate profile for any general type of gear tooth
3. Generate involute gear tooth profile and to study effect of undercutting and rack shift using a model
4. Verify principle of gyroscope
5. Find natural frequency of undamped vibrations of single degree freedom system.
6. Find damping coefficient of torsional free damped vibration system.
7. To determine the characteristic curve of a centrifugal governor and to find its coefficient of insensitiveness and stability
8. Study of forced vibration system for frequency response and resonance
9. Study and describe Noise and vibration measuring instruments

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Thomas Bevan	Theory of Machines	Longman publications
2	J.E. Shigley	Theory of Machines and Mechanisms	International edition McGraw hill
3	Jagdishlal	Theory of Machines	Metropolitan book co. pvt. Ltd. New Delhi
4	S.S.Rattan	Theory of Machines	Tata McGraw hill
5	G.K. Grover	Mechanical Vibrations	New Chand and Bros. Roorkee
6	R.S. Khurmi	Theory of Machines	Eurasia publishing house (pvt.) Ltd. New Delhi
7.	P.L.Ballaney	Theory of Machines	Khanna publications

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Tool Engineering

Course Code: R14ME5205

Course Category: Specialised

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	50	50	100

Rationale:

Mechanical engineering diploma holders are dealing with various cutting tools, tool holding devices, different press tools, jigs, fixtures, dies etc. He/She should be able to select the proper press tool operation, sheet metal specification, design parameters for die, a press tool as per given application of the component, tool material and tool geometry on the basis of technical as well as economic parameters. So it is virtually important to give suitable exposure to these areas.

Objectives:

The students will be able to

1. Select cutting tool and its material using data book and manufacturers' catalogue.
2. Estimate tool wear and tool life.
3. Use press tools and dies effectively.
4. Decide strip layout for given component.
5. Decide appropriate cutting fluid for machining process improvement.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	1.1 Metal Cutting Principle: Essential features of metal cutting, types of metal cutting- orthogonal cutting and oblique cutting, physical principle of metal cutting (chip formation), mechanism of chip formation, analysis of orthogonal cutting. Thermal aspects and other factors affecting performance of metal cutting. 1.2 Cutting Fluids: Introduction to cutting fluids, purpose of cutting fluid, types of cutting fluids, properties and applications of cutting fluids, various application techniques. Effect on environment, storage and disposal of cutting fluids, swarf removal.	3
2	2.1 Tool Geometry of Various Cutting Tools : Nomenclature and importance of various angles & surfaces of single point cutting tools and multi point cutting tools such as milling cutter, drill, tap, reamer, broach, grinding wheel etc. 2.2 Form Tools: Introduction, classification and selection of form tools. 2.3 Cutting Tool Materials :	4

	Introduction to cutting tool material, requirements of cutting tool materials, properties required for cutting tools. Properties, composition and applications of various cutting tool materials. Heat treatment carried out on various tools, purpose of heat treatment. Recent developments in cutting tools.	
3	3.1 Elements of Jigs and Fixtures : Introduction to jigs and fixtures. Locating, Clamping, Indexing, Tool guiding, Locking and Auxiliary elements. Swarf removal and fool proofing of jigs and fixtures. Use of dowel pins, setting block etc. 3.2 Milling Fixture : Introduction, definition and types of fixtures. Construction of milling fixture, types of milling fixtures, application and examples of milling fixture. 3.3 Lathe Fixture : Introduction to lathe fixture, construction of lathe fixture, types of lathe fixture, application and examples of lathe fixture.	2
4	4.1 Drill Jig : Types of drill jig, general consideration in design of drill jigs. Drill bushings, methods of construction of drill jigs. 4.2 Sheet Metal Blanking and Piercing Dies : Power press types, general press information, cutting action in punch and die operation, die clearance. Blanking and piercing die construction, pilots, strippers and pressure pads. Strip layout.	2
5	5.1 Drawing and Progressive Dies: Theory of drawing operation, shell-blank calculation, drawing radii and clearance, drawing forces and shell defect. Types of drawing dies, design consideration for progressive dies, design procedure for progressive dies. 5.2 Forming Dies : Solid form dies, pad type form dies, curling dies, embossing dies, coining dies, bulging dies, assembly dies, pressure die casting. Applications of forming dies.	3
6	6.1 Materials for various Parts of Press : Materials for various parts of press such as punch, die, stripper, die block, bolster plate, bed of ram, die shoe, guide post, punch plate, punch holder, back up plate, ram etc. 6.2 Plastics: Revision of plastics & moulding processes. Engineering applications of plastics. Dies for plastic moulding. Faults and remedies in moulded components.	2
	Total	16

Teaching Methodology: Chalk board, Discussions, PPT, Industrial Visit, Transparencies, Model and Charts.

Term Work:

Skills to be developed:

i) Intellectual Skills:

- Selection of appropriate tool for a particular operation.
- Understand the importance of cutting tool nomenclature.
- Identify materials for jigs, fixtures, dies and other industrial components.
- Selection of appropriate jigs and fixtures for a given component.
- Improvement of interpersonal skills through presentations.
- Enhance learning to learn skills.

ii) Motor Skills:

- Preparation of power point presentation / Transperancies.

Assignments:

Twelve assignments consisting of at least one on each topic are to be completed.

Professional Practices:-

At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.

One visit to a relevant industry and student will submit a report of the visit as a part of term work.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Donaldson, George H. Lecain and V.C. Goold	Tool Design	Tata-McGraw Hill Publishing Company Ltd., 1976, Reprint-2002.
2	P.C. Sharma	Reston Publishing Company, Inc	S.Chand and Company Ltd., 1994.
3	R. K. Jain and S. C. Gupta	Production Technology	Khanna Publishers, 1986.
4	P. H. Joshi	Jigs and Fixtures	Tata-McGraw Hill Publishing Company Ltd., 2001.
5	V. K. Mahajan	Tool And Die Maker	Tata-McGraw Hill Publishing Company Ltd., 1981.
6	M. H. A. Kempster	An Introduction To Jig and Tool Design	ELBS.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Welding Technology

Course Code: R14ME5206

Course Category: Specialised

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	50	50	100

Rationale:

Fabrication technology has invaded virtually in every branch of manufacturing like bridges, ships, building construction, boilers, pressure vessels, pipe lines, automobiles, power plants, etc. With the wide spread applications, knowledge of the same has become essential for students who desires to take up career in fabrication.

Objectives:

The students will be able to

1. Understand the principles and operations of different welding types.
2. Learn the precautions and applications for different welding processes.
3. Know inspection procedure of weld.
4. Select the appropriate jig and fixture as per application.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Introduction to Fabrication Processes – Riveting, Welding process, Classification of welding, surface and edge preparation. Safety recommendation in welding- protection of welders, protection from welding rays, ventilation and health protection. Gas Welding Processes- Oxy- acetylene welding, principle of operation and types of welding flames, welding techniques- leftward and rightward, other fuel gas welding processes, their advantages and disadvantages.	3
2	Arc Welding Processes- Definition, principle, equipments, joint preparations, operation procedures of carbon arc welding, flux shielded metal arc welding, submerged arc welding, TIG and MIG welding, electro slag welding, electro gas welding, plasma arc welding, stud welding. Welding electrodes, shielding gases and mixtures. Resistance Welding Processes- Definition, fundamentals, advantages and disadvantages. Applications of resistance welding- spot welding, seam welding, projection welding, resistance butt welding, flash butt welding. Braze Welding and Soldering- Definition, principle of operation, fluxes and fillers, advantages and disadvantages.	3

3	Thermal Cutting of Metals- Definition, types of cutting processes, principle of operation, advantages and disadvantages. Radiant Energy Welding- Definition, principle, operational procedures of electron beam welding, laser beam welding. Thermo Chemical Welding- Definition, principle, operational procedures of thermit welding, atomic hydrogen welding. Weldability- Definition and concept of weldability, effect of alloying elements on weldability. Defects in Weld- Crack distortion, incomplete penetration, porosity and blow holes, poor fusion, poor weld bed appearance, its causes and remedies. Welding Symbols- Representing the welds, basic weld symbols, location of welds, dimension of welds.	3
4	Inspection of Welding- Destructive testing, tensile test, bend test, impact test, hardness test. Non-Destructive Testing- Visual inspection, leak inspection. Welding of Cast Iron- Welding characteristics, welding processes used for cast iron. Welding of Carbon Steels- Welding of low carbon, medium carbon, high carbon steel.	3
5	Welding of Alloy Steels- Introduction to alloy steels, effect of alloying elements and welding of low alloy high strength steels. Welding of Stainless Steel- Welding use for stainless steel. Welding of Aluminium and its Alloys- Welding processes used for it. Welding of Dissimilar Metals- concepts and metallurgical problems in dissimilar metals welding.	2
6	Welding Jigs and Fixtures- Welding jigs and fixtures concept with suitable example. Welding Distortion- concept of distortion during welding, its causes and remedies.	2
	Total	16

Teaching Methodology: Chalk board, Discussions, PPT, Industrial Visit, Transparencies, Model and Charts.

Term Work :

Skills to be developed:

i) Intellectual Skills :

- Selection of suitable welding process.
- Reading of welding symbols and dimensions.
- Understanding of welding parameters.
- Enhance learning to learn skills.

ii) Motor Skills:

- Preparation of power point presentation / Transperancies.

Assignments:

Twelve assignments consisting of at least one on each topic are to be completed.

Professional Practices:

At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.

One visit to relevant industry and student will submit a report of the visit as a part of term work.

Learning Resources:**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	O.P. Khanna	A Text Book of Welding Technology	Dhanpat Rai Publications, New Delhi
2	S.V. Nadkarni	Modern Arc Welding Technology	Oxford and IBH Publications Co.
3	Metal's Hand Book, Vol-6	Welding and Brazing	American Society of Metals
4	Richard L.Little	Weld and Welding Technology	Tata McGraw Hill Publications, New Delhi.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Alternate Energy Sources

Course Code : R14ME5207

Course Category: Specialised

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme							
TH	PR	PAPER	HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-		-	-	-	50	50	100

Rationale:

The existing methods of producing conventional energy will be inadequate in providing the needs of the future demands. Considerable research is being done to investigate the possibility of producing energy from non conventional sources. Development of appropriate designs may be necessary to make use of non conventional sources. This course produces the background to the understanding of the different types of Alternate Energy Sources.

Objectives:

Students will be able to

- 1) Develop awareness for effective utilization of alternate energy sources.
- 2) Identify different components of solar energy and wind energy devices.
- 3) Identify and analyze biomass plant.
- 4) Understand basic principles of geothermal and tidal energy.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Introduction: Sources of energy in nature – hydro, fossil fuel, solar, wind, tidal, biomass, nuclear, geothermal, renewable and nonrenewable sources. Clean Development Mechanism (CDM), Overview of India's Energy and Power Sector, National Energy Strategy of India, Primary Energy Sources for Power Generation, Electrical Power Sector planning in India, India's Nonconventional, Renewable and Alternate Energy Planning.	3
2	Wind Energy: Availability of wind, Types of wind mills for water pumping and generation of electricity. Power transmission mechanism, Blade design, Rotor design, Tower design, Locking devices and Radar.	2
3	Biomass Energy: Chemistry of biogas generation, biomass gasification, types of digesters, their construction and working, uses and application of biogas. Variables affecting simple gas plants. Use of biogas for diesel engine. Emission norms: emissions from renewable fuels and its effect on environment. Study of environment protection norms.	2
4	4.1 Solar Energy: Availability, limitations, efficiency by first and second law of thermodynamics, Application of solar energy. Energy radiated by Sun.	5

	Angular relationship of Earth and Sun positions, Sun path diagram measurement of solar radiations (on horizontal and tilted surfaces). 4.2 Solar Collectors and Concentrators : Types and constructional details of flat plate collectors, energy balance for flat plate collectors, limitations of flat plate collectors, various types of concentrators, their advantages, energy balance equation, heliostats, selection of materials for collectors and concentrators. 4.3 Application : Solar water and space heating systems, solar stills, construction and selection. Solar timber seasonary plants, solar cold storage and air conditioning, solar cookers with different designs, solar thermal power plant. 4.4 P.V Cell : Types, working principle, performance and rating.	
5	Energy Conservation and Energy Audit: Need of energy conservation, National energy strategies and National energy plans, energy management, energy conservation. Energy audit – types, cost comparison of energy resources and conversions, energy conservation opportunities. Concept of carbon credits.	2
6	6.1 Geothermal and Tidal Energy: Sources and application of Geothermal energy, types of Geothermal energy plants. Tidal energy availability, suitable locations, study of single ebb and double ebb cycle. Tidal power plant. 6.2 Fuel Cells: Types and working, analysis of operations and actual performance.	2
Total		16

Teaching Methodology: Chalk Board, Discussions, PPT, Guest lectures, Transparencies.

Term Work :

Skills to be developed:

i) Intellectual Skills:

- Understand need and importance of alternate energy sources.
- Identify alternate energy sources.
- Selection of site for various non conventional power plants.
- Enhance learning to learn skills.

ii) Motor Skills:

- Preparation of power point presentation / Transperancies.

Assgnments:

Twelve assignments consisting of at least one on each topic are to be completed.

Professional Practices:

1. At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.
2. One visit to a relevant industry.
3. Case study for MSEB domestic bill calculation.

Learning Resources :**A) Books :**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Sukhatme S.P	Solar Energy	Tata McGraw Hill Publications, New Delhi.
2	Garg H.P. and Prakash J.	Solar Energy Fundamentals and Applications	Tata McGraw Hill Publications, New Delhi.
3	Dr.B.B.Parulekar and S.Rao	Energy Technology	Khanna Publishers.
4	G. D. Rai	Alternate Energy Sources	Khanna Publishers.

B) CD/CASSETTES:

CD's developed by Maharashtra Energy Development Agency (M.E.D.A), Yerwada – Pune-06.

C) Web sites for references:

Ministry of Non conventional Energy sources- (www.mnes.nic.in)
Bureau of Energy and Efficiency- (www.bee-india.nic.in)
(www.mahaurja.com)

DIPLOMA PROGRAMME IN : MECHANICAL ENGINEERING

Course : Power Plant Engineering

Course Code : R14ME5204

Course Category : Specialised

Credits : 3

Teaching and Examination Scheme :

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	50	50	100

Rationale :

The consumption of electrical energy per capita is universally accepted as a scale for measuring the living standard of a country. The demand for energy is increasing day by day and existing power generation capacity is inadequate to meet this increasing demand. Industries are expected to generate their own power and supply the excess power to national grid. Alternate energy sources are also harnessed to meet the increasing demand. Diploma engineers should know the layout, components of different power plants and economic aspects of power plants.

Objectives:

The students will be able to

1. Understand present and future power scenario of India.
2. Calculate efficiency of power generation cycles.
3. Understand working of power plants, and its safety parameters.
4. Draw layout, understand the working and compare different power plants.
5. Appreciate economical and operational aspects of power plants.

Course Details :

UNIT	NAME OF THE TOPIC	HOURS
1	INTRODUCTION TO POWER PLANTS 1.1 Power scenario in India, primary energy sources in india and there availability, principle types of power plant, principle power plant in India 1.2 Factors influencing their selection, Cost Structure 1.3 Analysis of thermodynamic cycles- Carnot cycle, Rankine cycle, Reheat cycle, Regenerative cycle	2
2	THERMAL POWER PLANT 2.1 Site selection of steam power plant, General layout of steam power station 2.2 Coal and ash handling system-Equipments for in plant handling of coal such as belt conveyor, bucket elevator, Coal crushing, Pulverized fuel handling system, Ball mill, Bowl mill Pulverized fuel burner, Hydraulic and pneumatic ,Dry and wet ash handling and Disposal of ash, effect of ash, Electrostatic precipitator. Back filters, flue gas conditioning 2.3 Fuels-Types of fuels, weathering of coal, moisture, sulphur & oxygen in coals 2.4 Condensers and cooling water system. Ponds, Spray Tanks, Cooling Towers (For Thermal Power Plant) only.	4

3	GAS TURBINES POWER PLANT 3.1 Introduction and application of Gas Turbine power plant 3.2 Methods of reheating, Advantages and disadvantages of reheat cycle, Regeneration Gas turbine cycle. 3.3 Type of gas Turbine Power Plant General Layout, selection of site 3.4 Gas turbine power plants in India 3.5 Cogeneration Gas power plant in India	3
4	HYDROELECTRIC POWER PLANT 4.1 Introduction and classification of hydroelectric power plant, site selection 4.2 Selection of Hydraulic Turbine. 4.3 Hydroelectric power plant Auxiliary, safety measures in Hydro-station	3
5	NUCLEAR POWER PLANT 5.1 Types of nuclear reactors. Nuclear fuels, coolant & Moderators 5.2 Working of PWR, BWR, CANDU, BREEDER type reactor. Safety, Precautions and waste disposals.	2
6	ECONOMICS OF POWER PLANT 6.1 Estimation and Prediction of load, Load duration curves, 6.2 Cost analysis, different terms like maximum demand, average load, load factor, plant capacity factor, plant use factor 6.3 Factor affecting Economics of generation and Distribution of power plant, Tariffs, coal factor, Heat rate	2
	Total	16

Teaching Methodology : Discussions, Chalk-Board, Charts, Transparencies, PPT, Visits

Term Work :

Skills to be developed:

i) Intellectual Skills :

- Understand concepts of basic cycles related to power plant.
- Interpret steam tables, Mollier chart and relationship between different thermodynamic properties.

ii) Motor Skills:

- Preparation of power point presentation / Transparencies.

Assignments:

Ten assignments, consisting of at least one on each topic, are to be completed.

Professional Practices:

2. At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.
2. One visit to any one power plant.
3. Case study for economics of power generation calculation.

Learning Resources :

Books :

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Arora and Domkundwar	Power Plant Engineering	Dhanpat Rai & co.
2	M. M. El-Wakil	Power Plant Engineering	TATA McGraw-Hill.
3	P K Nag.	Power Plant Engineering	Tata McGraw-Hill
4	G.D.Rai	An Introduction to Power plant engineering,	Khanna Publishers, IIIrd edition, 2001

Web sites for references: www.ntpc.com

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING

Course : Total Quality Management

Course Code: R14ME5208

Course Category: Specialized

Credits : 3

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	--	--	--	--	50	50	100

Rationale:

Indian organizations are facing a challenge from the inflow of MNCs ever since the Government implemented the policies of liberisation, privatization & globalization. In the light of this, there is a dire need of new ideas, approaches and techniques for attaining a competitive edge. The course aims at exposing various aspects of TQM like cost of quality, QC tools, Kaizen, quality circles, team work for quality, customer satisfaction, benchmarking, quality culture, quality standards and quality audit.

Objectives:

The students will be able to

1. Know about detail clauses of ISO 9000:2000 series
2. Know about the TQMEX model, Japanese 5 – S practice, Deming cycle, Juran’s trilogy, Kaizen etc.
3. Understand the concept of six sigma, total waste elimination, incoming material control.
4. Know old as well as new tool for quality improvement.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	ISO 9000 : System, Management system, Quality management system, What is ISO 9000 series of standards? Structure, scope and approach of ISO 9000 (2000) series standards, 8 Quality management principles. ISO 9000:2000, Types of audit, Benefits and stages of Audits. Advantages and disadvantages of ISO 9000. Registration of ISO 9000, Validity of registration, Organizing the documentation. ISO 9001: ISO 9001:2000, Quality management systems – Requirements for quality assurance, Advantages of ISO 9001 (2000) , Reversed ISO 9001:2000 standard characteristic, Comparison of ISO 9001 (2000) and ISO 9001 (1994). Ten tips of moving to ISO 9001 (2000). ISO 14000 & ISO14001, Comparison of ISO14000 and ISO 9000, Why ISO 14001.	3
2	TQM : TQM – Definition, Aim, and guide line principles, salient features. Difference between ISO & TQM. The TQMEX model, Japanese 5-S practice, 5 pillars of TQM, Core concept of TQM- Quality for profit, Right first time. Acceptance Quality Level. Quality Gurus: Philip crossby, A.V. Feignenbaum, Ishikawa,	3

	Shigeo shingo, Deming's 14 point methodology, Juran's quality trilogy. Kaizen : Concept of Kaizen, Kaizen v/s innovation, Kaizen and management process oriented and result oriented management. Company wide quality control (CWQC). Kaizen the practice. Deming cycle- PPCA cycle, PDCA cycle, SDCA cycle, Quality Control Circles. Types of Kaizen- Management, Group and Induction Oriented.	
3	Six Sigma: Introduction, concept, Quality approaches models, Belts in six sigma, six sigma cost and savings, eliminate waste (DMAIC), six sigma in manufacturing and six sigma in service industry. Zero defect programme. Quality Challenge facing Industry, Total Quality & Internationalism, Role of Govt. 9 M's affecting Quality. 4 Jobs of Quality Control. Role of Statistics in QC	2
4	Quality of Product Design and Development: Introduction, quality of design, Product development, FMEA, FMECA. Tools for Quality Improvement : Quality improvement, Methods of quality improvement, Break through sequence, Tally sheet, Graphs, Histograms, stratification, Scatter diagram, Pareto diagram, frequency distribution, flow chart, Brainstorming, 5 W & 1 H. New Q. Tools : Flow diagrams, Flow chart, Cause and effect diagram, Relations diagram, Tree diagram, Matrix flow diagram, Matrix data analysis diagram, Arrow diagram, Applications of new tools.	3
5	Incoming Material Control : Need, Principles of vendor relations in Quality, Pattern for incoming material control routine: - Purchase analysis, Vendor selection & order placement. Material receipt & material examination, material disposal. Vendor relations, Vendor ratings and Vendor quality ratings. Control Charts & Acceptance Sampling : Use of X & R chart, p chart. np Chart, c Chart for Quality Control. Sampling inspection, OC curve and terms in OC curve, uses of OC curve, IS 2500 for selection of sampling plans	2
6	Total waste Elimination: What is waste? Classes of wastages, Sources of waste, Waste identification, Steps of waste elimination, TWE methods. Achieving Total Commitment to Quality : Introduction, Total commitment to quality, Activities for achieving total commitment to quality, Quality education and training for total commitment to quality, Quality mindedness, Participative approaches for total commitment to quality, Other key approaches, Communication, motivation for development of TQM.	3
	Total	16

Teaching Methodology: Discussions, Chalk-Board, Transparencies.

Term Work:

Skills to be developed:

Intellectual Skills :

- Understand TQM Methodolgy.
- Report writing on ISO 9000, ISO 9001.
- Enhance learning to learn skills.

Motor Skills :

- Preparation of power point presentation / Transperancies.

Assignments:

Twelve assignments consisting of at least one on each topic are to be completed

Professional Practices:

At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.

One visit to a relevant industry and student will submit a report of the visit as a part of term work.

Learning Resources:**Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. K. C. Arora	Total Quality Management	S.K. Kataria & Sons Pub., New Delhi.
2	Juran and Gryna	Quality Planning & Analysis	Tata McGraw Hill Publications, New Delhi.
3	Tapan P. Bagchi	ISO 9000	Wheeler Publications.
4	R.K. Jain	Engineering Metrology	Khanna Publications, New Delhi.
5	Poornima M. Charantimath	Total Quality Management	Pearson Education Pub., New Delhi.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**Course : Robotics and Automation****Course Code: R14ME5209****Course Category: Specialised****Credits : 3****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	50	50	100

Rationale:

Computers have become pervasive in all walks of life. Its impact is felt more in the industrial sector. In order to remain competitive in the global economy, use of computers in manufacturing especially in Robotics and automation area needs more emphasis. The course aims at appraising the student about the application of these technologies in the real world.

Objectives:

The students will be able to

1. Understand the importance of Robotics and automation.
2. Understand part programming of robots and their utilities.
3. Write part programming for given component.
4. Know fundamental concepts of FMS & CIM.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Robotics : Robot - definition and concept. Robotics systems, basic components, physical configuration. Basic motions, robot drive systems, scheme of pneumatics and hydraulic power supply and their basic components in the circuits and there, industrial applications.	3
2	2.1 Robot Grippers:- Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper systems including Mechanical, Hydraulic and Pneumatic systems. 2.2 Robotic Sensors:- Characteristics of sensing devices, Classification, Selection and applications of sensors. Types of Sensors, Need for sensors and vision system in the working and control of a robot. 2.3 Introduction to robot programming	3
3	Automation : Definition and concept of automation. Organs of manufacturing organization and breakdown of a part spending its time. New issues for change. Types of arguments for and against automation, types of production, functions of manufacturing, information about processing cycle in typical manufacturing firm. Automation strategies, automated flow lines, methods of work part transport. Transport mechanism. Automation for machining operations. Inspection CMM, CIM industrial applications.	3

4	Flexible Manufacturing Systems (FMS) and Computer Integrated Manufacturing (CIM): Introduction to FMS, benefits of FMS, FMS equipment, tool monitoring systems, FMS process control. CIM implementation, benefits of CIM.	2
5	Automated Material Handling Systems : automatic guided vehicles (AGV), robots, robot applications, basic components of robot , cost of acquisition of a robot, investment and operating costs, automated storage and retrieval system, advantages of AS & RS.	2
6	Group Technology and Flexible Manufacturing System (FMS) : Introduction, concept, definition and need, sub systems of FMS, comparing with other manufacturing approaches. Major elements of FMS such as loading stations, palletizing stations, tool changer; automated guided vehicle (AGV), automated storage and retrieval systems. Typical cell layout. Special attachments, coolant system, computer control system, applications and benefits of FMS.	3
	Total	16

Teaching Methodology : Power Point Presentations (PPT), Guest Lecturers, Visits.

Assignments:

Eight assignments consisting of at least one on each topic are to be completed.

Professional Practices:

At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.

One visit to a relevant industry and student will submit a report of the visit as a part of term work.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Groover M.P. & Zimmers E.W.	Computer Aided Design and Manufacturing	Prentice Hall of India.
2	Ibrahim Zeid	CAD/CAM Theory and Practice	Tata McGraw Hill Publishing Co., New Delhi.
3	Radhakrishna P. & Subramanyam	CAD/CAM/CIM	Wiley Easteen Ltd.
4	Farzdak Haidri	CAD/CAM & Automation	Nirali Prakashan, Pune.
5	Groover	Industrial robotics	Prentice Hall of India.

DIPLOMA PROGRAMME: MECHANICAL ENGINEERING**Course : Plant Engineering****Course Code: R14ME5210****Course Category: Specialised****Credits : 3****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	--	--	--		50	50	100

Rationale:

Course envisages a holistic approach to all auxiliary functions in an industry to keep the plant operational in the most optimal manner. It includes various functions like layout planning, material handling, planning of plant operational facilities, maintenance aspects, safety measures, pollution control aspects and replacement of old equipment.

Objectives:

The students will be able to

1. Appreciate importance of various utilities like water, electricity, steam and air.
2. Understand and select material handling devices.
3. Appreciate various procedures of maintenance and maintenance schedules.
4. Carry out energy audit of the plant.

Course Details:

UNIT	NAME OF THE TOPIC	HOURS
1	Basic Plant Facilities : Building – Types of buildings, ventilation and lighting, roads and parking. Electrical power, distribution, utilization, stand by units. Heating ventilation and air conditioning. Water supply- purification, use and disposal, Rain water harvesting. Sanitation. Planning of auxiliary services such as steam, compressed air, etc.	3
2	Layout of Facilities: Types of layouts- product, process, cellular, concept of flow, types of flow. Group technology aspect, PQ analysis, systematic layout analysis, PQRST analysis, material flow, REL charts, space requirements, Space diagram.	2
3	Material Handling: Planning, principles of material handling, data collection & analysis, various types of material handling equipment, classification, unit load concept, introduction to AGUs.	3

4	Maintenance : Types of maintenance, breakdown, preventive, predictive, scheduled. Introduction to TPM, repair cycle analysis, repair complexity, organization, of maintenance function. Product life cycle concept, space part management, maintenance manuals, history cards, work measurement and incentives for maintenance workers, computerized maintenance and housekeeping. Plant Safety : Introduction to safety, safety against chemical and mechanical hazards, accident prevention practices, fire fighting, pollution and environmental considerations, training in safety, introduction to safety codes.	3
5	Energy Conservation and Audit : Need of energy conservation, National energy strategies and national energy plans, energy management, energy conservation and energy audit – types, cost. Comparison of energy resources and conversions, energy conservation opportunities. Concept of carbon credits. Industrial Waste and Waste Disposal: Waste disposal, effluent water treatment, sewage water treatment, scrap disposal/ recycling, Recycling of biowaste.	3
6	Performance Modelling: Active & passive safety features in automobiles, Introduction to advanced safety aspects such as air bags, collapsible steering, crash bars, etc.	2
Total		16

Teaching Methodology: Chalk Board, Discussions, PPT, Guest lectures, Transparencies.

Term Work :

Skills to be developed:

Intellectual Skills:

- Enhance learning to learn skills.
- Selection of suitable material handling equipment.

Motor Skills:

- Preparation of power point presentation / Transparencies.

Assignments:

Twelve assignments consisting of at least one on each topic are to be completed.

Professional Practices:

3. At least two topics from the syllabus have to be selected by group of students and they are supposed to give seminar / presentation.
2. One visit to a relevant industry.
3. Case study for Energy audit.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Lindley Higgins & Keith Mobley	Maintenance Engineering Handbook	McGraw Hill Publications.
2	Rudenco	Material Handling Handbook	MIR Publications.
3	Garg H.P	Industrial Maintenance	S.Chand and Co. Publications, New Delhi.
4	R.C. Mishra & K. Pathak	Maintenance Engineering & Management	Prentice Hall of India.
5	Robert C. Rosaler	Standard Handbook of Plant Engineering	McGraw Hill Publications, New York.