RADHA GOVIND UNIVERSITY
RAMGARH, JHARKHAND

Department of Mechanical Engineering

Under Faculty of Engineering and Technology

Choice Based Credit System Curriculum for Diploma in Mechanical Engineering

(Effective from Academic Session 2025-26)

Scheme of Teaching and Examination for

1st Semester of 3 Years Diploma in Engineering (All Branches except Non Tech)

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Communication Skill – I	101	Theory	3	-	-	3	100	80	20	26	40
2.	Engineering Math – I	102	Theory	3	1	-	3	100	80	20	26	40
3.	Engineering Physics - I	103	Theory	3	-	-	3	100	80	20	26	40
4.	Engineering Chemistry – I	104	Theory	3	-	-	3	100	80	20	26	40
5.	Engineering Graphics – I Th	105	Theory	2	-	-	4	50	40	10	13	20
6.	Fundamental of Computer	106	Theory	2	-	-	3	50	40	10	13	20
7.	Engineering Physics Lab – I	107	Practical	-	-	2	4	50	40	10	13	20
8.	Engineering Chemistry Lab- I	108	Practical	-	-	2	4	50	40	10	13	20
9	Engineering Graphics – I SS	109	Sessional	-	-	4	-	50	30	20	-	25
10	Communication Skill I	110	Sessional	-	-	2	-	50	30	20	-	25
11.	Fundamental of Computer - I	111	Sessional	-	-	2	-	50	30	20	-	25
12.	Workshop - I	112	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**16**	**1**	**16**						

Total Marks : Theory : Practical : Sessional :
L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

29/3/25

Scheme of Teaching and Examination for

2nd Semester of 3 Years Diploma in Engineering (All Branches except Non Tech)

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Communication Skill – II	201	Theory	3	-	-	3	100	80	20	26	40
2.	Engineering Math – II	202	Theory	3	1	-	3	100	80	20	26	40
3.	Engineering Physics - II	203	Theory	3	-	-	3	100	80	20	26	40
4.	Engineering Chemistry - II	204	Theory	3	-	-	3	100	80	20	26	40
5.	Programming in C	205	Theory	3	-	-	3	100	80	20	26	40
6.	Engineering Physics II	206	Practical	-	-	2	3	50	40	10	13	20
7.	Engineering Chemistry II	207	Practical	-	-	2	3	50	40	10	13	20
8.	Programming in C	208	Sessional	-	-	4	3	50	30	20	-	25
9.	Workshop Practices	209	Sessional	-	-	4	4	100	60	40	-	50
10.	Professional Practice I	210	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**	**1**	**16**						

Total Marks : Theory : Practical : Sessional :

L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester

29/3/25

Scheme of Teaching and Examination for

3rd Semester of 3 Years Diploma in Mechanical Engineering

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Engineering Math – III	301	Theory	4		-	3	100	80	20	26	40
2.	Machine Drawing	MEC303	Theory	3	-	-	3	100	80	20	26	40
3.	Engineering Materials	MEC304	Theory	3	-	-	3	100	80	20	26	40
4.	Engineering Mechanics	MEC305	Theory	3	-	-	3	100	80	20	26	40
5.	Strength of Materials	MEC306	Theory	3	-	-	3	100	80	20	26	40
6.	Machine Drawing Lab	MEC307	Sessional	-	-	4	-	100	60	40	-	50
7.	Engineering Mechanics Lab	MEC308	Practical	-	-	2	4	50	40	10	-	20
8.	Strength of Materials Lab	MEC309	Practical	-	-	4	4	100	80	20	-	40
9.	DLS	302	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**16**		**14**						

Total Marks : Theory : Practical : Sessional :
L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Sumit. Nishma Rupak 7/3/24

Scheme of Teaching and Examination for

4th Semester of 3 Years Diploma in Mechanical Engineering

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Manufacturing Technology	MEC402	Theory	3	-	-	3	100	80	20	26	40
2.	Fluid Mechanics & Machine	MEC403	Theory	3	-	-	3	100	80	20	26	40
3.	Thermal Engineering	MEC404	Theory	3	-	-	3	100	80	20	26	40
4.	Theory of Machine	MEC405	Theory	3	-	-	3	100	80	20	26	40
5.	Electrical Engineering	MEC406	Theory	3	-	-	3	100	80	20	26	40
6.	Manufacturing Tech Lab	MEC407	Practical	-	-	2	4	50	40	10	-	20
7.	Fluid Mechanics & Machine Lab	MEC408	Practical	-	-	2	4	50	40	10	-	20
8.	Theory of Machine Lab	MEC409	Practical	-	-	2	4	50	40	10	-	20
9.	Thermal Engineering Lab	MEC410	Practical	-		2	4	50	40	10		20
10.	Electrical Engineering Lab	MEC411	Practical	-	-	2	4	50	40	10	-	20
11	Professional Practice II	401	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**14**						

Total Marks : Theory : Practical : Sessional :
L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

29/3/25

Scheme of Teaching and Examination for

5 th Semester of 3 Years Diploma in Mechanical Engineering

Duration of Semester : 14
Weeks Student Contact Hours : 36 Hrs
Total Marks : 800

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Power Engineering	MEC 503	Theory	3	-	-	3	100	80	20	26	40
2.	Adv. Manufacturing Technology	MEC 504	Theory	3	-	-	3	100	80	20	26	40
3.	Metrology & Quality Control	MEC 505	Theory	3	-	-	3	100	80	20	26	40
4.	Electronics Engineering	MEC 506	Theory	3	-	-	3	100	80	20	26	40
5.	Elective I	MEC 507/508/509/510	Theory	3	-	-	3	100	80	20	26	40
6.	Power Engineering Lab	MEC 511	Practical	-	-	2	4	50	40	10	-	20
7.	Adv. Manufacturing Tech. Lab	MEC 512	Practical	-	-	2	4	50	40	10	-	20
8.	Metrology & Quality Control Lab	MEC 513	Sessional	-	-	2	-	25	15	10	-	13
9.	Electronics Engineering Lab	MEC 514	Sessional	-	-	2	-	25	15	10	-	13
10.	Elective-I Lab	MEC 515/516/517/518	Sessional	-	-	2	-	50	30	20	-	25
11.	In Plant Training	502	sessional	-	-	-	-	50	30	20	-	25
12.	DLS	501	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**14**						

Elective I (Power Plant Engineering – MEC 507/ Automobile Engineering –MEC 508/ CAD/CAM & Robotics – MEC 509/ Installation & Maintenance MEC510)

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Cantered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.
6. In plant Training of 04 weeks duration to be undertaken after 4th semester Exam and before start of 5th semester classes.

Scheme of Teaching and Examination for

6th Semester of 3 Years Diploma in Mechanical Engineering

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs (Max.)**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Industrial Engineering & Management	601	Theory	3	-	-	3	100	80	20	26	40
2.	Design of Machine Elements	MEC 604	Theory	3		-	3	100	80	20	26	40
3.	Industrial Fluid Power	MEC 605	Theory	3	-	-	3	100	80	20	26	40
4.	Measurements & Automation	MEC 606	Theory	3	-	-	3	100	80	20	26	40
5.	Elective II	MEC 607/608/609/610	Theory	3	-	-	3	100	80	20	26	40
6.	Industrial Fluid Power Lab	MEC 611	Practical	-	-	2	4	50	40	10	-	20
7.	Measurements & Automation Lab	MEC 612	Practical	-	-	2	4	50	40	10	-	20
8.	Design of Machine Elements Lab	MEC 613	Sesssional	-	-	2	-	50	30	20	-	25
9.	Elective II Lab	MEC 614/615/616/617	Sessional	-	-	2	-	50	30	20	-	25
10.	Project Work	603	Sessional	-	-	4	-	50	30	20	-	25
11.	Professional Practices	602	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**		**16**						

Elective (Mechatronics – MEC 607/ Ref. & Air Conditioning -MEC 608/ Machine Tool Design.-MEC 609/ Alt. Source of Energy- MEC 610)

Total Marks : Theory : Practical : Sessional :

L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Course Name : 03 Years Diploma in Engineering

Semester : First

Subject Title : Communication skills-I

Subject Code : 101

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	1		100	80	20	26	40	3 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

The comprehensive knowledge of communication and communication skill is essential for role of technicians in industry. Diploma pass outs are key persons between workforce and management and they need to be most effective in communication skills. The communication often includes grammar of the language in practice which is these days English. The inhouse practice before the faculty as part of scheme will develop the abilities in students a practical aspect of effective communication. Further exercises have been included for improving oral communication. Practical exposure gives a comprehensive communication skill effectiveness.

OBJECTIVES:

1. Comprehend the given passage
2. Answer correctly the questions on seen and unseen passages
3. Increase the vocabulary
4. Apply rules of grammar for correct writing

CONTENTS: Theory

Name of Topic	Hours	Marks
PART : 1 TEXT • Comprehension- Responding to Questions from text (Spectrum) • Vocabulary-Understanding meaning of new word from text. • Identifying part of Speech from text.	10	18

PART-II : Application of Grammar • Verbs • Tense • Do as directed (active/passive, Direct/Indirect, affirmative/negative/assertive/interrogative, question tag, remove too, use of article, preposition, conjunction, punctuation) • Correct the errors from the sentences.	10	18
PART-III : Paragraph Writing • Types of Paragraph (Narrative, Descriptive, Technical) • Unseen passage for Comprehension.	04	8
PART-IV : Vocabulary Building. • Synonyms • Antonyms • Homophones • Use of Contextual word in a given Paragraph	06	12
PART-V : Soft Skill Development • Speaking Skill • Introduction to Group Discussion • Process of Group Discussion • Leadership skill • Instant public speaking	08	16
PART-VI Etiquettes &Body Language • Telephone etiquettes listening/speaking • Problems of telephonic Conversation • Verbal/ oral etiquettes • Physical appearance • Eye Contact/Body Language • Group Discussion	4	8
Total	42	80

List of Assignment :

1. **Building of Vocabulary**
   25 words from the glossary given at the end of each chapter, to be used to make sentences.
2. **Applied Grammar**
   Identify the various parts of speech and insert correct parts of speech in the sentences given by the teachers.
3. **Punctuation**
   Punctuation 20 sentences given by the teachers.
4. **Tenses**
   List 12 tenses and give two examples for each tense.
5. **Dialogue Writing**
   Write at least two dialogues on different situations. (Conversation between two friends, conversation between two politicians etc.)
6. **Identifying the Error**
   Identify the error in the sentences given by the teachers. (20 Sentences)
7. **Idioms and Phrases**
   Use of Idioms and Phrases in sentences. (20 Examples)
8. **Biography**
   Write a short biography on your favorite role model approximately. (250-300 words with pictures)

ACTIVITIES TO BE CONDUCTED DURING PRACTICALS

01. Student should perform role-plays on the situations given by the teachers. (04 Hours)
02. (e.g. V. Sasikumar & Dhamija 2nd edition (04 Hrs) or Linuga Phon L-21 Multimedia (Desirable)

Learning Resources :
Reference Books :

Sl. No.	Title	Author	Publisher
01.	Spectrum-A Text Book on English	--------	SBTE, Maharastra
02.	Contemporary English Grammar structures and composition	David Green	Macmillan

03.	English for practical Purpose	Z.N. Patil et el	Macmillan
04.	English Grammar and composition	R.C.Jain	Macmillan
05	Grammer & Composition	Nesfield	
06	Technical English		Longman
07	English Workplace	Editor- Mukti Sanyal	Macmillan
08	Thesaurus	Rodgers	Macmillan
09	Dictionary	Oxford	Oxford University
10	Dictionary	Longman	Oriental Longman

Web Sites for Reference :

Serial No.	Website Address
01	www. edufind.com
02	www.english_the _the_easy_eay.com
03	www.englishclub.com
04	www.english_grammar_lessons.com
05	www.wikipedia.org/wiki/english_grammar

Course Name : 03 Years Diploma in Engineering

Semester : First

Subject Title : Engineering Chemistry-I

Subject Code : 104 / 108

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03			100	80	20	26	40	3 Hrs
Practical		2	50	40	10	13	20	4 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

Chemistry is a basic science subject which is essential to all engineering courses. It gives knowledge of engineering materials, their properties, related applications & selection of materials for engineering applications.

Due to technological progress there are hazardous effects on environment & human life. The core knowledge of environmental effects will bring awareness in students about the precautions & preventions to be taken to reduce the ill effects.

This subject will generate curiosity of carrying out further development in engineering fields.

OBJECTIVES: The student will be able to:

1. Draw the orbital configuration of different elements.
2. Represent the formation of molecules schematically.
3. Describe the mechanism of electrolysis.
4. Identify the properties of metals & alloys related to engineering applications.
5. Identify the properties of non metallic materials, related to engineering applications.
6. Compare the effects of pollutants on environments & to suggest preventive measures & safety.

Content: Theory

Chapter No.	Name of the Topic	Hours	Marks
01	**Atomic Structure** Definition of Atom, Fundamental Particles of Atom – their Mass, Charge, Location, Definition of Atomic no, Atomic Mass no., Isotopes & Isobars, & their distinction with suitable examples, Bohr's Theory, Definition, Shape of the orbitals & distinction between Orbits & Orbitals, Hund's Rule, Aufbau's Principle (till Atomic no. 30), Definition & types of valency (Electrovalency & Covalency), Octet Rule, Duplet Rule, Formation of Electrovalent & Covalent Compounds e.g. Nacl, $CaCl_2$, MgO, $AlCl_3$, CO_2, H_2O, Cl_2, NH_3, C_2H_4, N_2, C_2H_2. Distinction between electrovalent & covalent compounds.	06	12
02	**Electrochemistry** Electrolytic dissociation, Arrhenius Theory of Ionisation, Degree of Ionisation & factors affecting degree of ionization. Significance of the terms involved in Electrolysis- Such as Conductors, Insulators , Dielectrics, Electrolyte, Non Electrolyte, Electrolysis, Electrolytic Cell, Electrodes. Mechanism of Electrolysis. Concept of electrode potential such as reduction potential & oxidation potential. Electrochemical Series, Electrolysis of $CuSO_4$ Solution by using Cu Electrode & Platinum Electrode, Electrolysis of NaCl solution & fused NaCl by using carbon electrode, Faraday's first & second law of Electrolysis & Numericals, Electrochemical Cells & Batteries, Definition, types such as Primary & Secondary Cells & their examples. Construction, Working & Applications of Dry Cell & Lead – Acid Storage Cell, Applications of Electrolysis such as Electroplating & Electro refining, Electrometallurgy & Electrotyping	08	16
03	**Metals & Alloys** **3.1 Metals (Marks:10)** Occurrence of Metals, Definition of Metallurgy, Mineral, Ore, Gangue, Flux & Slag, Mechanical Properties of metals such as Hardness, Toughness, Ductility, Malleability, Tensile strength, Machinability, Weldability, Forging, Soldering, Castability. Stages of Extraction of Metals from its Ores in detail i.e. Crushing, Concentration, Reduction, Refining. Physical Properties & Applications of some commonly used metals such as Fe, Cu, Al, Cr, Ni, Sn, Pb, Zn, Co, Ag, W. **3.2 Alloys (Marks: 08)** Definition of Alloy, Purposes of Making alloy. Preparation Methods, Classification of Alloys such as Ferrous & Non Ferrous & their examples. Composition, Properties & Applications of Alnico, Duralumin, Dutch Metal, German Silver / Nickel Silver, Gun Metal, Monel metal, Wood's Metal, Babbit metal.	10	18

04	**Non Metallic Materials** **4.1 Plastics (Marks: 04)** Definition of Plastic, Formation of Plastic by Addition & Condensation Polymerisation by giving e.g. of Polyethylene & Backelite plastic Respectively, Types of Plastic, Thermosoftening & Thermosetting Plastic, with Definition, Distinction & Compounding of Plastics – Resins, Fillers, Plasticizers, Acceleraters, Pigments & their examples, Engineering Applications of Plastic based on their properties. **4.2 Rubber (Marks: 04)** Natural Rubber: Its Processing, Drawbacks of Natural Rubber, Vulcanisation of Rubber with Chemical Reaction. Synthetic Rubber: Definition, Distinction Between natural & synthetic rubber. Properties of rubber such as elasticity, abrasion resistant, stress & strain and related engg. application. **4.3 Thermal Insulating Materials (Marks: 04)** Definition & types. Characteristics of insulators. Thermal insulators. Properties & Applications of glasswool, Asbestos, Cork.	06	12
05	**Environmental Effects (Awareness Level)** **5.1 Pollution & Air pollution (Marks 10)** Definition of pollution & pollutant, Causes of Pollution, Types of Pollution - Air & Water Pollution. **Air Pollution** Definition, Types of Air pollutants their Sources & Effects, Such as Gases, Particulates, , Radio Active Gases, Control of Air Pollution, Air Pollution due to Internal Combustion Engine & Its Control Methods, Deforestation their effects & control measures. Causes , Effects & control measures of Ozone Depletion & Green House Effects. **5.2 Water Pollution & Wastes (Marks 12)** Definition, Causes & Methods of Preventing Water Pollution, Types of Waste such as Domestic Waste, Industrial Waste, their Physical & Biological Characteristics, Concept & significance of BOD, COD, Biomedical Waste & E – Waste, their Origin, Effects & Control Measures. Preventive Environmental Management (PEM) Activities.	12	22
	Total	**42**	**80**

Practical:

Intellectual Skills: 1. Analyse given solution
2. Interpret the results

Motor Skills : 1. Observe Chemical Reactions
2. Measure the quantities Accurately
3. Handle the apparatus carefully

List of Experiments:

01 – 07 Qualitative Analysis of **four salts ,** Containing One Basic & One Acidic Radical Listed below

Basic Radicals:

Pb^{+2}, Cu^{+2}, Al^{+3}, Fe^{+2}, Fe^{+3}, Cr^{+3}, Zn^{+2}, Ni^{+2}, Ca^{+2}, Ba^{+2}, Mg^{+2}, K^{+}, NH_4^{+}.

Acidic Radicals:

Cl^{-}, Br^{-}, I^{-}, CO_3^{-2}, SO_4^{-2}, NO_3^{-}.

05 To Determine E.C.E. of Cu by Using $CuSO_4$ Solution & Copper Electrode

06 To standardize KMnO4 using Sodium oxalate.

07 To determine percentage of Fe in the given mohr's salt.

08 To Prepare a chart to showing application of metals like Fe, Cu, Al, Cr, Ni, Sn, Pb, Co.

09 To determine Carbon Monooxide, CO_2 content emission from petrol vehicle

10 To Determine Dissolved Oxygen in a Water Sample.

Learning Resources:

Reference Books:

Sr. No.	Author	Name of the book	Publisher
01	Jain & Jain	Engineering Chemistry	Dhanpat Rai and Sons
02	S. S. Dara	Engineering Chemistry	S. Chand Publication
03	B. K. Sharma	Industrial Chemistry	Goel Publication
04	S. S. Dara	Environmental Chemistry & Pollution Control	S. Chand Publication
05	Vedprakash Mehta	Polytechnic Chemistry	Jain brothers
06	Uppal	Engineering Chemistry	

Course Name : 03 Years Diploma in Engineering

Semester : First

Subject Title : Engineering Graphics-I

Subject Code : 105

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
02	0	4	50+50	40+30	10+20	13 TH	20+25	4 Hrs (TH)

NOTE:

Internal marks for theory will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

Normally Graphical representation are used for expressing intents and contents. Engineering Graphics is the language of engineers. The concepts of Engineering Graphics are used to develop, express the ideas, and conveying the instructions which are used to carry out jobs in the field Engineering. The course illustrates the techniques of graphics in actual practice. This preliminary course aims at building a foundation for the further course in drawing and other allied subjects.

OBJECTIVES:

The student should be able to:-

1) Draw different engineering curves and know their applications.
2) Draw orthographic projections of different objects.
3) Visualize three dimensional objects and draw Isometric Projections.
4) Use the techniques and able to interpret the drawing in Engineering field.
5) Use computer aided drafting packages.

Chapter	Name of Topic		No. of Sheet	No. of Hr.	
				Theory	Practical
01.	1.1- 1.2- 1.3-	Drawing Instruments and sheet layout Letters and Numbers as per BIS: SP46-2003 Scale (Plane and diagonal scale)	02	01	04

02	2.1- 2.2- 2.3-	Curves and Conic Section To draw ellipse by directrix and arc of circle method To draw parabola by directrix and rectangle method To draw hyperbola by rectangle and directrix method.	01	02	04
03	3.1- 3.2-	Introduction to orthographic projection. Projection of point on principal, auxiliary and profile planes. Idea of shortest distance.	01	01	04
04	4.1- 4.2- 4.3-	Projection of straight line on principal plane in the following cases. Parallel to both H.P and V.P Inclined to one plane and parallel to other plane. Inclined to both plane.	01	02	04
05	5.1-	Projection of different simple shapes eg. Circle, Triangle, Rectangle, Pentagon, & Hexagon on principal plane (Inclined to one plane and to both planes)	01	02	04
06	6.1-	Projection of simple solid. Projection of Prism, Pyramid, Cone, Cylinder, and Cube with their axis inclined to one reference plane and parallel to other.	01	02	04
07	7.1- 7.2-	Section of simple solids with true shape of sectioned portion. Development of solid surfaces eg. Prism, Cylinder, Cone, Pyramid and Cubes.	01	02	04
08	8.1-	Isometric Scale and their use in drawing isometric views of single and compound solids. (Simple case only)	01	02	04
09	9.1-	Intersection of solids. Curves of intersection of the surfaces of the solids in the following case; a. Prism with Prism b. Cylinder with cylinder c. Prism with cylinder d. Cylinder with cone with different axis.	01	02	04

10	10.1-	Prospective Projection	01	02	04
11	11.1-	AutoCAD Basics, Layers, multi-layer images, graphic interfaces, different views to be drawn.	03	10	16
		Total-	**14**	**28**	**56**

Learning Resources:

a. Book-

Sl. No.	Author	Title	Publication
1.	N.D.Bhatt	Engineering Drawing	Charotkar Publishing House
2.	R.K.Dhawan	Engineering Drawing	S.Chand Co.
3.	K.R.Mohan	Engineering Graphics	Dhanpat Rai & Publication Co.
4.	P.J.Shah	Engineering Drawing	----
5.	P.S.Gill	Engineering Drawing	----
6.		Mastering AutoCAD	BPB Publication

Course Name : 03 Years Diploma in Engineering

Semester : First

Subject Title : Engineering Mathematics-1

Subject Code : 102

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	01		100	80	20	26	40	3 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

Mathematics provides foundation for all engineering subjects. Deep thought is given while selecting topics of this subject known as “Engineering Mathematics” which intends to teach students basic facts, concepts and principles of mathematics as a tool to analyze engineering problems. It lays down the foundation for understanding core engineering and technology subjects.

OBJECTIVE:

This subject helps the students to develop logical thinking, which is useful in comprehending the principles of all other subjects. Analytical and systematic approach towards any problem is developed through learning of this subject. Mathematics being a versatile subject can be used as a tool at every stage of human life.

Sub Objective:

This subject is divided into four units 1) Algebra, 2) Trigonometry, 3) Coordinate Geometry and 4) Vector. Upon completion of these Units the student shall be able to:

1.1 Use Logarithms in engineering calculations
1.2 Resolve Rational Fraction into sum of Partial Fractions in engineering problems
1.3 Use Matrices for solving engineering problems
1.4 Understand the concept of Binomial Expansion and use of Permutation & Combination

2.1 Solve simple problems on Compound Angles
2.2 Solve problems using the formulae for Multiple and Sub- multiple Angles
2.3 Apply Transformations for solving the problems in Trigonometry
2.4 Use Inverse Trigonometric Functions for solving engineering problems
2.5 Understand Properties of triangles

3.1 Appreciate the concept of position of any point in a plane or in space
3.2 Distance between two points and its application in solving engineering problems
3.3 Solve the problems on straight line
3.4 Solve the problems on Circles

4.1 Appreciate the concept of a new type of physical quantity called Vector
4.2 Algebra of Vectors
4.3 Solve engineering problems like work done, moment of force about a point as well as about a line.

Chaper no	NAME OF TOPICS	Hours	Marks
	ALGEBRA		
1	**1.1 Prerequisites Revision of** ▪ Arithmetic, Geometric and Harmonic Progressions, ▪ Formula of nth term and sum to n-terms of A.P. and G.P. ▪ Expression of $\sum n$, $\sum n^2$ and $\sum n^3$. ▪ Quadratic equations with real coefficients and relation between their roots & coefficient	01	01
	1.2 Logarithms: ▪ Definition of logarithm (Natural and Common logarithm.) ▪ Laws of logarithm ▪ Examples based on 1.2.1 to 1.2.2	03	04
	1.3 PARTIAL FRACTION ▪ Definition of Polynomial Fraction Proper & Improper Fractions and definition of Partial fractions. ▪ To Resolve proper fraction into partial fraction with denominator containing non repeated linear factors, repeated linear factors and irreducible non repeated quadratic factors. ▪ To resolve improper fraction into partial fraction.	03	06

	.4 DETERMINANT AND MATRICES. **Determinant ---------- 4 Marks** ▪ Definition and expansion of determinants of order 2 and 3. ▪ Cramer's rule to solve simultaneous equations for 2 and 3 unknowns. **Matrices---------- 12Marks** ▪ Definition of a matrix of order m X n and types of Matrices with examples. ▪ Algebra of matrices such as equality, addition, subtraction, scalar multiplication and multiplication of two matrices. ▪ Transpose of a matrix. ▪ Minor, Cofactor of an element of a matrix, adjoint of matrix and Inverse of matrix by Adjoint method. ▪ Solution of simultaneous equations containing 2 and 3 unknowns by matrix inversion method. ▪ Idea of Rank of Matrix and their calculation	08	16
	1.5 BINOMIAL THEOREM ▪ Definition of factorial notation, definition of permutation and combinations with formula (without proof). ▪ Derivation of simple identities and solution based on it ▪ Binomial theorem for positive index. ▪ General term, Middle term, independent term and coefficient of x^n ▪ Binomial theorem for negative index (only idea). ▪ Approximate value (only formula)	02	04
2	TRIGONOMETRY		
	2.1 REVISION ▪ Measurement of an angle (degree and radian). Relation between degree and radian. ▪ Trigonometrical ratios of 0^0, 30^0, 45^0, 60^0, 90^0, $90^0 \pm \theta$, $180^0 \pm \theta$ and $360^0 \pm \theta$ ▪ Fundamental identities.	01	01
	2.2 TRIGONOMETRIC RATIOS OF ALLIED, COMPOUND, MULTIPLE & SUBMULTIPLE ANGLES Questions based on numerical computations.	03	06
	2.3 Transformation formula of Product into sums or difference and vice versa, simple problems based on it	03	06
	2.4 INVERSE TRIGONOMETRIC RATIOS ▪ Definition of inverse trigonometric, ratios, Principal values of	02	04

	inverse trigonometric ratios. ▪ Relation between inverse trigonometric ratios.		
	2.5 PROPERTIES OF TRIANGLE Sine, Cosine, Projection and tangent rules (without proof). Simple problems.	02	04
03	COORDINATE DISTANCES		
	3.1 POINT AND DISTANCES ▪ Distance formula, Section formula, midpoint, centroid of triangle. ▪ Area of triangle and condition of collinearity.	**2**	**04**
	3.2 STRAIGHT LINE ▪ Slope and intercept of straight line. ▪ Equation of straight line in slope point form, slope-intercept form, two-point form, two-intercept form, normal form. General equation of line ▪ Angle between two straight lines condition of parallel and perpendicular lines. ▪ Intersection of two lines. ▪ Length of perpendicular from a point on the line and perpendicular distance between parallel lines.	**05**	**10**
	3.3 CIRCLE ▪ Equation of circle in standard form, centre – radius formula and diameter formula. ▪ General equation of circle, its centre and radius, simple problem	**02**	**04**
	VECTOR ALGEBRA		
	4 VECTORS ▪ Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) ▪ Dot (Scalar) product with properties. ▪ Vector (Cross) product with properties.	03	06
	4.4 Applications 4.4.1 Work done and moment of force/s about a point & line	**02**	04
	TOTAL:	42	80

LEARNING RESOURCES:

Sr. No.	Title	Authors	Publications
1	Mathematics: A Textbook for Class XI Part I &II	National Council of Educational Research and Training	
2	Mathematics: A Textbook for Class XII Part I &II	National Council of Educational Research and Training	
3	Mathematics for Class XI Volume I and II	R. D. Sharma	Dhanpat Rai Publication, New Delhi.
4	Mathematics for Class XII Volume I and II	R. D. Sharma	Dhanpat Rai Publication, New Delhi.
5	Co ordinate Geometry	S. L. Loney	S. Chand Publication
6	Trigonometry	S. L. Loney	S. Chand Publication
7	Higher Algebra	H. S. Hall & S. R. Knight	Metric edition, Book Palace, New Delhi
8	Higher Sr. Secondary School Mathematics for XI & XII	R.S. Agrawal	Bharti Bhawan, Patna
9	Vector Algebra	L Prasad	Bharti Bhawan, Patna

Note:

In board examination, question setter may be advised to select 20% questions of objective, 30% of short type and remaining 50% of long type based on basic concepts, formula and calculations respectively.

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Course Name : 03 Years Diploma in Engineering

Semester : First

Subject Title : Engineering Physics-I

Subject Code : 103/ 107

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	1		100	80	20	26	40	3 Hrs
Practical		2	50	40	10	13	20	4 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

Basic science forms the foundation of Engineering. In particular Physics provides fundamental facts, principles, laws, and proper sequence of events to streamline Engineering knowledge.

OBJECTIVES:

Student will be able to:

- Measure given dimensions by using appropriate instruments accurately.
- Select proper measuring instrument on the basis of range, least count & precision required for measurement.
- Differentiate kinetic and kinematics and solve the problems on kinematics and kinetics.
- Use principles of illumination for enhancing work efficiency.
- Analyze variation of sound intensity with respect to distance.
- Identify different factors affecting acoustical planning of buildings.
- Select proper material for intended purpose by studying properties of materials.
- Identify good & bad conductors of heat.
- Identify, analyze, discriminate and interpret logical sequence of field problems with the study of physics.

CONTENTS: Theory

CHAPTER	CONTENT	HOURS	MARKS
1.	**UNITS AND MEASUREMENTS** **1.1** Need of measurement and unit in engineering and science, definition of unit , requirements of standard unit, systems of units-CGS,MKS and SI, fundamental and derived quantities and their units **1.2** Definition of dimensions with examples, principle of homogeneity of dimensions, limitations of dimensions. **1.3** Definition of accuracy, precision and error, estimation of errors – absolute error, relative error and percentage error, rules and identification of significant figures. **(Numericals on percentage error and significant figures)**	**04**	**06**
2	**MECHANICS** **2.1 Motion along a straight line and Force** Concept of scalar and vector quantities, Equations of motion with constant acceleration (derivation not required), Equations of motion of falling body under gravity, Newton's laws of motion, Force, inertia, Action and reaction, tension, , momentum, impulse and impulsive force with practical examples (basic Idea), Conservation of linear momentum, **(Simple problems on linear motion)**	**04**	**10**
	2.2Angular Motion Definition of angular displacement, angular velocity and angular acceleration, relation between linear velocity and angular velocity, definition of simple harmonic motion (SHM), SHM as a projection of uniform circular motion on any diameter, equation of SHM, derivation of displacement, velocity and acceleration of a body executing SHM.	**05**	**08**
3	**GRAVITATION** Newton's laws of gravitation,Newton's gravitational constant (G) and its SI unit, Acceleration due to gravity (g) and its relation with "G",Variation of g with altitude and latitude(deduction not required) **(Simple problems)**	**03**	**06**
4.	**WORK , ENERGY & POWER** Definition of work, energy and power, equations for P.E. & K.E., Work-Energy principle, Representation of work by using graph, work done by a torque (no derivation) **(Numericals on work, potential and kinetic energy)**	**02**	**06**

5.	**GENERAL PROPERTIES OF MATTER** **5.1 Elasticity** Deforming force, restoring force, elastic and plastic body, stress and strain with their types. elastic limit, Hooke's law, Young's modulus, bulk modulus, modulus of rigidity and relation between them (no derivation). **(Numerical on stress, strain and Young's modulus)**	**04**	**08**
	5.2 Surface Tension. Molecular force, cohesive and adhesive force, Molecular range , sphere of influence, Laplace's molecular theory, Definition of surface tension and its S.I. unit, angle of contact, capillary action with examples, shape of meniscus for water and mercury, relation between surface tension , capillary rise and radius of capillary (no derivation),effect of impurity and temperature on surface tension **(Numerical on relation between surface tension, capillary rise and radius)**	**04**	**08**
	5.3 Viscosity Definition of viscosity, viscous force, velocity gradient, Newton's law of viscosity, coefficient of viscosity and its S.I. unit, streamline and turbulent flow with examples, critical velocity, Reynolds's number and its significance, derivation of viscous force for free fall of spherical body through viscous medium, upthrust, terminal velocity, Stoke's law (statement and formula). **(Numerical on coefficient of viscosity, Reynolds number and Stoke's formula)**	**04**	**08**
CHAPTER	**CONTENT**	**HOURS**	**MARKS**
6	**HEAT** **Transmission of heat and expansion of solids:** Three modes of transmission of heat -conduction, convection and radiation, good and bad conductor of heat with examples, law of thermal conductivity, coefficient of thermal conductivity and its S.I. unit, Definition of linear, aerial and cubical expansion and relation between them. (no derivation) (Numericals on law of thermal conductivity, and coefficients of expansions)	**04**	**08**
7	**ACOUSTICS** **7.1 Sound** Definition of wave motion, amplitude, period, frequency, and wavelength, relation between velocity, frequency and wavelength , longitudinal and transverse wave, definition of stationary wave , node and antinode, forced and free vibrations, definition of resonance with examples, derivation of formula for velocity of sound with end correction. **(Numericals on relation $v = n\lambda$ and resonance)**	**04**	**06**

	7.2 Acoustics of Building Acoustics-concept and definition, Intensity and loudness of sound, echo, Reverberation standard reverberation time, Sabine's formula, Conditions for good acoustics, Factors affecting Acoustical planning of auditorium. **(Numericals on Sabine's formula)**	**04**	**06**
	TOTAL	**42**	**80**

Practical:

Skills to be developed

1) **Intellectual skills-**

Proper selection of measuring instruments on the basis of range, least count, precision and accuracy required for measurement.

Analyze properties of matter & their use for the selection of material.

To verify the principles, laws, using given instruments under different conditions.

To read and interpret the graph.

To interpret the results from observations and calculations.

To use these results for parallel problems.

2) **Motor skills-**

Proper handling of instruments.

Measuring physical quantities accurately.

To observe the phenomenon and to list the observations in proper tabular form.

To adopt proper procedure while performing the experiment.

To plot the graphs.

List of Experiments:

1. To know your Physics Laboratory.
2. To use Vernier Callipers for the measurement of dimensions of given object.
3. To use Micrometer Screw Gauge for the measurement of dimensions (Length, Thickness, Diameter) of given object.
4. To use spherometer for the measurement of thickness of a given glass piece.
5. To calculate Young's modulus of elasticity of steel wire by Vernier method
6. To study capillary phenomenon and to verify that the height of liquid in capillary is inversely proportional to the radius of capillary
7. To determine coefficient of viscosity of given liquid using Stoke's Method
8. To calculate the Linear Thermal coefficient of expansion for copper by using Pullinger's apparatus.
9. To determine refractive index of a glass using glass slab by pin method. ($\sin i/\sin r=\mu$).
10. To determine the velocity of sound by using resonance tube.

Reference Books:

Sr. No.	Name of book	Author	Publisher & Address
1.	Physics-I	V. Rajendran	Tata McGraw- Hill raw- Hill publication, New Delhi
2.	Applied physics	Arthur Beiser	Tata McGraw- Hill raw- Hill Publication, New Delhi
3.	Engineering Physics	by R.K.Gaur and S.L.Gupta	Dhanpat Rai Publication, New Delhi.
4.	Fundamentals of Physics	Resnick ,Halliday & Walker	Wiley India Pvt. Ltd.
5.	Core Physics-I	A. Kumar	Bharti Bhavan
6.	Pradeep's Fundamental Physics-XI	K.L. Gomber & K.L Gogia	Pradeep Publication
7.	S. Chand's Principles of Physics-XI	V.K Mehta & Rohit Mehta	S. Chand Publication
8.	Dinesh New Millennium Physics-XI	S. K Sharma	Dinesh Publication

Course Name:- All Branches of Diploma in Engineering

Semester: First

Subject Title: Fundamental of Computer

Subject Code; 106/111

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
02	0		50	40	10	13	20	3 Hrs
Sessional		2	50	30	20		25	

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

In Engineering Education role of computers and its knowledge is day by day increasing and every documentation and analysis requires basic fundamentals of computers. The accessibility to internet and presentation techniques are essential elements these days which is fully dependent on knowhow of computers irrespective of branches or discipline.

OBJECTIVES:

Student will be able to:

1. Understand a computer system that has hardware and software components, which controls and makes them useful.
2. Understand the operating system as the interface to the computer system.
3. Use the basic function of an operating system.
4. Set the parameter required for effective use of hardware combined with and Application software's.
5. Compare major OS like Linux and MS- Windows.
6. Use file managers, word processors, spreadsheets, presentation software's and Internet.
7. Have hands on experience on operating system and different application software.
8. Use the Internet to send mail and surf the World Wide Web.

CONTENTS : Theory

Chapter	Name of Topic	Hr	Marks
1.	**Fundamentals of Computer** 1.1 Introduction 1.2 Type of Computer 1.3 Components of PC 1.4 Inputs & Output Devices 1.5 Computer Languages 1.6 Memory of Computer	4	6
2.	**Introduction to MS Office** 3.1 MS- Word : Introduction, Starting MS-Word Screen and its Components, Elementary Working with MS-Word 3.2 MS- Excel: Introduction, Starting MS-Excel, Basics of Spreadsheet, MS- Excel Screen and its Components, Elementary Working with MS-Excel. 3.3 MS –Power Point: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and Its Components, Elementary Working with MS-PowerPoint.	8	12
3.	**Introduction to Internet** 4.1 What is Internet? 4.2 Computer Communication and Internet. 4.3 WWW and Web Browsers. 4.4 Creating own Email Account. 4.5 Networking and types.	4	6
4.	**Introduction to HTML and Software** 5.1 Introduction to HTML. Working of HTML 5.2 Creating and loading HTML pages, tags. 5.3 Structure of on HTML, Document, Stand Alone Tags. 5.4 Formatting text, Adding Images, Creating hyper Links, Tables. 5.6 Cyber security. 5.7 Computer virus.	8	10
5.	**Information Technology** 6.1 Current IT Tools. 6.2 Social networking, mobile computing, cloud computing. 6.3 Introduction of IOT and IOE 6.4 Computer Application in various fields like Data analysis, database management, artificial intelligence.	6	6
	Total	30	40

List of Practical

Exp- 1

Identification of different part of computer system and peripherals

Exp – 2: Operations on operating system

1. Create a new folder and do the following:
    a. Make a new folder in it.
    b. Rename the initial folder.
    c. Opening a new file.
    d. Creating document in note pad.
    e. Move the initial folder.
    f. Copy the initial folder.
    g. Delete the initial folder
2. Implement the various well known features of Windows operating system such as Notepad, WordPad, Calculator, System tools etc. enclosed in Start→Programs→Accessories.
3. Implement various display properties by right clicking on the Windows Desktop.
4. Explore the taskbar of Windows.
5. Set the wall paper and screen saver.
6. Set the date /time.

Exp.3Basic operations on MS Word

1. Create a document and
    a. Put Bullets and Numbers
    b. Apply various Font parameters.
    c. Apply Left, Right, and Centre alignments
    d. Apply Hyperlinks
    e. Insert pictures
    f. Insert ClipArt
    g. Show the use of Word Art
    h. Add Borders and shading
    i. Show the use of Find and Replace.
    j. Apply header/footers

Exp- 4 Advance operations on MS Word

2. Create any document and show the use of File→Versions.
3. Create any document and show the difference between paste and paste special.
4. Create any document and show the use of Washout/Watermark.
5. Implement the concept of mail merge.
6. Implement the concept of macros.
7. Implement the concept of importing a file/document.
8. Implement the concept of merging the documents.
9. Create a student table and do the following :
    a. Insert new row and fill data
    b. Delete any existing row.
    c. Resize rows and columns.
    d. Apply merging/ splitting of cells
    e. Apply sort.
    f. Apply various arithmetic and logical formulas.
    g. Apply various arithmetic and logical formulas.
10. Create your resume using General Templates.

Exp- 5Basic operation on electronic spreadsheet/excel

Computer the division of each and every student of a class.

2. Generation of Electricity Bill
3. Generation of Telephone Bill
4. Generation of Salary statement of an employee
5. Generation of Mark Sheet of a student.
6. To compute mean / median / mode.
7. Generation graph to show the production of goods in a company during the last five years.
8. Compare the cost, overheads and sales figure of a company for last three years through appropriate chart.

Exp – 6 Advance operations on electronic spreadsheet

1. Generation the following worksheet

Roll No.	Marks
2050	67
2051	49
2052	40
2053	74
2054	61
2055	57
2056	45

and do the following:

a. Create chart of the marks.
b. Compute sum of marks using auto sum, auto calculate and sum function.
c. Compute average of marks.
d. Show pass or fail if marks are above 50 or less than 50
e. Put header and footer in the spread sheet.

Importing and exporting data from other files.
Program development in excel using simple commands.

Exp – 7 Power Point Presentation preparation

1. Make a presentation of College Education System using
   a. Blank Presentation
   b. From Design Template
   c. From Auto Content Wizard

Exp – 8 Animation and various effect in Power Point Presentation, exporting and importing contents from word/excel

1. Make a presentation on “Wild Life " and apply the following:
   a. Add audio and video effects
   b. Apply various Color Schemes
   c. Apply various animation schemes.
   d. Apply slide show

Exp – 9 Simple program in HTML

1. Create any webpage using following HTML tags:
    a. Background Colour
    b. Font (Colour, Size, Face)
    c. Bold / Italic / Underline
    d. Big / Small
    e. H 1, H 2, etc.
    f. Marquee
    g. Ordered / Unordered List
    h. Data list
2. Create Employee Table and apply various operations on it using HTML. Also put Border around the table.
3. Create Internal and External Hyperlinks in a Webpage.
4. Implement the concept of Frames in a Webpage.
5. Insert an image in a Webpage.
6. Design Home page of your Institute
7. Design Web page for tourism spots in your area
8. Prepare your CV and link on the web page
9. Use animation of image in a web page
10. Insert a table and perform table handling in web page

Exp – 10 Basics of Internet, surfing, email account opening and transactions through email account

Connect the Internet; open any website of your choice and save the Web Pages.

2. Search any topic related to your syllabus using any search engine and download the relevant material.
3. Create your E-Mail ID on any free E-Mail Server.
4. Login your E-Mail ID and do the following:
    a. Read your mail
    b. Compose a new Mail
    c. Send the Mail to one person
    d. Send the same Mail to various persons
    e. Forward the Mail
    f. Delete the Mail
    g. Send file as attachment
5. Surf Internet using Google to find information about yours state college.
6. Surf Internet using Google to find Tourism information about your state.
7. Surf Internet using Yahoo to find Hotel around your state

Text Books:

i) C.S. French "Data processing and Information Technology ", BPB Publications.
ii) P.K Sinha Computer Fundamentals , BPB Publications
iii) Guy Hart-Davis “The ABCs of Microsoft Office Professional Edition", BPB Publication.
iv) Karl Schwartz, “Microsoft Windows 98 Training Guide"

Course Name : 03 Years Diploma in Engineering

Semester : First

Subject Title : Workshop-I

Subject Code : 112

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
01		4	50	30	20	--	25	---

Rationale:

Engineering diploma technician is expected to know basic workshop practice. like Wood working, Sheet metal. The students are required to identify, operate, control various machines, select and use various tools and equipments related to Wood working and sheet metal processes together with exposure to fabrication soldering and joint making of various types.

Objectives:

The student will able to

- Know basic workshop processes.
- Read and interpret job drawing.
- Identify, select and use various marking, measuring, holding, striking and cutting tools & equipments.
- Operate, control different machines and equipments.
- Inspect the job for specified dimensions
- Produce jobs as per specified dimensions.
- Adopt safety practices while working on various machines.

CONTENTS:

Sr.No.	Details Of Theory Contents	Jobs	Theory (hr)	Practice(hr)
01	**CARPENTRY SHOP** 1. Introduction. 2. Various types of woods. 3. Different types of tools, machines and accessories. 4. Practice Job a. Preparation of cross lap joints. b. T Lap joints c. Dovetail Joints d. Wood turning	04	04	**14**

02	**FITTING SHOP**: 1. Introduction 2. Various marking, measuring, cutting, holding and striking tools. 3. Different fitting operation like chipping, filing, right angle, marking, drilling, tapping etc. 4. Working Principle of Drilling machine, Tapping dies its use. 5. Safety precautions and safety equipments. 6. Practice 3 Jobs (V groove, Square notch, Fitting of two parts)	03	03	12
03	**SHEET METAL SHOP.** 1. Introduction 2. Various types of tools, equipments and accessories. 3. Different types of operations in sheet metal shop. 4. Soldering and riveting. 5. Safety precautions 6. Practice Jobs (Making funnel, tray, cylinder)	03	03	14
04	**TURNING SHOP** 1. Introduction 2. Various marking, measuring, cutting, holding and striking tools. 3. Working Principle of Drilling machine, Tapping dies its use. 4. Drilling and Tapping 5. Turning: Plain, taper 6. Threading and Knurling 7. Safety precautions and safety equipments.	**03**	**04**	**16**
	Total	13	14	56

Skill to be developed:

Intellectual Skills:

1. Ability to read job drawing
2. Ability to identify and select proper material, tools, equipments and machine.
3. Ability to select proper parameters (like cutting speed, feed, depth cut use of lubricants) in machine.

Motor Skills:

1. Ability to set tools, work piece, and machines for desired operations.
2. Ability to complete job as per job drawing in allotted time.
3. Ability to use safety equipment and follow safety procedures during operations.
4. Ability to inspect the job for confirming desired dimensions and shape.
5. Ability to acquire hands-on experience.

Notes: 1] The Faculty/ Instructor shall give demonstration to the students by preparing a specimen job as per the job drawing.

2] The workshop diary shall be maintained by each student duly signed by Faculty/Instructor of respective shop

Books:

- S.K. Hajara Chaudhary- Workshop Technology-Media Promotors and Publishers, New Delhi
- B.S. Raghuwanshi- Workshop Technology- Dhanpat Rai and sons, New Delhi
- R K Jain- Production Technology- Khanna Publishers, New Delhi
- H.S.Bawa- Workshop Technology- Tata McGraw Hill Publishers,New Delhi
- Kent's Mechanical Engineering Hand book- John Wiley and Sons, New York
- Electronics Trade & technology Development Corporation.(A Govt. of India undertaking) Akbar Hotel Annex, Chanakyapuri, New Delhi- 110 021
- Learning Materials Transparencies, CBT Packages developed by N.I.T.T.E.R. Bhopal.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF MECHANICAL ENGINEERING
POLYTECHNIC (2nd) SEMESTER SYLLABUS

Scheme of Teaching and Examination for
1st Semester of 3 Years Diploma in Engineering (All Branches except Non Tech

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Communication Skill – I	101	Theory	3	-	-	3	100	80	20	26	40
2.	Engineering Math – I	102	Theory	3	1	-	3	100	80	20	26	40
3.	Engineering Physics - I	103	Theory	3	-	-	3	100	80	20	26	40
4.	Engineering Chemistry – I	104	Theory	3	-	-	3	100	80	20	26	40
5.	Engineering Graphics – I Th	105	Theory	2	-	-	4	50	40	10	13	20
6.	Fundamental of Computer	106	Theory	2	-	-	3	50	40	10	13	20
7.	Engineering Physics Lab – I	107	Practical	-	-	2	4	50	40	10	13	20
8.	Engineering Chemistry Lab- I	108	Practical	-	-	2	4	50	40	10	13	20
9	Engineering Graphics – I SS	109	Sessional	-	-	4	-	50	30	20	-	25
10	Communication Skill I	110	Sessional	-	-	2	-	50	30	20	-	25
11.	Fundamental of Computer - I	111	Sessional	-	-	2	-	50	30	20	-	25
12.	Workshop - I	112	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**16**	**1**	**16**						

Total Marks : Theory : Practical : Sessional :
L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Scheme of Teaching and Examination for

2nd Semester of 3 Years Diploma in Engineering (All Branches except Non Tech)

Duration of Semester : **14 Weeks**
Student Contact Hours : **36 Hrs**
Total Marks : **800**

Sl. No.	Name of Subject	Subject Code	Subject	Teaching Scheme			Examination Scheme					
				L	T	P	Hours of Exam	Full Marks of Subject	Final Exam / committee marks	Internal Assessment	Pass Marks Final / Ext. Exam	Pass Marks in Subjects
1.	Communication Skill – II	201	Theory	3	-	-	3	100	80	20	26	40
2.	Engineering Math – II	202	Theory	3	1	-	3	100	80	20	26	40
3.	Engineering Physics - II	203	Theory	3	-	-	3	100	80	20	26	40
4.	Engineering Chemistry - II	204	Theory	3	-	-	3	100	80	20	26	40
5.	Programming in C	205	Theory	3	-	-	3	100	80	20	26	40
6.	Engineering Physics II	206	Practical	-	-	2	3	50	40	10	13	20
7.	Engineering Chemistry II	207	Practical	-	-	2	3	50	40	10	13	20
8.	Programming in C	208	Sessional	-	-	4	3	50	30	20	-	25
9.	Workshop Practices	209	Sessional	-	-	4	4	100	60	40	-	50
10.	Professional Practice I	210	Sessional	-	-	4	-	50	30	20	-	25
Total Hours of Teaching per week :				**15**	**1**	**16**						

Total Marks : Theory : Practical : Sessional :
L : Lecture, T : Tutorial P : Practical

Note:
1. Period of Class hours should be of 1 hrs duration as per AICTE norms.
2. Remaining Hrs every week has been marked for students for Library and Student Centered Activities.
3. Drawing / Graphics / Practical / Sessional examinations will be held at parent institution.
4. Board will depute examiner for Practical examination.
5. Regarding sessional examination the parent institution will form a three member committee and this committee will examine the sessional records and hold viva of the examinee for 60 % marks allotted to the subject. Marks for remaining 40 % will be provided by the Faculty concerned on the basis of evaluation of each job / work throughout the semester.

Course Name : All Branches of Diploma Engineering

Semester : Second

Subject Title : Communication Skills

Subject Code : 201

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	1		100	80	20	26	40	3 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

Rationale:

The Students have been already been exposed to the Language Skills pertaining to English, leading to a better understanding of English & use of grammar, developing a base for the language. Now with a view to achieve some mastery over the language & to develop Communication Skills, which is the main objective of this subject, the basic concepts of communication, Non-verbal and written skills have been Introduced.

Objectives:

The Students will be able to:

1) Understand and use the basic concepts of communication and principles of effective communication in an organized set up and social context.
2) Give a positive feedback in various situations, to use appropriate body language & to avoid barriers for effective communication.
3) Write the various types of letters, reports and office drafting with the appropriate format.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Introduction to communication:** 1.1 Definition, communication cycle., 1.2 The elements of Communication: sender- message – channel- Receiver –Feedback. 1.3 Concept of Communication Process. 1.4 Stages in the process: defining the context, knowing the audience, designing the message, encoding, selecting proper channels, transmitting, receiving, decoding and giving feedback. (Case lets.)	04	08
02	**Types of communication** 2.1 Formal Communication. 2.2 Formal: Types – a) Vertical Communication. b) Horizontal Communication. 2.3 Informal: Types – a) Diagonal Communication. 2.4 Verbal Vs Non-Verbal Communication. 2.5 Verbal: Types-a) Oral Communication. b) Written Communication. 2.6 Non-Verbal: Types- a) Body Language. b) Graphic Language.	06	10
03	**Principles of Effective Communication :** 3.1 Principles of Effective Communication. (One example each.) 3.2 Communication barriers & how to overcome them. 3.3 Developing effective messages: Thinking about purpose, knowing the audience, structuring the message, selecting proper channels, minimizing barriers & facilitating feedback. (Examples: Writing articles for newspapers, magazines.)	04	08
04	**Non verbal- graphic communication**: 4.1 Non- verbal codes: A- Kinesecs , B- Proxemics , C – Haptics D-Vocalics , E- Physical appearance. F -Chronemics , G –Artifacts. (One example each.) 4.2 Aspects of Body Language. Types of Body Language. (One example each.) 4.3 Interpreting visuals & illustrating with visuals like tables, charts & graphs.	06	12
05	**Formal written skills :** 5.1 Office Drafting: Circular, Notice, and Memo. 5.2 Job Application with resume. 5.3 Business correspondence: Enquiry, Order letter, Complaint letter, and Adjustment letter. 5.4 Report writing: Accident report, Fall in production, Progress Report,, Investigation Report. 5.5 Defining, Describing Objects &Giving Instructions. 5.5.1 Defining Objects- Appearance, It's Use. 5.5.2 Describing Objects- Purpose, Components, Functions, Applications. 5.5.3 Giving Instructions- Precise, Directive, Imagistic Statements of a futuristic stance.	10	20

06	**Oral Skills :** 6.1 Phonetics and Phonology - Introduction - Phonetics symbols - Consonants/vowels/Dipthongs - Stress and Intonation 6.2 Discussion Skills - Importance of group discussion - Leadership skills - Team management 6.3 Presentation Skills - Importance of presentation - Planning of presentation - Handling stage fright 6.4 Mock Interview - The Interview process - Pre-Interview preparation - Answering strategies	12	22
	Total	**42**	**80**

Assignments:

1. Communication Cycle (With the Help of Diagram) + Any two communication situations to be represented with the help of Communication Cycle. (Use Pictures)
2. Communication Situations (List of 5 Communication situations stating the type of communication viz; Vertical, Horizontal, Diagonal.
3. Barriers That Hinder a Particular Communication Situation. (State the type of barrier, and how to overcome them). (04 Caselets)
4. Writing articles (two) in keeping with the parameters of developing effective messages. (Collect samples from newspapers, articles, Internet and pate them in the assignment.)
5. Business Letters: a) Job Application with Resume. b) Enquiry Letter.
   c) Order Letter.
   d) Complaint Letter.
6. Non-Verbal Communication:
   a) Body Language: Five Illustrations of appropriate use of Body Language used on the part of student in formal and Informal setups. (Example- formal setup- classroom
   b) Graphic Language: Five Illustrations of the use of Signs, Symbols, Colours, Maps, Graphs, Charts in day to day life.
7. Presentation Skills: Select topic (current issues) and ask students to give a class presentation as per the principles of effective communication and paste these topics as an

assignment in the file.

8. Non-Verbal Codes: Kinesics, Physical Appearance, Haptics. (Collect five pictures per group of five students on the above mentioned non-verbal codes, analyse and discuss them in the class. Ask the students to paste these pictures along with explanation in their individual files.

GUIDELINES: Teachers can make use of group discussions, class presentations, role plays, simulations, caselets, listen and repeat drills with the help of cassettes etc to give a hand on experience for students.

Students should maintain the Institute Files to write all the eight assignments with aprper Index and get it duly certified.

Learning

Resources:

Books:

Sr. No.	Author	Title	Publisher
01	SBTE, Mumbai.	Text book of Communication Skills.	SBTE, Mumbai.
02	M.Ashraf Rizvi	Effective Technical Communication	Tata McGraw Hill Companies.
03	Krushna Mohan, Meera Banerji	Developing Communication Skills	Macmillan
04	Joyeeta Bhattacharya	Communication Skills.	Reliable Series
05	Jayakaran	Every ones guide to effective writing.	Apple Publishing.
06	Website: www.mindtools.com/page8.html-99k		
07	Website: www.khake.com/page66htm/-72k		
08	Website: www.BM Consultant India.Com		
09	Website: www.letstak.co.in		
10	Website: www.inc.com/guides/growth/23032.html-45k		

Course Name : 03 Years Diploma Engineering

Semester : Second

Subject Title : Engineering Chemistry-II

Subject Code : 204 / 207

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03			100	80	20	26	40	3 Hrs
Practical		2	50	40	10	13	20	4 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

This syllabus of chemistry of 2^{ND} semester for all the branches of Diploma Engineering has been given the name "Engineering Chemistry". In this it is intended to make students learn about the Engineering Materials and their appropriate uses, Lubrication process and protection of machines in different working environments, quality of water and its treatment as per the requirement, corrosion and its control by various methods.

OBEJECTIVE:

The student will be able to:

1. Suggest the appropriate use of metals, alloys and non-metallic material in engineering.
2. Knowledge of corrosion of metal and control methods.
3. Knowledge of choosing suitable lubricants for smooth running machines.
4. Implementing the knowledge and utilization of water and water treatment to serve the requisites of a particular use.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
1.	**Electrochemistry:** Conductivity of Electrolytes – Concept of Ohms Law, Specific Conductance, Specific Resistance, Equivalent Conductivity & Molar Conductance, Variation of Specific, Molar and Equivalent Conductance with dilution. Concept of: Cell Constant, PH, POH and Buffer solution. Numerical based on PH and POH. Application of PH and Buffer solution.	**04**	**08**
2.	**Metals and Alloys** **2.1 Metals:** Definition of Metallurgy, Brief introduction of the terms involved in metallurgy. Metallurgy of Iron: Resources of Fe, Important Ores of Iron, Extraction process, Smelting in Blast Furnace, Chemical Reactions in Blast Furnace. Composition of Pig Iron. Engineering applications of Pig Iron, Cast Iron, wrought Iron or Malleable Iron. Metallurgy of Copper: Important ores of Copper, Extraction of Copper from chief ore. Engineering properties of Copper and applications. Metallurgy of Aluminium: Important Ores of Aluminium, Extraction of Aluminium from Alumina by Electrolytic Reduction Process, Electrolytic Refining of Aluminium, Engineering Properties of Aluminium & Uses. **2.2 Alloys:** **Ferrous Alloys** Various methods of steel making, Composition, Properties &Applications of Plain Carbon Steel (Low Carbon, medium Carbon, High Carbon & Very Hard Steel) & Effect of Various Alloying Elements (Cr, W, V, Ni, Mn, Mo, Si) etc. on Steel. **Non-Ferrous Alloys:** Copper Alloys–Brass, Bronze, Nickel Silver or German Silver, their Composition, Properties & Applications. Aluminium Alloys – Duralumin, Magnalium, their Composition, Properties & Applications Other Alloys: Definition, Compositions, Properties &Applications of Soft Solder, Tinmann's Solder, Brazing Alloy, Plumber's Solder, Rose Metal.	**12**	**24**
3	**Non-Metallic Engineering Matrerial** **3.1 Ceramics:** Definition, Properties & Engineering Applications, Types – Structural Ceramics, Facing Material, Refractories, Fine Ceramics, Special Ceramics. **3.2 Refractories:**	**06**	**12**

	Definition, Properties, Applications & Uses of Fire Clay Bricks, Silica Bricks and Masonry Bricks. **3.3 Composite Materials:** Definition, Properties, Advantages, Applications & Examples. **3.4Adhesives:(Marks 4)** Definition, Characteristics, Advantages of adhesives, examples such as phenol-formaldehyde resin, urea formaldehyde resin, epoxy resin- their properties and applications as an adhesives.		
4	**Water:** Characteristics, Sources, Impurities, Hard & Soft Water, Causes of Hardness, Types of Hardness, Degree of Hardness, Boiler and Steam Generation, Scale & Sludge Formation – Causes, Disadvantage, Softening Methods such as Boiling, Clark's, Soda Ash, Lime Soda, Zeolite & Ion Exchange Methods with Principle Chemical Reactions. Plumbo solvency & its Removal. Numerical Problems.	**5**	**10**
5	**Corrosion:** Definition of Corrosion, Types of Corrosion (Dry and Wet chemical Corrosion) and their mechanism. Protection of metal from corrosion (Corrosion Control). Application of Protective Coatings like metal coating such as Galvanising, Tinning, Metal Spraying, Sherardizing, Electroplating and Metal Cladding. **Paints & Varnishes:** **Paints** Definition, Characteristics of Good Paint, Constituents & their functions & Examples, Methods of Applications. Introduction to Chemical Resistant Paints, Heat Resistance Paint, Cellulose Paint, Luminous Paints, Emulsion Paints, Metal Paints, Cement Paints, Water Paint or Distempers. **Varnishes:** Definition, Characteristics, Constituents, Types, Composition, Properties & Application of Japans, Enamels, Lacquers.	**09**	**16**
6	**Lubricant and Lubrication:** Lubricant – Definition, Classification with examples. Functions of lubricant, Lubrication – Mechanism of Lubrication (Fluid Film, Boundary and Extreme Pressure). Physical Characteristics of Lubricants Such as Viscosity, Viscosity Index, Oiliness, Volatility, Flash & Fire Point, and Cloud& Pour Point, Chemical Characteristics such as Acid Value or Neutralization Number, Emulsification, Saponification Value, Selection of Lubricants, Characteristics of Transformer oil.	**06**	**10**
	Total	**42**	**80**

List of Practical:

1	To determine neutralization point of Fatty Acid and ammonium hydroxide. Calculate normality and strength of Fatty Acids.
2	To determine the equivalent conductivity of precipitation of $BaCl_2$ with H_2SO_4 by titrating method. Also find the normality and strength of $BaCl_2$ Solution.
3	To verify Faraday's second law of electrolysis.
4	To determine PH of given solution by universal indicator and PH meter.
5	To determine the strength of given hydrochloric acid solution by titrating it against sodium hydroxide solution by using PH meter.
6	To determine thinner content in Oil paint.
7	To determine the flash and fire point of a given sample of lubricating oil.
8	To prepare Phenol formaldehyde resin (Backelite)
9	To determine viscosity of given lubricating oil.
10	To determine the alkalinity of given sample of water to decide the suitability of water for use in industry, steam generation, etc.
11	To determine degree of hardness of water by EDTA method to find the suitability of water in industrial and domestic use.
12	Study of fire clay bricks and furnaces.

Learning Resources Books:

Sl. No	Authors	Nameofthebook	Publisher
1	Jain&Jain	EngineeringChemistry	DhanpatRaiandSons
2	S.S.Dara	EngineeringChemistry	S. ChandPublication
3	B. K.Sharma	IndustrialChemistry	GoelPublication
4	S.S.Dara	EnvironmentalChemistry &PollutionControl	S. ChandPublication
5	VedprakashMehta	Polytechnicchemistry	JainBrothers

Course Name : 03 Years Diploma in Engineering

Semester : Second

Subject Title : Engineering Mathematics-II

Subject Code : 202

Teaching and Examination Scheme:-

Teaching Scheme			Examination Scheme					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	01		100	80	20	26	40	3 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

Rationale:

The subject is extension of Engineering Mathematics - 1 of First Semester and stepping into the prerequisites to learn Applied Mathematics applicable in engineering solutions. Engineering Mathematics lay down the foundation to understand and express principles and laws involved in other technological subjects. The study of Engineering Mathematics will help to develop the skills essential for new emerging avenues.

Objective:

The student will be able to acquire knowledge of mathematical terms, concepts and principles. They can acquire sufficient mathematical techniques and can develop the ability to apply mathematical methods to solve technical and day to day practical problems.

Sub Objective:

This course is divided into five units. After completion of this course one could become able to learn the following.

1. Intuitive meaning of Function, Limit and Continuity for solving the problems
2. Differentiation and its meaning in engineering situations
3. Applications of the Differentiation

3.1 Understand the Geometrical Applications of Derivatives

3.2 Use Derivatives to find extreme values of functions

3.3 The concept of Derivatives as Rate Measure

3.4 Use Derivatives to find Radius of Curvature.

4. Basic terms of Statistics And Prob

5. Complex Number

5.1 Representation of Complex numbers in various forms

5.2 Definition of complex number, its operations and property.

5.3 De-Moivre's theorem (without proof) and simple problems.

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**1. Function, Limit and Continuity** 1.1 Function ▪ Definition of variable, constant, intervals and their type ▪ Definition of Function, value of a function and types of functions, Simple Examples ▪ Definition of sinh x, cosh x and tanh x and some hyperbolic identities 1.2 **Use the concepts of Limit for solving the problems** ▪ Explain the concept of limit and intuitive meaning of $\lim_{x\to a} f(x)=l$ and its properties. ▪ Derive the Standard limits $\lim_{x\to a}\frac{x^n-a^n}{x-a}$, $\lim_{x\to 0}\frac{\sin x}{x}$, $\lim_{x\to 0} Cosx$, $\lim_{x\to 0}\frac{\tan x}{x}$, $\lim_{x\to 0}\frac{a^x-1}{x}$, $\lim_{x\to 0}\frac{e^x-1}{x}$, $\lim_{x\to 0}(1+x)^{\frac{1}{x}}$, $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x$ with simple example. ▪ Evaluate the limits of the type $\lim_{x\to\infty}\frac{f(x)}{g(x)}$. ▪ Explain the Concept of continuity of a function at a point and in interval with some examples whether a given function is continuous or not.	06	12

	2. **Differentiation and its meaning in engineering situations** ▪ Concept of derivative of a function y = f(x) from the first principle as $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ and Standard notations to denote the derivative of a function. ▪ Derivatives of elementary functions like x^n, a^x, e^x, log x, sin x, cos x, tanx, secx, cosecx, cot x and Invise Trigonometrical function using the first principles. ▪ Rules for differentiation of sum, difference, scalar multiplication, product and quotient of functions with illustrative and simple examples. ▪ Differentiation of a function of a function (Chain rule) with illustrative examples such as (i) $\sqrt{t^2+\frac{2}{t}}$ (ii) $x^2\sin 2x$ (iii) $\frac{x}{\sqrt{x^2+1}}$ (iv) $\log\left(\sin(\cos x)\right)$.etc ▪ Differentiation of a function with respect to another function and also differentiation of parametric functions with examples. ▪ Derivatives of some simple hyperbolic functions (without Proof). ▪ Differentiation of implicit function with examples. ▪ Logarithmic differentiation of some functions with examples like $[f(x)]^{g(x)}$. ▪ Concept of higher order derivatives (second and third order) with examples. ▪ Concept of functions of several variables, partial derivatives and difference between the ordinary and partial derivatives with simple examples.	**12**	**24**

	3. Applications of the Differentiation 3.1 Geometrical Applications of Derivatives ▪ State the Geometrical meaning of the derivative as the slope of the tangent to the curve y=f(x) at any point on the curve. ▪ Equation of tangent and normal to the curve y=f(x) at any point on it. ▪ The concept of angle between two curves and procedure for finding the Angle between two given curves with illustrative examples. 3.2 Use of Derivatives to find extreme values of functions ▪ The concept and condition of increasing and decreasing functions with illustrative examples. ▪ Find the extreme values (maxima or minima) of a function of single variable - simple problems yielding maxima and minima. 3.3 Concept of Derivatives as Rate Measure with illustraribe examples. 3.4 Concept of Derivatives to find Radius of Curvature with illustraribe examples.	**14**	**24**
	4. Statistics ▪ Measures of Central tendency (mean, median, mode) for ungrouped and grouped frequency distribution. ▪ Graphical representation (Histogram and Ogive Curves) to find mode and median ▪ Measures of Dispersion such as range, mean deviation, Standard Deviation, Variance and coefficient of variation. Comparison of two sets of observations.	**04**	**08**
	5. Complex Number. ▪ Represent the complex number in various forms like modulus-amplitude, polar form, Exponential (Euler) form – illustrate with examples ▪ Modulus, Conjugate and Argument of Complex Number and their properties. ▪ Operations on complex numbers (Equality, Addition, Subtraction, Multiplication and Division) with examples. ▪ Square root of complex number ▪ Cube roots of units and their properties, simple problems based on them. ▪ De-Moivre's theorem (without proof) and simple problems.	**6**	**12**
	Total	**42**	**80**

Tutorial: Tutorials are to be used to get enough practice for solving problems. It is suggested that in each tutorial at least five problems should be solved.

Learning Resources:

Books:

Sr. No	Title	Authors	Publications
1	Mathematics: A Textbook for Class XI Part I & II	National Council of Educational Research and Training	
2	Mathematics: A Textbook for Class XII Part I & II	National Council of Educational Research and Training	
3	Mathematics for Class XI Volume I and II	R. D. Sharma	Dhanpat Rai Publication, New Delhi.
4	Mathematics for Class XII Volume I and II	R. D. Sharma	Dhanpat Rai Publication, New Delhi.
5	Higher Engineering Mathematics	B.S Grewal	Khanna Publication, New Delhi
6	Higher Sr. Secondary School Mathematics for XI & XII	R.S. Agrawal	Bharti Bhawan, Patna

Note:

In board examination, question setter may be advised to select 20% questions of objective, 30% of short type and remaining 50% of long type based on basic concepts, formula and calculations respectively.

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Course Name : 03 Years Diploma Engineering

Semester : Second

Subject Title : Engineering Physics-II

Subject Code : 203/ 206

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03			100	80	20	26	40	3 Hrs
Practical		2	50	40	10	13	20	4 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

RATIONALE:

Basic science forms the foundation of Engineering. In particular Physics provides fundamental facts, principles, laws, and proper sequence of events to streamline Engineering knowledge.

Objectives : The Student will be able to :

1. Analyze the basic properties of light.
2. Differentiate between field intensity and potential.
3. List the advantages of optical fibre.
4. Describe principal of working of optical fibre.
5. Differentiate between conductor, Insulator and semi conductor on the basis of band theory.
6. Know simple idea of Nano Technology.
7. Know simple idea of non conventional sources of energy.

Contents : Theory

Chapter	Name of the Topic	Hours	Marks
1.	**LIGHT** **Properties of light** Reflection, refraction, Snell's law, physical significance of refractive index, definition of dispersion of light along with ray diagram. **(Numericals on refractive index)**	**03**	**06**
2.	**Electric Field and Potential** **2.1 Electric field** Electric charge, Coulomb's inverse square law, Definition of unit charge, Electric field, Electric lines of force and their properties, Elect field intensity, Electric flux, Electric flux density. **(Numericals on Coulombs law, Electrical Intensity)**	05	08
	2.2 Electric Potential Concept of potential, Definition and unit, Potential due to point charge using integration method, Potential difference between two points, Definition of dielectric strength and breakdown potential. **(Numericals on electric potential)**	05	08
	2.3 Capacity & Condensers Electrostatics capacity & its S.I unit, Capacity of parallel plate condenser, Condensers in series & parallel (Formula only,no derivation), Uses of condensers. **(Simple problems)**	03	06
3	**CURRENT ELECTRICITY** Ohm's law, Resistance and its unit, Specific resistance, Factors affecting resistance, Kirchhoff's law and its application to Wheat stone bridge circuit.	03	08
4	**Fiber Optics** Introduction, Total internal reflection, critical angle, acceptance angle. Structure of optical fiber, Numerical Aperture, Fiber optic materials, Types of optical fibers, Applications in communication systems. **(Numerical on critical angle, numerical aperture)**	05	08
5	**Band Theory of Solids** Energy levels in solids, Valence & conduction bands, forbidden gap, Conductors, Semiconductors and Insulators,	05	08

	Intrinsic and Extrinsic Semiconductors, p-type and n-type semiconductors, P-N junction diode-forward and reversed biased characteristics.		
6	**MODERN PHYSICS.** **7.1 Photo electricity** Concept of photon**,** Plank's hypothesis, properties of photon, photo electric effect, Laws of photoelectric effect, work function, Einstein's photoelectric equation(no derivation), Basic Concept of Solar Energy. **(Numericals on Energy of photon, work function, photoelectric equation)**	03	06
	7.2 LASER Properties of laser, Characteristics and applications of Laser	01	04
	7.3 X-rays Introduction to X-rays, production of X-rays using Coolidge tube, minimum wavelength of X-rays, properties and applications. of X-rays **(Numericals on minimum wavelength of x-rays)**	02	06
7	**Introduction to nanotechnology** Definition of nanoscale, nanometer & nanoparticle, applications of nanotechnology- electronics, automobiles, medical, textile, cosmetics, environmental, space and defence.	03	06
8	**Non- Conventional Sources of energy** Introduction- Non Renewable and renewable (Alternate) energy sources, Examples- Solar Energy, Wind Energy, Tidal Energy, Geo-Thermal Energy and Bio-Mass. Advantages and disadvantages of renewable energy.	04	06
	Total	**42**	**80**

Practical :

Skills to be

Developed :

Intellectual

Skills :

- Proper selection of measuring instruments on the basis of range, least count, precision and accuracy required for measurement.
- To verify the principles, laws, using given instruments under different conditions.
- To read and interpret the graph.

- To interpret the results from observations and calculations.
- To use these results for parallel problems.

Motor
Skill :

- Proper handling of instruments.
- Measuring physical quantities accurately.
- To observe the phenomenon and to list the observations in proper tabular form.
- To adopt proper procedure while performing the experiment.

List of Experiment :

1. To represent simple harmonic motion with the help of vertical oscillation of spring to determine spring constant (K) (Stiffness Constant).
2. To determine time period of oscillation of compound bar pendulum and calculate acceleration due to gravity (g).
3. To calculate refractive index of material of prism using spectrometer device.
4. To determine effective capacitance of series and parallel combination of capacitors by calculating its reactance.
5. Verification of Ohm's Law.
6. To convert galvanometer into ammeter of required range using appropriate value of shunt.
7. To verify Total Internal Reflection (TIR) phenomenon for given glass slab and to calculate critical angle of incidence.
8. Determination of Energy Gap (Forbidden Gap) of a semi-conductor.
9. To determine I-V characteristics of P-N junction Diode.
10. To verify inverse square law by using photoelectric cell.

Learning :

Recourses :

Books :

Sr. No.	Author	Title	Publisher
01.	Arthur Beiser	Applied physics	Tata McGraw-Hill
02.	R.K.Gaur and S.L.Gupta	Engineering Physics	Dhanpatrai and Sons.
03.	Rensic and Halliday	Physics	Wiley publication
04.	Dr. S.K. Kulkarni	Nanotechnology-Principles and practices	Capital publishing company
05.	S.K.Gupta	ABC of Physics	Modern Publisher New Delhi
06.	A.S. Vasudeva	Senior Practical Physics	S.K.Kataria & Sons.
07.	Core Physics-II	A. Kumar	Bharti Bhavan
08.	Pradeep's Fundamental Physics-XII	K.L. Gomber & K.L Gogia	Pradeep Publication
09.	S. Chand's Principles of Physics-XII	V.K Mehta & Rohit Mehta	S. Chand Publication
10.	Dinesh New Millennium Physics-XII	S. K Sharma	Dinesh Publication

Course Name : 03 Years Diploma in Engineering

Semester : Second

Subject Title : Professional Practice-I

Subject Code : 210

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External
			50	30	20	---	25	---

Rationale:

Most of the diploma holders are employed in industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests.

While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and attitude, in addition to basic technological concepts.

The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion. These are planned in the semester so that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

1. Acquire information from different sources.
2. Prepare notes for given topic.
3. Present given topic in a seminar.
4. Interact with peers to share thoughts.
5. Prepare a report on industrial visit, expert lecture.

Sr. No.	Activity
1	**Industrial Visits:** Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form part of the term work. Visits to any two of the following : i) Construction site for residential / Public building. ii) Petrol Pump iii) Media Center iv) Small Scale industry. v) Domestic Appliances repair centre vi) Visit public utility place
2	**Lectures by Professional / Industrial Expert to be organized on any three topics of the following suggested areas or any other suitable topics:** i) Pollution control. ii) Fire hazards due to short circuits iii) Fire Fighting / Safety Precautions and First aids. iv) Vedic Mathematics and Abacus. v) Topics related to Social Awareness such as –Traffic Control System, Career opportunities , Communication in Industry, Yoga Meditation, Aids awareness and health awareness
3	**Group Discussion :** The students should discuss in group of six to eight students and write a brief report on the same as part of term work. The topic for group discussions may be selected by the faculty members. Some of the suggested topics are - i) Sports ii) Cultural iii) Discipline and House Keeping iv) Current topic related to Electrical Engineering field.

4	**Literature Survey** **Student will be provided an emerging engineering topic for literature survey from Internet and other media. Based on inputs on the topics students will prepare a report and submit the sample for evaluation after due presentation before the faculty.**
5	**Presentation preparation and demonstration on live sociao economics technical aspects.** **Students in batch of maximum 5 numbers are expected to prepare a power point presentation on a topic with minimum of 20 slides.** **The topics can be from the following:** **a. Rural vs urban divide** **b. Make in India** **c. Gender equality** **d. Satellite launching programs of India** **e. Global Stake in Economics of India** **f. Super power in making: India** **g. Bottom of the pyramid** **h. Social Responsibility of Individual** **i. Swachh Bharat ABhiyan** **j. Namami Gange Project** **k. Digital India**

Course Name : 03 Years Diploma in Engineering

Semester : Second

Subject Title : Programming in C

Subject Code : 205/208

Teaching and Examination Scheme:

Teaching Scheme			**Examination Scheme**					
L	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	0		100	80	20	26	40	3 Hrs
Sessional		2	50	30	20		25	3 Hrs

NOTE:

Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

Rationale : These days computer knowledge is essential for engineers. Analysis and logical development of basic entities is any engineering field requires software development which in turn requires a programming tool. The best opted tool for program development paving way for software is C language these days. The advancement of C and subsequent program development utilising the concepts of strings arrays decision making in unconditional and conditional manner is required.

Objectives:

1. Development of flowcharts/algorithms for engineering problem solutions.
2. Structural modular program development for software implementation.
3. Working upon a statistical attributes on different aspects of engineering problem for arriving at best suited solutions.
4. Decision making in various atmosphere and conditions.
5. A tool for better learning and grasp of basics.

Chapter	Contents	Hours	Marks
01	**Basics of C** 1.1 Introduction to number system 1.2 Introduction to flowchart and algorithm 1.3 History of C, where C stands 1.4 C character set ,tokens ,constants ,variables, keywords 1.5 C operators (arithmetic, Logical, assignment, relational, increment and decrement, conditional, bit wise, special, operator precedence),C expressions data types. 1.6 Formatted input, formatted output.	**06**	**12**
02	**Decision making** 2.1 Decision making and branching if statement (if, if-else ,else-if ladder, nested if-else) Switch case statement ,break statement. 2.2Decision making and looping while, do, do-while statements for loop, continue statement**.**	**06**	**10**
03	**Arrays and Strings** 3.1 Arrays Declaration and initialization of one dimensional, two dimensional and character arrays, accessing array elements. 3.2 Declaration and initialization of string variables, string handling functions from standard library (strlen(), strcpy(), strcat(), strcmp()).	**08**	**16**

04	**Functions, Structures** 4.1 Functions Need of functions, scope and life time of variables, defining functions, function call (call by value, call by reference), return values, storage classes. category of function (No argument No return value, No argument with return value, argument with return value), recursion 4.2 Structures Defining structure, declaring and accessing structure members, initialization of structure, arrays of structure.	**08**	**16**
05	**Pointers** 5 Understanding pointers, declaring pointer variable, initialization of pointer variable, accessing address of a variable, pointer expressions, Pointers arithmetic, pointers and arrays, array of pointers	**08**	**16**
06	**File Handling** File System Basics, opening and closing of files, reading and writing in files, File opening modes, string I/O in files.	06	**10**
	Total	42	**80**

Exp. -1: Introduction to C compiler

Exp. -2: Simple basic program in C language using unconditional branching statements.

Exp. -3: Development of C program using conditional branching and subroutines.

Exp.-4 : Development of program for functions.

Exp. – 5 : Development of program in c for operation of one dimensional arrays.

Exp. – 6 : Development of program in c for operation of Multi-dimensional arrays.

Exp.- 7: Development of program in C for display using in different modes.

Exp.-8: Development of program in C for operation on structures.

Exp.-9 : Development of program in C for operation on pointers.

Exp.-10: Development of program in C for file handling.

Course Name : 03 Years Diploma in Engineering

Semester : Second

Subject Title : Workshop- II

Subject Code : 209

Teaching and Examination Scheme:

Teaching Scheme			Examination					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
		4	50	30	20	--	25	---

Rationale:

Engineering diploma technicians are expected to know basic workshop practice with special reference to Gas and arc Welding, Gas cutting, Drilling, Tapping, Plumbing and Hot Working Processes. The students are required to select and use various tools and equipments for welding, fitting, tapping drilling, plumbing and forging operations.

Objectives:

The student will able to:

- Know basic workshop processes.
- Read and interpret job drawings.
- Identify, select and use various marking, measuring, and holding, striking and cutting tools & equipments wood working and sheet metal shops.
- Operate, control different machines and equipments.
- Select proper welding rods and fluxes.
- Inspect the job for specified dimensions
- Produce jobs as per specified dimensions.
- Adopt safety practices while working on various machines.

Notes: 1] The Faculty/Instructor shall give demonstration to the students by preparing a specimen job as per the job drawing.

2] The workshop diary shall be maintained by each student duly signed by Faculty/Instructor of respective shop.

CONTENTS: Subject practical content as shown in the table below: Skill to be develop.

Intellectual Skills:

1. Ability to read job drawings.
2. Ability to identify and select proper material, tools and equipments and machines.
3. Ability to select proper parameters (like cutting speed, feed, depth cut use of lubricants) in machine.

Motor Skills:

1. Ability to set tools, work piece, and machines for desired operations.
2. Ability to complete job as per job drawing in allotted time.
3. Ability to use safety equipment and follow safety procedures during operations.
4. Ability to inspect the job for confirming desired dimensions and shape.
5. Ability to acquire hands-on experience

Sr. No.	Details of	Job	Theory	Practice
01	**HOUSE WIRIING AND ELECTRICAL FITTING** 1. Introduction 2. Various types of electrical wiring 3. Safety precautions 4. Preparation of different type of joints 5. Wiring of two way switching system 6. Wiring of two bulb, one fan one power point with a fuse connection. 7. Introduction to commonly used equipments, earth resistance measurement 8. Fault finding and repairing of common household appliances	03	02	10
02	**Electronics** 1. Introduction to different types of components 2. Soldering practice 3. Soldering of a pyramid 4. Soldering of a battery eliminator circuit/charger 5. Soldering on PCB 6. Introduction to desoldering and practice 7. Introduction to CRO and other electronic measuring instrument	03	02	10
03	**WELDING SHOP** 1. Introduction to equipments and accessories used in welding 2. Gas, Arc, Spot, welding practice 3. Lap welding practice 4. Butt welding practice 5. Spot welding practice	**03**	**04**	**12**
04	**PLUMBING SHOP** 1. Introduction. 2. Various marking, measuring, cutting, holding and striking tools. 3. Different types of G.I. & PVC pipes, flexible pipes used in practice. 4. Piping layout. 5. G.I. & PVC pipes fittings and accessories, Adhesive solvents- chemical action,	**03**	**03**	**12**

05	**Black Smithy Shop** 1. Introduction to tools and techniques 2. Preparation of commonly used instruments such as flat chisel, ring, screw driver.	**03**	**03**	**12**
	Total	**15**	**14**	**56**

Skill to be developed:

Intellectual Skills:

1. Ability to read job drawing
2. Ability to identify and select proper material, tools, equipments and machine.
3. Ability to select proper parameters (like cutting speed, feed, depth cut use of lubricants) in machine.

Motor Skills:

1. Ability to set tools, work piece, and machines for desired operations.
2. Ability to complete job as per job drawing in allotted time.
3. Ability to use safety equipment and follow safety procedures during operations.
4. Ability to inspect the job for confirming desired dimensions and shape.
5. Ability to acquire hands-on experience.

01	**TURNING SHOP** Note:1] One job related to Plane and Taper turning, threading and knurling 2] One job related to Drilling and tapping 3] Batch size should be selected depending on volume of work. 4]Job allotted should comprise of 6-8 hours of actual working 5] Student shall calculate the cost of material and labor cost for their job from the drawing.
02	**WELDING SHOP** **Note:**1] One job of standard size (Saleable/marketable article shall be preferred) 2] Batch size should be selected depending on volume of work . 3] Job allotted should comprise of 6-8 hours of actual working operations. 4] Student shall calculate the cost of material and labor required for their job from the drawing.
03	**PLUMBING SHOP** • Demonstration of PVC pipe joint with various fittings. • Exercise for students on preparing actual pipeline layout for PVC pipe. Preparing actual drawing and bill of material.

(Note: Utility item are not to be assessed

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	S.K. Hajara Chaudhary	Workshop Technology	Media Promotors and Publishers,New Delhi
02	B.S. Raghuwanshi	Workshop Technology	Dhanpat Rai and Sons, New Delhi
03	R K Jain	Production Technology	Khanna Publishers, New Delhi
04	H.S.Bawa	Workshop Technology	Tata McGraw Hill Publishers,New Delhi
05	--	Kent's Mechanical Engineering Hand book	John Wiley and Sons, New York

Video Cassettes / CDS

- Learning Materials Transparencies, CBT Packages developed by NITTER Bhopal.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF MECHANICAL ENGINEERING
POLYTECHNIC (3rd) SEMESTER SYLLABUS

Diploma in Engineering (All branch except Mining, Arch & Non Tech)

Semester : Third

Subject Title : Engineering Mathematics-III

Subject Code: 301

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
L TH	T	P	Full Marks.	External Exam Marks	Internal Exam Marks	External Pas Marks	Total Pass Marks	Duration of External Exams
03	01		100	80	20	26	40	3 Hrs

NOTE: Internal marks will be allotted on the basis of two snap tests and 2 assignment of equal marks to be conducted by the faculty teaching the subject.

Rationale:

The subject is extension of Engineering Mathematics – 1 & 2 of First year and stepping into the prerequisites to learn Applied Mathematics applicable in engineering solutions. Engineering Mathematics lay down the foundation to understand and express principles and laws involved in other technological subjects. The study of Engineering Mathematics will help to develop the skills essential for new emerging avenues.

Objective:

The student will be able to acquire knowledge of mathematical terms, concepts and principles. They can acquire sufficient mathematical techniques and can develop the ability to apply mathematical methods to solve technical and day to day practical problems and to execute management plans with precision.

Sub Objective:

This course is divided into five units. After completion of this course one could become able to learn the following.

- Intuitive meaning and Methods of finding integration definite integration and its properties.
- Application of Integration in finding Area, volume of irregular shapes.
- Methods of solving differential equation of first order and first degree.
- Methods for finding approximate roots by using bisection, Regula-falsi,

Newton- Raphson method, Gauss elimination, Jacobi and Gauss- Seidal methods.

- Use of Binomial, Normal and Poisson distributions for solving different examplesUse of Laplace transform for solving problems of Differential Equations.
- Use of Fourier series for expansion of function at the given intervals

Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	**Integration:** 1.1 Definition of integration as anti-derivative. Integration of standard function. 1.2 Rules of integration (Integrals of sum, difference, scalar multiplication). 1.3 Methods of Integration. 1.3.1 Integration by trigonometrical transformation. 1.3.2 Integration by substitution 1.3.3 Integration by parts. 1.3.4 Integration of rational and irrational functions. 1.3.5 Integration by Partial fractions.	7	16
	1.4 Definite Integration. 1.4.1 Concept of definite integrations with examples. 1.4.2 Properties of definite integral with simple problems.	3	
	1.5 Applications of definite integrals. 1.5.1 Area under the curve. 1.5.2 Area bounded by two curves.	3	
2	**Differential Equation** 2.1 Definition of differential equation, order and degree of differential equation. Formation of differential equation. 2.2 Solution of differential equations of first order and first Degree such as variable separable form, reducible to Variable separable, Homogeneous and Linear Differential Equation.	6	16
	2.3 **Applications of Differential equations.** 2.3.1 Rectilinear motion (motion under constant and variable acceleration) 2.3.2 Newton's Law of Cooling	3	
3	**Numerical Methods** **3.1 Solution of algebraic equations** Bisection method, Regula falsi method and Newton–Raphson method.	3	16
	3.2 Solution of simultaneous equations containing 3 unknowns		

	3.2.1 Gauss elimination method. 3.2.2 Jacobi's Iterative method. 3.3.3 Gauss Seidal method.	3	
	3.3 Interpolation 3.3.1 Concept of interpolation and extrapolation. 3.3.2 Different operators (Δ, ∇ & E),relation between them, some problems based on operators , formation of Difference Table. 3.3.3 Newton's Forward and Backward difference interpolation formulae. 3.3.4 Lagrange's interpolation formula. 3.3.5 Problems based on above.	6	
	3.4 Numerical Differentiation &Integration. 3.4.1 Newton's forward and backward difference formulae for first and second order differentiation at any point. 3.4.2 Numerical integration Trapezoidal rule and Simpson's 1/3rdrule.	3	
4	**4.1 Probability:** 4.1.1 Definition of random experiment, sample space, event occurrence of event and types of events (impossible, mutually exclusive, exhaustive, equally likely) 4.1.2 Definition of probability, addition and multiplication theorems of probability.	05	16
	4.2 Probability Distribution 4.2.1 Binomial distribution. 4.2.2 Poisson's distribution. 4.2.3 Normal distribution 4.2.4 Simple examples based on above .	05	
5	**Laplace Transform** 5.1 Definition of Laplace transforms Laplace transform of standard functions**.** 5.2 Properties of Laplace transform such as Linearity, first shifting, second shifting, multiplication by t^n, division by t. 5.3 Inverse Laplace transforms. Properties-linearly first shifting, second shifting. Method of partial fractions,	3	16
6	**Fourier Series** 6.1 Definition of Fourier series (Euler's formula). 6.2 Series expansion of continuous functions in the intervals $(0,2l),(-l,l),(0,2\pi),(-\pi,\pi)$	3	

7	**Linear Programming** **7.1 Introduction** **7.2 Solution of Linear Programming problem (LPP) by Graphical Method.**	3	
	TOTAL:	56	80

Tutorial: Tutorials are to be used to get enough practice for solving problems. It is suggested that in each tutorial at least five problems should be solved.

Learning Resources:

Text Book:

Sr. No	Title	Authors	Publications
1	Higher Engg. Mathematics	B. S. Grewal	Dhanpat Rai

Ref. Books:

Sr. No	Title	Authors	Publications
1	Engineering Mathematics	H.K.Das	S.Chand & Company LTD, New Delhi
2	Higher Engineering Mathematics	B.V,Ramana	Mcgraw Hill Education (India) Private limited , New Delhi
3	Practical Mathematics	I.B. Prasad	Khanna
4	Introductory Method of Numerical Analysis	S.S.Shastri	P.H.I
5	Linear Programming	G. Hadley	
6	A text book for class 12, Part- I & II	NCERT	NCERT, Delhi

Note:
In board examination, question setter may be advised to select 20% questions of objective, 30% of short type and remaining 50% of long type based on basic concepts, formula and calculations respectively.

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3rd Semester Diploma in Engineering (Common)

Subject Title: Development of Life Skills- I

Subject Code :302

Rationale:

In today's competitive world, the nature of organizations is changing at very rapid speed. In this situation the responsibility of diploma holder is not unique. He will be a part of a team in the organization. As such the individual skills are not sufficient to work at his best.

This subject will develop the student as an effective member of the team. It will develop the abilities and skills to perform at highest degree of quality as an individual as well as a member of core group or team. Such skills will enhance his capabilities in the field of searching, assimilating information, managing the given task, handling people effectively, solving challenging problems.

THE SUBJECT IS CLASSIFIED UNDER HUMAN SCIENCE.

Objectives: The students will be able to:

1. Develop team spirit i.e. concept of working in teams
2. Apply problem solving skills for a given situation
3. Use effective presentation techniques
4. Apply techniques of effective time management
5. Apply task management techniques for given projects
6. Enhance leadership traits
7. Resolve conflict by appropriate method
8. Survive self in today's competitive world
9. Face interview without fear
10. Follow moral and ethics
11. Convince people to avoid frustration

CONTENTS: Interaction by faculty / professional

Chapter	Name of the Topic	Suggested HOURS
1	**SOCIAL SKILLS** Society, Social Structure, Develop Sympathy And Empathy.	01
2	Swot Analysis – Concept, How to make use of SWOT.	01
3	**Inter personal Relation** Sources of conflict, Resolution of conflict , Ways to enhance interpersonal relations.	02

4	**Problem Solving** **I)STEPS IN PROBLEM SOLVING,** 1)Identify and clarify the problem, 2)Information gathering related to problem, 3)Evaluate the evidence, 4)Consider alternative solutions and their implications, 5)Choose and implement the best alternative, 6)6)Review **II)Problem solving technique**.(any one technique may be considered) 1) Trial and error, 2) Brain storming, 3) Lateral thinking	**02**
5	**Presentation Skills** Body language -- Dress like the audience Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT, Voice and language – Volume, Pitch, Inflection, Speed, Pause Pronunciation, Articulation, Language, Practice of speech. Use of aids –OHP,LCD projector, white board	**03**
6	**Group discussion and Interview technique** – Introduction to group discussion, Ways to carry out group discussion, Parameters— Contact, body language, analytical and logical thinking, decision making **INTERVIEW TECHNIQUE** Necessity, Tips for handling common questions.	**03**
7	**Working in Teams** Understand and work within the dynamics of a groups. Tips to work effectively in teams, Establish good rapport, interest with others and work effectively with them to meet common objectives, Tips to provide and accept feedback in a constructive and considerate way , Leadership in teams, Handling frustrations in group.	**02**
8	**Task Management** Introduction, Task identification, Task planning ,organizing and execution, Closing the task	**02**
	TOTAL	**16**

CONTENTS: PRACTICAL -

List of Assignment: (Any Eight Assignment)

1. SWOT analysis:- Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.
   a) Your past experiences,
   b) Achievements,
   c) Failures,
   d) Feedback from others etc.
2. Undergo a test on reading skill/memory skill administered by your teacher.
3. Solve the true life problem.
4. Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slump area, social activities like giving cloths to poor etc.(One activity per group)
5. Deliver a seminar for 10-12 minutes using presentation aids on the topic given by your teacher.
6. Watch/listen an informative session on social activities. Make a report on topic of your interest using audio/visual aids. Make a report on the programme. ####
7. Conduct an interview of a personality and write a report on it.
8. Discuss a topic in a group and prepare minutes of discussion. Write thorough description of the topic discussed
9. Arrange an exhibition, displaying flow-charts, posters, paper cutting, photographs etc on the topic given by your teacher.

Note: - Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic. The **term work** will consist of any eight assignments.

Mini Project on Task Management: Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management.

LEARNING RESOURCES:

BOOKS:

Sr. No	Title of the book	Author	Publisher
1	Adams Time management	Marshall Cooks	Viva Books
2	Basic Managerial Skills for All	E.H. Mc Grath , S.J.	Pretice Hall of India
3	Body Language	Allen Pease	Sudha Publications Pvt. Ltd.
4	Creativity and problem solving	Lowe and Phil	Kogan Page (I) P Ltd
5	Decision making & Problem Solving	by Adair, J	Orient Longman
6	Develop Your Assertiveness	Bishop , Sue	Kogan Page India
7	Make Every Minute Count	Marion E Haynes	Kogan page India
8	Organizational Behavior	Steven L McShane and Mary Ann Glinow	Tata McGraw Hill
9	Organizational Behavior	Stephen P. Robbins	Pretice Hall of India, Pvt Ltd

10	Presentation Skills	Michael Hatton (Canada – India Project)	ISTE New Delhi
11	Stress Management Through Yoga and Meditation	--	Sterling Publisher Pvt Ltd
12	Target setting and Goal Achievement	Richard Hale ,Peter Whilom	Kogan page India
13	Time management	Chakravarty, Ajanta	Rupa and Company
14	Working in Teams	Harding ham .A	Orient Longman

MACHINE DRAWING

Subject Code: - MEC303

L T P **Total Theory Hrs. 42**
3 2

Course Objectives:

1. To understand and apply national and international standards while drawing machine component.
2. To understand the concept of various tolerances and fits used for component design
3. To familiarize in drawing assembly, orthographic and sectional views of various machine components.

1. Auxiliary views **2+4**

1.1 Study of auxiliary planes,
1.2 Projection of objects on auxiliary planes.
1.3 Completing the regular views with the help of give an auxiliary view

Sectional Views

1.1 Types of sections
1.2 Conversion of pictorial view into sectional orthographic views (Simple Machine Parts)

2. Conversion of Projections **3+6**

2.1 Introduction to Orthographic & Isometric projections.
2.2 Conversion of isometric view into Ortho graphic views (Simple Machine Parts)
2.3 Draw missing view from the given Ortho graphic views-simple components
2.4 Conversion of orthographic views into is metric views (Simple Machine Parts)

3. Fasteners, Rivet and Riveted Joints **2+4**

3.1 Introduction and classification
(Types of threads, nuts, bolts, assembly of bolts and nuts with washers)
3.2 Shape of Rivet heads 3,3 Types of
Riveted joints

4. Conventional Representation **3+6**

4.1 Standard convention using SP–46(1988)
(a) Materials C.I., M.S, Brass, Bronze, Aluminum, wood, Glass, Concrete and Rubber
(b) Long and short break in pipe, rod and shaft.
(c) Ball and Roller bearing, pipe joints, cocks, valves, internal/External threads.
(d) Various sections-Half, removed, revolved, offset, partial and aligned sections.
(e) Knurling, serrated shafts, splinted shafts, and chain wheels.
(f) Springs with square and flat ends, Gears, sprocket wheel
(g) Counter sunk& counter bore.
(h) Tapers
4.2 Conventional Representation of holes, bolts, nuts and rivets.

5. Limits, Fits and Tolerances: **2+4**

1. Characteristics of surface roughness-Indication of machining symbol showing direction of lay, roughness grades, machining allowances, manufacturing methods.
2. Introduction to ISO system of tolerance, dimensional tolerances, elements of inter change able system, hole & shaft-based system, limits, fits & allowances. Selection of fit.

3. Geometrical tolerances, of form and position and its geometric representation.

6. Details to Assembly **7+14**

6.1 Introduction
6.2 Bearing–Foot Step Bearing & Pedestal Bearing
6.3 Lathe tool Post
6.4 Keys, Knuckle Joint and Cotter Joint
6.5 Screw Jack
6.6 Steam Stop Valve
6.7 Pipe Joints (Union Joint, Expansion Joint &Spigot & Socket Joint)

7. Assembly to Details **7+14**

7.1 Introduction–
7.2 Pedestal Bearing
7.3 Lathe Tail Stock
7.4 Drilling Jig
7.5 Automotive parts (Piston & connection rod)
7.6 Couplings–Flange Couplings, Flexible Couplings Universal couplings & Oldham's coupling
7.7 Fast & loose pulley
7.8 Valve– Not more than eight parts

Study of Production Drawing (Minimum 02 sheets)

Course Outcomes:

CO	COURSE OUTCOMES
CO 1	Apply the national and international standards in machine drawing.
CO 2	Apply limits and tolerances to assemblies and choose appropriate fits.
CO 3	Prepare production drawings with geometrical dimensioning and tolerances
CO 4	Assign machining and surface finish symbols.
CO 5	Prepare production drawings with geometrical dimensioning and tolerances
CO 6	Illustrate various machine components through drawings

Reference Book: -

01	N.D. Bhatt	Machine Drawing	Charotar Publication, Anand
02	IS Code SP46 (1988)	Code of practice for general engineering	Engineering Drawing Practice for School and colleges
03	L.K. Narayanan, P. Kannaich, Venkat	Production Drawing	New Age International Publication
04	P.S. Gill	Machine Drawing	S.K. Katariaand Sons
05	M.L. Dab hade	Engineering Graphics (For Typicon Auxiliary Views)	--
06	Sidheshwar	Machine Drawing	Tata Mc Graw Hill
07	R K Dhawan	Machine Drawing	S Chand

MACHINE DRAWING LAB
Subject Code: MEC307

List of Experiments: -

(Use first angle method of projection)

1. Auxiliary Views
   One sheet containing three problems on Auxiliary views.
2. Conversion of projection
   2.1 One sheet containing orthographic to isometric.
   2.2 One sheet containing isometric to orthographic.
   2.3 One sheet containing missing view.
3. Rivet and Riveted joints, Conventional Representation as per SP–46 (1988) –one sheet
4. Limit, Fit, Tolerances and Machining Symbols– one sheet
5. Details to Assembly
   5.1 One sheet covering any one assembly and its details.
   5.2 Solve at least two problems as home assignment.
6. Assembly to detailed drawings of components including conventional representation of Tolerances and surface finish symbols:
   6.1 One sheet covering any one assembly and its details
   6.2 At least two problems as home assignment.
7. Solve at least two problems on production drawing.
8. Two problems on assembly drawings using any AutoCAD Package.

ENGINEERING MATERIALS
Subject Code: -MEC304

L T P **Total Theory Hrs. 42**
3 **FM 100 (80+20) Hrs.**

Course Objectives:

1. Acquaint students with the structure, classification, and characteristics of engineering materials
2. Impart a fundamental knowledge of materials processing, such as casting, forming, machining, welding, etc.
3. Select and apply different metals and alloys for various engineering purposes based on their properties, standards, and performance[12].
4. Understand the structure, properties, and applications of ceramics, polymers, and electronic materials in the context of a molecular level understanding[23].

1. Engineering Materials and Their Properties **6 hrs**

1.1 Introduction, Classification and Application of Engineering materials, I.S specification of materials like plain carbon steel, Grey Cast iron, low alloy steels & bearing Materials.

1.2 Properties of metals: -Strength, elasticity, ductility, malleability, plasticity, toughness, hardness, Harden ability, brittleness, fatigue, thermal conductivity, electrical conductivity, thermal coefficient of linear expansion.

1.3 Imperfection in Crystals: - Basic concept of crystal, crystal pattern of unit cells, ideal crystal and crystal imperfection. Classify crystal imperfections or defects such as point defects, line defects, surface defect and volume defects. State types of dislocation.

2. Ferrous Metals and Alloys **10 (6+4) hrs.**

2.1- Ferrous Metals

2.1.1 Characteristics and application of ferrous metals, Flow diagram for production of Iron and Steel, Classification, composition and uses of cast iron, effect of alloying elements like Sulphur, silicon and phosphorous on cast iron.

2.1.2 Classification, composition and application of low carbon steel, medium carbon steel and high carbon steel with their chemical composition.

2.1.3 Magnetic materials: - Properties & Applications of commonly used magnetic materials (Permanent magnets and temporary magnets).

2.1.4 Fe-C Phase Equilibrium Diagram – Critical temperature lines, study of micro constituents of iron and steel.

2.1.5 Introduction of TTT curves.

2.2 - Alloy Steels

2.2.1 **Alloy Steels:** - Low alloy steel, high alloy steel, tools steel & stainless steel. Effect of various alloying elements such as – Chromium, nickel, manganese, molybdenum, tungsten, vanadium, etc.

2.2.2 **Tool Steels**: - High speed Steels (HSS), Hot & cold Working dies, shear, punches etc., properties & applications.

2.2.3 **Special Cutting Tool Materials** – Diamond, Stelites & Tungsten Carbide.

3. Non-Ferrous Metals and Alloys **6 hrs.**

3.1 Properties, applications & chemical compositions of copper alloys (naval brass, muntz metal, Gun metal & bronzes), Aluminum alloys (Y-alloy & duralumin)

3.2 Various Lead and Zinc alloys. Alloys used for high temperature services.

3.3 Bearing materials like white metals, leaded bronzes & copper lead alloys and their desired properties.

4. Heat Treatment of Steels **8hrs**

4.1 Basic concept of Heat treatment processes - Annealing, Normalizing, Hardening, Tempering. Aus tempering & Mar tempering.

4.2 Basic concept of Surface Hardening Processes - Flame Hardening, Induction Hardening, Nit riding, Cyaniding, Carburizing, Carbonic trading.

5. Non-Metallic Materials **6hrs.**

5.1 Polymeric Materials – Introduction to Polymers- types, characteristics, properties and uses.

5.2 Thermoplastic Plastics & Thermosetting Plastics - characteristics and uses of, Acrylics, Nylons, polyesters, Epoxies, Melamine's & Bakelite's.

5.3 Rubbers – Neoprene, Butadiene, Buna & Silicones – Properties & applications.

5.4 Properties and applications of following Engineering Materials – Ceramics, Abrasive, Adhesive and Insulating materials such as Cork, Asbestos, Thermocole and Glass Wool.

5.5 Introduction to Composite Materials – Laminated & Fiber, reinforced materials - Structure, Properties & Applications.

6. Destructive & Nondestructive Testing **6 hrs**

6.1 Destructive Testing – Types, Concept and processes of Hardness & Toughness.

6.2 Importance of Non-destructive testing, Difference between Destructive and Nondestructive testing.

6.3 Nondestructive testing methods - Radiography (X-Ray & Gamma Ray), Ultrasonic crack detection, Dye penetrates test.

CO	COURSE OUTCOMES
CO 1	Suggest suitable engineering materials for different application
CO 2	Identify various phases of metals and alloys through appropriate phase diagrams
CO 3	Apply suitable heat treatment process based on material properties.
CO 4	Evaluate the effect of alloying elements, properties and application of ferrous and non-ferrous metals.
CO 5	Evaluate the mechanical behaviour of materials for different applications
CO 6	Apply advanced materials such as polymers, ceramics and composites in product design, Correlate the structure-property relationship in metals/alloys in as-received and heat-treated conditions.

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Books Recommended:

1	A Text Book of Material Science & Metallurgy	OP Khanna
2	Material Science & Metallurgy	R K Rajput
3	Material Science & Metallurgy	V D Kedgeree
4	Material Science	W. Callister

ENGINEERING MECHANICS

Subject Code- MEC305

L	T	P	Total Theory Hrs. 42
3	2		F M: 100Th + 50Pr

Course Objectives:

1. To enable students to apply fundamental laws and basic concepts of rigid body mechanics.
2. To solve problems of bodies under rest or in motion.
3. To enable the students to apply conditions of static equilibrium to analyse physical.
4. To compute the properties of areas and bodies.

1. Introduction to Engineering Mechanics **2**

Definitions of mechanics, Engineering Mechanics, statics, dynamics, kinematics, kinetics, particles, body, rigid body, mass, weight, length, time, scalar and vector, S.I. units.

2. Force **10**

2.1 Force & Force system: - Definition of a force, S.I. unit of a force, representation of a force by vector and by Bow's notation method, classification of force system. According to plane and line of action, Characteristic sofa force, effects of a force, principle of transmissibility.

2.2 Resolution of a force: Definition, Method of resolution, Types of Components of a force – Perpendicular component and non-perpendicular component.

2.3 Moment of a force: - Definition, measurement of moment of a force, SI Unit, geometrical meaning of moment of a force, classification of moments according to direction of rotation, sign convention, law of moments, Varignon's theorem of moment and its use.

2.4 Definition, S.I. unit, measurement of a couple, properties of couple.

2.5 Composition of Forces: - Definition, Resultant force, methods of composition of forces, Analytical methods: Trigonometric method (law of parallelogram of forces) and Algebraic method (method of resolution) for calculation of result and for all force systems.

3. Equilibrium: **8**

3.1 Conditions of equilibrium-analytical and graphical conditions of equilibrium for concurrent, parallel force system, non-concurrent nonparallel force system, free body and free body diagram.

3.2 Lami's Theorem–Statement and explanation, Application of Lami's theorem for solving various engineering problem shaving two unknowns only.

3.3 Equilibrant–Definition, relation between result and equilibrant, equilibrant of concurrent and non-concurrent force system.

3.4 Collision- Collision of elastic and inelastic bodies, coefficient of restitution, loss of kinetic energy during impact. (Simple problem related with collision)

3.5 Truss - Introduction, Reaction at supports, Forces in a member by method of joints and method of

section, Simple problems on methods of joints only).

4. Centroid and Centre of Gravity:

4.1 Centroid: Definition of centroid & moment of an area about an axis, centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite Geometrical figures.

4.2 Centre of gravity: Definition, centre of gravity of simple solids such as cylinder, sphere, Hemisphere, Cone, cube, and rectangular block, centre of gravity of composite solids (Any types of hollow solids shall not be considered)

5. Friction **8**

5.1 Definition and basic concept of- friction, force of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation among angle of friction, angle of repose and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages of friction.

5.2 Equilibrium of bodies on level plane–external force applied horizontal and inclined (Pull & Push)

5.3 Equilibrium of bodies on inclined plane– external forces is applied parallel to the plane.

5.4 Ladder Friction & Wedge Friction (simple numerical only).

6 Simple Machines: **8**

6.1 Basic concept and definition of load, effort, mechanical advantage, velocity ratio and efficiency of a simple lifting machine, relation among mechanical advantage, velocity ratio and efficiency of a machine, Ideal machine, ideal effort and ideal load, friction in machines.

6.2 Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine (no derivation) and self-locking machine.

6.3 Basic concept of Lever& their types, Pulleys (fixed & movable), simple wheel and axle, winch crab, worm &worm wheel and screw jack (simple problems on lever only).

Course Outcomes:

CO	COURSE OUTCOMES
CO 1	Compute the resultant of system of forces in plane and space acting on bodies.
CO 2	Predict the support-reactions and the internal forces of the members of various trusses and frames.
CO 3	Analyse equilibrium problems with friction
CO 4	Apply transfer theorems to determine properties of various sections.
CO 5	Analyse equilibrium of connected bodies virtual work method
CO 6	Predict motion parameters of bodies under rectilinear, curvilinear and general plane motion

Recommended Books:

1. Engineering Mechanics R K Bansal
2. Engineering Mechanics D S Kumar
3. Engineering Mechanics R S Khurmi Reference Books
1. Vector Mechanics for Engineers: Statics & Dynamics Beer & Johnson
2. Engineering Mechanics: Statics & Dynamics I H Shames

ENGINEERING MECHANICS LAB

Subject Code: MEC308

List of Practical's:

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1) To verify law of polygon of forces.

2) To verify law of moments.

3) To verify Lami's theorem.

4) To determine the forces in members of a Jib crane.

5) Comparison of coefficient of friction of various pair of surfaces and Determination of angle of repose.

6) To verify force transmitted by members of truss.

7) Experimental location of centre of gravity of plane plate of uniform thickness.

8) Find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine and calculate maximum efficiency of Worm and worm wheel

9) Find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine and calculate maximum efficiency of Differential axle and wheel

10) Find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine and calculate maximum efficiency of Simple screw jack.

11) Study of Single purchase winch crab and Double purchase winch crab

12) Study of reversibility of the simple screw jack.

STRENGTH OF MATERIALS
Subject code MEC306

Course objectives:

The student should be able to:

1. Understand the fundamentals of solid mechanics.
2. Acquire elementary knowledge of stresses, strains & material properties.
3. Understand&analyzethebasicprinciplesinvolvedinthebehaviorofmachinepartsunderloadin the context of design in gait.
4. Understand& analyze the mechanical properties of the various materials

Contents:

Chapter	Name of the Topic	Hours	Marks
01	**Mechanical Properties of Materials, Simple stresses &Strains** 1.1 Mechanical properties– Elasticity, Plasticity, Rigidity, Ductility, Malleability, Toughness, Hardness, Brittleness, Creep, Fatigue. 1.2 Concept & Definition of Simple stresses &strains Types tensile, compressive, Shear, single & double shear, Hooke's law, Young's modulus, Modulus of Rigidity, Change in length of the bar having uniform & stepped cross section stress -strain curves for ductile &brittle materials. 1.3 Volumetric Strain, Bulk modulus, Poisson's ratio. Bi- Axial &Tri-axial stresses & strains. Relationship among E, G, &K. 1.4 Stresses & strains in bar so uniformly varying section subjected to axial load attend sonly, Composite sections having same length. 1.5 Temperatures tresses & strains of uniform & composite Sections. 1.6 Buckling of long columns 'Euler's theory, Rankin's theory equivalent length of the column for the cases of Both ends hinged, one end fixed and other free, both ends fixed, one end fixed and other end hinged. (Simple numerical only).	8	

02	**Bending Moment & Shear Force** 2.1 Concept & definition of Shear force & bending moment. Relation between rate of loading, shear force & bending moment. 2.2 Shear force & bending moment diagrams for cantilevers, simply supported beam & over hanging be am subjected to point loads, Uniformly distributed load, Uniformly varying load. 2.3 Location of point of contra flexure (Problem to be based on simply supported and cantilever beams with point load and UDL only)	06	
03	Principal stresses and planes. 3.1 Determine normal stress, shear stress and resultant stress on oblique plane 3.2 Define principal plane & principal stress 3.3 Determine principal plane, principal stresses analytically 3.4 Determine principal stress from Mohr's circle(only simple numerical). Thin Cylindrical shell -- 4 Marks • Stresses in thin closed cylindrical vessels subjected to internal pressure, Hoop stress, Radial & Axial Stress. (Simple numerical sonly)	06	

04	**Moment of Inertia** 4.1 Concept & definition of Moment of inertia, radius of gyration. Parallel & perpendicular axes theorem. (No derivation) 4.2 Moment of inertia of square, rectangular, circular, semicircular, Triangular, Hollow square, Rectangular &circular only. 4.3 MI of angle section, Channel section, Tee- section, I Section about centroidal axis& any other axis parallel to centroidal axis. 4.4 Polar moment of inertia.	06	
05	**Bending and Shear stresses** 5.1 Theory of simple bending, Assumptions in the theory of bending, moment of resistance, section modulus & neutral axis. Stress distribution diagram for Cantilever & simply supported beam. 5.2 Equation of bending (No derivation) 5.3 Simple numeral problem. 5.4 Concept of direct & transverses hear stress. 5.5 Shear stress equation (No derivation) 5.6 Shear stress distribution diagrams Averages hear stress & Maximum shear stress for rectangular &circular section.	06	
06	**Combination of Direct and Bending Stresses** 6.1 Concept of Axial load, eccentric load, direct stresses, bending stresses, maximum & minimum stresses. 6.2 Stress distribution diagram. 6.3 Condition for no tension in the section. 6.4 Problems on the above concepts for machine parts such as offset links, C clamp, Bench vice, Drilling machine frame etc. **(Simple problems on the above applications)**	04	
07	**Torsion** 7.1 Concept of Pure Torsion, Assumptions in theory of pure Torsion, Torsion equation for solid and hollow circular shafts. 7.2 Power transmitted by a shaft. 7.3 Comparison between Solid and Hollow Shafts subjected to pure torsion (no problem on composite and non-homogeneous shaft)	03	
08	**Deflection and Slope of Beam** **8.1** Concepts of Deflection & Slope of beams-relation between bending moment and slope. Deflection of simply supported beams and cantilever beams subjected to point load (No Derivation)	03	
	Total	**42**	

Course Outcomes:

CO	COURSE OUTCOMES
CO 1	The behavior of solid objects subject to stresses and strains.
CO 2	Helps to predict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio.
CO 3	Understand the behaviour of solid objects subject to various types of loading, such as axial, bending, torsion, shear, and buckling.
CO 4	Calculate the stresses and strains that develop within the objects due to the applied loads.
CO 5	Assess the load capacity, deformations, and stability of the objects based on their material properties and geometric dimensions.
CO 6	Compare the calculated stresses and strains with the material strength and failure criteria to determine the safety factor and design factor.

Reference Books:

SN	Author	Title	P
01	R K Rajput	Strength of Material	
02	B.K. Sarkar	Strength of Material	Tata McGraw hill New Delhi
03	Dr. RK. Bansal	A Text Book of strength of Material	Laxmi Publication New Delhi
04	S Ramamrutham	Strength of Material	Dhanpat Rai& Publication Nwe Delhi
05	R.S Khurmi	Strength of Material	S. Chand Company Ltd. Delhi
06	Andrew Pytel Fedrinand L.Singer	Strength of Material	Addison-Wesley Animprint of Addis on Wesley Longman, Inc.
07.	S.S. Ratan	Strength of material	TMH

Subject: Strength of Material's Lab

Subject Code: MEC309

List of Practical's: -

1. Hook's Law verification by Searl's apparatus.
2. Study and demonstration of Universal Testing Machine & its attachments
3. Tension Test on mild steel/Aluminum on UTM.
4. Compression test on cast iron on UTM.
5. Direct Shear Test of mild steel on UTM.
6. Brinell Hardness Test on Mild Steel.
7. Rock well hardness Test on Hardened Steel.
8. Izod & Charpy- Impact tests of a standard specimen.
9. Torsion Test of Mild steel bar.
10. To find Moment of Inertia of a flywheel.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF MECHANICAL ENGINEERING
POLYTECHNIC (4th) SEMESTER SYLLABUS

Manufacturing Technology

Subject Code : MEC402
Total Theory Hrs 42
F M 100 (80+20)
L T P
3

COURSE OBJECTIVES:

1. To identify and explain manufacturing concepts.
2. To impart students, knowledge on fundamentals concepts in metal casting, welding, and forming processes.
3. To enable students, understand basics of digital printing, powder metallurgy process and fabrication methods for polymer products and glass products.

1	**WELDING** **07HRS**
1.1	Define and classification of various welding processes
1.2	Gas& Arc welding-Principle, Equipment, applications, and types of Flames
1.3	Electrode specifications, current setting & use of flux in welding
1.4	Advance welding process- TIG, MIG, Thermit Welding, Submerge Arc Welding, Plasma Arc Welding, Laser Welding, Ultrasonic Welding, Forge Welding, Explosive Welding & Cold Pressure Welding
1.5	Resistance welding-Spot welding, Seam welding, Projection welding
1.6	Welding defects, non-destructive testing
1.7	Brazing and soldering: Types, Principles, Applications

2	**CASTING** **08HRS**
2.1	Introduction and history
2.2	Patterns-Material used, types, Patterns allowances, Cores, Core allowances.
2.3	Moulding Sand – Types, characteristics and properties of sand.
2.4	Moulds-Mould materials, Types, Moulding processes
2.5	Process and steps in Sand Moulding
2.6	Mould making a. Runner and Gating System b. Core, Chaplets and Chills. c. Parts of Mould
2.7	Melting practice. Types of furnaces with specific application Cupola furnace, Electric arc furnace.
2.8	Special casting processes. Viz die-casting, centrifugal casting, Investment casting, Continuous casting.
2.9	Casting defects and its remedies.

3	**FORGING** **06HRS**
3.1	Introduction, Hot & Cold forging
3.2	Press and hammer (Concept only)
3.3	Explain different forging tools, specification and uses

3.4	Describe various forging processes-Drop forging, Upset forging, stamping, Die forging, press forging.
3.5	Types of dies-Open Die, Closed Die (Single Impression and Multi-impression)
3.6	Closed die Forging operations- Fullering, Edging, Bending, Blocking, Finishing
3.7	Forging defects and their remedies

4	**Rolling and Extrusion** **04HRS**
4.1	Principles of rolling and extrusion.
4.2	Hot and cold rolling.
4.3	Introduction to various rolling mills.
4.4	Methods of extrusion–Direct, Indirect, backward & impact Extrusion, Hot & Cold extrusion processes - applications.

5	**Press Working** **05HRS**
5.1	Types of presses and their specifications
5.2	Die set components. –punch and die shoe, guide pin, bolster plate, stripper, stock guide, feed stock, pilot
5.3	Punch and die clearances for blanking and piercing, effect of clearance
5.4	Press working operations- cutting, bending, drawing, punching, blanking, notching, lancing

6	**Lathe** **04HRS**
6.1	Principle, types and specification of Lathes
6.2	Functions of basic parts and tools
6.3	Operations–grooving, Turning, parting off, Knurling, facing, Boring, Drilling, threading, step turning, taper turning.

7	**Drilling, Boring and Reaming** **04HRS**
7.1.1	Drilling
7.1.2	Introduction, classification of drilling machine& their parts
7.1.3	Drilling accessories
7.1.4	Nomenclature of twist drill
7.1.5	Cutting parameters
7.2	Reaming
7.2.1	Introduction.
7.2.2	Nomenclature of reaming tool
7.3	Boring
7.3.1	Introduction, classification of boring machine and their parts
7.3.2	Counter boring and counter sinking operations

6	**Maintenance and Maintenance Planning** **04HRS**
6.1	Introduction
6.2	Objective of maintenance
6.3	Types – planned and unplanned maintenance
6.4	Repair cycle and repair complexity
6.5	Equipment history card, work order

COURSE OUTCOMES:

1. Develop suitable casting processes for various materials and components
2. Identify a suitable welding process & Process Parameters for an application
3. Design a suitable metal forming system for making an industrial product
4. Analyse the influence of Process Parameters on the powder metallurgy process
5. Select fabrication method for glass and polymer products
6. Identify suitable manufacturing process for product realisation
7. Fabricate simple components by various manufacturing processes.

Manufacturing Technology Lab

1. To make one job on Spot welding machine.
2. One simple job on TIG/MIG welding.
3. Making of one simple wooden Pattern on wood turning lathe.
4. Preparation of green sand mould using single piece and multi-piece pattern with core.
5. Preparation of One simple Job (ex- ring) in forging shop.
6. One job on lathe is performing the operations- plain turning, step turning, grooving, knurling, chamfering, and thread cutting.
7. One composite job performing the operations-face milling, side and face milling (slotting), drilling / tapping (drilled hole should be perpendicular to slotting operation).
8. One job performing drilling, milling, and reaming.
9. Preventive maintenance of welding machine
10. Preventive maintenance of lathe

RECOMMENDED BOOKS:

1. Workshop Technology –Part-I & II, Hazra Choudhury, Media Promoters & Publishers Pvt. Ltd.
2. Workshop Technology, Part – I & II by W.A.S. Chapman, ELBS
3. Manufacturing Technology by P.N. Rao, TMH
4. Workshop Technology Vol. I & II by B.S. Raghuvanshi
5. Workshop Technology by Raghuvanshi, Dhanpat Rai & Sons
6. All about Machine Tools by H. Gerling, New Age International (P) Ltd.
7. Manufacturing Engineering and Technology by S. Kalpakjian, Addison-Wesley Publishing Co.

FLUID MECHANICS & MACHINE

Subject Code: MEC404
Total Contact Hrs: 42
Full Marks: 100 (80+20)
L T P
3

Course Objectives:

1. To apply hydrostatic law, principle of mass and momentum in fluid flows, concepts in Euler's and Bernoulli equations
2. To provide fundamental knowledge of fluids, its properties and behaviour under various conditions of internal and external flows.
3. To determine the losses in a flow system, flow through pipes, boundary layer concepts.

1	**Properties of fluid**	**2HRS**
1.1	Introduction, types of fluid, fluid mechanics, classification of fluid mechanics.	
1.2	Properties of fluid- Density, Specific gravity, Specific Weight, Specific Volume, Dynamic Viscosity, Kinematic Viscosity, Surface tension, Capillarity, Vapor Pressure, Compressibility.	

2	**Fluid Pressure & Pressure Measurement**	**6HRS**
2.1	Fluid pressure, Pressure head, Pressure intensity, buoyancy, meta canter and meta centric height	
2.2	Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure	
2.3	Simple and differential manometers, Burden pressure gauge	
2.4	Total pressure, centre of pressure of plane, regular surfaces immersed in liquid. Horizontally, vertically and inclined	

3	**Fluid Flow**	**8HRS**
3.1	Types of fluid flows	
3.2	Continuity equation	
3.3	Bernoulli's theorem	
3.4	Venture meter–Construction, principle of working, Coefficient of discharge, Derivation for discharge through venture meter.	
3.5	Orifice meter– Construction, Principle of working, hydraulic coefficients, Derivation for discharge through Orifice meter	
3.6	Weir and Notch- Define & Differentiate between weir and notch. (No Numerical)	
3.7	Pitot tube–Construction, Principle of Working. **(Simple Numerical only)**	

4	**Flow Through Pipes**	**4HRS**
4.1	Laws of fluid friction (Lamina rand turbulent)	
4.2	Darcy's equation and Chezy's equation for frictional losses.	
4.3	Minor losses in pipes	
4.4	Hydraulic gradient and total gradient line	
4.5	Hydraulic power transmission through pipe. **(Numerical to estimate major and minor losses)**	

5	**Impact of jet**	**3HRS**
5.1	Impact of jet on fixed vertical, moving vertical flat plates.	
5.2	Impact of jet on curved vanes with special reference to turbines & pumps (Simple Numerical son work done and efficiency)	

6	**Hydraulic Turbines** **7HRS**
6.1	Layout and classification of hydroelectric power plant.
6.2	Selection of turbine on the basis of head and discharge available
6.3	Construction and working principle of Pelt on wheel, Francis and Kaplan turbine
6.4	Calculation of Work done, Power, efficiency of turbine.
6.5	Draft tubes– types and construction, Concept of cavitations in turbines

7	**Centrifugal Pumps** **6HRS**
7.1	Construction, principle of working and applications.
7.2	Types of casings and impellers
7.3	Concept of multistage
7.4	Priming and its methods, Cavitations
7.5	Manometric head, Work done, Man metric efficiency, Overall efficiency, NPSH
7.6	Performance Characteristics of Centrifugal pumps.
7.7	Trouble Shooting
7.8	Introduction to submersible and jet pump(simple numerical on centrifugal pumps)

8	**Reciprocating Pump** **6HRS**
8.1	Construction, working principle and applications of single and double acting reciprocating pumps.
8.2	Concept of Slip, Negative slip, Cavitations and separation.
8.3	Use of Air Vessel
8.4	Indicate or diagram with effect of acceleration head & frictional head.
8.5	Trouble shooting(No Derivations and Numerical on reciprocating pumps.)

COURSE OUTCOMES:

1. Analyse various hydraulic systems by applying the fundamental laws of fluid statics.
2. Solve the fluid flow governing equations by taking suitable constraints and assumptions
3. Evaluate major and minor losses in pipes
4. Analyse the practical significance of open channel flows
5. Perform dimensional analysis on any real-life problems
6. Interpret the boundary layer aspects of laminar and turbulent flows
7. Experimentally determine the fluid properties and flow parameters using various experimental setups

FLUID MECHANICS & MACHINE LAB
SUBJECT CODE: MEC408

List of Practical:

1. Calibration of Bourdon pressure gauge with the help of Dead Weight Pressure gauge.
2. Determine the meta centric height of a floating body.
3. Verification of Bernoulli's Theorem.
4. Determination of Coefficient of Discharge of Venture-meter
5. Determination of Coefficient of discharge, coefficient of Contraction and co-efficient of velocity of orifice meter.
6. Determination of coefficient of discharge through rectangular notch.
7. Determination of coefficient of discharge through triangular notch.
8. To determine minor losses for flow through pipes.
9. Determination of coefficient of friction of flow through pipes.

RECOMMENDED BOOKS:

1. Hydraulics & Hydraulic Machines by Modi & Seth, Standard Book
2. Hydraulics & Hydraulic Machines by R.K. Bansal
3. Fluid Mechanics by A.K. Jain, Khanna Publishers
4. Hydraulic and Fluid Mechanics by Jagadish Lal, Metropolitan Book
5. Hydraulics, Fluid Mechanics and Fluid Machines by R.S. Khurmi
6. Fluid Mechanics & Hydraulics Machines by R K Rajput
7. Fluid Mechanics & Hydraulics Machines by Domkundwar
8. Hydraulics Machines by Jagadish Lal

THERMAL ENGINEERING
Subject code : MEC4

Teaching and Examination Scheme
Total Theory Hrs 42
L T P
3 2
F M 100 (80+20)

Rationale:
Mechanical engineers have to work with various power producing & power absorbing devices like boilers, turbines, compressors, pumps etc. In order to understand the principles, construction & working of these devices, it is essential to understand the concept of energy, work, heat & conversion between them. Hence it is important to study the subject of Thermal Engineering which is a core subject. It includes the study of various sources of energy, basic laws & concept of thermo dynamics, gas laws, properties of steam & generation. Heat transfer forms the basis for different power engineering application. Boilers find application in different process industries. Steam turbine sand condensers are the major component of any steam power plant. Mechanical engineer should understand working and application of these devices.

COURSE OBJECTIVES:
The Students should be able to:
1. Know various source so energy & their applications.
2. Apply fundamental concepts of thermo dynamics to thermo dynamic systems.
3. Understand various laws of thermo dynamics.
4. Apply various gas laws & ideal gas processes to various thermo dynamic systems.
5. Calculate properties of two-phase system by using steam tables/mollier charts.
6. Explain construction & working of boilers, mountings & accessories

COURSE CONTENT:

1	**Sources of energy**	**04HRS**
1.1	Classification of energy sources -Renewable, Non-Renewable	
1.2	Fossil fuels, CNG, LPG.	
1.3	Solar - Flat plate and concentrating collectors. - Solar Water Heater - Photo voltaic Cell, Solar Distillation	
1.4	Wind, Tidal, Geothermal	
1.5	Biogas, Biomass, Biodiesel	
1.6	Hydraulic, Nuclear	
1.7	Fuel cell– list of fuel cells	

2	**Ideal Gases** **02HRS**
2.1	Concept of Ideal gas, Charle's law, Boyle's law, Avogadro's law, equation of state, Characteristic gas constant and universal gas constant.

2.2	Ideal gas processes:- Isobaric, Isochoric, Isothermal, Adiabatic, Poly tropic, Isentropic with representation of the processes on P-Vand T-S diagram (only simple numerical)

3	**Fundamentals of Thermodynamics** **10HRS**
3.1	Concepts of pure substance, types of systems, properties Of systems, Extensive and Intensive properties, Point function and path function. units of each ,PV=MRT
3.2	Work and Energy -Thermo dynamic definition of work, heat, difference between heat and work, P.E., K.E, Internal Energy, Flow work, concepts of enthalpy, entropy
3.3	Laws of Thermo dynamic -Zeroth Law, Temperature measurement, principle of energy conservation, irreversibility, Second Law of Thermo dynamics, Kelvin Plank, Claudius statements and their equivalence, Concept of perpetual Motion machine 1 and 2.
3.4	Application of Thermo dynamic laws -Steady Flow Energy equation and its application open system like boiler, engine, nozzle, turbine, compressor & condenser.

4	**Steam and Steam Boiler** **8 HRS**
4.1	Generation of steam at constant pressure with representation on various charts such as T-H,T-S,H-S,P-H. Properties of steam and use of steam table, Quality of Steam and its determination with Separating calorimeter (no numerical)
4.2	Vapour process:- constant pressure, constant volume, constant enthalpy, constant entropy (numerical using steam table and Mollier chart), Rankin Cycle .
4.3	Steam Boilers:- -Classification of boilers. -Construction and working of Cochran, Babcock, and Wilcox, La-mont and Loeffler boiler. - Boiler draught: natural and forced.

5	**Steam Turbines and Condensers** **12HRS**
5.1	Steam Nozzle: Continuity equation, types of nozzels, concept of Mach number. Critical pressure, application of steam nozzles. (simple numerical)
5.2	Steam Turbine: Classification of turbines, Construction and working of Impilse and reaction turbine.
5.3	Compounding of turbines, Regenerative feed heating, bleeding of steam, nozzle control governing (with velocity diagrams) .
5.4	Steam condenser: Dalton's law of Partial pressure, function and classification of condensors, construction and working of surface condensor
5.5	Source so fair leakage, concept of condenser efficiency, vacuum efficiency (no numerical).
5.6	Cooling Towers, Force draught, natural draught and induced draught

6	**Heat Transfer** **6HRS**
6.1	Modes of heat transfer:- Conduction, Convection, and Radiation.
6.2	Conduction by heat transfer -Fourier's law, thermal conductivity, conduction through cylinder, thermal resistance, composite walls, combined conduction, and convection (simple numerical)
6.3	Heat transfer by Radiation:- Thermal Radiation, Absorptive, Transmissivity, Reflectivity, Emissivity, black and Gray bodies, Stefan- Bolts man law.
6.4	Heat Exchangers:- Shell and tube, plate type, multiphase heat

Course Outcome:

Upon successful completion of the course the students will be able to

1. Identify thermodynamics systems, point functions and path functions.
2. Solve engineering problems using zeroth and first laws of thermodynamics.
3. Analyse the heat and work interactions by applying the concepts of entropy principles and exergy.
4. Analyse thermodynamic systems involving pure substances and mixtures.
5. Calculate thermodynamics properties based on thermodynamics relations.
6. Analyse basic thermodynamic cycles of various systems

Thermal Engineering Lab
Subject code : MEC410

List of Practical's:-

1. Collection of technical data and specification of photovoltaic cell by referring to Manufacturers catalogues.
2. Study of heat transfer and concept of heat exchanges.
3. Study of solar water heating system.
4. Report on visit to wind power generation plant/biogas plant/hydraulic power Plant.
5. Calculation of thermal conductivity of a solid metallic rod.
6. Verification of Stefan -Boltzmann's law
7. Study and compare various heat exchangers such as radiators, evaporators, condensers, plate heat exchangers etc.
8. Trace the flue gas path and water-steam circuit with the help of boiler model and write are port.
9. Study of Babcock and Wilcox Boiler/Lancashire Boiler

Recommended Books:

Sr. No.	**Author**	**Title**	**Publication**
01	R. K. Rajput	A Course in Thermal Engineering	Laxmi Publication, Delhi
02	P. L. Ballaney	A Course in Thermal Engineering	Khanna Publishers
03	R. S. Khurmi	A textbook of Thermal Engineering.	S.Chand& co .Ltd.
04	Domkundwar V. M.	A Course in Thermal Engineering	Dhanpat Rai &Co.
05	P. K. Nag	Engineering Thermodynamics	Tata Mc Graw Hill
06	R. S. Khurmi	Steam Table &Mollier Diagram	S. Chand & co. Ltd.

THEORY OF MACHINE
(Subject Code : MEC405)

Total Contact Hrs 42
L T P
3 2

F M 100 (80+20)

COURSE OBJECTIVES:

1. To impart students' knowledge about forces acting on machine parts.
2. To enable students to understand the fundamental concepts of machines.
3. To facilitate students to understand the functions of cams, gears and fly wheels.
4. To make students to get an insight into balancing of rotations and reciprocating masses and the concepts of vibration.

1	**Fundamentals and types of Mechanisms** **6HRS**
1.1	Kinematics of Machines: Definition of Kinematics, Dynamics, Statics, Kinetics, Kinematic link, Kinematic Pair and its types, constrained motion and its types, Kinematic chain, and its types. Mechanism, inversion, machine, and structure. Inversions of Kinematic Chain .
1.2	Inversion of four bar chain, coupled wheels of Locomotive & Pantograph
1.3	Inversion of Single Slider Crank chain-Rotary I.C. Engines mechanism, Whit worth quick return mechanism,
1.4	Introduction to Inversion of Double Slider Crank Chain-Oldham's Coupling. Common Mechanisms
1.5	Geneva Mechanism
1.6	Ackerman's Steering gear mechanism.(No numerical)

2	**Velocity and Acceleration in Mechanism** **2HRS**
2.1	Concept of relative velocity, angular velocity and Angular acceleration of a point on a link.
2.2	Velocity and acceleration of points and links in mechanisms – relative velocity and instantaneous centre method (simple numerical based on analytical method).
2.3	Klein's construction to determine velocity and acceleration of piston of a reciprocating engine.

3	**Cams and Followers** **6HRS**
3.1	Concept, definition and application of Cams and Followers
3.2	Classification of Cams and Followers.
3.3	Different follower motions and their displacement diagrams like uniform velocity, SHM.
3.4	Drawing of profile of radial cam of roller, Follower with and without off set with reciprocating motion (Graphical method).

4	**Power Transmission** **8HRS**
4.1	Belt Drives-flat belt, V–belt & its applications, material For flat and V belt, angle of lap, belt length. Slip and creep. Determination of velocity ratio, ratio of tight side and slack side tension, centrifugal tension and initial tension, condition for maximum power transmission (Simple numerical)
4.2	Chain Drives–Advantages & Disadvantages, Selection of Chain & Sprocket wheels, methods of lubrication.
4.3	Gear Drives–Spur gear terminology, types of gears and gear trains, train value & velocity ratio for compound, reverted and simple epicycles gear train, methods of lubrication, Law of gearing. (simple numerical)
4.3	Rope Drives–Types, applications, advantages & Limitations of Steel ropes.

5	**Flywheel and Governors** **6HRS**
5.1	Flywheel-Concept, function and application of flywheel with the help of turning moment diagram for single cylinder 4-Stroke I.C. Engine (No Numerical). Coefficient of fluctuation of energy, coefficient of fluctuation of speed and its significance.
5.2	Governors-Types, concept, function, and application & Terminology of Governors. (numerical on Watt governor only)
5.3	Comparison between Flywheel and Governor.

6	**Brakes, Dynamometers, Clutches & Bearings** **10HRS**
6.1	Function of brakes and dynamometer, types of brakes and Dynamometers, comparison between brakes and dynamometer .
6.2	Construction and working of Shoe brake, Band Brake, Internal expanding shoe brake , Disc Brake ,
6.3	Concept of Self Locking & Self energizing brakes
6.4	Numerical problems to find braking force and braking torque for shoe brake. construction and working of Rope Brake Dynamometer, Introduction to Hydraulic Dynamometer and Eddy current Dynamometer.
6.5	Clutches and Bearing : -Clutches-Uniform pressure and Uniform wear theories. -Function of Clutch and its application, Construction and working of Single plate clutch, Introduction to Multi-plate clutch, Centrifugal Clutch, Cone clutch and Diaphragm clutch. (Simple numerical on single plate clutch). Bearings: Simple Pivot, Collar Bearing. Torque & power lost in friction (no derivation). Simple numerical

7	**Balancing & Vibrations** **2HRS**
7.1	Concept of balancing, Balancing of single rotating mass, State the causes and effect of unbalance.
7.2	Concept and terminology used in vibration, causes of vibration, and their harm full effect sand remedies.

8	**Gyroscope (Introduction only)** **2HRS**
8.1	Gyroscopic motion , Gyroscopic torque ,Gyroscopic effects ,Application of Gyroscope

Course Outcome:

Upon successful completion of the course the students will be able to

1. Apply different mechanisms for designing machines.
2. Compute velocity and acceleration of various plan mechanisms.
3. Apply the principles for analysing cams, gears and gear trains.
4. Synthesize mechanisms for doing useful work.
5. Analyze dynamic forces acting on mechanism.
6. Balance rotating and reciprocating masses and reduce vibrations.
7. Analyze gyroscopic effects on aeroplanes, ships and automobiles.
8. Measure and analyze free, forced and damped vibrations of mechanical systems

Theory of Machine Lab
Subject Code : MEC409

List of Practical:

1. To find the ratio of time of cutting stroke to the time of return stroke for quick return mechanism of a shaper machine.
2. Sketch & describe working of bicycle free wheel sprocket mechanism.
3. To find out the height of all types of Governors through Universal Governor Apparatus.
4. Determine the radius of rotation of fly ball for different speed of governor and draw a graph between radiuses of rotation versus speed.
5. Study of different types of CAM and follower through models.
6. Determination of power transmitted by any belt drive using any one dynamometer.
7. Dismantling and assembly of multi-plate clutch of two-wheeler.
8. Balancing of several masses rotating in a single plane by graphical method.
9. Study of gyroscopic model
10. Study of different types of gears, gear trains and drives through models

RECOMMENDED BOOKS:

1. The Theory of Machines by Thomas Bevan, CBS Publishers & Distributors
2. Theory of Machine by Saha, Jadavani
3. Theory of Machine by P. L. Ballaney
4. Theory of Machine by R.S. Khurmi
5. Theory of Machine by Abdullah Shariff, Dhanpat Rai& Sons
6. Theory of Machines by SS Ratan
7. Theory of Machine by J E Shigley

Electrical Engineering
Subject : MEC406

Full Marks : 100 (80+20)
L T P
3 2
Objectives:

This is a foundation course to understand the basic principles and behaviour of electrical circuits, electrical power apparatus and utilization of electrical energy.

1. Electrical Engineering Fundamentals &Theorems Module-1 (12 Hours)

Introduction to electrical circuits: Essence of electricity, Electric field, electric current, potential and potential difference, electric power, basic circuit components, ohm's law, Ideal and Practical Sources, Source Conversion, independent and dependent sources, Energy Stored in Inductor and Capacitor, series, parallel and series and parallel circuit.
DC Networks: Laws and Theorems applicable to DC networks (KCL & KVL, Node voltage & Mesh current analysis, Delta-Star & Star-Delta conversion, Superposition principle, Thevenin& Norton theorem),Transients in R-L and R-C circuits with DC excitation, Simple problems.
Introduction to Magnetic Circuits: Introduction to Electromagnetism, B-H curve, Permeability, Reluctance, Solution of magnetic circuits, Hysteresis and Eddy current loss.

2. AC Fundamentals Module-2 (6 Hours)

Single-Phase AC Circuits: Single-phase EMF Generation, Average and Effective value of periodic ac signals, Peak factor & Form factor, Pharos and Complex representation of sinusoids, Power factor, complex power.
Three-Phase AC Circuits: Comparison between single-phase and three-phase systems, three phase EMF Generation, Line and Phase quantities in star and delta networks,

3. Transformers Module-3 (8 Hours)

Single-Phase Transformers: Construction and principle of operation, EMF Equation, Transformation ratio, Practical and Ideal transformers, Transformer losses, Brief idea on Transformer Phasor diagram and transformer rating, Auto transformer. Introduction to 3 phase transformers

4. D C Machines Module-4 (8 Hours)

D.C. Machines: Principle of operation, construction, classification of DC machines, EMF equation of DC generator, Speed Equation of DC Motor. Series shunt and compound dc motors.

5. AC Machines & Power system Module – 4 (8 Hours)

Induction Motors: Introduction to Single-phase and Three-phase Induction Motors, Concept of Slip. Synchronous motors and special types of ac motors. Power Systems: Introduction to generation, transmission and distribution of AC Power, basic idea on grounding, and safety.

Text/reference books:

1. Rizzoni,Principles and Applications of Electrical Engineering., McGrawHill
2. Hughes, "Electrical & Electronic Technology", Ninth Edition Pearson Education.
3. V.D.Toro, "Basic Electrical Engineering", Prentice-Hall of India.
4. B.L.Theraja, A.K.Theraja, "A textbook of Electrical Technology" S.Chand. Ltd.

5. Rajendra Prasad, “Fundamentals of Electrical Engineering”, PHI,
6. 6.D P khothari and I J Nagratha “Basic electrical engineering” 2nd ed, TMH.
7. N.N.ParkerSmith,”Problems in Electrical Engineering”, CBS Publisher.

Electrical Technology Laboratory
Subject Lab : MEC411

List of Experiments:

1. Connection and measurement of power consumption of various lamps.
2. Measurement of armature and field resistance of DC machine.
3. V-I Characteristics of incandescent lamps and time fusing current characteristics of a fuse.
4. Calculation of current, voltage and power in series R-L-C circuit excited by single phase AC supply and calculation of power factor.
5. Study of various parts of DC machine.
6. Study of single-phase induction motor and fan motor.
7. Verification of superposition, Thevenin's and Norton's theorem.
8. Study of single-phase energy meter.
9. Open circuit and short circuit test of single-phase transformer.
10. Study of solar photo voltaic system.

Professional Practices-II
SubjectCode:401

Rationale:

Most of the diploma holders join industries. Due to globalization and competition in the industrial and service sectors the selection for the job is based on campus interviews or competitive tests. While selecting candidates a normal practice adopted is to see general confidence, ability to communicate and their attitude, in addition to basic technological concepts. The purpose of introducing professional practices is to provide opportunity to students to undergo activities which will enable them to develop confidence. Industrial visits, expert lectures, seminars on technical topics and group discussion are planned in a semester that there will be increased participation of students in learning process.

Objectives:

Student will be able to:

1. Acquire information from different sources
2. Prepare notes for given topic
3. Present given topic in a seminar
4. Interact with Perthshire thoughts
5. Prepare a report on industrial visit ,expert lecture.

Sl. No.	Activity Heads	Activities	Suggested Hrs
1.	Acquire information from different sources	Topic related to the branch and current area of interest i.e., articles in internet on which research or review is undergoing may be decided for the students group. The group may be restricted to maximum 5 students. Literature survey from Internet , print media and nearby practices may be undertaken. Minimum of 10 to 15 papers may be suggested for reading to get an overview and idea of matters.	12

2.	Prepare notes for given topic	Making review or concept to be penned down in form of a article .(the article or review may be of 8 – 10 pages length in digital form of 12 font size in Times New Roman font)	4
3.	Present given topic in a seminar	A seminar or conference or work shop on branch related topic is to be decided and all students in group of 5-6 students may be asked to present their views.	4
4.	Interact with peersto share thoughts	A power point presentation of the article prepared in stage 2 may be presented before the classmates and faculty members.	4
5.	Prepare a report on industrial visit ,expert lecture	A topic on best practices and product / software development may be assigned to the student group. The group may be asked to prepare a survey, come to opinion making and list out the activities to develop the activities with SWOT analysis.	12

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF MECHANICAL ENGINEERING

POLYTECHNIC (5th) SEMESTER SYLLABUS

Power Engineering

Subject Code: MEC 503

Hours 42
Full Marks : 80+20

Course objectives:

1. To make the students familiar with the engine fuel and air supply systems, electronic injection systems used in modern automotive engines.
2. To make the students understand about the combustion phenomenon of SI and CI engines, engine pollutants.
3. To teach the students on production and utilization of alternative solid, liquid and gaseous fuels.
4. To teach modern trends in IC engines.

1	**I.C. Engine and Testing** **12HRS**
1.1	Power Cycles - Carnot, Otto, Diesel, Dual-combustion, representation on P-V, T-S diagram. (air standard efficiency, simple numerical)
1.2	Explain classification of I.C. engines, Identify various I.C. engine parts &their functions.
1.3	Engine terminology:- Stroke, bore, piston speed, mean effective Pressure, compression & cut-off ratio etc.
1.4	Two stroke and four stroke Engines- Construction and working, comparison, valve timing Diagram, Turning moment diagram.
1.5	Brief description of I.C. Engine combustion (SI & CI), scavenging, pre-ignition, detonation, supercharging, turbo charging, simple Carburetor, M.P.F.I., C.R.D.I, fuel injection Pump Latest developments in I.C. engine.
1.6	Determination of I.H.P., B.H.P. and F.H.P. & mechanical efficiency, indicated thermal efficiency, brake thermal efficiency, volumetric efficiency and specific fuel combustion, Heat balance sheet, Morse test. (Simple numerical)
1.7	Types of fuel, lubricant additives and their advantages.
1.8	Pollution considerations (Euro and Bharat Stage Norms).

2	**AIR COMPRESSER** **10HRS**
2.1	a. Introduction b. Classification of air compressors c. Definition: - Pressure ratio, Compressor capacity, Free airdelivered, Swept volume. d. Uses of compressed air e. Single stage, multi stage, single acting, double acting
2.2	Reciprocating air compressor : Construction and working of single stage and two stage compressor, Efficiency, Volumetric, Isothermal & Mechanical(Only simple numerical),Advantages of multi staging.
2.3	Rotary Compressor: Construction and working of screw, lobe, vane, centrifugalcompressors &Axial flow compressors (No numerical),Comparison and applications of reciprocating and rotarycompressors
2.4	Methods of energy saving in air compressors.

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 theircomparison.

3.3	Methods to improve thermal efficiency of gas turbine- Regeneration, inter- cooling,

	reheating using T- S diagram (no analytical treatment)
3.4	Jet Propulsion: Principles of turbojet, turbo propeller, Ram jet.
3.5	Rocket propulsion: Solid propellants, solid propellant rocket and liquid propellants, components of liquid propellants, liquid propellantRocket.

4	**Refrigeration and Air- Conditioning** **10HRS**
4.1	Air Refrigeration cycle: a. Define Refrigeration b. Explain methods of Refrigeration c. State unit of Refrigeration, C.O.P. d. Explain Carnot cycle, reversed Carnot cycle, bell Coleman cycle and derive the C.O.P. with simpleproblems. e. Explain open air and closed air refrigeration system.
4.2	Vapour compression system a. Explain the principle and analysis of vapour comp. Refrigeration system with help of P-H, T-S diagram,simple problem. b. Write down different types of refrigerants with theirproperties (Ammonia, CO2, F-11, F-12) c. Briefly Explain the working principle of Ice-plant,cold storage, domestic Refrigerator
4.3	Vapour absorption system: Explain the working principle of vapour absorption system
4.4	Psychometric: Psychometric properties of air, Dalton's law of partial pressure, psychometric chart & processes (No numerical)
4.5	Air conditioning systems: Definition of Air conditioning and classification of Airconditioning Systems.(Elementary treatment) Application- Window air conditioner.

CO	**COURSE OUTCOMES**
CO 1	Students able to know fuel supply systems, combustion and emission aspects of IC engines and recent developments in IC engines.
CO 2	Able to know the performance of the IC engine using performance parameter.
CO 3	Student able to produce compressed air by using Single stage, multi stage, single acting, double acting.
CO 4	Analyse and perform calculations for vapour compression refrigeration system
CO 5	Analyse different components of vapour compression refrigeration system
CO 6	Compare different refrigerants and suggest environmentally friendly refrigerant

REFERENCE BOOKS:

1. V. M. Domkundwar Course in Thermal Engineering. Dhanpat Rai & Co
2. P.L.Ballaney Thermal Engineering. Khanna Publishers
3. R.S.Khurmi Text Book of Thermal Engineering. S.Chand & Co. Ltd

Power Engineering Lab
Subject Code:ME511

List of Practical:

1. Study and running of two stroke petrol and diesel engine.
2. Study and running of four stroke petrol and diesel engine.
3. Performance test of four stroke diesel and petrol engine
4. Mechanical efficiency
5. Brake thermal efficiency
6. Specific fuel consumption/BHP/HR
7. Morse test on (multi cylinder) I.C. engine
8. Perform experiments on air compressor rig.
9. Trial on two-stage Reciprocating compressor.
10. Find the COP of refrigerator.
11. Study of Ice plant
12. Study of domestic refrigerator
13. Identify the components and trace the flow of refrigerant through various components in window air conditioner.

Advance Manufacturing Processes
Subject Code:504

Hours 42
Marks: 80 + 20

Course Objectives:

1. Objectives of non-traditional machining processes are to achieve high accuracies and good surface finishes and parts machined without burrs or residual stresses especially with materials that cannot be machined by conventional methods.
2. Providing knowledge of CNC Lathe and CNC Milling Machines.
3. Single spindle automates, transfer lines.
4. Introduction to PLC, Block diagram of PLC.
5. Providing ideas of Internet of things (IoT).

1	**Non –traditional machining processes** **15 HRS**
1.1	Introduction: Unconventional machining process – Need, Classification, Brief Overview of all techniques (Merits and demerits).
1.2	**Mechanical Energy Based Processes:** Abrasive Jet Machining (AJM), Water Jet Machining (WJM),Ultrasonic Machining (USM) –Working principles, Equipment used, Process parameters, Applications.
1.3	**Electrical Energy Based Process :** Electric Discharge Machining (EDM) – Working Principles, Equipment, Process parameters, Electrode / Tool, Power, Circuits. Tool wear, Dielectric, Flushing, Wire cut EDM and Applications.
1.4	**Chemical And Electro Chemical Energy Based Process:** Chemical Machining (CHM) – Etchants , Mask ant (Techniques of Applying mask ants) Process parameters, Applications. Principles of ECM – Equipment's, Electrical circuit, Process, Parameters and Applications.
1.5	**Thermal Energy Based Process:**Laser Beam Machining (LBM) ,Plasma Arc Machining (PAM),Electron Beam Machining (EBM) – Principles, Equipment, Types, Beam control techniques and Applications.

2	**CNC Lathe** **07HRS**
	Introduction, Classification, advantages, Positioning systemConstructional features. Part programming: programming format, word, statement, block, Preparatory and miscellaneous code, Fixed cycles in programming- canned cycle, do- loop,subroutine.

3	**CNC milling machines** **08HRS**
3.1	Concept of CNC milling machine, Vertical and horizontal machining centre: Constructional features, Axis identification, electronic control system. Automatic tool changer and tool magazine.
3.2	CNC programming: Preparatory functions (G code),miscellaneous functions (M code), Part programming Including sub routines and canned cycles with comparison (simpleprogramming based on sub routines)
3.3	Introduction to Computer aided part programming by usingAPT language

4	**Machine Tool Automation:** **04HRS**
4.1	Introduction and Need.
4.2	Single spindle automates, transfer lines.Elements of control system, Limit switches, Proximity switches,Block diagram for feedback and servo control system.
4.3	Introduction to PLC, Block diagram of PLC.

5	**Internet of things (IoT)** **04HRS**
5.1	Introduction to basic components
5.2	Different commonly used sensing & Actuating devices
5.3	Introduction to Artificial Intelligence (AI) & Expert system in relationto IoT.
5.4	Integration of different system.

6	**Maintenance of Machine Tools:** **04HRS**
6.1	Types , need and importance of maintenance activity
6.2	Basic maintenance practices for simple machine element, (Bearing,Coupling, Shaft and pulley etc.)
6.3	Repair cycle analysis, Repair complexity, Maintenance manual,Maintenance records, Housekeeping
6.4	Introduction to Total Productive Maintenance (TPM).

CO	**COURSE OUTCOMES**
CO 1	Understanding of working and principal of Electron beam, laser beam and laser beam processes.
CO 2	Able to understand different types of composite material characteristics
CO 3	Knowledge of types of micro & macro machining processes and their working knowledge
CO 4	Understand the latest e-manufacturing & nano technology
CO 5	Understanding CNC Programming and codes.
CO 6	Able to work with PLC and IOT

Reference Books:

Sl. No.	**Autho r**	**Title**	**Pu**
01	Amitabh Ghosh,	Manufacturing Science	East-West Press Pvt.
02	HMT, Bangalore	Production Technology	Tata Mc- Graw Hill
03	Pabla B.S. M.Adithan	CNC machines	New Age internationallimited.
04	H.P. Garg	Industrial maintenance	S. Chand & Co. Ltd.
05	Lindley R. Higgins	Maintenance Engg. Handbook	Mc Graw Hill
06	Bagman, Amsted	Manufacturing Processes	John Willey and Sons.
07	B.L. Juneja	Fundamental of metal cutting and machinetools	New age internationallimited.
08	Steve Krar, Albert Check	Technology of MachineTools.	McGraw-Hill Internationa l.
09	P.N.Rao	CAD/CAM Principals and Applications	Tata Mc Graw-Hill
10	P.N. Rao	Manufacturing Technology Metal Cutting &Machine tools	Tata McGraw-Hill

11	Jeff Heaton	Artificial Intelligence for Human	
12	S. Russel, P. Norvig	Artificial Intelligence : A modern approach	
13	Ela Kumar	Artificial Intelligence	
14	Dr. Jeeva Jose	Internet of things	Khanna pubs.

Advance Manufacturing Process Lab

Subject Code:MEC 512

Marks 50

List of Practical:

1) Two jobs on CNC lathe containing the operations like plain turning, taper turning andcurvature.
2) Two jobs on CNC milling having following operations–face milling, slotting.
3) Study and Report on part programming (using part programming and canned cycle) onmachining center.
4) Study and Report on machine tool installation procedure.
5) Dismantling and Assembly of any one–
   a) Tailstock on lathe
   b) Apron Mechanism.
6) Dismantling and Assembly of any one–
   a) Tapping attachment on drilling machine.
   b) Lathe Chuck
7) Study and Report on mounting and dismounting procedure of following (any two)–
   a) Milling machine arbor.
   b) Vertical milling head.
   c) Tool post
8) Study and Report on any one of the following USM, CHM.
9) Study and Report on any one of the following EBM, AJM.
10) Study and Report on any one of the following WJM, PAM.

Metrology & Quality Control
Subject Code: MEC 505

Full Marks : 80+ 20

Hours 42

Course Objectives:

1. Select suitable instrument / gauge / method of inspection for determining geometrical and dimensional measurements.
2. Calibrate measuring instruments and also design inspection gauges.
3. Understand the advances in Metrology such as use of CMM, Laser, Machine Vision System for Metrology etc.
4. Select and apply appropriate Quality Control Technique for given application.
5. Select and Apply appropriate Quality Management Tool and suggest appropriate Quality Management System (QMS)

1	**Introduction to metrology. 15HRS**
1.1	Metrology Basics: Definition of metrology, Categories of metrology, Scientific metrology, Industrial metrology, Legal metrology, need of inspection, Revision of (no questions be set) - Precision, Accuracy, Sensitivity, Readability, Calibration, Traceability, Reproducibility, Sources of errors, Factors affecting accuracy, Selection of instrument, Precautions while using an instrument for getting higher precision and accuracy
1.2	Limits, Fits ,Tolerances and Gauges: Concept of Limits, Fits, And Tolerances, Selective Assembly, Interchangeability, Hole and Shaft Basis System, Taylor's Principle, Design of Plug, Ring Gauges, IS919- 1993 (Limits, Fits & Tolerances, Gauges IS 3477-1973, concept of multi gauging and inspection
1.3	Linear Measurement: Description, working principle, method of reading, least count for Vernier calipers, Micrometers (Outside micrometers, InsideMicrometers), Depth gauge, Height Gauge, Feeler Gauge, Slip gauges(category, use, Selection of Slip Gauges for setting particulardimension) , Length bars.
1.4	Angular Measurement: Concept, Instruments for Angular, Measurements, Working and Use of Universal Bevel Protractor, Sine Bar, Spirit Level, Principle of Working of Clinometers, Angle Gauges (With Numerical on Setting of Angle Gauges
1.5	Standards and Comparators: Definition and introduction to line standard, end standard, Wavelength standard, .Definition, Requirement of good comparator, Classification, use of comparators, Working principle of comparators, Dial indicator, Sigma comparator, Pneumatic comparator, Electrical, Electronic, Relative advantagesand disadvantages

2	**Threads and Gear Metrology 05HRS**
2.1	Screw thread Measurements, Types of thread, Errors in threads, Pitch errors, Measurement of different elements such as major diameter, minor diameter, effective diameter, pitch, two wire methods, Thread gauge micrometer, Working principle of floating carriage dial micrometer
2.2	Gear Measurement and Testing, Analytical and functional inspection, rolling test, Measurement of tooth thickness, gear tooth vernier, Errors in gears such as backlash, run out, composite

3	**Testing Techniques 8HRS**

3.1	Measurement of surface finish: Primary and secondary texture, Sampling length, Lay, terminologyas per IS 3073- 1967, direction of lay, Sources of lay and its significance, CLA, Ra, RMS, Rz values and their interpretation, Symbol for designating surface finish on drawing, Various techniques of qualitative analysis.
3.2	Machine tool testing: Parallelism, Straightness, Squareness, Coaxiallity, roundness, runout, alignment testing of machine tools.as per IS standard procedure

4	**Quality Control** **08HRS**
4.1	Quality : Definitions, meaning of quality of product & services, Quality characteristics, Quality of design, Quality of conformance, Quality of performance, Concept of reliability, Cost, Quantity assurance, Cost of rework & repair, Quality & Inspection, Inspection stages
4.2	Total Quality Management : a. Principles and concept of total quantity management. b. Quality Audit: Concept of audit practices, lead assessor certification. c. Six sigma: Statistical meaning, methodology of system Improvement
4.3	ISO 9000 Series & other standards, Concept, ISO 9000 series quality standards, QS14000, Standards in general, Its evaluation & Implications, necessity of ISO certification, other Quality systems

5	**Elementary Statistics & it's application in quality control** **06HRS**
5.1	**Statistical Quality Control** – Meaning and importance of SQC, Variable and attribute Measurement . control charts – inherent andassignable sources of variation, control charts for variables – X & R charts, control charts for attributes p, 100p np, C, U - charts (simple numerical based on charts), process capability of machine, determination of statistical limits, different possibilities, Rejection area, statistically capable and incapable processes.
5.2	**Acceptance Sampling –** Concept, Comparison with 100% inspection,Different types of sampling plans, with merits and demerits.

CO	**COURSE OUTCOMES**
CO 1	Understand the methods of measurement and selection of measuring instruments, standards of measurement.
CO 2	Identify and apply various measuring instruments
CO 3	Explain tolerance, limits of size, fits, geometric and position tolerances and gauge design.
CO 4	Recommend the Quality Control Techniques and Statistical Tools appropriately
CO 5	Analyze the Data collected
CO 6	Develop an ability of problem solving and decision making by identifying and analysing the cause for variation and recommend suitable corrective actions for quality improvement.

Reference Books:

Sl. no.	**Author**	**Title**	**Publisher**
1	R. K. Jain	Engineering Metrology	Khanna Publisher
2	J.F.W. Galyer & C. R. Shotbolt	Metrology for engineers	ELBS
3	K. J. Hume	Engineering Metrology	Kalyani publishers

4	I.C. Gupta	A text book of Engineering. metrology	Dhanpat Rai and Sons
5	M. Adithan & R. Bahn	Metrology Lab manual	T.T.T.I.
6	M. Mahajan	Statistical Quality Control	Dhanpat Rai & Sons
7	T.T.T.I Chennai	Quality Control	Tata McGraw Hill
8	Juran U.M & Gryna	Quality planning & analysis	Tata McGraw Hill
9	National Productivity council	Inspection & Quality control	N.P.C
10	N. Logothetis	Managing for Total Quality	Prentic -Hall
11	Lauth Alwan	Statistical Process analysis	Tata McGraw Hill

Metrology & Quality Control
Subject Code : MEC 513

List of Practical's:

1. Standard use of basic measuring instruments. Surface plate, v-block, sprit level, combination set, filler gauge, screw pitch gauge, radius gauge, vernier caliper, micrometer and slip gauges to measure dimension of given jobs.
2. To find unknown angle of component using sine bar and slip gauges.
3. Study and use of optical flat for flatness testing.
4. Measurement of screw thread elements by using screw thread micrometer, screw pitch gauge.
5. Study and use of dial indicator as a mechanical comparator for run out measurement, roundnesscomparison.
6. Measurement of gear tooth elements by using gear tooth vernier caliper and verification of geartooth profile using profile projector.
7. Testing of machine/ machine tool for flatness, parallelism, perpendicularity by Dial indicator.
8. Draw the normal distribution curve and find standard deviation, variance, range.
9. To draw the normal distribution curve and find standard deviation, variance, range.
10. To draw and interpret the control limit for variable measurement (X – bar and R - chart)

Electronics Engineering
Subject Code: MEC506
Full marks: 80 + 20 = 100,
Hours42

1	**Basic Electronics**	**(10 Hours)**
1.1	Semiconductor: Intrinsic, extrinsic, energy band concept, P N Junction, potential distribution across PNjunction and associated terminologies.	
1.2	Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Special types of diodes. Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers), Diode clipper and clamper circuits, Light emitting diodes.	
1.3	Bipolar Junction Transistors (BJTs): Simplified structure and physical operation of n-p-n and p-n-p transistors in the active region, Equivalent circuits, h parameters, Current-voltage characteristics of BJT, BJT as an amplifier and as a switch, BJT Circuits at DC, Biasing in BJT amplifier circuits CE Amplifiers, Voltage follower, Cascading of stages.	
1.4	Field Effect Transistor (FET): Fundamentals of FET Amplifier Circuits and Analysis, Introduction to MOSFET.	

2	**Operational Amplifier**	**(4 Hours)**
2.1	Operational Amplifier (Op-Amp): The ideal Op-Amp, Inverting and non-inverting configurations, Difference amplifier, CMRR, Application of Op-Amp (Summing amplifier, Integrator and Differentiator).	

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3	**Digital Electronics**	**(8 Hours)**
3.1	Digital Electronic Principles: Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to- Binary conversion, Simple binary arithmetic.	
3.2	Logic Gates and Boolean Algebra: The inverter, The AND, OR NAND NOR, Exclusive-OR and Exclusive-NOR gate, Boolean operations and expressions, Laws and Rules of Boolean algebra, De-Morgan's theorem, Boolean analysis of logic circuits, Standard forms of Boolean expressions, Boolean expression and truth table	
3.3	Combinational Logic and Their Functions: Basic combinational logic circuits, Implementation of combinational logic, The universal properties of NAND and NOR gates, Basic adders, Multiplexers and Demultiplexers., Elementary treatment of Latches, Basic concepts of Memory (RAMs) .	

4	**Microprocessor & Peripheral chips :**	**(8 hours)**
4.1	8085 and 808 Microprocessor, block diagram, pinout diagrams, interrupt, stack, paging, modes, features, instruction set and programming, 8255, 8279 chips.	

5	**Microcontroller:**	**(8 hours)**
5.1	Introduction to 8 and 16 bit microcontroller, instruction sets and programming introductory concept	

Electronics Engineering Lab
Subject Code : MEC514

List of Experiments

(At least 10 experiments has to be performed by the students)

1. Familiarization of electronic components and devices (Testing of semiconductor diodes andtransistors using digital multimeter)
2. Study and use of Oscilloscope, signal generator to view waveforms and measure amplitude andfrequency of a given waveform.
3. V-I characteristics of semiconductor diode and determining its DC and AC resistance.
4. Studies on half-wave and full-wave rectifier circuits without and with capacitor filter; recordingof the waveforms and measurement of average and rms values of the rectifier output.
5. V-I characteristic of an n-p-n or p-n-p transistor, DC biasing the transistor in common-emitterconfiguration and determination of its operating point (i.e., various voltages and currents).
6. CE multistage amplifier circuit frequency response.
7. Studies on Op-Amp applications (Inverting, non-inverting integrating and differentiatingconfigurations); recording of the input-output waveforms.
8. Studies on Logic gates (Truth table verification of various gates).
9. Gain-frequency response studies of FET and response of dc, RC and transformer coupledamplifiers.
10. Studies and experiments using MUX-DEMUX ICs.
11. Study on CMOS logic inverter.
12. 8085 simple programming
13. 8086 programming
14. 8 bit microprocessor interfacing
15. Study of microcontroller system
16. Simple programming for microcontrollers.

REFERENCE BOOKS:

1. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Boylestad and Louis Nashelsky, Pearson Education
2. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education
3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited
4. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education,
5. Microelectronic Circuits (Fifth Edition), Adel S. Sedra and Kenneth C. Smith, Oxford University Press, YMCA Library Building Jai Singh Road, New Delhi – 110 001.
6. Electronics Principles (7th Edition), Albert Malvino and David J. Bates, Tata McGraw-Hill Publishing Company Limited, New Delhi.
7. Linear Integrated Circuits by Gayakward
8. Microprocessor book by R K Gaonkar
9. 8086 Microprocessor by Lui & Gibbson
10. Microcontroller by Mazidi

Power Plant Engineering
Subject Code: MEC507
Hours 42
Full Marks: 80+20=100

Course Objectives:

1. Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
2. Understanding of Thermal Power Plant Operation, turbine governing, different types of high-pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
3. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
4. Basic knowledge of Different types of nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor
5. Understanding of Power Plant Economics, Energy Storage including compressed air energy and pumped hydro etc.
6. Discussing environmental and safety aspects of power plant operation.

1	**Introduction to power plant** **06HRS**
1.1	Power scenario in India and abroad
1.2	Types of power plants – Hydro, Nuclear, Thermal, Future trends inpower sector
1.3	Analysis of steam cycles- Carnot, Rankine, reheat cycle, Regenerative cycle, Methods of reheating, Advantages anddisadvantages of reheat cycle

2	**Hydro-Electric Power Plant** **06HRS**
2.1	Site selection for hydro-electric power plants
2.2	Classification of hydro-electric power plants
2.3	Advantages of hydro-electric power plants
2.4	Construction and operation of different components ofhydro-electric power-stations

3	**Steam Power Plant** **08HRS**
3.1	Layout of the steam power plant, general features of selection ofsite.
3.2	working of steam power plant
3.3	High pressure boilers – Construction and working ofSub-critical and Super-critical boilers
3.4	Coal and ash handling system- equipment's for in plant handling ofcoal such as belt conveyor, screw conveyor, bucket elevator, Coalcrushing, Pulverized fuel handling system, Ball mill, Pulverized fuel and their advantages, Multi retort stoker, Pulverized fuel burner, Hydraulic and pneumatic ash handling, Electrostatic precipitator.

4	**Gas turbine power plant** **04HRS**
4.1	Classification, General Layout, selection of site of Gas turbinepower plants in India.
4.2	Different arrangements of plant components
4.3	Comparison of Gas turbine plant with Steam power plant. Environmental impact of gas turbine power plant

5	**Nuclear power plant** **06HRS**
5.1	Elements of nuclear power station, layout, general criteria forselection of site.
5.2	Fusion and fission reaction, types of nuclear reactors, nuclear fuels, coolant & moderators.
5.3	Working of PWR, BWR, CANDU, BREEDER type reactor, Safety precautions, nuclear waste and its disposals.

6	**Non-conventional power generation plants** **04HRS**
6.1	Tidal power plant- factors affecting suitability of site, working ofdifferent tidal power plants, advantages and disadvantages
6.2	Wind power plant- different types, advantages andDisadvantages.
6.3	Solar power plant- suitability of site, different types of solar plates,advantages and disadvantages

7	**Waste Heat recovery** **04HRS**
7.1	Sources of waste heat
7.2	Heat recovery forms & methods – Sensible and latent Heat recovery.
7.3	Use of waste heat- Agricultural, green house, Animal shelter,Aqua cultural uses, process heating. Waste Heat recovery boilers

8	**Economics and operational aspects** **04HRS**
8.1	Prediction of load, selection of types of generation, number ofgenerating units
8.2	Load duration curves, cost analysis, elements, controlling the costof power plant (simple numerical) Major electrical equipment's in power station- generator, step-uptransformer, switch gear, (types, purpose & importance).

CO	COURSE OUTCOMES
CO1	Able to get the basics of Power Plants
CO2	Able to get the idea about the power generation by renewable and non-renewable energy resources.
CO3	Able to know about the different types of cycles and natural resources used in power plants and their applications.
CO4	Able to use of waste heat recover, economics and operational aspect

Power Plant Engineering Lab (Elective-I)
Subject Code : MEC515

List of Practical: Power Plant Engineering

1. Study of working principles of various components of hydro-electric power plants.
2. Study of working principles of various components of steam power plants.
3. Study of working principles of various components of gas turbine power plants.
4. Study of working principles of various components of nuclear power plants.
5. Visit to steam power plants/nuclear power plants/gas turbine power plants.
6. Hydro- electric powers plants and prepare a report.
7. Collect information & Technical details of Wind power plants.
8. Collect information & Technical details of solar power plants.
9. Assignment on Coal & Ash Handling system.
10. Assignment on Waste Heat recovery systems.
11. Study of economic and operational aspects of power plants (simple numerical).

Subject : Automobile Engineering
Subject Code : MEC508
Hours 42
Full Marks : 80+20=100

Course Outcomes:
1. To provide basics of automobile.
2. To understand the construction and working principle of various parts of an automobile.
3. Providing transmission and breaking knowledge
4. Imparting electrical system of automobile.
5. Providing knowledge of performance parameters.

1	**Introduction to Automobiles** **04HRS**
1.1	Introduction of Engine and its classification. Construction and working of 2 stroke and 4 stroke (petrol and diesel) & comparison.
1.2	Classification of automobile vehicles, types of automobile vehicles. a. Two and four wheeler chassis layout of an automobile vehicle, automobile body types b. 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. c. Aero dynamic body shapes & advantages. d. Automobile market in India and company collaboration

2	**Transmission Systems** **10HRS**
2.1	Need, principle and Requirements of transmission system. Its components and their functions.
2.2	**Clutch**: Function and purpose of clutch, types and construction of clutches as plate type, Centrifugal and diaphragm type clutch.
2.3	**Gearbox**-Need, function, types- constant mesh, sliding gear, synchromesh gearboxes, Epicyclic gearbox their construction and operation. Overdrive, transfer case, Two wheeler gearbox construction and operation
2.4	**Propeller shaft** types and construction, functions of universal and slip joints.
2.5	**Differential**-need,constructionandworking,differentialactionandoperation
2.6	**Axle**–Hot chaises 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, steering link age. construction and working of-re circulating ball type and rack and pinion. Wheel Geometry-caster, camber, king pin inclination, Toe in and Toe Out and their effect. Power steering

3.2	**Braking System:** Need of braking system, types of automotive braking systems for two and four wheeler vehicles– mechanical, hydraulic and air operated: a. Hydraulic braking systems: Layout & components of hydraulic braking systems. b. Construction and working of master cylinder and wheel cylinder. c. Internal and external Drum braking system, Disc Braking Systems and comparison d. Air braking system**:** lay out and working.

4	**Suspension Systems, Wheels and Tiers**
4.1	Necessity and Classification of Suspension System, Front and rear suspension system construction and working of Wish bone type, Mac Pherson type, Trailing link type, coiled springs, leaf spring and shock absorbers, air suspension system. Introduction of Air bag in automobile.
4.2	Types of wheel- spoke, disc, light alloy cast. Types of rims. Tyres- Desirable properties, types- redial ply, cross ply, tubeless. Tyres specifications. Factors affecting tyre life. Wheel alignment and balancing

5	**Electrical Systems**
5.1	Battery: Automotive battery construction and operation, battery capacity, Battery ratings.
5.2	Charging System: Need of charging system, principal Construction and operation of charging system (Alternator).Gauges-construction & working of Fuel level gauge
5.3	Starting System: Need of starting system, layout, and construction of starting motor, Bendix drive, over running clutch mechanism.
5.4	Lighting System: Layout of lighting system of two-wheeler and four-wheeler, Wiring harness, cable color coding.
5.5	Ignition System and their Components, Battery, magneto, electronic ignition system.

6	**Automobile performance**
6.1	a. Diagnosis of engine. b. Introduction of DTS-i, I3S, MPFI, ASFS, FI System c. Important precautions while using AC system.

CO	COURSE OUTCOMES
CO1	Acquire fundamental knowledge of various system of automobile.
CO2	Associate the function of each system with its design and layout.
CO3	Depict various systems using simple schematics
CO4	Able to apply concepts learn in core auto sector
CO5	Use automobile labs and workshop equipment competently and safely.
CO6	Use modern engineering tools necessary for automobile engineering practice

REFERENCE BOOKS:

Sr. No.	Author	Title	Publisher
01	Kirpal Singh	Automobile Engineering Vol. I	Standard Publication
02	Anthony Schwaller	Motor automotive technology	Delmar Publisher Inc.
03	Tim Gills	Automotive service	Delmar Publisher Inc.

04	Anil Chikkara	Automobile Engineering Vol. II	Satya Prakashan New Delhi
05	Crouse/Anglin.	Automobile Mechanics	TATA McGraw–HILL

Automobile Engineering Lab

Subject Code : MEC516

List of Practical:

1. Dismantling & assembling of a single plate dry clutch assembly.
2. Dismantling & assembling of a multi-plate clutch used in two wheelers, observe the operating linkages.
3. Dismantling & assembling of any two types of gear boxes observe gear shifting, gear ratio & compare them. Open & observe CVT.
4. Open & observe universal joints such as Hooks universal joint.
5. Dismantling & assembling the differential unit with bearing locations.
6. Dismantling & assembling of anyone type of rear axle.
7. Dismantling &assembling of the steering gear box, observe the components and steering linkages.
8. Dismantling &assembling of leaf spring.
9. Dismantle and assemble telescopic shock absorber, observe its components.
10. Observe and draw layout of hydraulic braking system. Open master cylinder, wheel cylinder, and brake drum. Observe the components.
11. Observeanddrawthelayoutofhydraulicallyoperatedairassistedbrakingsystem.
12. Dismantling & study of components of battery and function of charger.
13. Study of ignition, charging and starting system.
14. Study of lighting circuits, fuses and diagnosis of faults.

Subject : CAD/CAM & Robotics

Subject Code: MEC509

Total Marks: 80+20=100

Hours 42

Objectives:

Student should be able to:

1. Understand the fundamentals & use CAD.
2. Concept utilized rafting and modeling in CAD.
3. Prepare CNC part programming.
4. Operate CNC machines.
5. Conceptualize Robotics and Robotic Program

1	**Introduction to CAD/CAM**
1.1	Role and Need of Computers in industrial manufacturing. Product Cycle, CAD/CAM.CAD/CAM hardware:-Basic structure, CPU, Memory, I/O Devices, Storage devices and system configuration.

2	**Geometric Modelling**
2.1	Requirement of geometric modelling, Types of geometric models. Geometric construction methods:-sweep, solid modeling- Primitives & Boolean operations, free formed surfaces (Classification of surface only),Rapid Prototyping(No numerical treatment)

3	**Introduction to computer numerical Control**
3.1	Introduction- NC,CNC,DNC, Advantages of CNC, The coordinate system in CNC,Motion control system-point to point, straight line, Continuous path (Contouring).Absolute system and Incremental system, Feedback control system, Application of CNC.

4	**Part programming**
4.1	Fundamentals, manual part programming, NC–Words, Programming format, part programming, use of sub routines and do loops, computer aided part programming (APT).

5	**Industrial Robotics**
5.1	Introduction, Types of Robots and their working principle, physical configuration, basic robot motions, technical features such as-work volume, precision and speed of movement, weight carrying capacity, drive system, End effectors, robot sensors. Applications–Material transfer, machine loading, welding, spray coating, processing operation, assembly, inspection.

6	**Robot Programming**
6.1	Introduction, Robot programming, Robot programming techniques, On-line programming, Lead-through programming, Walk-through programming or teaching, Off-line programming, Task-level programming, Motion programming, Requirements for standard robot language, Types of robot languages

Subject : CAD/CAM & Robotics
Lab Subject Code: MEC517

List of Practical's:

1. Two assignment son CAD for 2D drafting.
2. Two assignments on CAD for 3D Modelling.
3. Manufacturing one turning component on CNC.
4. Manufacturing one Milling component on CNC.
5. At least four assignments on part programming using subroutines do loops for turning component.
6. Atleastfourassignmentsonpartprogrammingusingsubroutinesdoloopsformillingcomponent.
7. Report writing on visit to industry having CNC machine.
8. Report writing on visit to industry having robot Application.
9. Report writing on Robot Programming Language.
10. Write a Robot Program in any language with flow diagram.

RADHA GOVIND UNIVERSITY

RAMGARH, JHARKHAND

DEPARTMENT OF MECHANICAL ENGINEERING
POLYTECHNIC (6th) SEMESTER SYLLABUS

INDUSTRIAL ENGINEERING & MANAGEMENT (Common Paper)

Subject Code: 601

Full Marks:80+20= 100

L T P

3 0 0

Objective:

The students will be able to:

1. Familiarize environment in the world of work.
2. Explain the importance of management process in Business.
3. Identify various components of management.
4. Describe Role & Responsibilities of a Technician in an Organizational Structure.
5. Apply various rules and regulations concerned with Business & Social responsibilities of the technician.

COURSE CONTENT

1	**PRODUCTIVITY** **2HRS**
1.1	Production and productivity, importance of productivity, factors affecting productivity, means of increasing productivity.

2	**Plant Layout and Material Handling** **2HRS**
2.1	Definition of plant layout, objectives of good plant layout, principles of plant layout, types of plant layout, flow pattern, steps in planning the layout for a new enterprise, definition of material handling, functions and principles of material handling, material handling devices

3	**Work Study** **4HRS**
3.1	Definition, concept and need for work study, objectives of method study and work measurement, basic procedure/steps in method study, recording technique, critical examination, principles of motion economy, stop watch procedure for collecting time study data, including performance rating and allowances, work sampling

4	**Production Planning and Control (PPC)** **4HRS**
4.1	Definition and objectives of PPC, functions of PPC, routing, scheduling, loading, dispatching,production control definition and objectives, principle of sound production control system

5	**Material, Purchase and Stores Management** **4HRS**
5.1	Definition, functions& objectives of materials management, inventory control, economic order quantity (EOQ), ABC analysis. Objectives of purchasing department, buying techniques, purchasing procedure (steps involved in one complete purchasing cycle); functions of stores department, location and layout of stores, receipt and issue of materials.

6	**Quality Control and TQM** **4HRS**
6.1	Meaning of quality and quality control, dimensions of quality, quality circle, concept and definition of TQM, elements of TQM, Kaizen, 5 'S' and six sigma

7	**Management** **4HRS**
7.1	Various definitions, concept of management, levels of management, administration and management, scientific management by F. W. Taylor. Principles of management (14 principles of Henry Fayol). Functions of management - planning, organizing, coordinating, directing, controlling, decision making

8	**Organizational Management** **4HRS**
8.1	Organization - definition, steps in forming organization. Types of organization. Types of organization - line, line and staff, functions, project type. Departmentation- Organized and decentralized, authority and responsibility, span of control (management). Forms of ownership proprietorship, partnership, joint stock company, co-operative society, govt. sector.

9	**Human Resource Management** **6HRS**
9.1	Personnel Management – Introduction, definition, function. Staffing – Introduction to HR, Introduction to HR Planning, Recruitment procedure. Personnel- Training & Development – Types of training, Induction, Skill enhancement. Leadership & Motivation – Leadership- Styles& types, Motivation- Definition, Intrinsic, &Extrinsic, Maslow's theory of Motivation and its significance. Safety Management – Causes of accident, Safety Procedures. Introduction, Objectives & feature of Industrial Legislation such as – Factory act, ESI act, Workman compensation act, Industrial dispute act and salary & wages.

10	**Financial Management** **4HRS**
10.1	Financial Management- Objectives & Functions. Capital Generation & Management- Types of capitals, Sources of finance. Budgets and accounts- Types of budgets, Production budget (including variances report), Labour budget, Introduction to Profit & Loss Accounts (Only concept), Balance sheet etc.

11	**Entrepreneurship** **4HRS**
11.1	Concept and definition of entrepreneur and entrepreneurship, factors influencing entrepreneurship, entrepreneurial characteristics, need for promotion of entrepreneurship and small-scale industries, steps in setting up a small-scale industrial enterprise.

CO	COURSE OUTCOMES
CO 1	Analyze the way price of a product affects the demand for a product for consequent actions and predict demand for a product by making use of different demand forecasting techniques.
CO 2	Explain Break even analysis to determine safe production levels and costing of industrial products.
CO 3	Apply productivity techniques for continuous improvement in different functionalities of an industry
CO 4	Analyze the existing operations that happen in factories for establishing time standards for

	different activities.
CO 5	Demonstrate the knowledge of selection of location for the new plant & optimizing the layout within the plant for smooth production.
CO 6	Compute material requirement needed to satisfy the Master Production Schedule of a factory by having thorough understanding of MRP logic.

References Books :

1. Industrial Engineering and Management by O. P. Khanna
2. Industrial Engineering and Production Management by M. Mahajan.
   Publisher: Dhanpat Rai Publication (P) Ltd. New Delhi
3. Business Administration and Management by Dr. S. C. Saxena
   Publisher: Sahitya Bhawan, Agra.

Design of Machine Elements
Subject Code: MEC604

Hours 42

Full Marks: 80+20=100

Objectives:

1. A strong background in mechanics of materials-based failure criteria underpinning the safety-critical design of machine components.
2. An understanding of the origins, nature and applicability of empirical design principles, based on safety considerations.
3. An overview of codes, standards and design guidelines for different elements.
4. An appreciation of parameter optimization and design iteration.
5. An appreciation of the relationships between component level design and overall machine system design and performance.

1	**Introduction to Design**
1.1	Fundamentals: -Types of loads, concepts of stress, Strain, Stress– Strain Diagram for Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, bearing pressure Intensity, Crushing, bending and torsion, Principal Stresses (Simple Numerical).
1.2	Fatigue, Creep, S-N curve, Endurance Limit. Factor of Safety and Factors governing selection of factor of Safety. Stress Concentration–Causes & Remedies.
1.3	Converting actual load or to requinto design load or torque using design factors like velocity factor, factor of safety & service factor. Properties of Engineering materials, Designation of materials as per IS and introduction to international standards & advantages of standardization, use of design data book.
1.4	Theories of Elastic Failures– Principal normal stress theory, Maximum shear stress theory & maximum distortion energy theory

2	**Design of Shafts, Keys and Couplings**
2.1	Types of Shafts, Shaft materials, Standard Sizes, Design of Shafts (Hollow and Solid) using strength and rigidity criteria, ASME code of design for lines hafts supported between bearings with one or two pulleys in between or one over hung pulley
2.2	Design of Sunk Keys, Effect of Key ways on strength of shaft.
2.3	Design of Couplings– Muff Coupling, Flange Coupling, Bush-pin type flexible coupling

3	**Design of simple machine parts**
3.1	Cotter Joint, Knuckle Joint
3.2	**Design** of Levers: -Hand/Foot Lever & Bell Crank Lever
3.3	Design of C– Clamp, Off-set links, Overhang Crank, Arm of Pulley,

4	**Design of Power Screws and Spur Gear**
4.1	Thread Profiles used for power Screws, relative merits and demerits of each, self-locking and over hauling property. Torque required to overcome thread friction, efficiency of power screws, types of stresses induced
4.2	Design of Screw Jack, Toggle Jack.
4.3	Spur gear design considerations. Lewis's equation for static beam strength of spur gear teeth.

5	**Design of springs**
5.1	Classification and Applications of Springs, Spring– Terminology, materials and specifications. Stresses in springs, Wahl's correction factor, Deflection of springs, Energy store din springs
5.2	Design of Helical springs subjected to uniformly applied loads
5.3	Leaf springs–construction and application

6	**Design of Fasteners**
6.1	Riveted Joints-Design of riveted joints, efficiency and frictional resistance of riveted joints
6.2	Welded Joints- Representation of welds, Design of welded joints for static loads, strength of welds at varying load.
6.3	Stresses in Screwed fasteners, bolts of Uniform Strength. Design of Bolts subjected to fatigue loading.

7	**Ergonomics & Aesthetic consideration in design**
7.1	Ergonomics of Design Man–Machine relationship. Design of Equipment for control, environment &safety. Aesthetic considerations regarding shape, size, color & surface finish.

CO	**COURSE OUTCOMES**
CO 1	Analyse machine components using theories of failure
CO 2	Design machine parts against fatigue failures of components subjected to variable and cyclic loads
CO 3	Design springs for withstanding static and fatigue loads
CO 4	Design welded, riveted and bolted joints
CO 5	Design keys, cotter and knuckle joints, shafts and different types of couplings using computers
CO 6	Design engine components like piston, connecting rod, crankshaft and flywheel

Text Books:

[1] Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw- Hill International; 1989.

[2] Deutschman, D. Michel's, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, 1992.

[3] Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, 1994.

[4] Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.

[5] R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998

Design of Machine Elements Lab
Subject Code: MEC613

List of Assignments:

1. Assignment on selection of materials for given applications [at least two applications should be covered] using design data book. List the mechanical properties of material selected.
2. Assignment on design of simple machine parts like Cotter Joint, Knuckle Joint, Turn Buckle, (One example on each component) with free hand sketches.
3. Assignment on design of simple machine parts like Bell Crank Lever, off-Set link, Arm of Pulley (One example on each component) with free hands ketches.
4. Assignment on design of Screw Jack, Toggle Jack. (One example on each)
5. Assignment on design of Helical Springs, screwed joints, Welded joints [one each] with free hand sketches.
6. Assignment on various aspects of aesthetic design.

INDUSTRIAL FLUID POWER

Subject Code: MEC605 **Hours:42**

Full Marks : 80+20= 100

Objectives:

Fluid power plays an important role in many sectors of the economy: aerospace, machine tools, agricultural, industrial, processing equipment, transportation vehicles etc.

This course builds on the Fluid Mechanics and Dynamics courses and provides students with a theoretical framework as well as practical knowledge of fluid power systems.

1	**Introduction to oil hydraulic systems**
1.1	General layout of oil hydraulic systems.
1.2	Practical applications of hydraulic systems.
1.3	Merits and limitations of oil hydraulic systems

2	**Components of Hydraulic systems**
2.1	Pump – Construction, working principle, applications and symbol of Vane pump, gear pump, Geotropism, screw pump, piston pump.
2.2	Valves–Construction, working and symbols of Pressure control valves, pressure relief valve-direct, pilot operated, pressure reducing, pressure un loading, sequence valves, and counter balancing. Direction control valves–Poppet valve, spool valve,2 / 2, 3/2,4/2, 5/3.Flow control valves–pressure compensated; non-pressure compensated flow control valve.
2.3	Actuators- Construction, working and symbols of Rotary Actuators-Hydraulic motors. Linear Actuators–Cylinders-single acting, double acting.
2.4	Accessories –construction, working principle and symbols of Pipes, Hoses, fittings, Oil filters, Seals and gaskets, Accumulators, Hydraulic Circuits.

3	**Draw layout of oil different hydraulic circuit and explain their working**
3.1	Meter in, Meter out circuits
3.2	Bleed off circuit 3.3Sequencingcircuit–travel dependent, pressure dependent
3.3	Hydraulic circuits for Milling machine, Shaper machine, Motion synchronization circuit

4	**Introduction to pneumatic Systems**
4.1	General layout of pneumatic system
4.2	Applications of pneumatic system
4.3	Merits and limitations of pneumatic systems
4.4	Comparison of pneumatic system and hydraulic system

5	**Components of pneumatic system**
5.1	Compressor–Construction, working and symbol of Reciprocating & Rotarycompressors
5.2	Control Valves – Construction, working and symbol of Pressure regulating valves, Flow Control valves, Direction Control Valves
5.3	Actuators– Construction, working principle of Rotary Air motors, Linear-Actuator Single acting cylinder, double acting cylinder
5.3	Accessories–Pipes, Hoses, Fittings, FR Lun it (Construction, working principle and symbols of all components

6	**Pneumatic Circuits**
6.1	Speed control circuits for double acting cylinder for bidirectional air motor.

CO	COURSE OUTCOMES
CO 1	Understanding of the fundamental theoretical concepts governing fluid power
CO 2	Ability to formulate and analyze mathematical models of hydraulic and pneumatic circuits
CO 3	Familiar with common hydraulic and pneumatic components (pumps, actuators, motors, valves, etc.), their use, symbols, and their performance characteristics.
CO 4	Ability to design and implement simple fluid power systems.
CO 5	Through practical/demo lectures and design project students will gain familiarity with the actual components and fluid power circuits found in common industrial applications
CO 6	common in industrial applications using commercial components: circuits for directional, speed, pressure, force, and flow control.

REFERENCE BOOKS:

01 Pippen ger Hicks Industrial Hydraulics Mc Graw Hill International
02 Majumdar S.R Oil Hydraulic System-Principle and maintenance Tata Graw Hill 03
Majumdar S. R Pneumatics Systems Principles and Maintenance Tata Graw Hill 04
Stewart Hydraulics and Pneumatics Tara pore Wala Publication

Industrial Fluid Power Lab

List of Practical:

1 Demonstration of meter in and meter out circuit.

2. Demonstration of sequencing circuit.

3. Demonstration of hydraulic circuit for shaper machine.

4. Demonstration of pneumatic circuit for speed control of double acting cylinders.

5. Demonstration of pneumatic circuit for speed control of pneumatic motor.

6. Study of trouble shooting procedures of various hydraulic and pneumatic circuits.

7. Selection of circuit components for simple hydraulic and pneumatic circuits.

Measurement and Automation

Subject Code: MEC606

Objectives:

1. To gain knowledge of different process instruments.
2. To understand the use of liquids in thermometers.
3. To measure temperature using a thermometer.
4. To discover how thermometers work by creating and using a thermometer

1	Introduction:
1.1	Significance of measurement, types of measurement, classification of instruments
1.2	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
1.3	Dynamic Characteristics-Speed of response, Fidelity and Dynamic errors, Over shoot.
1.4	Measurement of error- Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors.

2	Displacement measurement and Temperature measurements:
2.1	Capacitive transducer, Potentiometer, LVDT, RVDT,Specification, selection & application of displacement transducer.
2.2	Non-electrical methods-bimetal and liquid in glass thermometer,pressure thermometer
2.3	Electrical methods- RTD, platinum resistance thermometer, thermistor, Thermo electric methods-elements of thermos couple,law of intermediate temperature, law of intermediate metals, thermo emf measurement. Quartz thermos meter, Pyrometers-radiation and optical

3	Flow measurements:
3.1	Variable head flow meters- Venturi, Flow nozzle, Orifice plate, Pitot tube. Variable area meter- Rota meter, Variable velocity meter- Anemometer
3.2	Special flow meter-Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter. Note: Simple numerical on above topics.

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4	Miscellaneous Measurement
4.1	Force & Shaft power measurement-Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer
4.2	Speed measurement- Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter & timer, Slipping Clutch Tachometer, Electrical Tachometers.
4.3	Stroboscope Strain Measurement-Stress-strain relation, types of strain gauges, strain gauge materials, selection and installation of strain gauges load cells, rosettes. Note: Simple numerical on above topics.

5	Automation
5.1	Basic elements of automated system, advanced automation functions, levels of automation
5.2	Flexible manufacturing system: -Introduction, Scope and benefits, Types, Major elements of FMS, FMS equipment, FMS application, Introduction to CIM.

6	ROBOTICS
6.1	Definition, Robot anatomy, Classification of robots. Sensors -Contact and non-contact, Touch, tactile, range and Proximity sensor
6.2	End effectors, Types of end effectors, Robot programming languages, Robot drives, Applications of robots, One specific application of industrial robot, Material handling, Automated guided vehicle system.

CO	COURSE OUTCOMES
CO 1	Understand how to solve the given standard partial differential equations.
CO 2	Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO 3	Understand the mathematical principles on Fourier transforms would provide them the ability to formulate and solve some of the physical problems of engineering.
CO 4	Construct z- transform and find inverse z-transform techniques for discrete time systems.
CO 5	Use the effective mathematical tools for the solutions of difference equations by using Z transform techniques for discrete time system.
CO 6	Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.

Sr. No.	Author	Title	Publication
01	A.K. Sawhney	Mechanical Measurements &Instrumentation	Dhanpat Rai & Sons, NewDelhi.
02	R.V. Jalgaonkar	Mechanical Measurement & Control	Everest PublishingHouse, Pune
03	D.S. Kumar	Mechanical Measurements &Control	Metropolitan Publications, New Delhi
04	C.S. Narang	Instrumentation Devices & Systems	Tata McGraw Hill Publications
05	R.K. Jain	Mechanical &Industrial Measurements	Khanna Publications, NewDelhi
06	B.C. Nakraand K.K. Chaudhry	Instrumentation, Measurement and Analysis	Tata Graw Hill Publication
07	P. Jagannathan	Robotics	Lakshmi Publication
08	Michel P. Groover	Industrial Robots-Technology, Programming and Applications	McGraw Hill

Measurement and Automation Lab

Subject Code: MEC612

List of Practical:

1. Measurement of strain by using a basic strain gauge and hence verify the stress induced.
2. Speed Measurement by using Stroboscope /Magnetic/Inductive Pick Up.
3. Measurement of flow by using rotameter.
4. Displacement measurement by inductive transducer.
5. Temperature control using Thermal Reed switch & Bimetal switch.
6. Temperature calibration by using Thermocouple.
7. Determination of negative temperature co efficient and calibration of at thermistor.
8. Measurement of force & weight by using a load cell.
9. Report writing on visit to industry having robot Application.
10. Report writing on visit to Industry having Automation in manufacturing.

MECHATRONICS (ELECTIVE-II)

Subject Code: MEC607

Full Marks: 80+20=100

Hours42

OBJECTIVES:
Students should be able to:
1. Identify various input and output devices in an automated system.
2. Understand and draw ladder diagrams.
3. Write simple programs for PLCs.
4. Interpret and use operations manual of a PLC manufacturer.
5. Use simulation software provided with the PLC.
6. Understand interfacing of input and output device

1	**Introduction to Sensors, Transducers and Actuators**
	Working and applications of Limit switches, proximity switches like inductive, capacitive and optical (deflecting and through beam type), Thumb wheel switches, magnetic reed switches, Optical encoders-displacement measurement, rotary, incremental, opto-couplers. Actuator – solenoids – on-off applications, latching, triggering Types of relays- solid state. Types of motors – DC motors, DC brushless motors, AC Motors, stepper motors, servo motors.

2	**8085 Microprocessor**
2.1	Architecture, Pin configuration, working of microprocessor, and applications. Instructions and simple programmers. Introduction to ICs used for interfacing such as–Programmable peripheral devices, USART, memory, keyboard, display – LCD, LED, I/O device, ADC, DAC etc.
2.2	**8051 Microcontroller:** Architecture, Pin configuration, working of microcontroller, Applications. Comparison of microprocessor and microcontroller, advantages and disadvantages.

3	**Programmable Logic Controller (PLC)**
3.1	Introduction, PLC definition, PLC block diagram, Difference between relay panel and PLC, ,power supply, input/output modules (analog, digital) concepts of sink/source, set/reset, latch/unlatch, advantages and disadvantages, installation , troubleshooting and maintenance.

4	**Selection of a PLC Programming equipment**
4.1	Programming formats Ladder diagrams and sequence listing, large process ladder diagram construction, flowcharting as a programming method, Basic PLC functions, Register basics, timer functions, counter functions, Intermediate functions – Arithmetic functions, number comparison and number conversion functions. Data handling functions- SKIP, Master control relay, Jump, Move, Block move, Table to register and register to table move functions. FIFO and LIFO functions, File Arithmetic and Logic function.

5	**ONS and CLR functions and their applications**
5.1	PLC digital bit functions and applications Sequencer functions and cascading of sequencers PLC matrix functions. Discrete and analog operation of PLC, Networking of PLCs. PLC auxiliary commands and functions, Online, offline, stop/run modes of operations, uploading/downloading between PLC and PC, Introduction to SCADA and DCS.

CO	COURSE OUTCOMES
CO 1	Students will acquire the knowledge of basic concepts, applications and elements of mechatronic systems.
CO 2	Students will experience design concepts, modelling and simulation of mechatronics system
CO 3	Identification of key elements of mechatronics system and its representation in terms of block diagram
CO 4	Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O Interfacing of Sensors, Actuators using appropriate DAQ micro-controller
CO 5	PID control implementation on real time systems
CO 6	Development of PLC ladder programming and implementation of real-life system.

REFERENCE BOOKS:

Sr. No.	Author	Title	Publication
1	Bolton W.	Mechatronics- Electronic control systems in Mechanical and ElectricalEngineering	Pearson Education Ltd.
2	Histand B.H. and	Introduction to Mechatronics and	Tata McGraw Hill
3	John W. Webb and Ronald Reis	Programmable Logic Controllers	Prentice Hall of
4	NIIT	Programmable Logic Control – Principles and Applications	Prentice Hall of
5	Kolk R.A. andShetty D.	Mechatronics systems design	Vikas Publishing, New Delhi
6	Mahlik N.P.	Mechatronics principles, concepts andapplications	Tata McGraw Hill Publishing

Mechatronics (Elective-II)
Subject Code : MEC614

List of Practical:

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

1. Identification and demonstration of different sensors and actuators.
2. Programme of addition and subtraction using 8085 microprocessors.
3. Programme of BCD operation 8085 microprocessor.
4. Study of PLC and execution of simple commands.
5. Demonstration of the working of various digital to analog and analog to digital converters.
6. Development of ladder diagram, programming using PLC for
    a) Measurement of speed of a motor
    b) Motor start and stop by using two different sensors
    c) Simulation of a pedestrian traffic controller
7. Execution of programmers for
    a) Simulation of four road junction traffic controller
    b) Lift / elevator control
    c) Washing machine control
    d) Tank level control

8. Trace, interpret and demonstrate the working of at least two electro hydraulic systems.
9. Descriptive study of options available in SCADA & DCS.

Refrigeration and Air Conditioning (Elective-II)
Subject Code : MEC608

Objectives:

- To understand the fundamentals of refrigeration and air conditioning.
- To calculate the cooling/heating load for different applications.
- To select the appropriate equipment for various RAC applications.
- To design and implement refrigeration and air conditioning systems as per the recommended standards.

1.	**Fundamentals of Refrigeration**
1.1	Introduction to refrigeration. Application of refrigeration. Elements of refrigeration system Refrigeration system. Unit of refrigeration, C.O.P. and refrigerating effect. Concept of heat engine, heat pump and refrigerator.
1.2	Methods of refrigeration: -Ice refrigeration, Refrigeration by expansion of air, Refrigeration by throttling of gas, Vapour refrigeration system, Steam jet refrigeration system on-conventional methods of refrigeration like Vortex tube, Pulse tube refrigeration, solar refrigeration.

2	**Refrigeration Cycles**
2.1	Reversed Carnot Cycle and its representation on PV and TS diagram. Air Refrigeration Cycles: -Bell Coleman air refrigerator, it's representation on PV and TS diagram, types and applications like air craft refrigeration using simple air-cooling system. (Simple numerical on Reversed Carnot cycle.)
2.2	Vapour Compression Cycle (V.C.C): Principle, components, Representation on P-H and T-S diagram effects of wet compression, dry compression, calculation of COP, Effect of superheating, under cooling, suction pressure and discharge pressure, Actual V.C.C., (simple numerical), Methods of improving COP.
2.3	Introduction to multistage V.C.C, its necessity, advantages.
2.4	Vapour Absorption system: -Principle, components and working of aqua- ammonia system (simple & practical) Li-Br Absorption System Electrolux Refrigeration System, Desirable properties of Refrigerant and absorbent used in Vapour Absorption System. Comparison of vapour compression refrigeration system and vapour absorption refrigeration system.

3	**Refrigerants**
3.1	Classification of refrigerants. Desirable properties of refrigerants. Nomenclature of refrigerants. Selection of refrigerant for specific applications. Concept of Green House Effect, Ozone depletion, Global warming. Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants etc.

4	**Equipment selection**
4.1	Components of Vapour Compression Refrigeration System a. Compressors: Classification, Construction and working of open type, hermetic, centrifugal, rotary, screw and scroll compressor and their applications. b. Condensers: Classification, description of air cooled and water-cooled condensers, comparison and applications of Evaporative condensers. c. Expansion devices: Types: - Capillary tube, automatic thermostatic expansion valve and their working principle & applications. Evaporators and chillers: Classification of evaporators Construction and working of Bare tube, Plate surface, finned, shell and tube, flooded and dry expansion evaporator Capacity of evaporator and their applications Classification of chillers. Construction and working of dry expansion Chillers and flooded chillers and their applications.
4.2	Selection criteria for Vapour compression refrigeration system components for the following applications: Water coolers, ice plants, cold storage, domestic refrigerator.

5	**Psychrometry**
5.1	Definition and necessity of air conditioning, Properties of Air, Dalton's law of partial pressure.
5.2	Psychrometric chart. Psychrometric processes, Bypass Factor, ADP, concept of SHF, RSHF, ERSHF, GSHF. Simple numerical using Psychrometric chart. Adiabatic mixing of Air streams.
5.3	Equipment's used for Air- conditioning like humidifier, dehumidifier, filter, heating and cooling coils.

6	**Comfort conditions and cooling load calculations**
6.1	Thermal exchange of body with environment, Factors affecting human comfort, Effective temp. and comfort chart, Components of cooling load- sensible heat gain and latent heat gain sources, calculation of cooling load (No numerical).

7	**Air- conditioning systems**
7.1	Air- conditioning cycle, Classification of A.C. systems, Industrial and commercial A.C. systems Summer, winter and year-round A.C. systems, Central and unitary A.C. systems Application areas of A.C. systems.

8	**Duct and Air distribution systems**
8.1	Duct systems: -Closed perimeter system, extended plenum system, radial duct system, duct materials, requirement of duct materials, losses in ducts Air distribution outlets, Supply outlets, return outlets, grills, diffusers, Fans and Blowers: -Types, working of fans and blowers, Insulation: -Purpose, properties of insulating material, types of insulating materials, methods of applying insulation.

RECOMMENDED BOOKS:

1.Refrigeration and air conditioning By C.P. Arora, TMH
2.Refrigeration and air conditioning By R.S. Khurmi
3.Refrigeration and air conditioning By P.L. Ballaney, Khanna Pub
4. Refrigeration and air conditioning By S.C. Domkundwar and Arrora
5.Refrigeration and air conditioning By M. Prasad, New Age International
6.Refrigeration and air conditioning By R.K. Rajput, S.K. Kataria & Sons
7.Refrigeration and air conditioning By P.N. Anantha Narayanan, Tata McGraw Hill

Refrigeration and Air Conditioning Lab
Subject Code: MEC615

List of Practical:
1. Trial on water cooler test rig.
2. Trial on ice plant test rig.
3. Visit to cold storage
4. Demonstration of domestic refrigerator in View of construction, operation and Controls used.
5. Demonstration of various controls like L.P./H.P.cut outs, thermostat, overload protector, solenoid valve used in RAC.
6. Identification of components of 'hermetically sealed compressor'.
7. Visit to repair and maintenance workshop in view of use of various tools and charging procedure.
8. Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).
9. Trial on A.C. test rig.
10. Visit to central A.C. plant in view of ducting system, insulation system and Air distribution system (e.g., frozen food industry/ice- cream industry/mushroom plants/textile industries).
11. Trouble shooting of domestic refrigerator/window air- Conditioner.

Machine Tool Design (Elective -II)

Subject Code: MEC609

Full Marks 80+20=100
Hours42

Objectives:

1. To develop a solution-oriented approach by in depth knowledge of Machine Tool Design.
2. To address the underlying concepts, methods and application of Machine Tool Design.
3. Apply Geometric Tolerancing principles in the designs of tooling.
4. Evaluate and select appropriate materials for tooling applications.
5. Design, develop, and evaluate cutting tools and work holders for a manufactured product.

1	**Introduction**
1.1	Forces, Velocities and Power Requirements during metal cutting, turning: Cutting force, Cutting Speed and Feed Rate. Drilling: Cutting forces, Cutting Speed and Feed Rate. Milling: Chip Section, cutting force, Milling with Cutter Heads.
1.2	General Requirements of the Machine Tool: Accuracy of Shape, Dimensional accuracy and surface finish of the components produced. High Productivity. High Technical and Economic Efficiency.
1.3	Design Principles: Stiffness and Rigidity of the Separate Constructional Elements and their Combined behaviour Under Load, Static Rigidity, Dynamic Rigidity, Natural frequencies, Damping, Mode of Vibration.

2	**Standardization of Spindle Speeds and Feed Rates**
2.1	Layout of Speed Change Gears. Saw Diagrams for Arithmetic Progression, Geometric Progression and Harmonic Progression of spindle speeds for Mechanical Stepped Drives for Machine Tools. Establishment of Gear Ratios, Layout of the Intermediate Reduction Gears, Calculation of Transmission Ratios, Pulley Diameter, Gear Wheel Diameters and Number of Teeth. Ray Diagram. Speed Diagram.

3	**Electrical, Mechanical and Hydraulic Drives for the Operational Movements**
3.1	Electric Drive and Control Equipment. Mechanical and Hydraulic Drives. Drives for Producing Rotational Movements, Stepped Drives, Step-less Drives. Drives for Producing Rectilinear Movements. Backlash Eliminator in the Feed Drive Nut.

4	**Design of Constructional Elements**
4.1	Machine Tool Structures, Structural Elements Design for Centre Lathe, Drilling Machine, Knee Type Milling Machine, Planning Machine, Boring Machine, and Grinding Machines.

5	**Design of Slide ways**
5.1	Design of slide ways for Tables, Saddles and Cross-slides. Antifriction Bearings for slide ways. Hydrostatically Lubricated slide ways
5.2	Design of Secondary Drives for Machine Tools: Design of Cutting Drives, Feed Drives and Setting Drives

CO	COURSE OUTCOMES
CO1	The student can identify different areas of Machine Tool Design
CO2	Can find the applications of all the areas in day-to-day life.
CO3	Understand basic motions involved in a machine tool.
CO4	Design machine tool structures, design and analyze systems for specified speeds and feeds.
CO5	Select subsystems for achieving high accuracy in machining.
CO6	Understand control strategies for machine tool operations.

S.N	Author	Title	Publication
01	N. K. Mehta	Machine Tool Design	Tata Mc-Graw Hill
02	Sen and Bhattacharya	Machine Tool Design	CBS Publication
03	S. K. Bosu	Machine Tool Design	Oxford and IBH
04	Acherkan	Machine Tool Design	Mir Publishing
05	F. Koenigsberger	Design Principles of Metal-Cutting Machine Tools	

Machine Tool Design Lab (Elective -II)

Subject Code : MEC616

List of Practical

1. Assignment on Tool geometry of SPIT (Single point turning tool)
2. Assignment on spur gear cutting operation on milling machine.
3. Assignment on study of chips and determination of chip reduction co-efficient in mild steel by HSS toll with different depth of cut.
4. Assignment on measurement of cutting forces (Px, Py and Pz) in straight turning.
5. Assignment on electrical drives and control equipment for operational movement.
6. Assignment on anti-fixation bearing used in slide-ways.
7. Assignment on backlash elimination in feed- Drives Nut.

Alternate Source Energy

Subject Code: MEC610

Marks : 80+20=100
Hours 42

Objectives:

- Explain the basic renewable energy sources like solar, wind, biomass etc.
- Explain various advantages and disadvantages of renewable energy sources.
- Familiarization with different standalone, off grid energy sources.
- Explain different technology associate with solar, wind, biomass and other renewable energy sources

1	**Introduction to Energy Sources**
1.1	Introduction. Major sources of energy: Renewable and Non-renewable. Primary and secondary energy sources. Energy Scenario: Prospects of alternate energy sources. Need of Alternate energy sources.

2	**Solar Energy**
2.1	Principle of conversion of solar energy into heat and electricity, Solar Radiation: Solar Radiations at earth's surface, Solar Radiation Geometry: Declination, hour angle, altitude angle, incident angle, zenith angle, solar azimuth angle, Applications of Solar energy: - Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations, Space heating and cooling.
2.2	Photovoltaic electric conversion. Solar distillation, Solar cooking and furnace. Solar pumping and Green House. Agriculture-Solar drying for foods (no derivations and numerical).

3	**Wind Energy**
3.1	Basic Principle of wind energy conversion. Power in wind, Available wind power formulation, Power coefficient, Maximum power, Main considerations in selecting a site for wind mills. Advantages and limitations of wind energy conversion. Classification of wind mills. Working of horizontal and vertical axis wind mills, their comparison, Main applications of wind energy for power generation and pumping.

4	**Energy from Biomass**
4.1	Common species recommended for biomass. Methods for obtaining energy from biomass, Thermal classification of biomass, Gasifier, Fixed bed and fluidized, Application of gasifier, Biodiesel properties, production and application, Agriculture waste as a biomass, Biomass digester, Comparison of Biomass with conventional fuels.

5	**Energy Conservation & Management**
5.1	Energy scenario in various sectors and Indian economy, Need for and importance of energy conservation and management, Concept of Payback period, Return on investment (ROI),Life cycle cost, Sankey diagrams, specific energy consumption.

6	**Energy Conservation Techniques**
6.1	Distribution of energy consumption, Principles of energy conservation. Energy audit, Types of audits. Methods of energy conservation, Cogeneration and its application, Combined cycle system. Concept of energy management, Study of different energy management techniques like Analysis of input. Reuse and recycling of waste, Energy education, Conservative technique and energy audit.

7	**Economic approach of Energy Conservation**

7.1	Costing of utilities like steam, compressed air, electricity and water. Ways of improving boiler efficiency, Thermal insulation, Critical thickness of insulation, Waste heat recovery systems, their applications, criteria for Installing unit. An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.

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CO	COURSE OUTCOMES
CO1	Able to understand the renewable energy sources available at present
CO2	Able to understand the solar energy operation and its characteristics
CO3	To educate the wind energy operation and its types
CO4	To educate the tidal and geothermal energy principles and its operation
CO5	Able to understand the biomass energy generation and its technologies
CO6	Able to understand economic approach of energy conversion.

REFERENCE BOOK:

SN	Author	Title	Publication
1.	Dr B.H. Khan	Non-conventional energy Resources	Tata McGraw Hill
2.	G. D. Rai	Non-conventional energy sources	Khanna publication
3.	S. P. Sukhatme	Solar energy	Tata McGraw Hill
4.	H. P. Garg	Solar energy	Tata McGraw Hill
5.	Arrora Domkundwar	Power plant engineering	Dhanpat Rai & co.
6.	P.H. Henderson	India- The energy sector	University Press
7.	D. A. Ray	Industrial energy conservation	Pergaman Press
8.	W. C. Turner	Energy management handbook	Wiley Press
9.	K. M. Mittal	Non-conventional energy source	--
10	Krupal Singh Jogi	Energy resource management	Sarup and sons

Alt. Source Energy Lab

Subject Code: MEC617

List of Practical-

1) To collect information about global and Indian energy market.
2) To perform an experiment on solar flat plate collector used for water heating.
3) To study and analyze performance of Solar Street lighting System.
4) To study construction and working of photo voltaic cell.
5) To study construction, working and maintenance of solar cooker.
6) Visit to plant of solar heating system for hotel/hostel/railway station etc.
7) To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
8) To visit a biomass/ biogas plant of municipal waste or elsewhere.
9) Perform energy audit for workshop/Office/Home/SSI unit.
10) Study of various waste heat recovery devices.