Study & Evaluation Scheme

of

Diploma in Engineering
(MECHANICAL ENGINEERING -PRODUCTION)

[Applicable w.e.f. Academic Session 2024-25]

Approved by Academic Council

FUTURE UNIVERSITY

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FUTURE UNIVERSITY

(Established under Govt. of U. P. Act No. 12, 2024)

Study & Evaluation Scheme
of
Diploma in Engineering (MECHANICAL ENGINEERING-PRODUCTION)
SUMMARY

Programme : Diploma in Engineering (MECHANICAL ENGINEERING-PRODUCTION)

Duration : Three years full time (Six Semesters)

Medium : English/ Hindi

Minimum Required Attendance : 75 percent

Credit

Maximum Credit : **132**

Minimum credit required for the degree : **120**

Assessment (Theory) :

Internal	External	Total
30%	70%	100%

Assessment (Practical) :

Internal	External	Total
30%	70%	100%

Internal Evaluation (Theory Papers)

Class Test I	Class Test II	Assignment(s)	Other Activity (including attendance)	Total
10 Marks	10 Marks	5 Marks	5 Marks	30 Marks

Internal Evaluation (Practical Papers)

Experiment File Viva	Mid Semester Exam	Attendance	Total
10 Marks	10 Marks	10 Marks	30 Marks

Duration of Examination (Theory) :

External	Internal
3 hrs.	1 ½ hrs

Duration of Examination (Practical) **:** As per the requirement of the practical paper.

To qualify the course a student is required to secure a minimum of 40% marks in aggregate including the semester end examination and teachers' continuous evaluation. (i.e. both internal and external).
A candidate who secures less than of 40% of marks in a course shall be deemed to have failed in that course. The student should have at least 50% marks in aggregate to clear the semester. In case a student has more than 40% in each course, but less than 50% overall in a semester, he/she shall re-appear in courses where the marks are less than 50% to achieve the required aggregate percentage of 50% in the semester.

Question Paper Structure

1. ***The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question No. 1 shall contain 8 parts representing all units of the syllabus and students shall have to answer any five (weight age 4 marks each).***
2. ***Out of the rest five questions, students shall be required to attempt all five questions, but there will be an internal choice of A or B. Each question will be from one unit of the syllabus. The weight age of Question No. 2 to 6 shall be 10 marks each.***

Faculty of Engineering & Technology

Department of Diploma in Engineering

Mechanical Engineering (Production)

Evaluation Scheme

Credit Framework for Diploma in Engineering - NEP-2020									
Sem.	**Major (Core)**	**Minor Stream**	**Multidisciplinary**	**Ability Enhancement course**	**Skill Enhancement Course**	**Value added Courses Common for All Diploma**	**Summer Internship**	**Research Project/Dissertation**	**Total Credit**
1.	14	5			3	2			24
2.	17	4	2			1			24
3.	12	4			5	1			22
4.	16			3		3			22
5.	17					1	2		20
6.	12		5			1		2	20

Total Credit- 132

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Polytechnic (Diploma in Engineering), Semester I

							Evaluation Scheme					
SN	Subject Name	Type	Category	Period			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total	Credit
				L	T	P	CT	TA	CT+TA	TE/PE	SW+ESE	Cr
1.	Mathematics-I	T	Major (Core)	3	1	-	20	10	30	70	100	4
2.	Applied Physics-I	T	Major (Core)	3	1	-	20	10	30	70	100	4
3.	Applied Chemistry	T	Major (Core)	3	1	-	20	10	30	70	100	4
4.	Communication Skills in English	T	Skill Enhancement	3	-	-	20	10	30	70	100	3
5.	Applied Physics Lab	P	Minor Stream	-	-	4	-	20	20	30	50	2
6.	Applied Chemistry Lab	P	Minor Stream	-	-	2	-	20	20	30	50	1
7.	Communication Skills Lab	P	Minor Stream	-	-	2	-	20	20	30	50	1
8.	Engineering Graphics	P	Major (Core)	-	-	4	-	20	20	30	50	2
9.	Engineering Workshop Practice Lab	P	Minor Stream	-	-	2	-	20	20	30	50	1
10.	General Proficiency	-	Value Added	-	-	2	-	50	50	-	50	1
11.	Sports & Yoga	-	Value Added	-	-	2	-	20	20	30	50	1
	Total			**12**	**3**	**18**	**80**	**210**	**290**	**460**	**750**	**24**

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Polytechnic (Diploma in Engineering), Semester II

							Evaluation Scheme					
SN	**Subject Name**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Mathematics-II	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
2.	Applied Physics-II	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
3.	Introduction to IT System	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
4.	Fundamentals of Electrica l& Electronic Engineering	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
5.	Engineering Mechanics	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
6.	Environmental Sciences	**T**	Multidisciplinary	2	-	-	20	10	**30**	**70**	**100**	**2**
7.	Applied Physics-II Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Introduction to IT System Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Fundamentals of Electrical Electronic Engineering Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
10.	Engineering Mechanics Lab	**P**	Minor Stream	-	-	2	-	20	**20**	**30**	**50**	**1**
11.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**15**	**4**	**10**	**120**	**190**	**310**	**540**	**850**	**24**

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Polytechnic (Diploma in Engineering), Semester III

							Evaluation Scheme					
SN	**SubjectName**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Applied Mathematics-III	**T**	Minor Stream	3	1	-	20	10	**30**	**70**	**100**	**4**
2.	Communication Skill-II	**T**	Skill Enhancement	3	-	-	20	10	**30**	**70**	**100**	**3**
3.	AI for Everyone	**T**	Skill Enhancement	2	-	-	20	10	**30**	**70**	**100**	**2**
4.	Mechanics of Solids	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
5.	Thermal Engineering	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
6.	Workshop Technology	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
7.	Mechanics of Solids LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Thermal Engineering LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Workshop Technology LAB	**P**	Major (Core)	-	-	4	-	20	**20**	**30**	**50**	**2**
10.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**15**	**2**	**10**	**120**	**170**	**290**	**510**	**800**	**22**

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Polytechnic (Diploma in Engineering), Semester IV

							Evaluation Scheme					
SN	**SubjectName**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Refrigeration and Air Conditioning	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
2.	Hydraulic and Pneumatics	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
3.	AI for Engineering	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
4.	Computer Aided Design and Manufacturing	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
5.	Energy Conservation	**T**	Ability Enhancement	3	-	-	20	10	**30**	**70**	**100**	**3**
6.	Universal Human Values	**T**	Value Added	2	-		20	10	**30**	**70**	**100**	**2**
7.	Refrigeration and Air Conditioning LAB	**P**	Major (Core)	-	-	4	-	20	**20**	**30**	**50**	**2**
8.	Computer Aided Design and Manufacturing LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Hydraulic and Pneumatics LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
10.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**15**	**2**	**10**	**120**	**170**	**290**	**510**	**800**	**22**

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Polytechnic (Diploma in Engineering), Semester V

							Evaluation Scheme					
SN	**SubjectName**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Industrial Training	**T**	Summer Training	-	-	-	-	50	**50**	**-**	**50**	**2**
2.	Theory of Machines	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
3.	Machine Design	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
4.	Engineering Materials	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
5.	Production Technology	**T**	Major (Core)	3	1	-	20	10	**30**	**70**	**100**	**4**
6.	Production Management	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
7.	Theory of Machine LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Machine Design LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	General Proficiency	**P**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**11**	**4**	**6**	**100**	**190**	**290**	**410**	**700**	**20**

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Polytechnic (Diploma in Engineering), Semester VI

							Evaluation Scheme					
SN	**SubjectName**	**Type**	**Category**	**Period**			**Sessional Component**		**Sessional (SW) (TS/PS)**	**End Semester Examination (ESE)**	**Total**	**Credit**
				L	**T**	**P**	**CT**	**TA**	**CT+TA**	**TE/PE**	**SW+ESE**	**Cr**
1.	Industrial Engineering	**T**	Major (Core)	3	-	-	20	10	**30**	**70**	**100**	**3**
2.	Industrial Management and Entrepreneurship Development	**T**	Multidisciplinary	3	-	-	20	10	**30**	**70**	**100**	**3**
3.	CNC Machines and Automation	**T**	Major (Core)	2	1	-	20	10	**30**	**70**	**100**	**3**
4.	Tool Engineering*	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
5.	Metrology and Measurement Instruments	**T**	Major (Core)	2	-	-	20	10	**30**	**70**	**100**	**2**
6.	Environmental Studies	**T**	Multidisciplinary	2	-	-	20	10	**30**	**70**	**100**	**2**
7.	CNC Machines and Automation LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
8.	Metrology and Measurement LAB	**P**	Major (Core)	-	-	2	-	20	**20**	**30**	**50**	**1**
9.	Project Work	**P**	Project	-	-	4	-	50	**50**	**200**	**250**	**2**
10.	General Proficiency	**-**	Value Added	-	-	2	-	50	**50**	**-**	**50**	**1**
	Total			**14**	**1**	**10**	**120**	**200**	**320**	**680**	**1000**	**20**

Note: - (*) Elective Subject

MATHEMATICS - I

L	*T*	*P*
3	1	-

COURSE OBJECTIVES

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D curves in solving various engineering problems of all fields.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

- Understand and apply angle measurements, T-Ratios, and graph functions.
- Grasp the concepts of limits, differentiation and apply differentiation rules.
- Resolve proper and improper fractions into partial fractions with various factors.
- Solve problems using permutations and combinations and apply the binomial theorem.
- Understand complex numbers in different forms , perform arithmetic operations and applications of De Moivre's theorem.

COURSE CONTENT

UNIT - I: Trigonometry **(10 Periods)**

Concept of angles, measurement of angles in degrees, grades and radians and their conversions, T-Ratios of Allied angles (without proof), Sum, difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T- Ratios ofmultiple angles, sub- multiple angles (2A, 3A, A/2). Graphs of | x | , sin x, cos x, tan x and e^x **.**

UNIT-II : Differential Calculus ***(14 Periods)***

Definition of function, concept of limits. Method to find the limits.

Differentiation of x^n*,* $\sin x$*,* $\cos x$*,* $\tan x$*,* e^x*,* $\log_e x$ *by definition. Differentiation of sum, product and quotientof functions. Differentiation of function of a function. Differentiation of trigonometric and inverse trigonometric functions, logarithmic differentiation, exponential functions.*

UNIT - III: Partial fractions: ***(10 Periods)***

Definition of polynomial fraction, proper & improper fractions and definitionof partial fractions. To resolve proper fraction and improper fraction into partial fraction with denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors.

UNIT- IV : Permutations , Combinations and Binomial theorem ***(10 Periods)***

Value of ^nP_r *,* ^nC_r *and formula based problems.*

Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theoremfor any index (expansion without proof); applications of Binomial theorem.

UNIT-V : Complex Numbers: ***(12 Periods)***

Definition, real and imaginary parts of a complex number, polar and Cartesian representation of a complex number and its conversion from one form to other, conjugate of a complex number, modulus and amplitude of a complex number. Addition, subtraction, multiplication and division of complex numbers. De Moivre's theorem and its applications.

INSTRUCTIONAL STRATEGY

The basic instructional strategy to teach basic mathematics, binomial theorem, trigonometry, differential calculus etc. should be conceptual with real world applications of relevant branch. More numerical and theoryexamples can be used for clear understanding of the content.

MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

RECOMMENDED BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, New Delhi (Revised Ed. 2018)
4. V. Sundaram, R. Balasubramanian, K.A. Lakshminarayanan, Engineering Mathematics, 6/e., Vikas Publishing House.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House,New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Periods)**	**Marks Allotted (%)**
1.	10	15
2.	14	25
3.	10	20
4	10	20
5	12	20
Total	**56**	**100**

APPLIED PHYSICS – I

L	*T*	*P*
3	1	2

COURSE OBJECTIVES

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

- Identify the use of S.I. system of measurement with accuracy and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyse and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc. .
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Understand the laws of thermodynamics, Carnot cycle and their applications.

COURSE CONTENTS

1. Units and Dimensions (8 Periods)

Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
Dimensions and dimensional formulae of physical quantities.
Principle of homogeneity of dimensions

Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities

Limitations of dimensional analysis

Error in measurement, accuracy and precision of instruments measuring instruments least count, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures and rounding off in calculation.

2. Force and Motion (10 periods)

Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.

Impulse and its Applications

Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.

Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)

Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist.

Gravitational force, Kepler's law of planetary motion.

Acceleration due to gravity and its variation with depth and height from earth surface.

3. Work, Power and Energy (8 periods)

Work: and its units, examples of zero work, positive work and negative work.

Friction: modern concept, types, laws of limiting friction, Coefficient of friction, reducing friction and its Engineering Applications.

Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications

Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation.

Mechanical Energy, Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.

Power and its units, calculation of power in numerical problems

4 Rotational Motion (8 periods)

Concept of translatory and rotatory motions with examples

Definition of torque with examples

Angular momentum, Conservation of angular momentum (quantitative) and its examples

Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring andsphere (hollow and solid) (Formulae only).

Rotational kinetic energy, Rolling of sphere on the slant plane

Comparison of linear motion and rotational motion.

5. Properties of Matter (12 periods)

Elasticity: definition of stress and strain, different types of modulii of elasticity, Hooke's law, significance of stress strain curve

Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure,Fortin's Barometer and its applications

Surface tension: concept, its units, angle of contact cohesive and adhesive forces, Capillary action ascent formula (No derivation), applications of surface tension, effect of temperature and impurity on surface tension

Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.

Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem (only formula) and their applications.

6. Heat and Thermometry (10 periods)

Concept of Heat and Temperature.

Modes of transfer of heat (Conduction, convection and radiation with examples)

Different scales of temperature and their relationship and definition of specific heat.

Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansionsand relation amongst them
Concept of Co-efficient of thermal conductivity and its engineering application.

Types of thermometers (Mercury Thermometer And Bimetallic Thermometer And TheirUses)

LIST OF PRACTICALS (To perform any Six Practicals)

1. To measure length, radius of a given cylindrical body like test tube, beaker using a one-year calipers and find volume of each object.
2. To determine diameter of a wire, a solid ball using a screw gauge.
3. To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
4. To verify parallelogram law of forces.
5. To find the coefficient of friction between wood and glass using a horizontal board.
6. To determine the atmospheric pressure at a place using Fortin's Barometer
7. To determine the viscosity of glycerin by Stoke's method
8. To verify law of conservation of mechanical energy (PE to KE).

9. To measure room temperature and temperature of hot bath using mercury thermometer and convert it into different scales.
10. To determine force constant of spring using Hooks law.

INSTRUCTIONAL STRATEGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENTS

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva Voice

RECOMMENDED BOOKS

1 Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
2 Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
4 B.Sc.Practical Physics by C L Arora, S. Chand Publication..
5 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6 Engineering Physics by DK Bhhatacharya& Poonam Tandan; Oxford University Press, New Delhi
7 Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8 V. Rajendran,physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
9 Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
10 Physics Volume 1, 5th edition, Haliday Resnick and Krane, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	08	15
2	10	18
3	08	15
4	08	15
5	12	19
6	10	18
Total	**56**	**100**

APPLIED CHEMISTRY

L	*T*	*P*
3	1	2

COURSE OBJECTIVES:

There are numerous number materials are used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry for technicians. On successful completion of this course content will enable technicians to understand, ascertain and analyses and properties of natural raw materials require for producing economical and eco-friendly finished products.

COURSE OUTCOMES

After undergoing this course, the students must be able to:

- Solve various engineering problems applying the basic knowledge of atomic structure andchemical bonding.
- Use relevant water treatment method to solve domestic and industrial problems.
- Solve the engineering problems using knowledge of engineering materials and properties.
- Use relevant fuel and lubricants for domestic and industrial applications
- Solve the engineering problems using concept of Electrochemistry and corrosion.

COURSE CONTENT

Unit 1: Atomic Structure, Chemical Bonding and Solutions (11 periods)

Rutherford model of atom, Bohr's theory (expression of energy and radius to be omitted), and hydrogen spectrum explanation based on Bohr's model of atom, Heisenberg uncertaintyprinciple, Quantum numbers – orbital concept. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximummultiplicity Aufbau rule, electronic configuration.

Concept of chemical bonding – cause of chemical bonding, types of bonds: ionic bonding (NaCl example),
covalent bond (H_2, F_2, HF hybridization in $BeCl_2$, BF_3, CH_4, NH_3, H_2O), coordination bond, in NH_4^+ and anomalous properties of NH_3, H_2O due to hydrogen bonding, andmetallic bonding.

Solution – idea of solute, solvent and solution, methods to express the concentration of solution molarity (M = mole per liter), Molality, Normality, ppm, mass percentage, volume percentage and mole fraction.

Unit 2: Water (11 periods)

Graphical presentation of water distribution on Earth (pie or bar diagram). Classification of soft and hard water based on soap test, salts causing water hardness, unit of hardness andsimple numerical on water hardness.

Cause of poor lathering of soap in hard water, problems caused by the use of hard water inboiler (scale andsludge, foaming and priming, corrosion etc), and quantitative measurement of water

i). Water softening techniques – soda lime process, zeolite process and ion exchange process.

ii). Municipal water treatment (in brief only) – sedimentation, coagulation, filtration, sterilization.

iii) Water for human consumption for drinking and cooking purposes from any water sources andenlist Indian standard specification of drinking water (collect data and understand standards).

Unit 3: Engineering Materials (11 periods)

Natural occurrence of metals – minerals, ores of iron, aluminium and copper, gangue (ma- trix), flux, slag, metallurgy – brief account of general principles of metallurgy.

Extraction of - iron from haematite ore using blast furnace, aluminium from bauxite along with reactions. Alloys – definition, purposes of alloying, ferrous alloys and non-ferrous withsuitable examples, properties and applications.

General chemical composition, composition based applications (elementary idea only

detailsomitted):Port land cement and hardening, Glasses Refractory and Composite materials.

Polymers – monomer, homo and co polymers, degree of polymerization, simple reactions involved inpreparation and their application of thermoplastics and thermosetting plastics (using PVC, PS, PTFE, nylon
– 6, nylon-6,6 and Bakelite), rubber and vulcanization of rubber.

Unit 4: Chemistry of Fuels and Lubricants (11 periods)

Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV andLCV), calculation of HCV and LCV using Dulong's formula.

Proximate analysis of coal solid fuel

Petrol and diesel - fuel rating (octane and cetane numbers),

Chemical composition, calorific values and applications of LPG, CNG, water gas, coal gas, producer gas andbiogas.

Lubrication – function and characteristic properties of good lubricant, classification with examples, lubrication mechanism – hydrodynamic and boundary lubrication, physical proper- ties (viscosity and viscosity index, oiliness, flash and fire point, could and pour point only) and chemical properties (coke number, total acid number saponification value) of lubricants.

Unit 5: Electro Chemistry (12 periods)

Electronic concept of oxidation, reduction and redox reactions.
Definition of terms: electrolytes, non-electrolytes with suitable examples, Faradays laws ofElectrolysis and simple numerical problems.Industrial Application of Electrolysis –

- Electrometallurgy
- Electroplating
  Electrolytic refining.

Application of redox reactions in electrochemical cells –

- Primary cells – dry cell,
- Secondary cell - commercially used lead storage battery, fuel and Solar cells.Introduction to Corrosion of metals –

- Definition, types of corrosion (chemical and electrochemical), H_2 liberation and O_2 absorption mechanism of electrochemical corrosion, factors affecting rate of corrosion.
  Internal corrosion preventive measures –
- Purification, alloying and heat treatment and External corrosion preventive measures: a) metal (anodic, cathodic) coatings, b) organic Inhibitors.

INSTRUCTIONAL STRATEGY

Unit 1: Atomic Structure, Chemical Bonding and Solutions

Assignments: Writing electronic configuration of elements up to atomic number 30 (Z= 30). Numerical on molarity, ppm, mass percentage, volume percentage and mole fractionof given solution.

Seminar: 1. Quantum numbers,

2. Discuss the metallic properties such as malleability, ductility, hardness, high melting point, conductance of heat and electricity, magnetic propertiesof metals. Projects: Model of molecules $BeCl_2$, BF_3, CH_4, NH_3, H_2O.

Unit 2: Water

Assignments: Simple problems on hardness calculation.

Seminar: 1. Quality and quantity requirement of water in house and industry.

2. Quality of control measures of effluents (BOD & COD).

Projects: Collect water samples from different water sources and measure of hardnessof water.

Unit 3: Engineering Materials

Assignments: Preparation of table showing different ores of iron, copper and aluminiummetals alongwith their chemical compositions and classify in to oxide sulphide halide ores.

Seminar: Discuss the chemical reactions taking place in blast furnace in extractionof Fe, Cu and Al metals.

Projects: Make table showing place of availability of different ores in India and show places on Indiamap.

Unit 4: Chemistry of Fuels and Lubricants

Assignments: Calculation of HCV and LCV of fuel using fuel composition in Dulong's formula.Seminar: Chemical structure of fuel components influence on fuel rating.

Projects: Mapping of energy recourses in India. Collection of data of various lubricants available inthe market.

Unit 5: Electro Chemistry

Assignments: Simple problems on Faradays laws of electrolysis.Seminar:

1. Corrosion rate and units.
2. Corrosion preventions.

Projects: Mapping of area in India prone to corrosion. Collection of data of various electrochemical cells batteries used in equipment and devices and avail- able in market. Visit to sites such as Railway station to watch corrosion area in railways and research establishment in and around the institution.

LIST OF PRACTICALS:

Perform any Ten Laboratory Practicals.

Volumetric and Gravimetric analysis:

1. Preparation of standard solution of oxalic acid or potassium permanganate.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. Standardization of KMnO4 solution using standard oxalic acid and determine the percentage of iron present in given Hematite ore by KMnO4 solution.
4. Iodometric estimation of copper in the copper pyrite ore.
5. Volumetric estimation of total acid number (TAN) of given oil.
6. Volumetric estimation of:
   a) Total hardness of given water sample using standard EDTA solution.
   b) Alkalinity of given water sample using 0.01M sulphuric acid.
7. Proximate analysis of coal:
   a) Gravimetric estimation of moisture in given coal sample.
   b) Gravimetric estimation of ash in given coal sample.

Instrumental analysis:

8. Determine the conductivity of given water sample.
9. Determination of the iron content in given cement sample using colorimeter.
10. Determination of calorific value of solid or liquid fuel using bomb calorimeter.
11. Determination of viscosity of lubricating oil using Redwood viscometer.
12. Determination of flash and fire point of lubricating oil using Abel's flash point apparatus.
13. To verify the first law of electrolysis of copper sulfate using copper electrode.
14. Construction and measurement of emf of electrochemical cell (Daniel cell).
15. To study the effect of dissimilar metal combination.

(a) Open source software and website address:

1 www.chemguide.co.uk/atommenu.html (Atomic structure and chemical bonding)
2 www.visionlearning.com (Atomic structure and chemical bonding)
3 www.chem1.com (Atomic structure and chemical bonding)

4 https://www.wastewaterelearning.com/elearning/ (Water Treatment)
5 www.capital-refractories.com (Metals, Alloys, Cement, and Refractory Materials)
6 www.em-ea.org/guide%20books/book-2/2.1%20fuels%20and%20combustion.pdf (Fueland Combustion)
7 www.chemcollective.org (Metals, Alloys)
8 www.wqa.org(Water Treatment)

References/Suggested Learning Resources:

(b) Books :

1. Text Book of Chemistry for Class XI& XII (Part-I, Part-II); N.C.E.R.T., Delhi, 2017-18.
2. Agarwal, & Shikha, Engineering Chemistry, Cambridge University Press; New Delhi, 2015.
3. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
4. Dara, S. S. & Dr.S.S.Umare, Engineering Chemistry, S.Chand. Publication, New Delhi, New Del-hi, 2015.
5. Jain & Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.
6. Dr. Vairam, S., Engineering Chemistry, Wiley India Pvt.Ltd., New Delhi, 2013.
7. Dr. G. H. Hugar & Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II,NITTTR, Chandigarh, Publications, 2013-14.
8. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	11	20
2	11	20
3	11	20
4	11	20
5	12	20
Total	**56**	**100**

COMMUNICATION SKILLS IN ENGLISH

L	T	P
3	-	2

COURSE OBJECTIVES

Communication Skills play an important role in career development. This lab course aims at actively involving students in various activities to improve their communication skills with an emphasis on developing personality of the students.

COURSE OUTCOMES

After undergoing this course, the students must be able to:

1. Develop listening skills for enhancing communications.
2. Develop speaking skills with a focus on correct pronunciation and fluency.
3. Introduce the need for personality development - Focus will be on developing certain qualities which will aid students in handling personal and career challenges, leadership skills etc., for that purpose group discussion extempore and other activities should be conducted during lab classes.

COURSE CONTENTS

Unit -1 Communication: Theory and Practice **(08 Periods)**

Basics of Communication, Definition Process of Communication
Types of communication (formal and informal, verbal and non-verbal), 7 C's of Communication
Barriers to communication and ways to overcome them
Tools or devices of Communication

Unit – 2 Soft Skills for Professional Excellence **(04 Periods)**

2.1 Introduction to Soft skills and hard skills
2.2 Importance of soft skills
2.3 Applying soft skills across cultures

Unit – 3 Reading Comprehension: English for Communication ***(08 Periods)***

On Communication
Professional Development of Technicians
Leadership and Supervision
The Romance of Reading
Sir C V Raman

Unit: 4 Professional Writing ***(14 Periods)***

CV Writing, Covering Letter, Resume, Notices, Precis -Writing, Official Letters (Memo, Circular, Office Orders, Agenda, Minutes of Meeting, Report Wring, E-mail Drafting)

Unit: 5 Vocabulary and Grammar ***(08 Periods)***

Sentence and its Types
Parts of Speech
Tenses
Active and Passive Voice

Punctuation
One Word Substitution, Idioms and Phrases

LIST OF PRACTICALS

Unit-1 Listening skills

1.1 Introduction to listening process and practice
1.2 Listening to recorded lectures/speeches/poems/interviews and Dialogues

Unit 2 Introduction to phonetics

2.1 Sounds: consonants, vowels (Monophthongs and Diphthongs)
2.2 Transcription of words (IPA) syllable diversion and word stress

Unit 3 Speaking skills

3.1 Self and Peer introduction
3.2 Extempore-Just a minute session
3.3 Greeting and starting conversation
3.4 Leave taking
3.5 Wishing well
3.6 Talking about likes and dislikes
3.7 Asking questions-polite responses
3.8 Apologizing/forgiving
3.9 Complaining/Warning
4.0 Asking and giving information
4.1 Getting and giving Permission
4.2 Asking for and giving Opinion
4.3 Delivering formal speeches
4.4 Mock Interviews
4.5 Presentation
4.6 Conversation practices in various situations such as -asking address, enquiries at places like retail shop, service center, bank, customer care etc.

Unit 4 Building Vocabulary

Word Formation
Phrasal Verbs, Foreign Phrases, Jargons
Word Games such as crosswords, scrabble, quiz spell it etc. (To enhance self-expression andvocabulary of participants.

INSTRUCTIONAL STRATEGY

Student should be encouraged to participate in role play and other student centered activities in class roomand actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests, mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; DhanpatRai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prsad, S.K. Katria& Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UPBTE/NITTTR.
8. English for Communication (text Book Published by IRDT, Kanpur 1998).

Websites for Reference:

1. http://www.mindtools.com/ page 8.html – 99k
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Unit No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	20
2	4	10
3	8	20
4	14	30
5	8	20
Total	**42**	**100**

Engineering Graphics

L	*T*	*P*
-	-	4

COURSE OBJECTIVES

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day to day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, shouldbe to develop conceptual skills in the students following BISSP 46 – 1988.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Identify and use of different grades of pencils and other drafting instruments whichare used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawingsof objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles(orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise notvisible in normal view
- To make projections of Solid
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches.
- Identify conventions for different engineering materials, symbols, sections of regularobjects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

COURSE CONTENT

Unit – I Basic elements of Drawing ***(05 Sheets)***

Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards. Different types of lines as per BIS specifications Practice of vertical, horizontal and inclined lines,geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with thehelp of drawing instruments.
Common symbols and conventions of materials used in engineering.
Free hand and instrumental lettering (Alphabet and numerals) – Capital Letter, single stroke, vertical andinclined, series of 5,8,12 mm in the ratio of 7:4.

Dimensioning-

Necessity, method and principles, Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches Scales.
***Scales** –Needs & importance (theory), R.F., type of scales, and length of scale, drawing of plain and diagonalscales.*

Unit – II Orthographic projections (05 Sheets)

Introduction, Projection of Points in different quadrant, Projection of Straight Line- parallel to both planes, perpendicular and inclined to reference plane, Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1st angle only, Three views of orthographic projection of different objects. Identification of surfaces.

Unit – III Projection of Solid and Sections (05 Sheets)

Definition and types of Solids, To make projections, sources, Top view, Front view and Side view of varioustypes of Solid, Importance and salient features.
Drawing of full section, half section, partial or broken out sections, Off-set sections, revolved sections and removed sections, Convention sectional representation of various materials, conventional breaks for shafts,pipes, rectangular, square, angle, channel, rolled sections.

Unit – IV Isometric Projections (03 Sheets)
Introduction, Isometric scale and Natural scale, Isometric view and isometric projection, Illustrativeproblems related to objects containing lines, circles and arcs shape only.
Conversion of orthographic views into isometric view /projection.

Unit-V Introduction to Auto CAD

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.
Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.

INSTRUCTIONAL STRATEGY

Teacher should show model of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings.

Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs forpractice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawing
- Use of software

RECOMMENDED BOOKS

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

ENGINEERING WORKSHOP PRACTICE

L	*T*	*P*
-	-	4

COURSE OBJECTIVES

The course aims to provide hands-on experience and practical skills in various essential workshops, including carpentry, fitting, welding, sheet metal, plumbing, and painting and polishing. Students will gain proficiency in using different tools and machines, understanding and executing various processes and operations, and completing multiple jobs that involve intricate tasks. This practical knowledge will equip students with the necessary skills to handle real-world tasks efficiently, fostering a deeper understanding of the techniques andsafety measures required in each shop.

COURSE OUTCOMES

At the end of the course, the student will be able to:

1. Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking, and cutting tools & equipment's and machines
2. Explain job drawing and complete jobs as per specifications in allotted time
3. Inspect the job for the desired dimensions and shape
4. Operate, control different machines and equipment's adopting safety practices

DETAILS OF PRACTICAL CONTENTS

1. CARPENTRY SHOP

Demonstration of different wood working tools / machines.

Demonstration of different wood working processes, like plaining, marking, chiselling, grooving, turning of wood etc.

Three jobs involving joint like mortise and tenon, dovetail, bridle, and half lap.

2. FITTING SHOP

Demonstration of different fitting tools and drilling machines and power tools

Demonstration of different operations like filing, drilling, tapping, sawing, cutting etc.

Three fitting job involving practice of cutting, chipping, filing, marking, hacksawing, drilling, tapping, etc.

3. WELDING SHOP

Demonstration of different welding tools/machines.

Demonstration on Arc Welding, Gas Welding, MIG welding, gas cutting and rebuilding of broken parts with welding.

Two simple job involving butt and lap joint and T. Joint using electric arc welding.

4. SHEET METAL SHOP

Demonstration of different sheet metal tools/machines.

Demonstration of different sheet metal operations like sheet cutting, bending, edging, end curling, lancing, soldering, brazing, and riveting.

Three simple job involving sheet metal operations, soldering, and riveting.

Jobs

Cutting Practices

Single / Double Seam Joint

Cylinders

5. PLUMBING SHOP

Demonstration of different plumbing tools, accessories, valves and different pipe fittings and joints (GI and PVC).

Demonstration of different plumbing operations like cutting, threading, pipe fitting (GI and PVC).

5.3 One simple job involving pipe cutting and external thread cutting on GI pipe.

6. PAINTING AND POLISHING SHOP

Introduction of paints, Varnishes, Reason for Surface preparation, Advantage of painting, other method of surface coating i.e. Electroplating etc.

Jobs

To prepare a wooden surface for painting apply primer on side and to paint in the same side.

To prepare metal surface for painting, apply primer and paint on same side.

To Prepare a metal surface for spray painting. First spray primer and paint the same by spray gun and compressor system.

REFERENCES:

1. S.K. Hajara Chaudhary, Workshop Technology, Media Promoters and Publishers, New Delhi, 2015
2. B.S. Raghuwanshi, Workshop Technology, Dhanpat Rai and sons, New Delhi 2014
3. J.P. Bhati, Engineering Workshop, C.B.H. Publication, Jaipur.
4. K. Venkat Reddy, Workshop Practice Manual, BS Publications, Hyderabad 2014
5. Kents Mechanical Engineering Hand book, John Wiley and Sons, New York
6. Roop Lal and Bharadwaj P. K., Prarambhik KaryashalaTakneeki (Hindi), Vayu Education of India, New Delhi

1.7 SPORTS AND YOGA

L T P

- - 2

COURSE OBJECTIVES

To make the students understand the importance of sound health and fitness principles as they relate to better health. To expose the students to a variety of physical and yogic activities aimed at stimulatingtheir continued inquiry about Yoga, physical education, health and fitness. To create a safe, progressive, methodical and efficient activity based plan to enhance improvement and minimize risk of injury .To develop among students an appreciation of physical activity as a lifetime pursuit anda means to better health.

COURSE OUTCOMES:

On successful completion of the course the students will be able to:

- Practice Physical activities and Hatha Yoga focusing on yoga for strength, flexibility, andrelaxation.
- Learn techniques for increasing concentration and decreasing anxiety which leads to stronger academic performance.
- Learn breathing exercises and healthy fitness activities
- Understand basic skills associated with yoga and physical activities including strength and flexibility, balance and coordination.
- Perform yoga movements in various combination and forms.
- Assess current personal fitness levels.
- Identify opportunities for participation in yoga and sports activities.
- Develop understanding of health-related fitness components: cardiorespiratory endurance, flexibility and body composition etc.
- Improve personal fitness through participation in sports and yogic activities.
- Develop understanding of psychological problems associated with the age and lifestyle.
- Demonstrate an understanding of sound nutritional practices as related to health andphysical performance.
- Assess yoga activities in terms of fitness value.
- Identify and apply injury prevention principles related to yoga and physical fitness activities.
- Understand and correctly apply biomechanical and physiological principles elated to exercise and training

COURSE CONTENT

1 Introduction to Physical Education

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education

2 Yoga

- Meaning & Importance of Yoga
- Elements of Yoga- Gyan Yoga, Bhakti Yoga, Karm Yoga, Hathyoga, Astang Yoga .
- Introduction - Asans, Pranayama, Meditation & Bandh , Mudra and shat Karm .

- Meaning of Practice of various Yogic Sukhasan, Vyayams
- Practice of Asans and Benefits – Sidhasana, Padmasana,Vajrasana, Shasakasan, Singhasan, Gomukhasan, Virasan, Dhanurasan, Matsnyendrasan, Gorakhasan, Paschimottansan, Mayurasan, Garunasan, Pawanmuktasan, Kurmasan, Mandukasan, Shalabhasan, Makrasan, Bhujangasan, Naukasan, Shavasan, Sharvangasans, Halasan.
- Practice and Benefits of Pranayamas – Anulom- Vilom, Surya Bhedhi, Ujjayi, Sheetkari, Bhastrika, Bharamri, Murchha, kewali etc .
- Practice of Meditation – Meaning of Meditation, Types , Techniques, Benefits .

3 Olympic Movement

- Olympic Symbols, Ideals, Objectives & Values
- Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award,
- Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

4 Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness & Wellness
- Components of Physical fitness
- Concept of Positive Lifestyle

5 Yoga & Lifestyle

- Ideal life style
- Asans and pranayams a preventive measures
- Yoga and Immunity
- Concept of Yogic diet.
- **Life Style Diseases-** Yoga management of Diseases, Yoga management of Stress, Yoga management of Obesity, Yoga management of High Blood Pressure, Yoga management of Insomia, Yoga management of Asthma, Yoga management of Joints Pains, Yoga management of Digestive Disorders .

6 Fundamentals of Anatomy & Physiology in Physical Education, Sports and Yoga

- Define Anatomy, Physiology & Its Importance
- Effect of exercise on the functioning of Various Body Systems.
- Circulatory System,
- Respiratory System,

7 Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.

8 Training and Planning in Sports

- Meaning of Training
- Warming up and limbering down

9 Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development

10 Doping

- Meaning and Concept of Doping

11 Sports Medicine

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention.

12 Sports / Games

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball, Yoga etc.

- History of the Game/Sport.
- Specifications of Play Fields and Related Sports Equipment.
- Important Tournaments and Venues.

References:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Light On Yoga By B.K.S. Iyengar.
3. Health and Physical Education – NCERT (11th and 12th Classes)

MATHEMATICS - II

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3	1	-

COURSE OBJECTIVES

This course is designed to give a comprehensive coverage at an introductory level to the subject of matrices, integral calculus, coordinate geometry, basic elements of vector algebra and first order differential equations.

COURSE OUTCOMES

After undergoing this course, the students will be able to:

- Solve linear equations using determinants and matrix algebra.
- Perform integration techniques, solve area and volume problems.
- Solve first order differential equations and apply numerical methods.
- Form and interpret equations of lines, circles and conics.
- Perform vector operations and solve related engineering problems of relevant branch.

COURSE CONTENTS

UNIT - I: Determinants and Matrices (10 periods)

Elementary properties of determinants upto 3rd order, consistency of equations, Crammer's rule. Algebra of matrices, inverse of a matrix, matrix inverse method to solve a system of linear equations in three variables.

UNIT - II: Integral Calculus (12 periods)

Integration as inverse operation of differentiation. Simple integration by substitution, by parts and by partial fractions (for linear factors only). Introduction to definite integration. Use of formulae - $\int_0^{\frac{\pi}{2}} \sin^n x\,dx$, $\int_0^{\frac{\pi}{2}} \cos^n x\,dx$, $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x\,dx$ *for solving problems ,where m and n are positive integers.*

Applications of integration for (i). Simple problems on evaluation of area bounded by a curve and axes.(ii). calculation of volume of a solid formed by revolution of an area about axes. (Simple problems).

UNIT-III: Differential Equations & Numerical Methods (15 periods)

Definition of differential Equations, order and degree of a differential equation, formation of differential equations, solution of first order and first degree differential equations by variable separable method (simple problems). Trapezoidal rule, Simpson's 1/3 and Simpson's 3/8 rule and their applications in simplecases. MATLAB – Simple Introduction.

UNIT - IV: Two dimensional Co-Ordinate Geometry ***(10 periods)***

Equation of straight line in various standard forms (without proof), intersection of two straightlines,angle between two lines. Parallel and perpendicular lines, perpendicular distance formula.

General equation of a circle and its characteristics. To find the equation of a circle, given:

i. Centre and radius,

ii. Three points lying on it and

iii. Co-ordinates of end points of a diameter;

Definition of conics (Parabola, Ellipse, Hyperbola), their standard equations without proof. Problemson conics when their foci, directories or vertices are given.

UNIT - V: Vector Algebra ***(9 periods)***

Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector product of two vectors. Simple problems related to work, moment and angular velocity.

INSTRUCTIONAL STRATEGY

The content of this course is to be taught on conceptual basis with plenty of real world examples. Differential equations and applications of differential equations can be taught with engineeringapplications of relevant branch.

MEANS OF ASSESSMENT

– Assignments and Quiz/Class Tests
– Mid-term and End-term Written Tests
– Model/Prototype Making

RECOMMENDED BOOKS

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi, 40th Edition, 2007.
2. G. B. Thomas, R. L. Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edition, 1995.
3. S.S. Sabharwal, Sunita Jain, Eagle Parkashan, Applied Mathematics, Vol. I & II, Jalandhar.
4. Comprehensive Mathematics, Vol. I & II by Laxmi Publications, Delhi.
5. Reena Garg & Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	**Time Allotted (Periods)**	**Marks Allotted (%)**
1.	10	20
2.	12	20
3.	15	25
4	10	20
5	9	15
Total	**56**	**100**

APPLIED PHYSICS – II

L	*T*	*P*
3	1	2

COURSE OBJECTIVES

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles.In all contents, SI units should be followed.

COURSE OUTCOMES

After undergoing this subject, the student will be able to;

- Define wave motion its types (Transverse and Longitudinal), Periodic and Simple Harmonic Motion, solve simple problems.
- Define the terms: frequency, amplitude, wavelength, velocity of a wave.
- Explain various Engineering, Medical and Industrial applications of Ultrasonics.
- Apply acoustics principles to various types of buildings to get best sound effect
- Explain diffraction, interference, polarization.
- Define capacitance and its unit. They will be able to explain the function of capacitors in simple circuits, solve simple problems using C=Q/V
- Explain the role of free electrons in insulators, conductors and semiconductors, qualitatively the terms: potential, potential difference, electromotive force.
- Explain the concept of electric current, resistance and its measurement.
- List the effects of an electric current and their common applications, State and apply Ohm's law, calculate the equivalent resistance of a variety of resistor combinations, determine the energy consumed by an appliance, distinguish between AC and DC electricity
- Explain Bio-Savart Law, Ampere’s law, Lorenz Force.
- State the laws of electromagnetic induction, describe the effect on a current-carrying conductor when placed in a magnetic field
- Explain operation of moving coil galvanometer, simple DC motor
- Apply the knowledge of diodes in rectifiers, adapters IC’s and various electronic circuits. Apply the concept of light amplification in designing of various LASER based instruments and optical sources.
- Explain total internal reflection and apply this concept for optical fiber and its uses in Medical field and Communication.

COURSE CONTENTS

1. Wave motion and its applications (8 periods)

Wave motion, transverse and longitudinal wave motion with examples. Sound and light waves and their properties. Definition of wave velocity, frequency and wave length and their relationship.

Wave equation y = r sin wt, phase, phase difference, principle of superposition of waves and amplitude

Simple Harmonic Motion (SHM): definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M., Energy of a body executing S. H. M., study of vibration of cantilever and determination of its time period, concept of simple harmonic progressive wave.

Free, Damped and forced oscillations, Resonance with examples.

Echo and reverberation, Sabine formula for reverberation time(without derivation), coefficient of absorption of sound, methods to control reverberation time and their applications, Acoustics of building.

Ultrasonic – Introduction properties and applications in engineering and medical applications.

2 Electrostatics (8 periods)

Concept of charge, Coulombs law, Electric field of point charges, Electric lines of force and their properties, Electric flux, Electric potential and potential difference.

Gauss law of electrostatics: Application of Gauss law to find electric field intensity of straight charged conductor, plane charged sheet and charged sphere.

Capacitor and its working principle, Types of capacitors.Capacitance and its units. Capacitance of parallel plate capacitor. Series and parallel combination of capacitors (numerical).

Dielectric and its effect on capacitance, dielectric break down.

4. Current Electricity (8 periods)

Electric Current and its unit, direct and alternating current Resistance and its units,

Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance of a wire, Colour coding of carbon Resistances, Ohm's law.

Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge)

Concept of terminal potential difference and Electromotive force (EMF).

Heating effect of current, Electric power, Electric energy and its units (related numerical problems),Advantages of Electric Energy over other forms of energy

5. Electromagnetism (8 periods)

Types of magnetic materials. Dia, para and ferromagnetic materials with their properties.

Magnetic field and it units, magnetic intensity, magnetic lines of force, magnetic flux and its units,magnetization.

Concept of electromagnetic induction, Faraday's Laws, Lorentz force (Force on moving charge in magnetic field). Force on current carrying conductor.

6. Semiconductor physics (8 periods)

Energy bands in solids (Definition only)Types of materials (insulator, semi conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction and P N junction diode and its V-I characteristics

Diode as rectifier – half wave and full wave rectifier (center taped),

Semiconductor transistor, PNP and NPN (concepts only) and some electronic application (list only)

Application of semiconductor diodes (Zener, LED).

7. Modern Physics (8 Periods)

Lasers: Energy levels, ionization and excitation potential, spontaneous and stimulated emission, population inversion, pumping methods.

Types of lasers: Ruby, He- Ne lasers, Laser characteristic, Engineering and medical applications of lasers.

Fiber optics- introduction to optical fibers, light propagation, acceptance angle and numerical aperture, fiber types, application in telecommunication, medical and sensors.

Nano Science and Nano technology: Introduction, nano particles and nano materials, properties at Nano scale, Nano technology, nano technology based devices and applications.

LIST OF PRACTICALS (To perform minimum six experiments)

1. To determine the velocity of sound with the help of resonance tube.
2. To determine the time period of a cantilever.
3. To verify the laws of reflection from a plane mirror / interface.
4. To verify the laws of refraction (Snell's law) using a glass slab.
5. To determine the focal length and magnifying power of a convex lens.
6. To verify laws of resistances in series and parallel combination.
7. To verify ohm's laws by drawing a graph between voltage and current.
8. To measure very low resistance and very high resistances using Slide Wire bridge
9. Conversion of Galvanometer into an Ammeter and Voltmeter of given range.
10. To draw characteristics of a PN junction diode and determine knee and break down voltages.
11. To verify the Kirchhoff's Law using electric circuit.
12. To find numerical aperture of an optical fiber.

INSTRUCTIONAL STRATEGY

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Mid-Term and End-Term written test
–Model Making
–Actual Lab & Practical Work
–Viva-Voice

RECOMMENDED BOOKS

1. Text Book of Physics (Part-I, Part-II); N.C.E.R.T., Delhi
2. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
3. A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi
4. Practical Physics, by C. L. Arora, S Chand publications
5. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
6. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications.
7. Physics Volume 2, 5th edition, Haliday Resnick and Krane, Wiley publication
8. Fundamentals of Physics by Haliday, Resnick & Walker 7th edition, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	8	15
2	8	15
3	8	15
4	8	15
5	8	15
6	8	15
7	8	10
Total	**56**	**100**

INTRODUCTION TO IT SYSTEMS

L	T	P
2	-	4

COURSE OBJECTIVES

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools using MS Office/Open Office/Libre Office using internet etc., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

Note:

Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.
- Use online office tools (Google suits)

COURSE CONTENTS

1. Introduction to Computers and Peripherals. (05 Periods)

Introduction, Computer Generations, Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, Keyboard, Mouse, display devices, Printer, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

1. Operating System and Application Software (06 Periods)

System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/LibreOffice, Working with windows OS, Desktop components, Menu bars, creating shortcut of program. Installation of Application software's, Antivirus and Drivers.

2. Office Tools: MS Office/Open Office/ Libre Office (06 Periods)

Creation of document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc, google presentation)

3. Internet (06 Periods)

Network topologies, Basics of Networking,– LAN,MAN, WAN, Connecting Devices(Bridge, Switch, Router, Gateway),Wi-Fi technologies, Concept of IP Address, DNS, Search Engines, e- mail, Web Browsing.

4. Basics of Information Security (05 Periods)

Introduction to security, Security threats: detection and prevention, Indian Cyber laws.

LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of computer and list their functions.
2. Installation of operating system. (windows/linux/others)
3. Installation of various application software and peripheral drivers.
4. Creation and Management of files and folders (Rename, delete, search)
5. Installation of Antivirus and remove virus.
6. Scanning and printing documents.
7. Browsing, Downloading, Information using Internet.
8. E-Mail ID creation, composing, sending and receiving e-mail. Attaching a file with e- mail message.

9. Word Processing (MS Office/Open Office) File Management, Editing documents, Mail Merge, Security etc.
10. Spread Sheet Processing (MS Office/Open Office/Libre Office)Addition, deletion, formulation,Securityetc.
11. PowerPoint Presentation (MS Office/Open Office/Libre Office)Preparing Slides, customization, animation, Security etc.
12. Google Suite.

INSTRUCTIONAL STRATEGY

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office/Libre office/Google Suit in addition to working on internet. The student should be made capable of working on computers independently.

MEANS OF ASSESSMENT

- Class Tests/Quiz
- Software Installation and Use
- Viva-Voce
- Presentation

RECOMMENDED BOOKS

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi
3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net…Set…Go… Surviving in an e-world by AnushkaWirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

Reference websites

1. www. tutorialspoint..com
2. www.sf.net
3. Gsuite.google.com
4. Spoken-tutorial.org

5. Swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	5	18
2	6	21
3	6	22
4	6	21
5	5	18
Total	**28**	**100**

FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L T P

3 1 2

COURSE OBJECTIVES

To learn basic concepts of various active and passive electronic components, signals, measuring instruments, digital electronics, electric and magnetic circuits, ac circuits, transformer, motors and their applications. To help the students deal with the electrical and electronics engineering principles and applications in industrial processes of different fields.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Understand and identify key electronic components and their applications.
- Use and understand basic electrical measuring instruments.
- Grasp the fundamentals of logic gates, Boolean algebra, and digital circuits.
- Understand basic concepts of electric and magnetic circuits.
- Analyze A.C. circuits and understand phase relationships and power calculations.
- Understand the principles and applications of transformers and electrical machines.
-

COURSE CONTENTS

UNIT- I Overview of electronic components: (12 Periods)

Active and Passive components, Resistor, Capacitor, Inductor and their types. Introduction to semi- conductor, Intrinsic and Extrinsic semi-conductors, P-N Junction diode - forward and reverse bias, V-I characteristics, Zener diode, LED. Bipolar Junction Transistor - PNP and NPN Transistor and their characteristics. Basics of FET, MOSFET.

UNIT- II Basic measuring instruments**: **(06 Periods)

Basic concept of Ideal and non-ideal voltage and current sources, sinusoidal and non sinusoidal waveforms, ammeter, voltmeter, wattmeter and digital multimeter, CRO (Block diagram, working and its uses).

UNIT –III Overview of Digital Electronics**:* ***(10 Periods)

Analog and digital signal, advantages of digital system. Introduction to Logic levels and Boolean Algebra, Basics of number system, Logic Gates-Truth Table and Symbol of AND, OR, NOT, NAND, NOR, ExOR, ExNOR Gates. Introduction to Latch, Flip Flops, Combinational Circuit and Sequential Circuit.

Unit -IV Electric and Magnetic Circuits: ***(8 Periods)***

Definitions of basic terms, such as Current, Resistance, EMF, Potential Difference, Power and Energy,Ohm's Law and its limitation, Kirchhoff's laws; M.M.F, magnetic force, flux, permeability, hysteresisloop, reluctance, leakage factor and BH curve; Electromagnetic induction, Faraday's laws ofelectromagnetic induction, Lenz's law; Dynamically induced emf; Statically induced emf; Equations ofself and mutual inductance; Analogy between electric and magnetic circuits.

Unit -V A.C. Circuits: ***(10 Periods)***

Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor Peak Factor, impedance, phase angle, and power factor; Mathematical and phasor representation of alternating emf and current; A.C in resistors, inductors and capacitors; A.C in R-L series, R-C series, R- L-C series circuits; Power in A. C. Circuits, power triangle; Relationship between line and phase voltage and line and phase current in Star and Delta connections.

Unit -VI Transformers and Machines: ***(10 Periods)***

Single phase transformer: Construction, working principle, types, EMF equation, transformation ratio oftransformers. Brief idea of Auto transformer.

Machines: DC machines: Types, EMF equation of generator and motor.

Single Phase Induction Motor: Principle of operation and introduction to methods of starting.Three Phase Induction Motor: Construction and Principle of operation.

INSTRUCTIONAL STRATEGY

The instructional strategy combines lectures, demonstrations, and hands-on labs. Lectures will cover key concepts, while demonstrations will illustrate component functions and instrument operations. Hands- on labs will provide practical experience with electronic components and measuring instruments. Interactive quizzes and problem-solving sessions will reinforce and assess understanding, ensuring practical application of theoretical knowledge.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Lab & Practical Work
–Viva-Voice

List of Practicals

1. Identify various passive and active electronic components in the given circuit.
2. Determine the value of given resistor using digital multi-meter to confirm with color code.
3. Exercise of soldering and de-soldering of components in circuits.
4. To study performance of PN-junction diodes and draw its V-I characteristics.
5. To measure frequency, time period and amplitude of a sinusoidal signal using CRO.
6. To measure voltage and current using digital multi-meter.
7. To verify the truth tables for all logic gates – NOT, OR, AND, NAND, NOR, XOR, XNOR.
8. Implement and realize Boolean Expressions with Logic Gates
9. Verify the Kirchhoff's laws.
10. Measure voltage, current and power in 1-phase circuit with resistive load.
11. Measure voltage, current and power in R-L series circuit.
12. Verify the ohms law.
13. Use of voltmeter, ammeter, and watt-meter.
14. Connect resistors in series and parallel combination on bread board and measure its value using digital multi-meter.
15. Connect capacitors in series and parallel combination on bread board and measure its value using multi-meter.

REFERENCE BOOKS –

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Publishing House.
2. Mittle and Mittal, Basic Electrical Engineering, McGraw Education, New Delhi, 2015, ISBN: 978-0-07-0088572-5.
3. Saxena, S. B. Lal, Fundamentals of Electrical Engineering, Cambridge University Press, latest edition, ISBN: 9781107464353.
4. Theraja, B. L., Electrical Technology Vol – I, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924405.
5. Theraja, B. L., Electrical Technology Vol – II, S. Chand Publications, New Delhi, 2015, ISBN: 9788121924375.
6. Jegathesan, V., Basic Electrical and Electronics Engineering, Wiley India, New Delhi, 2015, ISBN: 97881236529513.
7. Sedha, R.S., A Textbook of Applied Electronics, S. Chand, New Delhi, 2008, ISBN-13: 978-8121927833.
8. Malvino, Albert Paul, David, Electronics Principles, McGraw Hill Education, New Delhi, 2015, ISBN-13: 0070634244-978.

9. Mehta, V.K., Mehta, Rohit, Principles of Electronics, S. Chand and Company, New Delhi, 2014, ISBN-13: 9788121924504.
10. Bell, David, Fundamentals of Electronic Devices and Circuits, Oxford University Press, New Delhi, 2015, ISBN: 9780195425239.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	13	20
2	05	10
3	10	15
4	8	15
5	10	20
6	10	20
Total	**56**	**100**

ENGINEERING MECHANICS

L T P
3 1 2

COURSE OBJECTIVES

The course provides a foundational understanding of mechanics, covering force systems, equilibrium, and beam analysis under different loads. It explores friction and its applications, centroids and moments of inertia for various shapes, and the principles and applications of simple lifting machines.

COURSE OUTCOMES

After completing this course, student will be able to:

1. Identify the force systems for given conditions by applying the basics of mechanics.
2. Determine unknown force(s) of different engineering systems.
3. Apply the principles of friction in various conditions for useful purposes.
4. Find the centroid and centre of gravity of various components in engineering systems.
5. Select the relevant simple lifting machine(s) for given purposes.

COURSE CONTENTS

Unit – I Basics of Mechanics and Force System : (12 Periods)

Significance and relevance of mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.

Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

Unit– II Equilibrium : (11 Periods)

Equilibrium and Equilibrant, Free body and free body diagram, Analytical and graphical methods of analysing equilibrium. Lami's Theorem – statement and explanation, Application for various engineering problems.

Beam- Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load.

Unit– III Friction : (11 Periods)

Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.

Unit– IV Centroid and Moment of Inertia : (11 Periods)

Concept, definition and determination of Centroid of plain figures (square, rectangle, triangle, circle, semi-circle, quarter circle) and Centre of gravity of symmetrical solid bodies (Cube, cuboid, cone, cylinder, sphere, hemisphere).

Concept of moment of inertia, Radius of Gyration, Theorem of perpendicular and parallel axis theorem. Concept of Second moment of area of standard areas (Rectangle, Triangle and circle) and composite area (L,T,I section).

Unit – V Simple Lifting Machine : *(11 Periods)*

Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio,efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanicaladvantage and efficiency, reversible and non-reversible machines, conditions for reversibility.

System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency. Working principle and application of wheel and axle, Weston's Differential Pulley Block , simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application [Simple problems on the above topics]

List of practical to be performed:

1. To study various equipment related to Engineering Mechanics.
2. To find the M.A.,V.R., Efficiency and law of machine for differential Axel and Wheel.
3. To find the M.A.,V.R., Efficiency and law of machine for Simple Screw Jack.
4. Derive Law of machine using Worm and worm wheel.
5. Determine resultant of concurrent force system applying law of Polygon of forces using force table.
6. Determine resultant of concurrent force system graphically.

7. Determine resultant of parallel force system graphically.
8. Verify Lami's theorem.
9. Study forces in various members of Jib crane.
10. Determine force reaction's for simply supported beam.
11. Determine Coefficient of friction for motion on horizontal and inclined plane.
12. Determine centroid of geometrical plane figures.

INSTRUCTIONAL STRATEGY

The instructional strategy includes lectures, visual aids, and interactive examples for key mechanics concepts and force systems, along with problem-solving sessions. Equilibrium concepts are taught with practical demonstrations and hands-on beam analysis. Friction is explored through case studies and practical demonstrations, followed by exercises. Centroid and moment of inertia are covered with visual aids and practical tasks. Simple lifting machines are introduced through lectures and demonstrations, with problem-solving on mechanical advantage and efficiency.

MEANS OF ASSESSMENT

–Assignment & Quiz
–Lab & Practical Work
–Viva-Voice

RECOMMENDED BOOKS :

1. D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
2. Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
3. Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
4. Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.
5. Dhade, Jamadar & Walawelkar, Fundamental of Applied Mechanics, Pune Vidhyarthi Gruh.
6. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
7. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.
8. Bhavikatti S.S., Engineering Mechanics, New Age International Publishers

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	**Time Allotted (Periods)**	**Marks Allotted (%)**
1	12	20
2	11	20
3	11	20
4	11	20
5	11	20
Total	**56**	**100**

ENVIRONMENTAL SCIENCE

L	T	P
3	-	-

COURSE OBJECTIVES:

A diploma holder must have knowledge of different types of pollution caused due to industriesand constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. He should know the concept of hazards and disaster management.

COURSE OUTCOMES:

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and sustainable development.
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Explain environmental legislation acts.
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Analyze the impact of human activities on the environment
- Understand the basic concept of disaster and hazards.
- Analyze the impact of disaster on various social components.

COURSE CONTENT

1. Introduction (06 Periods)

Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non- renewable. Global Warming, Climate change and its impact ,Green House Effect, Acid Rain, Conceptof Green Building, Ground water management.

2. Air Pollution and Noise pollution (08 Periods)

Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air Pollution Control Methods. Introduction to Air Pollution and its Prevention and Control Act 1981 & Environmental Protection Act 1986 and Function of State pollution control board and National GreenTribunal (NGT).
Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.

3. Water Pollution and Soil Pollution (11 Periods)

Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollutionon human health, Turbidity, pH, total suspended solids, total dissolved solids, Concept of dissolved O_2, BOD, COD. Prevention of water pollution. Introduction to Water (Prevention and Control of Pollution) Act 1974.Concept of rain water harvesting system.
Sources of soil pollution, Types of Solid waste- House hold, Hospital, From Agriculture,

Biomedical, Animal waste and human waste, sediments and E-waste, Plastic Waste .Effect of Solid waste, Disposal of Solid Waste- Solid Waste Management.

4. Disaster Causes and Hazards (6 Periods)

Introduction
Classification of Natural Disasters
Classification of Natural Disasters in India

- Earthquake
- Tsunami
- Flood
- Drought
- Land Slide
- Thunderstorm and Lightening

5 Disaster Management (11 Periods)

Framework

- Yokohama Strategy for a Safer World (1999)
- The Hyogo Framework for Action (HFA) (2005-2015)
- Sendai Framework for Action (SDGS) (2015-2030)

Disaster Management, Preparedness and Response in India

- National Disaster Management Authority (NDMA) Guidelines
- National Policy on Disaster Management (2009)
- National Disaster Management Act (2005)
- NDRF (National Disaster Response Force), SDRF (State Disaster Response Force), DDRF (District Disaster Response Force), and Aapda Mitra.
- Case studies of disaster management efforts: COVID-19 Pandemic, Earthquakes, Firefighting, Thunder Storm, and Lightning.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests

RECOMMENDED BOOKS –

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.

2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and DeepPublications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; DhanpatRai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Katariaand Sons,New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/BTE/NITTTR,Chandigarh.
9. Disaster Management Second Edition AICTE Recommended by S C Sharma, Khanna Publishers
10. Bharat Bhautik Paryavaran Class 11, By NCERT.
11. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna publishing House, New Delhi

Websites for Reference:

- http://swayam.gov.in
- https://www.amazon.in/Prabhandhan
- https://ncert.nic.in/textbook.php?khgy1=0-6
- https://rb.gy/yergl

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	15
2	8	20
3	11	25
4	6	15
5	11	25
Total	**42**	**100**

Program Outcome (POs) – Diploma

1. **PO 1: Engineering knowledge:** An ability to apply knowledge of mathematics, science, and engineering practices.
2. **PO 2: Problem analysis**: An ability to identify and solves engineering problems.
3. **PO 3: Design/development of solutions:** An ability to design a component, or process to meet desired needs within realistic constraints.
4. **PO 4: Conduct investigations of complex problems:** An ability to use the skills, and modern engineering tools necessary for solving engineering problems.
5. **PO 5: Modern tool usage:** The broad education and understanding of new engineering techniques necessary to solve engineering problems.
6. **PO 6: The engineer and society:** Achieve professional success with an understanding and appreciation of ethical behavior, social responsibility, and diversity, both as individuals and in team environments.
7. **PO 7: Environment and sustainability:** Articulate a comprehensive world view that integrates diverse approaches to sustainability.
8. **PO 8: Ethics:** Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
9. **PO 9: Individual and team work:** An ability to analyses the local and global impact of computing on individuals, organizations, and society.
10. **PO 10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **PO 11: Project management and finance:** Implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.
12. **PO 12: Life-long learning:** A recognition of the need for, and an ability to engage in life-long learning.

APPLIED MATHEMATICS-III

L T P

3 1 0

COURSE OBJECTIVES

Contents of this course provide understanding of some elementary and advanced mathematics algorithms and their applications of solving engineering problems. Content of this course will enable students to use some advanced techniques like Beta-Gamma function, Fourier series, Laplace transform and probability distributions in solving complex engineering problems.

LEARNING OUTCOMES

After understand this course, the students will be able to:

- Understand matrix operations and uses of matrix in different problems.
- Apply elementary row and column operations in finding inverse of a matrix.
- Find Eigen values, Eigen vectors of matrix and their different properties.
- Understand degree/order of differential equations and their solution techniques.
- Use differential equations in engineering problems of different areas.
- Find Fourier series expansion of a function.
- Apply Laplace transform and their applications in solving engineering problems.
- Understand concept of probability distribution and their applications.

DETAILED CONTENTS

UNIT-1, MATRICES	PERIODS
Algebra of Matrices:- Addition, Multiplication of Matrices, Null Matrix and a unit matrix, Square matrix, Symmetric, Skew symmetric, Hermitian, Skew hermition, Orthagonal, Unitary, diagonal and Triangular matrix, Determinant of a matrix. Definition and Computation of inverse of a matrix. Elementary Row/Column Transformation: - Meaning and use in computing inverse and rank of a matrix. **Linear Dependence: -** Linear dependence/independence of vectors, Definition and computation of rank of matrix. Computing rank through determinants, Elementary row transformation and through the concept of a set of independent vectors, Consistency of equations.	**10**
UNIT-2, Differential Calculus	**PERIODS**
Function of two variables, identification of surfaces in space, conicoids. **Partial Differentiation:-** Directional derivative, Gradient, Use of gradient f, Partial derivatives, Chain rule, Higher order derivatives, Euler's theorem for homogeneous functions, Jacobians. **Vector Calculus: -** Vector function, Introduction to double and triple differential and integration of vector functions, gradient, divergence and curl, differential derivatives.	**08**
UNIT-3, Differential Equation	**PERIODS**
Formation, Order, Types, Solution: - Formation of differential equations through physical, geometrical, mechanical and electrical considerations, Order, Degree of differential equation, Linear, nonlinear equation.	**08**
UNIT-4, Integral Calculus	**PERIODS**
Beta and Gamma Functions: - Definition, Use, Relation between the two, their use in evaluating integrals. **Fourier Series: -** Fourier series of f(x),-n<x<n, Odd and even function, Half range series.	**08**

Laplace Transform:-Definition, Basic theorem and properties, Unit step and Periodic functions, inverse Laplace Transform, Solution of ordinary differential equations	
UNIT-5, Probability and Statistics	**PERIODS**
Probability: - Introduction, Addition and Multiplication theorem and simple problem.	**06**

RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-III by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-II by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

COMMUNICATION SKILLS – II

L T P

3 0 0

COURSE OBJECTIVES

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

COURSE OUTCOMES

After undergoing the subject, the students will be able to:

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organized set up and social context.

DETAILED CONTENTS

UNIT-1, Functional Grammar	**PERIODS**
1.1 Prepositions 1.2 Framing Questions 1.3 Conjunctions 1.4 Tenses	**8**
UNIT-2, Reading	**PERIODS**
2.1 Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the Passage should be covered under this topic.	**8**
UNIT-3, Writing Skill	**PERIODS**
3.1 Correspondence Business Letters- Floating Quotations, Placing Orders, Complaint Letters.	**8**
UNIT-4, Official Letters Writing Skill	**PERIODS**
4.1 Official Letters Letters to Government and other Offices Memos, Circular, Office Orders	**8**
UNIT-5, Report Writing	**PERIODS**
5.1 Agenda & Minutes of Meeting Report Writing	**8**

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project-oriented manner were the learning happens as a byproduct.

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.

2 Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.

3 High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.

4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

FSEC301	AI FOR EVERYONE	L T P 2 0 0	2 credits

Course Objectives:

CO1	**Introduce** fundamental concepts of Artificial Intelligence (AI) and its real-world applications.
CO2	**Familiarize** students with basic AI techniques such as machine learning, natural language processing, and computer vision.
CO3	**Enhance** understanding of ethical considerations and societal impacts of AI.
CO4	**Develop** problem-solving skills using AI tools and frameworks.
CO5	**Encourage** critical thinking about the future of AI in various domains such as healthcare, education, business, and security.

Unit-I

Introduction to AI (Concept + Hands-on): What is AI? Understanding AI vs. Machine Learning vs. Deep Learning, AI in daily life: Smart assistants, AI in social media, AI in e-commerce, Prompt Engineering, Real Life Applications of AI. Tools: Explore AI-based tools (Google AI, ChatGPT , MetaAI,Gemini).

Unit-II

Introduction to Machine Learning and Deep Learning: Introduction to learning theory, Methods and Models.Supervised vs. Unsupervised Learning (Examples from real life), Reinforcement Learning, Introduction to ANN and Deep Learning.

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Unit-III

Computer Vision & Image Processing: Introduction to Image processing and Computer Vision ?, Hardware used, Face Recognition, Object Detection, and AI-powered Cameras, How AI understands text & speech, AI in Chatbots, Sentiment Analysis, and AI-based Translation Practical

Unit-IV

AI in Automation & Robotics: AI-powered automation in businesses, How AI is used in robotics and smart homes, Ethical AI & Responsible AI, Bias in AI and fairness in decision-making, How to use AI responsibly.

Unit-V

Mini AI Projects (Without Coding): Hands-on Project Options: AI for Image Classification: Train an AI model to recognize objects Create an AI Chatbot: Use Dialog flow or Chatbot.com AI in Business: Automate tasks using AI-based productivity tools.

* **Students will present their AI Project (Simple AI-based tool using existing platforms) Complete an AI-based quiz & get a certification.**

Text books and References:

1. **Stuart Russell & Peter Norvig** – *Artificial Intelligence: A Modern Approach* (Pearson, 4th Edition)
2. **John Paul Mueller & Luca Massaron** – *Artificial Intelligence For Dummies* (Wiley)"A beginner-friendly guide to AI concepts, applications, and future trends."
3. **Thomas H. Davenport & Nitin Mittal** – *All in on AI: How Smart Companies Win Big with Artificial Intelligence* (Harvard Business Review Press), Explains AI strategies in business and industry.

COURSE OUTCOMES:

CO1	**Understand** the fundamental principles and applications of AI in different industries.
CO2	**Explain** key AI techniques, including supervised and unsupervised learning, deep learning, and neural networks.
CO3	**Analyze** ethical challenges and biases in AI systems and their impact on society.
CO4	**Apply** AI-driven solutions in fields like healthcare, finance, and automation.
CO5	**Critically evaluate** the benefits and risks associated with AI technologies.

MECHANICS OF SOLIDS

L T P

3 1 1

COURSE OBJECTIVES

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts and columns. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

LEARNING OUTCOMES

- *After undergoing this course, the students will be able to:*
- *Interpret various concepts and terms related to strength of materials.*
- *Calculate stresses in bars of various cross-sections.*
- *Calculate energy stored by materials subjected to axial loads.*
- *Calculate moment of inertia of different sections.*
- *Interpret the concept of bending and torsion and calculate stresses on different section of materials.*
- *Draw and calculate shear force and bending moment diagrams of beam under given loading.*
- *Calculate stresses in thin cylindrical shells.*
- *Determine the diameter of shaft under combined bending and torsion.*
- *Calculate critical axial loads on column under different end constraints.*

DETAILED CONTENTS

UNIT-1, Stress and Strains & Resilience	**PERIODS**
Basic assumptions; Concept of load, stress and strain. Tensile compressive and shear stresses and strains. Concept of Elasticity, Elastic limit and limit of proportionality: - Nominal and true stress-strain diagrams. Hook's Law, Young Modulus of elasticity, Nominal stress, Yield point, plastic stage, Ultimate strength and breaking stress, Percentage elongation, Proof stress and working stress, Factor of safety, Shear Modulus, Deflection and Stiffness. Concepts of fatigue, creep and stress concentration Thermal stresses Resilience, proof resilience and modulus of resilience Strain energy due to direct stresses Stresses due to gradual, sudden and falling load	**10**
UNIT-2, Moment of Inertia	**PERIODS**
Concept of moment of inertia and second moment of area Radius of gyration Theorem of perpendicular axis and parallel axis (without derivation) Second moment of area of common geometrical sections: Rectangle, Triangle, Circle (without derivation); Second moment of area for L,T and I section Section modulus	**05**
UNIT-3, Bending Stresses	**PERIODS**
Concept of Bending stresses Theory of simple bending	**05**

Use of the equation $\sigma/y = M/I = E/R$ Concept of moment of resistance Bending stress diagram Calculation of maximum bending stress in beams of rectangular, circular, and T section. Permissible bending stress section modulus for rectangular, circular and symmetrical I section.	
UNIT-4, Shear Force and Bending Moment	**PERIODS**
Concept of beam and form of loading. Concept of end supports-Roller, hinged and fixed. Concept of bending moment and shearing force. S.F and B.M. Diagram for cantilever and simply support beams with and without overhang subjected to concentrated load and U.D.L	**8**
UNIT-5, Part- I, Thin Cylinder and Spherical Shells	**PERIODS**
Introduction to longitudinal stresses, circumferential or hoop stresses and radial stresses, Longitudinal and circumferential stresses in thin cylinder, Longitudinal and circumferential stresses in thin Spherical shells.	
Part-II, Slope and Deflections of Beam	
Definition of slope and deflection, sign convention. Circular bending. Calculation of maximum slope and deflection for the following standard cases by double integration or moment area method. a) Cantilever having point load at the free end b) Cantilever having point load at any point of the span c) Cantilever with uniformly distributed load over the entire span d) Cantilever having U.D.L. over part of the span from free end e) Cantilever having U.D.L. over a part of span from fixed end f) Simply supported beam with point load at centre of the span. g) Simply supported beam with U.D. L. over entire span. Note: - All examples will be for constant moment of inertia without derivation of formula.	**12**

LIST OF PRACTICALS

1. To find the sheer force at a given section of simply supported beam for different loading.
2. To find the value of 'E' for a steel beam by method of deflection for different loads.
3. To determine the Max-Fiber stress in X-section of simply supported beam with concentrated loads and to find the neutral axis of the section.
4. To determine the ultimate tensile strength, its modulus of Elasticity, stress at yield point, Elongation and contraction in X-sectional area of the specimen by U.T.M. through necking phenomenon.
5. To determine the ultimate crushing strength of materials like steel and copper and compare their strength.
6. To determine Rockwell Hardness No. and Brinell Hardness No. of a sample.
7. To estimate the Shock Resistance of different qualities of materials by Izod's test and Charpy test.
8. To determine the bending moment at a given section of a simply supported beam for different loading.
9. Top determine the various parameters of helical coil spring.
10. To determine the angle of twist for a given torque by torsion apparatus and to plot a graph between torque and angle of twist.

RECOMMENDED BOOKS

1. SOM by Birinder Singh; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Mechanics of Materials by Dr. Kirpal Singh; Standard Publishers Distribution, New Delhi.
4. Elements of SOM by D.R. Malhotra and H.C.Gupta; Satya Prakashan, New Delhi.
5. Mechanics of Solids by Karmveer Saini, Krishna Publication House, Meerut.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

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DIPLOMA IN ENGINEERING

THERMAL ENGINEERING

L T P

1 1 1

COURSE OBJECTIVES

A diploma holder in this course is supposed to maintain steam generators, turbines, compressors and other power plant equipment. Therefore, it is essential to impart him basic concepts of thermodynamics, steam generators, steam turbines, and compressors and about IC engines.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- *Apply thermodynamic laws.*
- *Solve basic problems of gas equation using perfect gas laws.*
- *Determine enthalpy, specific heat capacity and P-V-T surface of an ideal and real gas.*
- *Explain the working, construction and applications of steam boilers and steam generators*
- *Explain the functions and uses of air compressors.*
- *Interpret different modes of heat transfer.*
- *Explain the working of IC engine.*
- *Assist in testing an IC engine.*
- *Explain the functioning of steam turbine, gas turbine and jet propulsion.*

DETAILED CONTENTS

UNIT-1, Fundamental Concepts	**PERIODS**
Thermodynamic state and system, boundary, surrounding, universe, thermodynamic systems – closed, open, isolated, adiabatic, homogeneous and heterogeneous, macroscopic and microscopic, properties of system – intensive and extensive, thermodynamic equilibrium, quasi – static process, reversible and irreversible processes, Zeroth law of thermodynamics, definition of properties like pressure, volume, temperature, enthalpy, internal energy.	**08**
UNIT-2, Laws of Perfect Gases & , Thermodynamic Processes on Gases	**PERIODS**
Definition of gases, explanation of perfect gas laws – Boyle's law, Charle's law, Avagadro's law, Regnault's law, Universal gas constant, Characteristic gas constants, derivation Specific heat at constant pressure, specific heat at constant volume of gas, simple problems on gas equation. Types of thermodynamic processes – isochoric, isobaric, isothermal, hyperbolic, isentropic, polytropic and throttling processes, equations representing the processes Derivation of work done, change in internal energy, rate of heat transfer for the above processes.	**08**
UNIT-3, Laws of Thermodynamics & Properties of Steam	**PERIODS**
Laws of conservation of energy, first law of thermodynamics (Joule's experiment), Application of first law of thermodynamics to non-flow systems – Constant volume, constant pressure, Adiabatic and polytropic processes. Steady flow energy equation, Application of steady flow energy to equation, turbines, pump, boilers, nozzles. Heat source and heat sinks, statement of second laws of thermodynamics: Kelvin Planck's statement, Clasius statement, Perpetual motion Machine of first kind, second kind, Carnot engine, Introduction of third law of thermodynamics, concept of irreversibility, entropy, ideal and real gases. Formation of steam and related terms, thermodynamics properties of steam, steam tables, internal latent heat, internal energy of steam, Mollier diagram (H – S Chart), Expansion of steam, Hyperbolic, reversible adiabatic and throttling processes Quality of	**08**

steam (dryness fraction).	
UNIT-4, Air Standard Cycles & Air Compressors , Steam Generators	**PERIODS**
Meaning of air standard cycle – its use, condition of reversibility of a cycle Description of Carnot cycle, Otto cycle, Diesel cycle, simple problems on efficiency, calculation for different cycles Reasons for highest efficiency of Carnot cycle over all other cycles working between same temperature limits. Functions of air compressor – uses of compressed air, type of air compressors Single stage reciprocating air compressor, its construction and working, representation of processes involved on P – V diagram, calculation of work done. Rotary compressors – types, descriptive treatment of centrifugal compressor, axial flow compressor, vane type compressor. Uses of steam, classification of boilers, comparison of fire tube and water tube boilers. Construction features of Lancashire boiler, Nestler boiler, Babcock & Wilcox Boiler. Introduction to modern boilers.	**08**
UNIT-5, Introduction to Heat Transfer & , IC Engines	**PERIODS**
Modes of heat transfer, Fourier's law, steady state conduction, composite structures, Natural and forced convection, thermal radiation. Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle, Location and functions of various parts of IC engines and materials used for them. Testing of IC Engines: Engine power - indicated and brake power, Efficiency - mechanical, thermal. relative and volumetric, Methods of finding indicated and brake power, Morse test for petro1 engine, Heat balance sheet, simple numerical problems, Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO – 2.	**08**

LIST OF PRACTICALS

1. Demonstration of mountings and accessories on a boiler.
2. Demonstrate the working of air compressor.
3. Demonstration of heat transfer through conduction, convection and Radiation
4. Study of working of high pressure boiler
5. Study the working of Lancashire boiler and Nestler boiler
6. Dismantle an IC engine and note down the condition of various parts, removal and fitting of piston, rings, measuring of bore size, crank shaft ovality and assemble it.
7. Servicing of petrol injection system.
8. Valve servicing, grinding, lapping and fitting mechanism and tappet adjustment.
9. Inspection of ignition system of a multi-cylinder engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment, spark plug cleaning.
10. Service of cooling & lubrication system of IC engine and note down the functioning/testing of various components.
11. Determination of BHP by dynamometer.
12. Morse test on multi-cylinder petrol engine.

RECOMMENDED BOOKS

1. Engineering Thermodynamics by PK Nag; Tata McGraw Hill, Delhi.
2. Basic Engineering Thermodynamics by Roy Chaudhary; Tata McGraw Hill, Delhi.
3. Engineering Thermodynamics by CP Arora; Tata McGraw Hill, Delhi.
4. A Treatise on Heat Engineering by VP Vasandani and DS Kumar; Metropolitan Book Company.
5. Internal Commercial Engine by V. Ganeshan; Tata McGraw Hill, Education.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

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DIPLOMA IN ENGINEERING

WORKSHOP TECHNOLOGY

L T P

2 0 2

COURSE OBJECTIVES

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various manufacturing processes is required to be imparted, Hence the subject of workshop technology.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- *Fabricate welding joints using gas welding arc welding, TIG and MIG welding of mild*
- *Steel and stainless steel materials.*
- *Select suitable (most appropriate) process electrodes, various parameters of process for given job.*
- *Explain principle of operations of modern welding processes.*
- *Inspect various welding joints and castings.*
- *Prepare pattern for given job.*
- *Select material and type of patterns, cores.*
- *Prepare sand moulds manually and on machine.*
- *Select type of moulding sand, adhesives, compact, strength and parameters of sand for given job.*
- *Cast a mould.*
- *Identify a suitable furnace, alloying elements*
- *Carry out deburring of castings.*
- *Test the properties of moulding sand (permeability, Strength, refractoriness, adhesiveness, cohesiveness).*

DETAILED CONTENTS

UNIT-1, Welding	PERIODS
Welding Process: - Principle of welding, Classification of welding processes, Advantages and limitations of welding, Industrial applications of welding, Welding positions and techniques, symbols, Safety precautions in welding. **Gas Welding:-** Principle of operation, Types of gas welding flames and their applications, Gas welding equipment - Gas welding torch, Oxy acetylene cutting torch, Blow pipe, Pressure regulators, Filler rods and fluxes. **Arc Welding: -** Principle of operation, Arc welding machines and equipment, A.C. and D.C. arc welding, Effect of polarity, current regulation and voltage regulation, Electrodes: Classification, B.I.S. specification and selection, Flux for arc welding. Requirements of pre heating, post heating of electrodes and work piece, Welding defects and their testing methods. **Other Welding Processes:-** Resistance welding: Principle, advantages, limitations, working and applications of spot welding, seam welding, projection welding and percussion welding, Atomic hydrogen welding, Shielded metal arc welding, submerged arc welding, Welding distortion, welding defects, methods of controlling welding defects and inspection of welded joints, Welding defects and inspection. **Modern Welding Methods: -** Principle of operation, advantages, disadvantages and applications of, Tungsten inert gas (TIG) welding, other welding process, Metal inert gas (MIG) welding, Thermit welding, Electro slag welding, Electron beam welding, Ultrasonic welding, Laser beam welding,	**10**

and Robotic welding.	
UNIT-2, Pattern Making	**PERIODS**
Types of pattern, Pattern material, Pattern allowances, Pattern codes as per B.I.S., Introduction to cores, core boxes and core materials, Core making procedure, Core prints, positioning of cores.	**10**
UNIT-3, Moulding and Casting	**PERIODS**
Moulding Sand: - Properties of moulding sand, their impact and control of properties viz. permeability, refractoriness, adhesiveness, cohesiveness, strength, flow ability, collapsibility, Various types of moulding sand, Testing of moulding sand. Safety precautions in foundry. **Mould Making:-** Types of moulds, Step involved in making a mould, Molding boxes, hand tools used for mould making, Molding processes: Bench molding, floor molding, pit molding and machine molding, Molding machines squeeze machine, jolt squeeze machine and sand slinger. **Casting Processes: -** Charging a furnace, melting and pouring both ferrous and non ferrous metals, cleaning of castings, Principle, working and applications of Die casting: hot chamber and cold chamber, Investment and lost wax process, centrifugal casting. **Gating and Risering: -** System Elements of gating system, Pouring basin, sprue, runner, gates, Types of risers, location of risers, Directional solidification. **Melting Furnaces: -** Construction and working of Pit furnace, Cupola furnace, Crucible furnace – tilting type, Electric furnace. **Casting Defects: -** Different types of casting defects, Testing of defects: radiography, magnetic particle inspection and ultrasonic inspection.	**10**
UNIT-4, Metal Farming Process	**PERIODS**
Press Working- Types of presses, type of dies, selection of press die, die material. Press Operations- Shearing, piercing trimming, punching, notching, shaving, gearing, embossing, stamping. Forging- Open die forging, closed die gorging, Press forging, upset forging, swaging, up setters, roll forging, Cold and hot forging. Rolling- Elementary theory of rolling, Types of rolling mills, Thread rolling, roll passes, Rolling defects and remedies. Extrusion and Drawing- Type of extrusion- Hot and Cold, Direct and indirect, pipe drawing, tube drawing, wire drawing. Plastic Processing: - Industrial use of plastics, situation where used. Injection moulding-principle, working of injection moulding machine. Compression moulding-principle and working of compression moudling machine. Potential and limitations in the use of plastics.	**10**

LIST OF PRACTICALS

General introduction to hand tools used in foundry, welding and pattern making and smithy shop.

WELDING SHOP

- Job 1. Preparing gas welding joint in vertical/Horizontal position joining M.S. Plates
- Job 2. Exercise on gas cutting of mild steel plate with oxy-acetylene gas torch.
- Job 3. Exercise on gas welding of cast iron and brass part or component.
- Job 4. Exercise on preparation of T Joint by arc welding
- Job 5. Exercise on spot welding/seam welding
- Job 6. Exercise on MIG and TIG welding
- Job 7. Exercise on arc welding pipe joint MS.

PATTERN MAKING

- Job 1. Preparation of solid/single piece pattern.
- Job 2. Preparation of two piece/split pattern
- Job 3. Preparation of a pattern on wooden lathe
- Job 4. Preparation of a self cored pattern

- Job 5. Preparation of a core box.

FOUNDRY SHOP

- Job 1. Preparation of mould with solid pattern on floor.
- Job 2. Preparation of floor mould of solid pattern using copes.
- Job 3. Preparation of floor mould of split pattern in cope and drag of moulding box.
- Job 4. Moulding and casting of a solid pattern of aluminum
- Job 5. Preparing a mould of step pulley and also preparing core for the same.
- Job 6. A visit to cast iron foundry should be arranged to have firsthand knowledge of cast iron melting pouring and casting.
- Job 7. Testing of moisture contents and strength of moulding sand.
- Job 1. Preparation of single ended spanner by hand/machine forging.
- Job 2. Preparation of simple die
- Job 3. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine.
- Job 4. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
- Job 5. Preparation of utility item out of G.I. sheet.
- Job 6. Preparation of drilling Jig.

RECOMMEMDED BOOKS

- Workshop Technology by BS Raghuvanshi: Dhanpat Rai and Sons Delhi.
- Elements of Workshop Technology by SK Choudhry and Hajra: Asia Publishing House.
- Welding Engineering by RL Aggarwal and T Manghnani; Khanna Publishers, Delhi.
- A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi.
- Foundry Technology by KP Sinha and DB Goel; Roorkee Publishng House, Roorkee.
- A Text Book of Manufacturing Science and Technology by a Manna, Prentice Hall of India, Delhi.

REFRIGERATION AND CONDITIONING

L T P

3 1 2

COURSE OBJECTIVES

The diploma holders in Mechanical Engineering are responsible for supervising and maintenance of RAC system. For this purpose, the knowledge and skill covering basic principles of refrigeration and air conditioning is required to be imparted to the students. Moreover, RAC industry is expanding and employment opportunities in this field are good.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:-

- *Explain the working and construction features of refrigeration and air conditioning systems*
- *Draw and interpret various refrigeration cycles.*
- *Make basic calculation of psychometric properties and processes.*
- *Calculate heating and cooling load requirements of a room.*
- *Explain latest developments in the field of refrigeration and air conditioning.*
- *Calculate the properties of air by using psychometric chart.*
- *Detect faults in an air-conditioner/refrigerator.*
- *Carry out charging of air conditioner.*

DETAILED CONTENTS

Refrigeration, UNIT-1, Fundamentals of Refrigeration	**PERIODS**
Introduction to refrigeration, air conditioning, necessity of refrigeration meaning of refrigerating effect, units of refrigeration, COP, difference between COP and efficiency, methods of refrigeration, Reversed Carnot cycle and its representation on P-V and T-S diagram. Major application areas of refrigeration and air conditioning.	**08**
UNIT-2, Vapour Compression System	**PERIODS**
Introduction, principle, function, parts and necessity of vapour compression system, T- S and p– h charts, dry, wet and superheated compression. Effect of sub cooling, super heating, mass flow rate, entropy, enthalpy, work done, Refrigerating effect and COP. actual vapour compression system.	**08**
UNIT-3, Refrigerants, Air Refrigeration System & Vapour Absorption System	**PERIODS**
Functions, classification of refrigerants, Nomenclature of refrigerant, Desirable properties of refrigerant, selection of refrigerant. Introduction, advantages and disadvantages of air-refrigeration system over vapour compression system, bell – Collemann cycle, Boot strap system, calculation of mass flow rate, work done and COP, Introduction, principle and working of simple absorption system and domestic Electrolux refrigeration systems. Solar power refrigeration system, advantages and disadvantages of solar power refrigeration system over vapour compression system.	**08**
UNIT-4, Refrigeration Equipment & Psychometry	**PERIODS**
• Compressors- Function, various types of compressors • Condensers - Function, various types of condensers • Evaporators- Function, types of evaporators • Expansion Valves - Function, various types such as capillary tube, thermostatic • Expansion valve, low side and high side float valves, application of various expansion	**08**

valves • Safety Devices-Thermostat, overload protector LP, HP cut out switch. Definition, importance, specific humidity, relative humidity, degree of saturation, DBT, WBT, DPT, sensible heat, latent heat, Total enthalpy of air.	
UNIT-5, Applied Psychometry and Heat Load Estimation	**PERIODS**
Psychometric chart, sensible heating and cooling, Adiabatic cooling, Humidification and dehumidification, cooling and humidification, cooling and dehumidification, heating and humidification, heating and dehumidification, by pass factor, room sensible heat factor, effective room sensible heat factor, grand sensible heat factor, ADP, room DPT. Heating and cooling load calculation. Heating and humidification, cooling and dehumidification, window air-conditioning, split type air-conditioning, car air-conditioning, central air-conditioning, Inverter technology, auto-defrosting, blast cooling, star rating.	**08**

LIST OF PRCTICALS

- Demonstration of various refrigeration tools and equipment.
- Practice in cutting, bending, flaring, swaging and brazing of tubes.
- Study of thermostatic switch, LP/HP cut out overload protector filters, strainers and filter driers.
- Identify various parts of a refrigerator and window air conditioner.
- To find COP of Refrigeration system
- To measure air flow using anemometer.
- Charging of a refrigerator/ air conditioner.
- To detect faults in a refrigerator/ air conditioner
- Visit to an ice plant or cold storage plant. or central air conditioning plant.
- Demonstration and working of window type air-conditioner.

RECOMMENDED BOOKS

- Refrigeration and Air Conditioning by Domkundwar; Dhanpat Rai and Sons, Delhi.
- Refrigeration and Air Conditioning by CP Arora; Tata McGraw Hill, New Delhi.
- Refrigeration and Air Conditioning by R.S Khurmi and J.K. Gupta; S Chand and Company Limited, New Delhi.
- Refrigeration and Air Conditioning by Dr.Harjeev Khanna; Dhanpat Rai and Sons, Delhi.

HYDRAULIC AND PNEUMATICS

L T P

3 1 1

COURSE OBJECTIVE

Diploma holders in this course are required to deal with problems of fluid and use of hydraulics and pneumatics in power generation. For this purpose, knowledge and skills about fluid mechanics and machinery, hydraulics and pneumatics systems are required to be imparted for enabling them to perform above functions.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- *Explain fluid properties, their units and conversion.*
- *Measure different types of pressures.*
- *Maintain different types of pressure gauges.*
- *Calculate flow and discharge of various liquids.*
- *Apply Bernoulli's theorem for calculating pipe diameter and height of pipe from ground.*
- *Calculate pipe friction and losses in pipelines.*
- *Specify hydraulic machines for different applications.*
- *Apply Pascal's law in practical applications.*
- *Explain the functions of various components used in hydraulic and pneumatic system.*
- *Maintain hydraulic and pneumatic system.*

DETAILED CONTENTS

UNIT-1, Introduction	**PERIODS**
Fluid, types of fluid; properties of fluid viz mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, surface tension, kinematic viscosity and dynamic viscosity and their units.	**06**
UNIT-2, Pressure and its Measurement	**PERIODS**
Concept of pressure (Atmospheric Pressure, gauge pressure, absolute pressure), Pressure measuring devices: peizometer tube manometers - simple U-tube, differential single column, inverted U-tube, micro manometer including simple problems, Bourdon pressure gauge, Diaphragm pressure gauge, dead weight pressure gauge.	**07**
UNIT-3, Flow of Fluids & Flow through Pipes	**PERIODS**
Types of fluid flow – steady and unsteady, uniform and non-uniform, laminar and turbulent; rate of flow and their units; continuity equation of flow; potential energy of a flowing fluid; total head; Bernoulli's theorem (statement and proof) and its applications. Discharge measurement with the help of venture-meter, orifice meter, pitot-tube, limitations of Bernoulli's theorem simple problems. Definition of pipe flow, wetted perimeter, hydraulic mean depth, hydraulic gradient; loss of head due to friction; Chezy's equation and Darcy's equation of head loss (without proof), Reynold's number and its effect on pipe friction; siphon, power developed. Water hammer, anchor block, syphon, surge tank (concept only). Loss of head in pipes due to sudden enlargement, sudden contraction, obstruction on flow path, change of direction and pipe fittings (without proof).	**08**
UNIT-5, Hydraulic System	**PERIODS**
Description, operation and application of hydraulic systems – hydraulic ram, hydraulic jack, hydraulic brake, and hydraulic accumulator, hydraulic door closer, hydraulic press.	**05**

UNIT-6, Water Turbines and Pumps & Oil Power Hydraulic and Pneumatics	PERIODS
Concept of a turbine, types of turbines –impulse and reaction type (concept only), difference between them. Construction and working of pelton wheel, Francis turbine, Propeller and Kaplan turbines. Unit speed, unit power, unit discharge, specific speed of turbines, Cavitations. Concept of hydraulic pump, single acting reciprocating pump (construction and operation only), vane, screw and gear pumps. Construction, working and operation of centrigual pump. Performance, efficiencies and specifications of a centrifugal pump, pitting, cavitation, priming. Introduction to oil power hydraulic and pneumatic system Statement of Pascal law and its applications, Industrial applications of oil power hydraulic and pneumatic system.	**14**

LIST OF PRACTICALS

1. Measurement of pressure head by employing.
   i) Peizometer tube
   ii) Single and double column manometer
2. To find out the value of coefficient of discharge for a venturimeter.
3. Measurement of flow by using venturimeter.
4. Verification of Bernoulli's theorem.
5. To find coefficient of friction for a pipe (Darcy's friction).
6. To study hydraulic circuit of an automobile brake and hydraulic ram.
7. Study the working of a Pelton wheel and Francis turbine.
8. To study a single stage centrifugal pump for constructional details and its operation to find out its normal head and discharge.
9. Direct operation of single and double acting cylinder.
10. Automatic operation of double acting cylinder in single cycle using limit switch.

RECOMMENDED BOOKS

1. Fluid Mechanics by KL Kumar; S Chand and Co Ltd., Ram Nagar, New Delhi.
2. Hydraulics and Fluid Mechanics Machine by RS Khurmi ;S.Chand& Co. Ltd., New
3. Delhi.
4. Fluid Mechanics through Problems by RJ Garde; Wiley Eastern Ltd., New Delhi.
5. Fluid Mechanics by Dr AK Jain, Khanna Publishers, New Delhi.
6. Hydraulic and Pneumatic Control by K Shammuga Sundaram, S. Chand & Co. Ltd., New Delhi
7. Hydraulics and Hydraulic Machinery by Dr. Jagadish Lal; Metropolitan Book Company Ltd., Delhi.
8. Hydraulic and Pneumatic Power and Control Design, Performance and Application byYeaple, McGraw Hill, New York..
9. Pneumatic Controls by Festo Didactic; Bangalore.
10. Pneumatics Control: An Introduction to the Principles by Werner Deppert and Kurt Stoll; Vogel – Verlag.

FCS406	AI for Engineering	L T P 3 0 0	3 credits

CourseObjectives:

CO1	To understand the concepts of Artificial Intelligence (AI).
CO2	To understand strength of and weakness of searching algorithms.
CO3	To learn and compare the searching techniques for AI applications.
CO4	To acquaint with the various knowledge representation & experts' systems.
CO5	To understand basic probability notations in artificial Intelligence/ Game theory.

Unit-I

Introduction: History & overview of Artificial Intelligence, Different Definitions, Problem Solving Strategies,Applications, Physical Symbol System Hypothesis, production systems, Characteristics of production, Agentsand Environments,Concept of rationality,Nature of environments,Structure of agents.

Unit-II

Searching Techniques: Search Strategies-Informed-Uninformed Search, depth first search, breadth firstsearch,Heuristic Search Strategies, Evolutionary algorithms Local Search Algorithms, Backtracking Search – Game Playing – OptimalDecisions in Games – Alpha – Beta Pruning.

Unit-III

KNOWLEDGE REPRESENTATION: Syntax and semanticsof First Order Logic,Prolog Programming,Forward ChainingBackwardChaining Resolution,KnowledgeBased Agents, Example, Propositional Logic,Reasoning Patterns in Propositional Logic, Inference in First Order Logic Knowledge Base Reasoning Systems for Categories.

Unit-IV

Game Playing: Constraint Satisfaction Problems(CSP), constraint propagation, backtracking search for CSP, local search forCSP, structure of CSP , Minimax& Alpha-Beta Pruning Algorithm, Imperfect Real-time decisions.

Unit-V

APPLICATIONS: AI applications, Language Models, Information Retrieval, Information Extraction, Natural Language Processing, Machine Translation, Speech Recognition, Robot, Hardware, Perception, Planning & Moving.

Fuzzy logic,Probabilistic Reasoning Structured knowledge, graphs, frames and related structures.

TextbooksandReferences:

1. Artificial Intelligence by Luger (Pearson Education).

2. Artificial Intelligence, A Modern Approach. Stuart Russell and Peter Norvig.
3. Artificial Intelligence: Elaine Rich, Kevin Knight, Mc-GrawHill.
4. Introduction to AI & Expert System: Dan W.Patterson, PHI.

COURSEOUTCOMES:

CO1	To understand the fundamentals of Artificial Intelligence.
CO2	To design smart system using different search strategies of Artificial Intelligence.
CO3	To analyze various basic probability notations, game theory.
CO4	Implement Artificial Intelligence solutions using logical reasoning.
CO5	To apply various algorithms for Artificial Intelligence application development.

COMPUTER AIDED DESIGN AND MANUFACTURING

L T P

2 0 1

COURSE OBJECTIVE

Manufacturing of this century belongs to computerized equipment & machine tools to manufacture a variety of components with high quality, high precision & low cost at a faster rate. Commuter Aided Designing, Computer Aided manufacturing, & Flexible Manufacturing Systems-all are the part of Computer Integrated Manufacturing which help to achieve the desired goals in manufacturing. After studying the subject, the students will be able to know about these integrated techniques which help a manufacturer to achieve his goal with in stipulated time.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Know about Computer aided design and manufacturing.
- Know the process of 2D & 3D transformations
- Know the method of viewing objects in 3D space.
- Know about CNC operations for turning and milling.
- Understand about tool path generation and verification.
- Know about flexible manufacturing system.
- Know about Rapid Prototype additive manufacturing
- Know about robotics.

DETAILED CONTENTS

UNIT-1, Introduction & Surface/Solid Modeling Using CAD/CAM	PERIODS
Introduction to CAD/CAM/CIM, Advantages of CAD/CAM, Product Cycle and CAD/CAM, Automation and CAD/CAM, Reasons for implementation of CAD/CAM, Steps involved in CAM operation. Introduction to parametric and non-parametric surfaces, Creation of simple surfaces using revolved surface, ruled surface and 3D surfaces, commands, Designing Software used in creation of solid models, Concept of solid models, Solid Primitives- Box, cylinder, Cone, Sphere, Wedge and torus, Construction of solid using Region, Extrude and Revolved feature, Creation of Composite solid using Boolean function e.g. Union, Subtraction and Intersection., Sectioning of Solids and modification of solid Edges and faces using solid editing, commands. Shell, Separate commands. Performing 3D operations like 3D array mirror and rotate, Creation of fillets and chamfers, dimensioning of solids, 2D and 3D transformation: Translation, Scaling, rotation, mirror, zooming, panning and clipping.	**15**
UNIT-2, Viewing Objects in 3D Space	**PERIODS**
Viewing the objects in different views, Concept of SW, SE, NE and Isometric Views. View Ports, Layout, changing from Model to Paper space Layout, Arranging the Drawing showing different views to get the hard copy, Plotting the drawing	**5**
UNIT-3, CAM & Flexible Manufacturing System	**PERIODS**
Setting up the jobs, defining the operation, creating geometry, Specifying the tools, machining parameters and type of machining, Back plotting and verification of operation, Post processing -	**10**

Converting the generated tool path in NC code depending on the system, setting up the parameter relating to communication like transfer of programs to, CNC machine, Transfer of drawing data from any CAD software to CNC MIC and generation of G-codes, M-codes. Introduction to FMS. Principles of flexibility, changes in manufacturing system - external changes and internal changes job flexibility, machine flexibility. Features of FMS – production equipment, support system, material handling system, computer control system. Advantages & limitations of FMS.	
UNIT-4, Manufacturing Applications-Rapid Prototyping, Robotics	**PERIODS**
3D printing Fused deposition modeling, Laminated object manufacturing, Selective laser sintering, Stereo lithography, Ball 3 to 2 particle manufacturing.	**05**
UNIT-5, ROBOTICS	**PERIODS**
Introduction to robot, Robot configuration, Robot motions, Robot programming languages, Work cell, control and interlock, robot sensors, Robot applications.	**05**

LIST OF PRACTICALS

1. Performing 3D operations like Array, mirror, rotation, translation using solid works.
2. Performing 3D operation- panning, zooming, clipping etc.
3. CNC Programming for turning operation
4. CNC Programming for pocket milling
5. CNC Programming for profile milling
6. CNC Programming for facing and drilling
7. Performing operation on trainer Lathe
8. Designing of Simple machine components
9. Designing of Crank shaft (Connecting Rod)
10. Performing simple assembly operations like- nut, bolt, coupling etc.

RECOMMENDED BOOKS

1. CAD/CAM by Mikell Groover and Zimmers; Prentice Hall of India Pvt. Ltd., Delhi.
2. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata McGraw Hill, New Delhi.
3. Introduction to Robotics by John J. Craig; Pearson Education Asia, Singapore.
4. Industrial Robot by Groover; Prentice Hall of India Pvt. Ltd., Delhi.
5. Robotics by YoremKorem; McGraw Hill International. Book Co., New Delhi.
6. CAD/CAM – Theory and Practice by Zeid; Tata McGraw Hill Publishers, New Delhi.
7. CAD/CAM/CIM by S. Radha Krishan.
8. CNC Machines by Dr. B.S. Pabla – New Age Publications.

ENERGY CONSERVATION

L T P

3 0 0

COURSE OBJECTIVE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

LEARNING OUTCOMES

After undergoing this subject, the students will be able to:

- *Define principles and objectives of energy management and energy audit.*
- *Understand Energy Conservation Act 2001 and its features.*
- *Understand various forms & elements of energy.*
- *Identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.*
- *Identify areas of energy conservation and adopt conservation methods in various systems.*
- *Evaluate the techno economic feasibility of the energy conservation technique adopted*.

DETAILED CONTENTS

UNIT-1, Basics energy	**PERIODS**
Classification of energy- primary and secondary energy, commercial and noncommercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators. Global fuel reserve, Energy scenario in India and state of U.P. Sector-wise energy consumption (Domestic, industrial, agricultural and other sectors), Impact of energy usage on climate.	**06**
UNIT-2, Energy Conservation and EC Act 2001	**PERIODS**
Introduction to energy management, energy conservation, energy efficiency and its need, Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation. Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating.	**06**
UNIT-3, Electrical Supply System and Motors	**PERIODS**
Types of electrical supply system, Single line diagram, Losses in electrical power distribution system, Understanding Electricity Bill: Transformers Tariff structure, Components of power, (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC) Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers, Electric Motors Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors.	**12**
UNIT-4, Energy Efficiency in Thermal Utilities & General Energy Saving Tips	**PERIODS**

& Energy Audit	
Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE), Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces, Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers, Efficient Steam Utilization	**11**
UNIT-5, Energy Conservation Building Code & waste heat recovery and Co-generation	**PERIODS**
ECBC and its salient features, Tips for energy savings in buildings: New Buildings, Existing Buildings. Concept, classification and benefits of waste heat recovery, Concept, and types of co-generation system.	**5**

PRACTICAL EXERCISE

1. To conduct load survey and power consumption calculations of small building.
2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy
5. Consumption by centrifugal pump.
6. 5. To measure and calculate energy saving by arresting air leakages in compressor.
7. 6. To measure the effect of blower speed on energy consumed by it.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015.
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015.
3. 3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015.
4. Handbook on Energy Audit & Environmental Management by Y P Abbi &Shashank Jain published by TERI. Latest Edition.

UNIVERSAL HUMAN VALUES

L T P

2 0 0

COURSE OBJECTIVE

This introductory course input is intended

1. *To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.*
2. *To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.*
3. *To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature*

Thus, this course is intended to provide a much needed orientation input in value education to the young enquiring minds.

Course Methodology

1. *The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-a-vis the rest of existence.*
2. *It is free from any dogma or value prescriptions.*
3. *It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.*
4. *This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self evolution.*
5. *This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.*

DETAILED CONTENT

UNIT-1, Course Introduction- Need, Basic Guidelines, Content and Process for Value Education	**PERIODS**
Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels	**08**
UNIT-2, Understanding Harmony in the Human Being- Harmony in Myself!	**PERIODS**
Understanding human being as a co-existence of the sentient 'I' and the material the Body' Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail ,Programs to ensureSanyam and Swasthya -Practice Exercises and Case Studies will be taken up in Practice Sessions.	**06**
UNIT-3, Understanding Harmony in Family and Society- Harmony in	**PERIODS**

Human-Human Relationship	
Understanding Harmony in the family – the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitvaas comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family! -Practice Exercises and Case Studies will be taken up in Practice Sessions.	**08**
UNIT-4, Understanding Harmony in the Nature and Existence- Whole existence as Co-existence	**PERIODS**
Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. -Practice Exercises and Case Studies will be taken up in Practice Sessions.	**04**
UNIT-5, Implications of the above Holistic Understanding of Harmony on Professional Ethics	**PERIODS**
Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics, Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations, To inculcate Human Values among Students: The Role of self ,Parents and Teachers. Practice Exercises and Case Studies will be taken up in Practice Sessions.	**08**

Reference Material

The primary resource material for teaching this course consists of

a) The text book (Latest Edition) R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
b) The teacher's manual (Latest Edition) R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
4. Ivan Illich, 1974, Energy & Equity, the Trinity Press, Worcester, and HarperCollins, USA.

5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, and Universe Books.

INDUSTRIAL TRAINING

L T P

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It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organized during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity 15%
b) Initiative in learning new things 15%
c) Presentation and Viva 15%
d) Industrial training report 55%

THEORY OF MACHINES

L T P

2 1 1

COURSE OBJECTIVE

A diploma holder in this course is required to assist in the design and development of prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Explain working of different types of mechanisms and draw their inversion.
- Solve problems on power transmission.
- Determine ratio of driving tension for flat and V-belt drive.
- Identify various types of gears and their applications.
- Construct turning moment diagram of flywheel for different types of engine.
- Construct Cam Profile.
- Calculate balancing of rotating mass and its position.
- Identify different type of vibrations, their causes, harmful effect and remedies.

DETAILED CONTENTS

Theory, UNIT-1, Simple Mechanisms	**PERIODS**
Introduction to link, kinematic pair, lower and higher pair, Kinematic chain, mechanism, Inversions. Different types of mechanisms (with examples).	**5**
UNIT-2, Part-I, Kinematics Analysis and synthesis	**PERIODS**
Displacement, velocity and acceleration of plane mechanism, Graphical and analytical techniques.	**11**
Part-II, Dynamics of Machine & Balancing	
Static and dynamic force analysis graphical and analytical approaches, Gyroscopic action in machines. Concept of balancing, Introduction to balancing of rotating masses (simple numerical)	
UNIT-3, Power Transmission	**PERIODS**
Introduction to Belt and Rope drives, Types of belt drives and types of pulleys, Concept of velocity ratio, slip and creep; crowning of pulleys (simple numerical), Flat and V belt drive: Ratio of driving tensions, power transmitted, centrifugal tension, and condition for maximum horse power (simple numerical), Different types of chains and their terminology, Gear terminology, types of gears and their applications; simple and compound gear, trains; power transmitted by simple spur gear.	**10**
UNIT-4, Flywheel	**PERIODS**
Principle and applications of flywheel, Turning - moment diagram of flywheel for different engines, Fluctuation of speed and fluctuation of energy - Concept only, Coefficient of fluctuation of speed and coefficient of fluctuation of energy.	**06**
UNIT-5, Cam and Follower & Vibrations	**PERIODS**
Introduction, types of Cam and follower, construction of Cam profile for constant velocity motion, constant acceleration motion and simple harmonic motion. Types-longitudinal, transverse and tensional vibrations (simple numerical), Dampening of vibrations, Causes of vibrations in machines, their harmful effects and remedies.	**08**

RECOMMENDED BOOKS

1. Theory of Machines by D.R. Malhotra; Satya Prakashan, New Delhi.
2. Theory of Machines by V.P Singh; Dhanpat Rai and sons, New Delhi.
3. Theory of Machines by Jagadish Lal; Metropolitan Publishers, New Delhi.
4. Theory of Machine by B.S Ubhi; S.K. Kataria and Sons, New Delhi.

MACHINE DESIGN

L T P

2 1 1

COURSE OBJECTIVE

A diploma holder in this course is required to assist in the Design and Development of Prototype and other components. For this, it is essential that he is made conversant with the principles related to design of components and machine and application of these principles for designing. The aim of the subject is to develop knowledge and skills about various aspects related to design of machine components.

LEARNING OUTCOMES

At the end of this course, students will be able to:

- *Explain the terms related to design.*
- *Understand Man- machine relationship.*
- *Use codes and standards for designing a component.*
- *Select material for designing a component.*
- *Interpret the various causes of design failures.*
- *Design shaft on the basis of strength and rigidity.*
- *Design various machine elements (key, joint, flange coupling and screwed joints).*

DETAILED CONTENTS

UNIT-1, INTRODUCTION	**PERIODS**
Design – Definition, Type of design, necessity of design, Comparison of designed and undersigned work, Design procedure, Characteristics of a good designer. Factor of safety, factors affecting factor of safety, stress, concentration, methods to reduce stress concentration, fatigue, endurance limit. General design consideration, Codes and Standards (BIS standards), Selection of materials, criteria of material selection, Ergonomics and Aesthetic Consideration in design, Ergonomics of design-man-machine relationship. Design of equipment for control, environment and safety, Aesthetic consideration regarding shape, size, color and surface finish.	**10**
UNIT-2, Design Failure & Design of Shaft	**PERIODS**
Theories of failure, Classification of loads, Design under tensile, compressive and tensional loads. Type of shaft, shaft materials, Type of loading on shaft, standard sizes of shaft available, Shaft subjected to torsion only, determination of shaft diameter (hollow and solid shaft) on the basis of : - Strength criterion - Rigidity criterion Determination of shaft diameter (hollow and solid shaft) subjected to bending, Determination of shaft diameter (hollow and solid shaft) subjected to combined, torsion and bending.	**10**
UNIT-3, Design of Key	**PERIODS**
Types of key, materials of key, functions of key, Failure of key (by Shearing and Crushing). Design of key (Determination of key dimension), Effect of keyway on shaft strength. (Figures and problems).	**05**
UNIT-4, Design of Joints	**PERIODS**
Types of joints - Temporary and permanent joints, utility of various joints Temporary Joint: Knuckle Joints – Different parts of the joint, material used for the joint, type of knuckle Joint, design of the knuckle joint. (Figures and problems). Cotter Joint – Different parts of	**10**

the spigot and socket joints, Design of spigot and socket joint. Permanent Joint: Welded Joint - Welding symbols. Type of welded joint, strength of parallel and transverse fillet welds. Strength of combined parallel and transverse weld. Riveted Joints. : Rivet materials, Rivet heads, leak proofing of riveted joint caulking and fullering. Different modes of rivet joint failure. Design of riveted joint – Lap and butt, single and multi riveted joint.	
UNIT-5, Design of Flange Coupling	**PERIODS**
Necessity of a coupling, advantages of a coupling, types of couplings, design of muff coupling, design of flange coupling. (Both protected type and unprotected type).	**05**

Note:-

a) Use of design data book during the examinations is allowed.
b) The paper setter should normally provide all the relevant data for the machine design in the question paper.

RECOMMENDED BOOKS

1. Machine Design by R.S. Khurmi and JK Gupta, Eurasia Publishing House (Pvt.) Limited, New Delhi.
2. Machine Design by V.B.Bhandari, Tata McGraw Hill, New Delhi.
3. Engineering Design by George Dieter; Tata McGraw Hill Publishers, New Delhi.
4. Mechanical Engineering Design by Joseph Edward Shigley; McGraw Hill, Delhi.
5. Machine Design by Sharma and Agrawal; Katson Publishing House, Ludhiana.
6. Design Data Handbook by D.P. Mandali, SK Kataria and Sons, Delhi.
7. Machine Design by A.P.Verma; SK Kataria and Sons, Delhi
8. Machine Design by AR Gupta and BK Gupta; Satya Parkashan, New Delhi.

ENGINEERING MATERIALS

L T P

2 1 0

COURSE OBJECTIVES

Lot of development has taken place in the field of materials. New materials are being developed and it has become possible to change the properties of materials to suit the requirements. Diploma holders in this course are required to make use of different materials for various applications. For this purpose, it is necessary to teach them basics of metal structure, properties, usage and testing of various ferrous and non ferrous materials and various heat treatment processes. This subject aims at developing knowledge about the characteristics, testing and usage of various types of materials used in industries.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- *Distinguish between metals and non metals and ferrous and non ferrous materials.*
- *Explain the arrangement of atoms in various crystals.*
- *Carry out various heat treatment processes.*
- *Analyze microstructure and changes in microstructure due to heat treatment.*
- *Classify various types of plastics and rubber.*
- *Explain properties and applications of composites, ceramics and smart materials.*
- *Select suitable material to be used for various engineering applications.*
- *Perform destructive and non-destructive testing of materials.*

DETAILED CONTENTS

UNIT-1, Introduction	PERIODS
Materials, History of Material Origin, Scope of Material Science, Overview of different engineering materials and applications. Classification of materials, Thermal, Chemical, Electrical, Mechanical properties of various materials, Present and Future needs of materials, Overview of Biomaterials and semi-conducting materials, Various issues of Material Usage-Economical, Environment and Social.	**06**
UNIT-2, Crystallography	**PERIODS**
Fundamentals:- Crystal, Unit Cell, Space Lattice, Arrangement of atoms in Simple Cubic Crystals, BCC, FCC and HCP Crystals, Number of Atoms per unit Cell, Atomic Packing Factor. **Deformation:** - Overview of deformation behavior and its mechanism, behavior of material under load control and strain control. **Failure Mechanisms:** - Overview of failure modes, fractures, fatigue and creep.	**08**
UNIT-3, Metals And Alloys, , Heat Treatment	**PERIODS**
Ferrous Materials:- Different iron ores, Raw materials in production of iron and steel, Basic process of iron-making and steel-making, Classification of iron and steel. **Cast Iron: -** Different types of Cast Iron, manufacturing and their use. Classification of Grey cast iron and S.G. iron. **Steals:-** Steels and alloy steel, Classification of plain carbon steels, Properties and usage of different types of Plain Carbon Steels, Effect of various alloys on properties of steel, Use of alloy steels (high speed steel, stainless steel, spring steel, silicon steel). **Non Ferrous Materials:-** Properties and uses of Aluminum, Copper and Zinc and their alloys Purpose of heat treatment, solid solutions and its types. Formation and decomposition of Austenite,	**12**

Martensitic Transformation-simplified Transformation Cooling Curves. Various heat treatment	
UNIT-4, Plastics, , Advanced Materials & Advanced Materials	**PERIODS**
Important sources of plastics, Classification-thermoplastic and Thermoset and their uses, Various trade names of plastics, Plastic coatings, food grade plastics. Applications of plastic in automobile and domestic use. Rubber classification- Natural and synthetic. Selection of rubber Composites-Classification, properties, applications. Ceramics-Classification, Properties and applications. Adhesives-Classification, Properties and applications. Smart materials- Properties and applications. Overview of Tool and Die materials, Materials for bearing metals, Materials for Nuclear Energy, Refractory materials.	**06**
UNIT-5, Identification and Testing of Materials (Destructive and NDT)	**PERIODS**
Identification of metal by giving mini projects. Destructive testing: Stress testing, hardness testing, Non-destructive testing: - Eddy-current, Magnetic-particle, Liquid penetration, radiographic, Ultrasonic and visual testing.	**06**

LIST OF PRACTICALS

1. Use of diamond polishing apparatus.
2. To perform following heat treatment process on materials of known carbon percentage and checking the change in the properties.
    a) Annealing
    b) Normalising
    c) Care hardening
3. Preparation of specimens and study of micro structure of given metals and alloys on metallurgical microscope.
    a. Brass
    b. Bronze
    c. Grey Cast Steel
    d. Low Carbon Steel
    e. High Carbon Steel
    f. High Speed Steel
4. To prepare specimen for microscope examination for polishing.
5. To determine composition of alloy steel by steeloscope.

RECOMMENDED BOOKS

1. Text book of Material Science by R.K. Rajput; Katson Pubs, Ludhiana.
2. Text book of Material Science by V.K. Manchanda; India Publishing House, Jalandhar.
3. Introduction to Material Science by A.R. Gupta, Satya Prakashan, New Delhi.
4. Material Science and Engineering Raghuan by Raghvaan PHI.
5. Material Science by Hazra, Chaufhary.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

PRODUCTION TECHNOLOGY

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COURSE OBJECTIVES

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes, modern machining methods, tools, jigs, and fixtures is required to be imparted. Hence the subject of production technology.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Perform turning, step turning, taper turning, threading and knurling operation on lathe machine.
- Resharpen/grind single point tool.
- Select material and tool geometry for cutting tools on lathe.
- Explain uses of lathe accessories and different types of lathes.
- Perform drilling, reaming, counter boring, counter sinking and tapping operations on drilling machine.
- Explain the nomenclature of a drill and milling cutter.
- Describe the features of various types of Milling machines
- Use milling machine accessories and attachments.
- Perform milling machine operations on vertical and horizontal milling machine.
- Perform keyway cutting and angular/step surface shaping on shaper.
- Explain geometry of single point cutting tool, various types of lathe tool sand tool materials.
- Explain the features of locating devices, clamping devices, jigs, and fixtures.
- Select cutting fluid for different materials and operations.

DETAILED CONTENTS

UNIT-1, Cutting Tools, and Materials	Periods
Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, cutting speed, feed and depth of cut and their effect Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, satellite, ceramics, and diamond.	**05**
UNIT-2, Lathe & Milling	**Periods**
Principle of turning, Description, and function of various parts of a lathe, Classification, and specification of various types of lathes, Drives and transmission, Work holding devices, Lathe tools: Parameters/Nomenclature and applications, Lathe operations: - Plain and step turning, facing, parting off, taper turning, , drilling, reaming, boring, threading and knurling, form turning, spinning. Cutting parameters – Speed, feed, and depth of cut for various materials and for various operations, machining time. Speed ratio, preferred numbers of speed selection. Lathe accessories: -Centres, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning attachment, tool post grinder, milling attachment,. Brief description of capstan and turret lathe, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe. Specification and working principle of milling machine, Classification, brief description and applications of milling machines, Details of column and knee type milling machine, milling machine accessories.	**08**
UNIT-3, Part-1, Drilling & Boring	**Periods**
Principle of drilling. Classification of drilling machines and their description. Various operations performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping. Speeds and feeds during drilling, impact of these parameters on drilling, machining time. Types of drills and their features, nomenclature	**10**

of a drill, Drill holding devices. Types of reamers. Principle of boring, Classification of boring machines and their brief description. Specification of boring machines. Boring tools, boring bars, and boring heads. Description of jig boring machine.	
Part-2, Shaping and Planning & broaching	
Working principle of shaper and planer, Type of shapers, Type of planers, Quick return mechanism applied to shaper and planer machine. Work holding devices used on shaper and planer, Types of tools used and their geometry. Specification of shaper and planer. Speeds and feeds in above processes. Types of broaching machines – Single ram and duplex ram horizontal type vertical type pull up, pull down, push down. Elements of broach tool, broach tooth details – nomenclature, types, and tool material	
UNIT-4, Jigs and Fixtures, Cutting Fluids and Lubricants	**Periods**
Importance and use of jigs and fixture, Principle of location, locating devices, Clamping devices, Types of Jigs – Drilling jigs, bushes, template jig, plate jig, channel jig, leaf jig. Fixture for milling, turning, welding, grinding, Advantages of jigs and fixtures. Function of cutting fluid, Types of cutting fluids, Difference between cutting fluid and lubricant, Selection of cutting fluids for different materials and operations, Common methods of lubrication of machine tools.	**07**
UNIT-5, Grinding & Modern Machining Processes	**Periods**
Purpose of grinding, Various elements of grinding wheel – Abrasive, Grade, structure, Bond, Common wheel shapes and types of wheels – built up wheels, mounted wheels, and diamond wheels. Specification of grinding wheels as per BIS. Truing, dressing, balancing, and mounting of wheel .Grinding methods – Surface grinding, cylindrical grinding, and centreless– Cylindrical grinder, surface grinder, internal grinder, centreless grinder, tool and cutter grinder .Selection of grinding wheel, Ultrasonic machining (USM): Introduction, principle ,process, advantages and limitations, applications, Electro Chemical Processes - Electro chemical machining (ECM) – Fundamental principle, process, applications, Electrical Discharge Machining (EDM) - Introduction, basic EDM circuit, Principle, metal removing rate, dielectric fluid, applications, Laser beam machining (LBM) – Introduction, machining process and applications, Plasma arc machining (PAM) and welding – Introduction, principle process and applications.	**10**

PRACTICAL EXERCISES

TURNING SHOP

- Job 1. Grinding of single point turning tool.
- Job 2. Exercise of simple turning and step turning.
- Job 3. A composite job involving, turning, taper turning, external thread cutting and knurling.

ADVANCE FITTING SHOP

- Job 1. Exercise on drilling, reaming, counter boring, counter sinking and taping
- Job 2. Dove tail fitting in mild steel
- Job 3. Radius fitting in mild steel
- Job 4. Pipe threading with die

MACHINE SHOP

- Job 1. Prepare a V-Block up to ± 0.5 mm accuracy on shaper machine
- Job 2. Exercise on key way cutting and spline cutting on shaper machine.
- Job 3. Produce a rectangular block by facing on a slotting machine
- Job 4. Produce a rectangular slot on one face with a slotting cutter
- Job 5. Produce a rectangular block using a milling machine with a side and face cutter
- Job 6. Prepare a slot on one face using milling machine

FORGING SHOP/FITTING SHOP/SHEET METAL SHOP

- Job 1. Preparation of single ended spanner by hand, machine forging
- Job 2. Preparation of simple die
- Job 3. Demonstration of spinning process on lathe and spinning a bowl on a lathe machine
- Job 4. Demonstration of grinding process on lathe machine and grinding a job on a lathe machine
- Job 5. Preparation of utility item out of G.I. sheet
- Job 6. Preparation of drilling jig

ADVANCE TURNING SHOP

- Exercise of boring with the help of boring bar
- Exercises on internal turning on lathe machine
- Exercises on internal threading on lathe machine
- Exercises on external turning on lathe machine
- Resharpening of single point cutting tool with given geometry

RECOMMENDED BOOKS

1. Manufacturing Technology by Rao; Tata McGraw Hill Publishers, New Delhi
2. Workshop Technology Vol. I, II, III by Chapman; Standard Publishers Distributors. New Delhi.
3. Production Engineering and Science by Pandey and Singh; Standard Publishers Distributors, New Delhi.
4. A Text Book of Production Engineering by P.C. Sharma; S. Chand and Company Ltd., New Delhi.
5. Workshop Technology Vol. III, by R. P. Dhiman, Ishan Publications Jalandhar
6. Production Technology by HMT; Tata McGraw Publisher, New Delhi
7. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
8. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
9. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

PRODUCTION MANAGEMENT

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COURSE OBJECTIVE

Diploma holder is responsible for controlling production and quality of the product on the shop floor as well as for production planning and control. He is also required to supervise erection, installation and maintenance of equipment including material handling and undertake work-study for better utilization of resources. For this purpose, knowledge and skills about these topics need to be imparted to them. This subject aims at development of competencies to prepare material, equipment schedule and production control schedules and maintain required quality levels. In addition, it will also help in developing skills in erection, installation and testing of equipment.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- *Solve planning, scheduling, and sequencing problems for shop floor*
- *Interpret different kinds of production systems*
- *Prepare break-even analysis and Gantt chart.*
- *Explain the importance of inspection.*
- *Prepare various control charts.*
- *Apply different techniques to improve quality of products and processes.*
- *Carryout estimating and costing of production cost*
- *Explain the objective, importance, and types of maintenance.*
- *Explain the salient features of labour legislation Acts.*

DETAILED CONTENTS

UNIT-1, Production Planning and Control	**Periods**
Introduction, Objectives, and factors affecting PPC, Functions (Elements) of PPC - Planning, Routing, Loading, scheduling, dispatching, progressing and inspection, Types of production system - Flow or continuous production, Intermittent, Production, Production Control - Objectives and fields of production control, Production, control system, Break even analysis and Gantt chart.	**8**
UNIT-2, Inspection and Quality Control	**Periods**
Inspection – Introduction, Need and Importance, Types of Inspection, Role of operator and inspector in inspection, Quality Control, Introduction, Need and Importance, Factors affecting product quality, Quality Assurance, Statistical Quality Control (SQC), Acceptance Sampling, Sampling Plan- Single and double sampling plan, Operating Characteristics Curve, Control Charts – Introduction, advantages, Types of control charts (X, R, p and c charts), Concept of ISO 9000, ISO 14000 and TQM. QC tools, 6σ Approach.	**8**
UNIT-3, Cost Estimation	**Periods**
Definition and functions of cost estimation, Estimation procedure, Elements of cost, ladder of costs (simple numericals), Overhead expenses and its distribution, Depreciation- Concept and Definition, Methods of calculating depreciation- Straight line method, Diminishing Balance Method, Sinking fund method (Numerical problems). Cost control- definition and objectives, Capital cost control (planning and scheduling), operating cost control. Cost estimation for machining processes like turning, drilling, and milling. Cost estimation of forming processes like forging, pattern making, and casting.	**8**
UNIT-4, Repair and Maintenance	**Periods**
Objectives and importance of Maintenance, Different types of maintenance- Corrective or Breakdown maintenance, Scheduled Maintenance, Preventive Maintenance, Predictive	**8**

Maintenance, Nature of maintenance problems, Range of maintenance problems	
UNIT-5, Labour Legislation and Pollution Control Acts	**Periods**
Factory Act 1948, Workmen's compensation Act 1923, Apprentices Act 1961, Water Pollution Control Act 1947 and 1981, Air Pollution Control Act 1986, PF Act. Employee's state insurance (ESI) Act., Pollution control provision in Motor Vehicle Act.	**08**

LIST OF PRACTICALS

1. *Prepare a flow diagram*
2. *Prepare a Gantt chart*
3. *Draw X, R, p and c charts*
4. *Estimate the cost of turning*
5. *Estimate the cost of drilling*
6. *Prepare maintenance schedule*

RECOMMENDED BOOKS

1. *Production Management by C.L. Mahajan; Satya Parkashan Company Limited, New Delhi.*
2. *Mechanical Costing, Estimation and Project Planning by CK Singh; Standard Publishers, New Delhi.*
3. *Industrial Engineering and Management by T.R. Banga and SC Sharma; Khanna Publishers, Delhi.*
4. *Industrial Engineering and Management by O.P. Khanna; Dhanpat Rai and Sons, New Delhi.*

INDUSTRIAL ENGINEERING

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COURSE OBJECTIVE

A diploma holder in this course will have to conduct time and motion study to improve the methods/system. For this, knowledge and related skills in method study and work measurement are essential. Knowledge of industrial safety is also required. Hence this subject.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- *Use industrial engineering concepts to improve productivity*
- *Use resources optimally and economically.*
- *Apply work study techniques for improving production*
- *Explain various incentive plans*
- *Maintain inventory optimally and classify different types of inventories*
- *Take preventive measures to avoid accidents use of safety device.*

DETAILED CONTENTS

UNIT-1, Productivity	**Periods**
Introduction to productivity, factors affecting productivity, practical measurement of productivity, difference between production and productivity, causes of low productivity and methods to improve productivity, contribution of standardization in improving productivity.	**10**
UNIT-2, Work Study & Method Study	**Periods**
Definition and scope of work study; factors for selection of work study job, uses and limitations of work study, Inter-relation between method study and work measurement; Human aspects of work study; Role of work study in improving productivity. Definition, Objectives, and procedure for Method study analysis; Information collection and recording techniques through various diagrams.	**05**
UNIT-3, Motion Analysis & Work Measurement	**Periods**
Principles of Motion analysis; Therbligs and SIMO charts; Normal work area (Principle of motion economy), design and arrangement of work place. Ergonomics, design of tools and equipment's. Objectives; work measurement techniques, stop watch time study; principle, equipment used and procedure; systems of performance rating; standard elements of time, calculation of basic times; various allowances; guide for rest allowance in Indian conditions, calculation of standard time, work sampling, standard data, and its usage. Work sampling.	**15**
UNIT-4, Wages, and Incentives Schemes & Stores Management	**Periods**
Introduction to wages, Wage payment for direct and indirect labour, wage payment plans and incentives, various incentive plans, incentives for indirect labour. Different Layout and structures of stores, Inventory control, calculation of EOQ, Bin cards and various forms required in stores for documentation. Purchase procedures.	**05**
UNIT-5, Industrial Safety	**Periods**
Accident- causes, types, results, and control. Mechanical and electrical hazards- types, causes and preventive steps/procedure. Describe salient points of Factories Act 1948 for health and safety- wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels etc. Safety colour codes. Fire prevention and firefighting, equipment, and methods.	**05**

LIST OF PRACTICALS

1. *Stop watch time study on any machine-like lathe, drilling machine or milling machine*
2. *Method improvement - Assembly of bolt, nut and 3 washers*
3. *Determination of standard time for assembly of electrical switch*
4. *Preparation of flow process chart*
5. *Preparation of SIMO chart*
6. *Preparation of flow diagram*
7. *Preventive measure in case of electrocution*
8. *Preventive measures in case of snake/poisonous creature sitting*
9. *Use of first aid in case of minor accidents*
10. *Use of five extenuates/five drill*

RECOMMENDED BOOKS

1. *Work Study and Ergonomics by S Dalela and Sourabh*
2. *Industrial Engineering and Management by O.P. Khanna, Dhanpat Rai and Sons, Delhi.*
3. *Industrial Engineering and Management by M. Mahajan; Dhanpat Rai and Sons, New Delhi.*
4. *Introduction to Work Study, ILO Publication*
5. *Production and costing by GBS Narang; Khanna Publishers, New Delhi.*
6. *E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.*

INDUSTRIAL MANAGEMENT AND ENTREPRENERSHIP DEVELOPMENT

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COURSE OBJECTIVE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mindset with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- Explain the principles of management including its functions in an organization.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organization.
- Use marketing skills for the benefit of the organization.
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, JIT and CRM.

DETAILED OUTCOMES

UNIT-1, Introduction to Entrepreneurship	PERIODS
Concept /Meaning and its need, Qualities and functions of entrepreneur and barriers in entrepreneurship, Sole proprietorship and partnership forms and other forms of business organizations, Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organization: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks.	08
UNIT-2, Market Survey and Opportunity Identification/Ideation	PERIODS
Scanning of the business environment, Salient features of National and Haryana State industrial policies and resultant business opportunities, Types and conduct of market survey, Assessment of demand and supply in potential areas of growth, Identifying business opportunity, Considerations in product selection, Converting an idea into a business opportunity.	08
UNIT-3, Project report Preparation	PERIODS
Preliminary project report, Detailed project report including technical, economic and market feasibility, Common errors in project report preparations, Exercises on preparation of project report Sample project report.	08
UNIT-4, Introduction to Management	PERIODS

Definitions and importance of management, Functions of management: Importance and process of planning, organizing, staffing, directing and controlling, Principles of management (Henri Fayol, F.W. Taylor), Concept and structure of an organization, Types of industrial organizations and their advantages, Line organization, staff organization, Line and staff organization, Functional Organization.	08
UNIT-5, Leadership and Motivation	PERIODS
Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders, Motivation: Definition and characteristics, Importance of self motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor).	08

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by MK Garg
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

CNC MACHINES AND AUTOMATION

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COURSE OBJECTIVE

Diploma holders are required to supervise and handle specialized machines and equipment like CNC machines. For this purpose, knowledge and skills about NC machines, part programming in NC machines and tooling for CNC machines are required to be imparted for enabling them to perform above functions. This subject aims at development of knowledge and skills about CNC machines, tools, equipment and use of high tech machines for increased productivity and quality.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Explain the construction and tooling of CNC machine.
- Prepare simple part programme for different operations.
- Operate a CNC lathe.
- Operate a CNC milling machine.
- Diagnose common problems in CNC machines.
- Explain the trends in the field of automation.

DETAILED CONTENTS

UNIT-1, Introduction	**Periods**
Introduction to NC, CNC & DNC, their advantages, disadvantages and applications, Machine Control Unit, input devices, serial communication and Ethernet techniques, selection of components to be machined on CNC machines, Problems with conventional NC, New developments in NC, Axis identification, PLC Control and its components.	**08**
UNIT-2, Constructional details and Tooling	**Periods**
Design features, specification Chart of CNC machines, use of slide ways, balls, rollers and coatings, motor and lead screw, swarf removal, safety and guarding devices, various cutting tools for CNC machines, overview of tool holder, different pallet systems and automatic tool changer system, management of a tool room.	**08**
UNIT-3, Part Programming, System Devices	**Periods**
Part programming and basic concepts of part programming, NC words, part programming formats, simple programming for rational components, part programming using canned cycles, subroutines and do loops, tool off sets, cutter radius compensation and wear compensation, Actuators, Transducers and Sensors, Tachometer, LVDT, opto-interrupters, potentiometers for linear and angular position, encoder and decoder, axis drives, open loop system, close loop system.	**08**
UNIT-4, Problems in CNC Machines	**Periods**
Common problems in mechanical, electrical, pneumatic, and electronic and PC components of NC machines, diagnostic study of common problems and remedies, use of on-time fault finding diagnosis tools in CNC machines.	**08**
UNIT-5, Automation and NC system	**Periods**
Introduction to operations involved in turning machines- Facing OD and ID Rough cut, Finish cut, Taper turning, Drilling, Threading, Grooving and cut-off (parting). Introduction to operations involved in Milling-contouring, pocketing, Drilling, Facing, Circular tools paths. Different terms like clearance,	**08**

Retract, Feed plane, Depth of cut, lead in, lead out, and overlap. Simple programmes in Milling and Turning involving different operations Turning involving different operations.	

LIST OF PRACTICALS

1. Study the constructional details of CNC lathe.
2. Study the constructional details of CNC milling machine.
3. Study the constructional details and working of: Automatic tool changer and tool setter
   - Multiple pallets
   - Swarf removal
   - Safety devices
4. Develop a part programme for following lathe operations and make the job on CNC lathe and CNC turning center.
   - Plain turning and facing operations
   - Taper turning operations
   - Operation along contour using circular interpolation.
5. Develop a part programme for the following milling operations and make the job on CNC milling
   - Plain milling
   - Slot milling
   - Contouring
   - Pocket milling
6. Preparation of work instruction for machine operator
7. Preparation of preventive maintenance schedule for CNC machine.
8. Demonstration through industrial visit for awareness of actual working of FMS in production.
9. Use of software for turning operations on CNC turning center.
10. Use of software for milling operations on machine centers.

RECOMMENDED BOOKS

1. CNC Machines – Programming and Applications by M Adithan and BS Pabla; New Age International (P) Ltd., Delhi.
2. Computer Aided Manufacturing by Rao, Kundra and Tiwari; Tata McGraw Hill, New Delhi.
3. CNC Machine by Bharaj; Satya Publications, New Delhi.
4. 4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE, NITTTR, Chandigarh.

TOOL ENGINEERING

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COURSE OBJECTIVE

A diploma holder should have complete knowledge of basic tools, their materials and their optimal utilization. This subject imparts skill and awareness of quality production in minimum time by using jigs and fixtures.

LEARNING OUTCOMES

After completion of this course, the students will be able to:

- List various properties of cutting tools.
- Explain the geometry of cutting tools.
- Explain the principles of location.
- Describe the functions of various locating devices.
- Explain the working of various types of clamps.
- Explain the functioning of various types of drilling jigs.
- Discuss features of various types of fixtures

DETAILED CONTENTS

UNIT-1, Cutting Tools	**Periods**
Mechanical property and uses of high-speed steel, stellite, cemented carbide, ceramics diamond, study of commercially available cutting tools. Tool geometry of single point cutting tools, multipoint cutting tools, reamer, drill, milling cutter, throw-away inserts, chip breaker, tool and cutter maintenance, regrinding and lapping of tools.	**24**
UNIT-2, Location and Clamping	**Periods**
Principles of location, 3-2-1 principle, Location with previous machined hole, different locating devices, V-location, conical locations. Purpose of Clamping elements, types of clamps.	**16**
UNIT-3, Jigs and Fixtures	**Periods**
Need for jigs and fixtures, fundamental principles of jigs and fixtures design. Types of bushes, advantages of bushings. Types of drilling jigs- template jig, channel jig, latch jig, quick acting jig, indexing jig, box jig. Types of fixtures-simple fixture, milling fixture, welding fixture, turning fixture, assembly fixture & inspection fixture.	**30**

RECOMMENDED BOOKS

1. Production Engineering by P.C. Sharma; S. Chand & Company Ltd., Delhi.
2. Tool Design by Donaldson and Lecain; Tata McGraw Hill Company, New Delhi
3. Production Engineering & Design by Dr. Surender Kumar and Umesh Chandra
4. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

METROLOGY AND MEASUREMENT INSTRUMENTS

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COURSE OBJECTIVE

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- *Use vernier calliper, micrometer, and Height gauge for linear internal and external measurement.*
- *Use bore gauge, radius gauge, taper gauge, plug gauge, ring gauge, snap gauge for measurements.*
- *Use bevel protector, sine bar, slip gauge, dial indictor, angle deckor, and poppy dial for angular measurements.*
- *Measure spur gear characteristics using gear tooth vernier, outside diameter over dovel pins.*
- *Use tool makers microscope measure surface roughness parameters.*
- *Use profile projector, auto collimeter, angle deckor.*
- *Select and measure variables using electrical and electronics comparators and measuring instrument, sensors, transducers.*
- *Select and use non destructive testing methods.*
- *Explain the use of coordinate measuring machine.*
- *Use the concept of limits, fits and tolerance in assembly of components.*

DETAILED CONTENTS

UNIT-1, Introduction	**Periods**
Definition of metrology, Standard of measurement, Types of Errors - Controllable and random errors, Precision, accuracy, sensitivity, hysteresis, response time, repeatability,, calibration, uncertainty of measurement, interchangeability. Standardization and standardizing organizations.	**08**
UNIT-2, Linear and Angular Measurement	**Periods**
Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block. Construction features and use of instruments for precision measurements: vernier calipers, vernier height and depth gauges, micrometers. Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges. Cylinder bore gauges, feeler and wire gauges. Checking flatness, roundness and Squareness Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic .Construction and use of instruments for angular measurements: bevel protector, sine bar, angle gauges, clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.	**20**
UNIT-3, Measurement of Surface Finish, Limits, Fits and Tolerance	**Periods**
Terminology of surface roughness. Concept of primary texture and secondary texture. Factors affecting surface finish. CLA, RMS and RA value. Principle and operation of stylus probe instruments. Tomlinson surface meter and Taylor surface talysurf. Limits, Fits and Tolerance	**12**
UNIT-4, Measurement of Screw threads and Gauges	**Periods**

Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges. Measurements of gears (spur) – Measurement of tooth thickness, pitch, Gear Ball tester, Lead and Profile Testers. Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.	**10**
UNIT-5, Instrumentation	**Periods**
Various types of instruments used for mechanical quantities such as displacement, velocity, acceleration, speed and torque. Use of transducers and electronic counters, stroboscope, vibrating reeds and tachometers. Strain gauge – use of strain gauge and load cells various types of temperature measuring instruments such as thermometers, Thermistor, Bimetallic strip, Pyrometers.	**15**
Note: - There should be a visit to established metrology lab to familiarize students with purpose and need of metrology.	

LIST OF PRACTICALS

1. Internal and external measurements with vernier calliper and microscope
2. Measurement of linear dimensions with height gauge and depth gauge.
3. Measurement of flatness, concentricity with dial indicator
4. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
5. Use of plain plug and ring gauge, taper plug and ring gauge, thread plug and ring gauge and snap gauges.
6. Measurement of Angle using;
    i) Cylindrical rollers and spherical balls and slip gauges
    ii) Bevel protector
    iii) Sine Bar/Sine Table, Slip Gauges, Height Gauge and dial indicator.
    iv) Angle deckor.
7. Measurement of thread parameters by using tool maker's microscope.
8. Measurement of cylindrical bore using cylinder bore gauge for bore diameter, ovality and taper.
9. Measurement of surface roughness using surface roughness tester.
10. Measurement of a profile using profile projector.
11. Study and use of Auto-Collimator.
12. Determination of temperature of thermocouple, pyrometer, Infrared thermometer.

RECOMMENDED BOOKS

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

ENVIRONMENTAL STUDIES

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COURSE OBJECTIVE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- *Comprehend the importance of ecosystem and sustainable.*
- *Demonstrate interdisciplinary nature of environmental issues*
- *Identify different types of environmental pollution and control measures.*
- *Take corrective measures for the abatement of pollution.*
- *Explain environmental legislation acts.*
- *Define energy management, energy conservation and energy efficiency*
- *Demonstrate positive attitude towards judicious use of energy and environmental protection*
- *Practice energy efficient techniques in day-to-day life and industrial processes.*
- *Adopt cleaner productive technologies*
- *Identify the role of non-conventional energy resources in environmental protection.*
- *Analyze the impact of human activities on the environment.*

DETAILED CONTENTS

UNIT-1, Introduction	**PERIODS**
Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.	**05**
UNIT-2, Air Pollution	**PERIODS**
Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.	**05**
UNIT-3, Water Pollution	**PERIODS**
Impurities in water Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O2, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.	**10**
UNIT-4, Soil & Noise Pollution	**PERIODS**
Sources of soil pollution, Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste, Effect of Solid waste, Disposal of Solid Waste- Solid Waste Management. Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimize noise pollution.	**10**
UNIT-5, Environmental Legislation	**PERIODS**
Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air	**10**

(Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).	

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of pH of soil
7. To measure the noise level in classroom and industry.
8. To segregate the various types of solid waste in a locality.
9. To study the waste management plan of different solid waste
10. To study the effect of melting of floating ice in water due to global warming

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications , New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by ErachBharucha; University Press (India) Private Ltd., Hyderabad.
7. 7. Environmental Engineering and Management by Suresh K Dhamija; S K Katariaand Sons,
8. New Delhi.
9. E-books/e-tools/relevantsoftware to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.