GURU KASHI UNIVERSITY
PUNJAB - INDIA

Program Syllabus Booklet

Bachelor of Technology in Mechanical Engineering
(B. Tech ME-105)

Session: 2017-18

Guru Gobind Singh College of Engg. & Tech.
Guru Kashi University, Talwandi Sabo

GURU KASHI UNIVERSITY
PUNJAB - INDIA

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Introduction about Program

In order to make a career in the field of Mechanical Engineering, the candidates must pursue Bachelor of Technology (B.Tech) in Mechanical Engineering. Students who have qualified 10+2 with Physics and Maths or equivalent are eligible to pursue this course. The students with a Diploma in Engineering with a minimum of 60% marks are also eligible to get admissions in B.Tech program as a lateral entry.

Mechanical engineering is one of the broadest and most versatile of the engineering professions. This is reflected in the portfolio of current activities in the Department of Mechanical Engineering, one that has widened rapidly in the past decade. The course trains the students of the basics and different aspects of mechanical engineering. After completion of course, the salary package offered by employers are much higher. Students also have an option of appearing for GATE exam whose scorecard is evaluated by various government organizations for recruitment. Mechanical Engineers can also get numerous jobs in the private firms and top companies like Maruti Suzuki, Ashok Leyland, Mahindra and Mahindra, Swaraj, HMT, Godrej and ITC etc

Annexure-1

Semester: 1st (Chemistry Group)										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	100102	Engineering Chemistry	T	4	1	0	5	50	50	100
2	100201	Engineering Mathematics-II	T	4	1	0	5	50	50	100
3	103101	Basic Electrical Engineering	T	4	1	0	5	50	50	100
4	105101	Elements of Mechanical Engineering	T	4	1	0	5	50	50	100
5	105102	Engineering Graphics and Drawing	T/P	1	0	6	4	50	50	100
6	100106	Engineering Chemistry Laboratory	P	0	0	2	1	60	40	100
7	103102	Basic Electrical Engineering Lab	P	0	0	2	1	60	40	100
8	105103	Computer Graphics Lab	P	0	0	2	1	60	40	100
Total No. of Credits				27						

Semester: 2nd (Physics Group)										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	100101	Communicative English	T	3	0	0	3	50	50	100
2	100103	Engineering Mathematics-I	T	4	1	0	5	50	50	100
3	100104	Engineering Physics	T	3	1	0	4	50	50	100
4	102101	Fundamental of Computer Programming and Information Technology	T	3	0	0	3	50	50	100
5	104101	Basic Electronics and Communication	T	3	1	0	4	50	50	100
6	100105	Communicative English Laboratory	P	0	0	2	1	60	40	100
7	100107	Engineering Physics Laboratory	P	0	0	2	1	60	40	100
8	102102	Fundamental of Computer Programming and Information Technology Lab	P	0	0	4	2	60	40	100
9	104102	Basic Electronics and Communication Lab	P	0	0	2	1	60	40	100
10	105104	Manufacturing Practice	P	0	0	6	3	60	40	100
Total No. of Credits				27						

Semester: 3rd										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	105301	Applied Thermodynamics-I	T	4	1	0	5	50	50	100
2	105302	Metallurgy and Heat Treatment	T	3	0	0	3	50	50	100
3	105303	Machine Drawing	T	1	0	6	4	50	50	100
4	105304	Manufacturing Process-I	T	3	0	0	3	50	50	100
5	105305	Strength of Materials-I	T	3	1	0	4	50	50	100
6	105306	Theory of Machines-I	T	3	1	0	4	50	50	100
7	105307	Metallurgy and Heat Treatment Lab	P	0	0	2	1	60	40	100
8	105308	Manufacturing Process-I Lab	P	0	0	2	1	60	40	100
9	105309	Strength of Materials Lab	P	0	0	2	1	60	40	100
10	105310	Institutional Training*	P	0	0	0	2	60	40	100
Total No. of Credits				28						

Semester: 4th										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	100301	Engineering Mathematics-III	T	4	1	0	5	50	50	100
2	105401	Applied Thermodynamics-II	T	3	1	0	4	50	50	100
3	105402	Fluid Mechanics	T	3	1	0	4	50	50	100
4	105403	Manufacturing Process-II	T	3	0	0	3	50	50	100
5	105404	Strength of Materials – II	T	3	1	0	4	50	50	100
6	105405	Theory of Machines – II	T	3	1	0	4	50	50	100
7	105406	Applied Thermodynamics Lab	P	0	0	2	1	60	40	100
8	105407	Fluid Mechanics Lab	P	0	0	2	1	60	40	100
9	105408	Manufacturing Process-II Lab	P	0	0	2	1	60	40	100
10	105409	Theory of Machines Lab	P	0	0	2	1	60	40	100
Total No. of Credits				28						

Semester: 5th										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	105501	Automobile Engineering	T	3	0	0	3	50	50	100
2	105502	Heat Transfer	T	4	1	0	5	50	50	100
3	105503	Machine Design-I	T	3	1	0	4	50	50	100
4	105504	Mechanical Measurement and Metrology	T	3	0	0	3	50	50	100
5	105505	Numerical Methods in Engineering	T	3	1	0	4	50	50	100
6	105506	Automobile Engineering Lab	P	0	0	2	1	60	40	100
7	105507	Computer Aided Drafting Lab	P	0	0	2	1	60	40	100
8	105508	Heat Transfer Lab	P	0	0	2	1	60	40	100
9	105509	Machine Design Practice-I	P	0	0	2	1	60	40	100
10	105510	Mechanical Measurement and Metrology Lab	P	0	0	2	1	60	40	100
11	105511	Numerical Methods in Engineering Lab	P	0	0	2	1	60	40	100
12	105512	Industrial Training	P	0	0	0	4	60	40	100
Total No. of Credits				29						

Semester: 6th										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	100302	Environmental Science	T	3	1	0	4	50	50	100
2	105602	Fluid Machinery	T	3	1	0	4	50	50	100
3	105603	Industrial Automation and Robotics	T	3	0	0	3	50	50	100
4	105604	Machine Design-II	T	3	1	0	4	50	50	100
5	105605	Refrigeration and Air Conditioning	T	4	1	0	5	50	50	100
6		*Elective-I	T	3	1	0	4	50	50	100
7	105606	Fluid Machinery lab	P	0	0	2	1	60	40	100
8	105607	Industrial Automation and Robotics lab	P	0	0	2	1	60	40	100
9	105608	Machine Design-II Practice	P	0	0	2	1	60	40	100
10	105609	Refrigeration and Air Conditioning Lab	P	0	0	2	1	60	40	100
Total No. of Credits							28			

Semester: 7th										
Sr. No.	Course Code	Course Name	Type of course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	105701	6-Months Industrial Training	T/P	NA	NA	NA	20	500	500	1000
Total No. of Credits				20						

Semester: 8th										
Sr. No.	Course Code	Course Name	Type of Course T/P	(Hours Per Week)			No. of Credits	Internal Marks	External Marks	Total Marks
				L	T	P				
1	105801	CAD/CAM	T	3	1	0	4	50	50	100
2	105802	Industrial Safety and Environment	T	3	0	0	3	50	50	100
3	105803	Mechanical Vibrations	T	3	1	0	4	50	50	100
4	105804	Operations Research	T	3	1	0	4	50	50	100
5		#Open Elective	T	3	0	0	3	50	50	100
6		*Elective- II	T	3	1	0	4	50	50	100
7	105805	CAD /CAM Lab	P	0	0	2	1	60	40	100
8	105806	Mechanical Vibrations Lab	P	0	0	2	1	60	40	100
9	105807	Project	P	0	0	6	3	60	40	100
Total No. of Credits				27						

From any program of Engineering and Technology

*** To be from the same group**

List of Elective Subjects	
Group –I (Thermal Science)	
105901	IC Engine
105902	Non-Conventional Energy Resources
105903	Energy Conservation and Management
105904	Solar Energy Engineering and Design
105905	Heat Exchange Design
Group –II (Production Engineering and Manufacturing Science)	
105906	Metal Forming
105907	Non- Traditional Manufacturing
105908	Mechatronics
105909	Computer Aided Manufacturing
105910	Jigs and Fixture Design

Group – III (Design and General)	
105911	Modelingand Simulation
105912	Industrial Tribology
105913	Product Design and Value Engineering
105914	Finite Element Method
105915	Non Destructive Testing
Group – IV (Industrial Engineering)	
105916	Production Planning and Control
105917	Product Design and Development
105918	Total Quality Management
105919	Maintenance Engineering and Management
105920	Management Information Systems

Annexure-2

Course Name: Engineering Chemistry

Course Code: 100102

Semester: 1st

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT - I

1. **Spectroscopy and its Applications:**
   An introduction UV / Visible Spectroscopy: Selection rules; Line widths and intensity of spectral lines; Principle and instrumentation; Electronic Transitions; Chromophores andauxochromes; Factors affecting $\lambda_{Max}$and intensity of spectral lines; Franck-Condon principle; Applications.IR Spectroscopy: Principle and instrumentation; Vibrational frequency; Fundamental modes of vibrations and types; Anharmonics; Factors affecting vibrational frequency; Applications.NMRSpectroscopy: Principle and instrumentation; Chemical shift; Spin-Spin Splitting; High resolution NMR spectrum (PMR only).
2. **Photochemistry:**
   Introduction; Photo-physical and photochemical processes; Light sources in photochemistry; Beer-Lambert Law; Laws of Photochemistry; Quantum yield (primary and overall); Primary and secondary photochemical reactions; Jablonski diagram, Photovoltaic cells.

UNIT - II

3. **Water and its Treatment:**
   Boiler feed water: Boiler feed problems; Specification, Scales and sludge formation; Priming and foaming; Caustic embrittlement; Boiler corrosion; Different methods of the water purifications and softening; Desalination of water; Water for domestic use: Specification; Disinfection of water.
4. **Green Chemistry and its Applications:**
   Introductory overview – Definition and concepts of Green chemistry; Emergence of Green chemistry; Twelve principles of Green Chemistry with emphasis on the use of alternative feedstock (bio-fuels); Use of innocuous reagents in natural processes; Alternative solvents; Design of safer chemicals; Designing alternative reaction methodology, Minimizing energy consumption.

UNIT - III

5. **Corrosion and its Prevention:**
   Introduction; Different types of corrosion – Wet, Dry corrosion and other forms of corrosion; Mechanisms of wet corrosion; various methods of corrosion control.
6. **Catalysis and Polymers:**
   Introduction; Catalysis and general characteristics of catalytic reactions; Homogenous catalysis; Enzyme catalysis including their mechanism; Classification of polymers;

Mechanism of addition and condensation polymerization; Phenol formaldehyde resin; Urea formaldehyde resin.

UNIT - IV

7. **Nanochemistry:**
   Introduction; Materials self-assembly; Molecular vs. materials self-assembly; Self-assembling materials; Two dimensional assemblies; Mesoscale self assembly; Nanoscale materials; Future perspectives, Nanocrystals.
8. **Petrochemicals:**
   Introduction; First, second and third generation petrochemicals; Primary Raw Materials for Petrochemicals. Natural gas: Natural gas treatment processes; Natural gas liquids; Properties of natural gas; Crude oil: Composition of crude oil- Hydrocarbon compounds, Non-hydrocarbon compounds, Production of ethylene and propylene. Metallic crystals, Crude oil classification, Physical separation processes, Conversion processes.

References Books:

1. Kemp,W.(1991).*Organic Spectroscopy*. Palgrave Foundations.
2. Skoog,D. A.,Holler,F. J.,&Timothy, A. N. (1998).*Principles of Instrumental Analysis*(5th Edition). Saunders College Publishing. Philadelphia.
3. Castellan G. W.(1995).*Physical Chemistry*. Saunders College Publishing. Philadelphia.
4. Poole C. P., & Owens, F. J.(2003).*Introduction to Nanotechnology*. Wiley Interscience.
5. Foster L.E. (2007).*Nanotechnology, Science Innovation and Opportunity*. Pearson Education.

Course Name: Engineering Mathematics – II

Course Code: 100201

Semester: 1st

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT - I

1. **Matrices:**

   Linear dependence of vectors and rank of matrices. Elementary transformation, Gauss-Jordan method to find inverse of a matrix, Consistency and solution of algebraic equations, Linear transformations, Eigen values, Eigen Vectors, Cayley Hamilton Theorem,

UNIT - II

2. **Integral Calculus:**

   Rectification of standard curves; Areas bounded by standard curves; Volumes and

surfaces of revolution of curves. **D**ouble and triple integration, Change of order of integration, Change of variable. Application of double integration to find areas. Application of double and triple integration to find volumes, Beta and gamma functions.

UNIT - III

3. **Application of Vector Calculus:**

Flux, Solenoid and irrotational vectors. Gauss Divergence theorem. Green's theorem in plane. Stoke's theorem.

Statistics:

Discrete and continuous probability distributions. Binomial, Poisson and Normal distribution.

UNIT - IV

4. **Complex Numbers:**

De- Moivre's theorem and applications, Exponential and logarithmic complex functions, Circular and hyperbolic functions of complex variables, Summation of trigonometric series.

References Books:

1. Thomes, G.B. &Finney, R.L.(1995).*Calculus and Analytic Gemetry*. Ninth Edition; Addition Wesley
2. Kreyszig, E.(1998).*Advanced Engineering Mathematics*. Eighth Edition; John wiley.
3. Grewal, B.S.(1965).*Higher Engineering Mathematics*.Khanna Publishers, New Delhi.
4. Ram, B.(2009).*Advance engineering Mathematics*. Pearson Education.

Course Name: Basic Electrical Engineering

Course Code: 103101

Semester: 1st

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT - I

1. **DC Network Theorems**

Circuit elements and related terminology, Illustration and Limitations of ohm's Law , Kirchhoff's Laws statements and Illustration, Method of solving circuits by

Kirchhoff's Laws, Star-Delta conversions, Computation of resistance in constant temperature, Resistance at different temperatures, Units, Work, Power and Energy (Electrical, Thermal and Mechanical) DC transients –for R-L and R-C series circuits.

Theorems

Thevenin's theorem, Superposition theorem, Norton Theorem, Maximum Power transfer theorem, Reciprocity theorem,

UNIT - II

2. **AC Fundamental**

Production of alternating voltage, Waveforms, Average and RMS values, Peak factor, form factor, Phase and phase difference, Phasor representation of alternating quantities, Phasor diagram, Behavior of AC series, Parallel and series parallel circuits, Power factor, Power in AC circuit, Effect of frequency variation in RLC series and parallel circuit, Q factor, Band width of resonant circuit.

3. **Electromagnetism**

Magnetic circuits, Analogous quantities in magnetic and electric circuits, Faradays' law, self and mutual inductance, Energy stored in magnetic field, Hysteresis and Eddy current losses, and Electromechanical Energy conversion

UNIT - III

4. **DCMachines**

Construction, Types of armatures winding (Lap and wave)

DC generator: Principle of operation, EMF equation, Applications.

DC motors: Principle of operation, Speed-torque Characteristics (shunt and series machine).

UNIT - IV

5. **Single PhaseTransformer**

Principle of Operation, Construction, EMF equation, Losses of a transformer, Open and short circuit tests and efficiency.

6. **Three Phase InductionMotor**

Types, Construction, Production of rotating field, Principle of operation, Applications.

References Books:

1. Muthusbramanian,R. S., Salivahanan, K.A.,&Muraleedharan.(1899).*Basic Electrical and Electronics and Computer Engg.*Tata Mcgraw-Hill.
2. Theraja, B.L. & A.K. Theraja.(1959).*A Text Book of Electrical Tech*. Twenty Third

Edition; S. Chand.
3. Deltoro, Vincent.(1989).*Fundamentals of Electrical Engg*. Prentice Hall.
4. Sawhney, A.K. (2012).*A Course in Electrical and Electronics Measurements and Instrumentation*. Dhanpat Rai and Co.

Course Name: Elements of Mechanical Engineering

Course Code: 105101

Semester: 1st

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT - I

1. **Fundamentals of Thermodynamics:**

Definition, Concept of thermodynamic system, boundary and surroundings, Type of System Open, Closed and isolated systems, State, Property, Process and cycle,Reversible, Quasi-static and irreversible processes and conditions for reversibility, Energy and its forms energy transfer across system boundaries, Heat and work, property and energy as point and path functions, Ideal gas and characteristic gas equation, Zeroth law of thermodynamics, Concept of thermal equilibrium and principle ofthermometry.

2. **First Law of Thermodynamics and ItsApplications:**

Essence and corollaries of the first law, Analytical expressions applicable to a process and cycle internal energy, Enthalpy and specific heats first law analysis of steady flow, applications of steady flow energy equation to various engineering devices, Closed and opensystems,Analysisofnon-flow(CloseSystem)andflow(OpenSystem)processesfor an ideal gas under constant volume (Isochoric), Constant pressure (Iso baric), Constant temperature (Isothermal), Adiabatic and polytropic conditions, Analysis of free expansion and throttlingprocesses.

UNIT - II

3. **Second Law ofThermodynamics:**

Limitations of first law, Need of second law of thermodynamics, Various statements of secondlawandtheirequivalence,Applicationsofstatementsofsecondlawtoheatengine, Heat pump and refrigerator, Philosophy of Carnot cycle and its consequences, Carnot theoremforHeatenginesandheatpump,Claussiusinequality,Conceptand;philosophyof

entropy and entropy changes during various processes, Temperature entropy chart and representation of various processes onit.

4. **Gas Power Cycles:**

Concept and philosophy of Air Standard Cycle and Air standard Efficiency, Some basic definitions of Piston-Cylinder arrangement, Working of Otto cycle, Diesel cycle, Dual cycle and Brayton cycle their representation on P-V and T-S Charts, Comparison of Otto cycle, Diesel cycle, Dual cycles, Mean Effective Pressure, Introduction to constructional features and working of two stroke and four stroke petrol and diesel engines and their comparison.

UNIT - III

5. **Classification of EngineeringMaterials:**

Introduction Materials and Engineering, Classification of Engineering Materials, Significance of various Mechanical Properties of Materials e.g., Elasticity, Plasticity, strength, Ductility, Brittleness, Malleability, Toughness, Resilience hardness, Mach inability, Formability, Weld ability, Properties, Composition, and Industrial Applications of materials metals (ferrous- cast iron, tool steels, stainless steels and non ferrous- Aluminum, brass, bronze), Polymers (natural and synthetic, thermoplastic and thermosetting), Ceramics (glass, optical fibre glass, cements), Composites (fibre reinforced, metal matrix), Smart materials (piezoelectric, shape memory, Thermo chromic, Photo chromic, Magneto rheological), Conductors, Semi-conductors and Insulators, Organic and Inorganic materials, Selection of materials for engineering applications.

UNIT - IV

6. **Mechanics of Solids:**

Concept of stress strain curve, Yield point, Elastic limit, Ductility, Elongation, True stress and true strain, Strain energy and resilience, Tension, Compression, Torsion, Bending, Hardness, Fatigue, Creep, Impact, Concept and philosophy of stress and strain, Normal, Shear and Temperature stresses longitudinal and lateral strain, Poisson's ration, Sudden and impact load, Stresses in composite bar due to application of load and temperature, Elastic constants and their significance , Relations between Elastic constants (Without Proof); Young modulus of Elasticity, Poisson's ratio, Modulus of rigidity, and Bulk modulus, Moment of inertia and centre of gravity of section I,T and C.

References Books:

1. Nag, P.K.(2005). *Engineering Thermodynamics*. Tata McGrawHill.
2. Yadav, R.(2002).*Thermodynamics and Heat Engines*.Central PublishingHouse.
3. Rogers, G.& Mayhew, Y.(2002).*Engineering Thermodynamics*. PearsonEducation.
4. Rao, Y.V.C.(2003) .*An Introduction to Thermodynamics*. New Age International (P) Limited.
5. Cengel, Y.A. & Boles, M.A.(2011).*Thermodynamics – An Engineering Approach*. Tata McGrawHill.
6. Singh, S. (2016). *Strength of materials*. Khanna Publishers.

Course Name: Engineering Graphics and Drawing

Course Code: 105102

Semester: 1st

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT – I

1. **Basic Concepts of Drawing and Projections:**

   Various types of lines, Principles of dimensioning, Size and location dimensions, Symbols, Conventions, Scales (plane and diagonal) and lettering as per IS code of practice (SP-46) for general Engg. Drawing. Exercises on lettering techniques free hand; Printing of letters and numerals in 3,5,8 and 12mm sizes, Vertical and inclined at 75^{o} Instrumental lettering in single stroke. Relevance of projection, Type of projections, Perspective, Orthographic, Axonometric and their basic principles, System of orthographic projection: in reference to quadrants and octants, Illustration through simple problems ofprojection.

UNIT – II

2. **Projection of Points:**

   Different methods of angle of projections; Projection of points on Plane and projection of point on Auxiliaryplanes.

3. **Projection ofLines:**

   Projection of lines, True lengths of lines and their horizontal and vertical traces. Rotation method and auxiliary plane method and traces of line.

4. **Projection ofPlanes:**

   Difference between plane and lamina. Projection of lamina Parallel to one and

perpendicular to other, Perpendicular to one and inclined to other, Inclined to both reference planes and Lamina oblique to three reference planes. Application of auxiliary planes, and trace ofplanes.

UNIT – III

5. **Projection of Solids:**

   Definition of solids, Types of solids: Right and oblique solids; solids of revolution and polyhedrons etc. and their auxiliary views. Visible and invisible details in the projection. Use rotation and auxiliary plane method to draw the projections.

6. **Section of Solids:**

   Definition of Sectioning and its purpose. Principle and Procedure of Sectioning, Types of sectional planes. Illustration through their practice on projection of solids, sectioning by auxiliary planes.

7. **Intersection of Surfaces/Solids:**

   Purpose of intersection of surfaces, Intersection between the two cylinder, Two prisms, Prism and pyramid, Pyramid and pyramid, Cylinder and prism, Cone and cylinder, Sphere and cylinder etc., Use of cutting plane and line method.

8. **Development ofSurface:**

   Concept of development, Parallel line, Radial line and triangulation method. Development of prism, Cylinder, Cone and pyramid surface for both right angled and oblique solids and development of unique surfaces like hopper, Tray, sphereetc.

UNIT – IV

9. **Isometric Projection:**

   Classification of pictorial views, Basic Principle of Isometric projection, Difference between isometric projection and isometric drawing. Isometric projection of solids.

10. **OrthographicProjection:**

    Concept of Orthographic Projection, Drawing missing lines and missing view in orthographic projections. Interpretation of production drawings.

References Books:

1. Gill, P.S. (2001).*Engineering Drawing*. S.K; Kataria and Sons,Ludhiana.
2. Bhatt, N.D.(2012).*Engineering Drawing*.Charotar Book Stall, TulsiSadan, Anand.
3. French, T.E. &Vierck, C.J.(1993).*Graphic Science*. McGraw-Hill, New York.
4. Zozzora, F.(1958).*Engineering Drawing*.McGraw Hill, NewYork.

Course Name: Engineering Chemistry Laboratory

Course Code: 100106

Semester: 1st

L T P

Credit: 01 **0 0 2**

Course Contents

1. **Analysis ofEffluents**
   a) Determination of water by EDTAmethod.
   b) Determination of H_2O by dissolved oxygenanalyzer.
   c) Determination of turbidity byNephelometer
   d) Determination of ResidualChlorine.
2. **Analysis of Fuels andLubricants**
   a) Determination of Moisture, Volatile and ash content by proximateanalysis.
   b) Determination of Flash andFire point byAbee"s Apparatus
   c) Determination of theviscosity.
   d) Determination of Acid Value and Aniline point ofoil
   e) Determination of refractive index foroils.
3. **InstrumentalAnalysis**
   a) Determination λ-max by spectrophotometer and determination of unknown conc of binary mixture of twoliquids.
   b) Determination of the surface tension bystalagmometer.
   c) Determination of the concentration of a solutionconductometerically.
   d) Determination of the strength of a solution pHmeterically.
   e) Distinction between acid, ester, ketone using IRspectrophotometer.
   f) Determination of bathochromic shifts, hypsochromic and hyperchromic, hypochromic shift of benzene and itsderivatives
4. **Chromatography**
   a) Determination of Rf value of amino acid by TLC and identification of the amino acidpresent.
   b) Separation of metallic ions by paper chromatography. Separation of Ions by using complexingagents
   c) Separation of plant pigments, Chlorophyll and carotenoids by column chromatography.
   d) Determinationoftheionexchangecapacityofthegivenionexchanger.

e) Separation of ions by ion-exchangemethod.

5. Synthesis andGreen Chemistryexperiments

a) Preparation of a polymer phenol/urea formaldehyde resin or hexamethylenediamineadipic acid polymer and determination of carbonyl value or acidvalue.

b) Preparation ofaspirin.

c) Preparation of ethyl-2-cyano-3-(4‟-methoxyphenyl)-propeonate (Microwave assisted reaction)

d) Base catalyzed aldol condensation by GreenMethodology

e) Acetylation of primary amines using ecofriendlymethod.

Note: Each student is required to perform two experiments from each of the 5 titles (presented bold) depending on his/her Branch and Aptitude.

References Books:

1. Vogel, A.I.. (1980).*Quantitative Inorganic Analysis*.OxfordELBS.
2. Vogel, A.I..(1987).*Quantitative Organic Analysis*.Oxford ELBS.

Course Name: Basic Electrical Engineering Lab

Course Code: 103102

Semester: 1st

L T P

Credit: 01 **0 0 2**

Course Contents

List of Experiments:

1. To verify ohm's law.
2. To find voltage and current relationship in R-L seriescircuit.
3. To study resonance of R-L-Ccircuits.
4. Open circuit and short circuit test of a single phase transformer.
5. Startingand reversingofspeed of a D.C. shunt motor by changing connections.
6. Measurement of power in a three phase circuit by two watt meter method.
7. No load characteristics of D.C. shunt Generators.
8. To measure power and power factor in a single–phaseAC-circuit.
9. To verify Kirchhoff's Law.
10. To connect 3 identical single phase transformers for three phase power transformations

through following connections (a) star-delta (b) star-star (c) delta-star (d) delta-delta and to find phase and line voltage ratio.

11. To start and reverse the direction of I-Q a.c. motor.
12. To verify super position theorem.
13. To verify Norton's theorem.
14. To verify thevein's theorem.
15. To verify maximum power transformer theorem.

Course Name: Computer Graphics Laboratory

Course Code: 105101

Semester: 1st

L T P

Credit: 01 **0 0 2**

Course Contents

List of Experiments:

1. Practice related to 2-D computer sketching. Different command used in computer graphics software and theirapplications.
2. Study and draw 2-D sketching entities like lines, Rectangle, Parallelogram polygon, circle etc., Using three coordinates systemlike
   (a) Link
   (b) Gasket
   (c) BasePlate
   (d) Bracketsetc.
3. Draw the different type of 1D modeling entries using viewing commands to view them (Isometric projection). Practice of various commands available for 1D drawing like extrude, revolveetc.

Course Name: Communicative English

Course Code: 100101

Semester: 2nd

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT - I

1. **Developing Habits of Independent and FastReading**

   Students will be required to read a prescribed prose. The essays in the anthology will be read by students at home with the help of glossary given in the book. Progressing from one lesson to another, they should learn to read fast. Students are supposed to keep a record of their reading in the form of notes, difficulties, summaries, outlines and reading time for each essay. Class teacher may use this record for awards of internal assessment (ifany)

UNIT - II

1. **Developing Comprehension Skills**

   Teacher will provide guided comprehension of the prescribed texts in the class and help students in answering the questions given at the end of each lesson. Teacher can construct more questions of factual and inferential nature to enhance the comprehension skills of the students. The teacher shall also guide students to do the grammar exercise given at the end of eachlesson.

2. **Developing skills in PersonalWriting**

   Students will be required to learn short personal write-ups involving skills of description and narration. The types of composition task may include personal letter writing, telegram writing. Notice writing, diary writing etc. The teacher shall instruct the students about the appropriate format and usual conventions followed in such writings. The teacher may also prescribe composition /writing book if so required.

UNIT - III

1. **Business writing:**

   Business letters; elements of business writing; kinds of business letters – office order memorandum, report, purchase order, quotations and tenders, job application letters, personal resume and curriculum vitae etc.

UNIT - IV

1. **Development of Speaking Skills:** Public speaking – formal speaking-audience analysis – effective use of voice and body language – importance of confidence building – group discussion – presentation skills- seminar – interview skills development – telephone etiquettes – opinion basedspeaking.

References Books:

1. Vandana, R. S.(2006).*The Written Word*. Oxford University Press, NewDelhi.
2. Samantaray, S.(2017).*Business Communication and Communicative English*. Sultan

Chand, NewDelhi.

3. Dhanavel, S.P.(2009).*English and Communication Skills for Students of Science and Engineering (with AudioCD)*.Orient BlackswanPvt Ltd.
4. Gimson, A.C.(1971).*An Introduction to the Pronunciation of English*.ELBS
5. Bansal, R.K. & Harrison.(1991).*J.B. Spoken English*.Orient Longman,Hyderabad.
6. Sinclair J. E.(1990).*Collins Cobuild English GrammarCollins*.London : Collins.
7. Leena. Sen (2007).*Communication Skills*.Prentice Hall.

Course Name: Engineering Mathematics – I

Course Code: 100101

Semester: 2nd

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT - I

1. **Ordinary Differential Equations of firstorder**

Exact Differential equations, Equations reducible to exact form by integrating factors; Equations of the first order and higher degree.

UNIT - II

2. **Linear Ordinary Differential Equations of second and higherorder**

Solution of linear Ordinary Differential Equations of second and higher order; methods of finding complementary functions and particular integrals. Special methods for finding particular integrals: Method of variation of parameters. Cauchy's homogeneous and Legendre's linear equation,

UNIT - III

3. **PartialDerivatives:**

Function of two or more variables; Partial differentiation; Homogeneous functions and Euler's theorem; Composite functions; Jacobians. Curvature of Cartesian curves; Curvature of parametric and polar curves.

4. **Applications of partialdifferentiation:**

Equation of tangent and normal to a surface; Taylor's and Maclaurin's series for a function of two variables; Errors and approximations; Maxima and minima of function of several variables.

UNIT - IV

5. InfiniteSeries:

Comparison test, Integral test, Ratio test, Rabee's test, Logarithmic test, Cauchy's root test. Convergence and absolute convergence of alternating series.

ReferencesBooks:

1. Thomes, G.B.(1995).*Calculus and Analytic Geometry*.Addison Wesley.
2. Kreyszig.(1991).*Advanced Engineering Mathematics*. JohnWiley.
3. Grewal, B.S.(2002).*Higher Engineering Mathematics*. Khanna Publishers NewDelhi.
4. Babu,R.(2009).*Advance Engineering Mathematics*.PearsonEducation.

Course Name: Engineering Physics

Course Code: 100104

Semester: 2nd

L T P

Credits: 03 **3 1 0**

Course Contents

UNIT - I

1 Electrostatics and dielectrics:

Divergence and curl of a vector and their physical meaning, electric flux, Relation between electric field and potential, Charge distribution, Gauss law, Dielectric polarization, Types of polarization, Introduction to Maxwell equations and their importance, Equation of EM waves in free space, Velocity of EM waves.

2 **Magnetic Materials and superconductivity**:

Basic ideas of Dia, Para, Ferro and ferri magnetic materials, Magnetic anisotropy, Magnetostriction, Introduction to superconductors, Critical temp, Critical field, Type1 and type2 superconductors, Meissner effect, B.C.S theory of superconductivity, Londons equations.

UNIT - II

3 Laser:

Spontaneous and stimulated emission, Einstien coefficient, Population inversion, pumping, Components of laser, Three level and Four level laser, Ruby laser, He-Ne laser, Semiconductor laser, Holography.

4 **Optical Fibrecommunication**:

Introduction, Optical communication (block diagram), Optical fiber physical structure, Basic theory of propagation of light, Modes of propagation, Acceptance angle, Numerical aperture, Normalized frequency, Losses in optical fibre, (scattering losses, Macro bending and Micro bending losses, material and pulse dispersion), Fiber connectors, Splices, Couplers, Applications of opticalfibre.

UNIT - III

5 Theory of relativity:

Concept of ether, Michelson Morley experiment, Einstiens postulates of theory of relativity, Gallilian transformation, Lorentz transformation equations, Length contraction, Time dilation, Simultaneity in relativity, Variation of mass with velocity, Mass energy and Energy momentumrelation.

6 Modernphysics:

Need of quantum theory, Wave particle duality, De Broglie concept, Wave and gp velocity, Heisenberg uncertainty principle and its applications (particle in a box), normalization wave function, Orthogonal wave function, Schrodinger wave equation, applications of S.W.E Particle in a box, eigen value, eigen function.

UNIT - IV

7 Elements of crystallography:

Unit cell, Basis, Space lattice, Crystal system, Introduction, Production of x rays, Hard and soft x rays, Continuous and characteristic x rays, Braggs law in crystals, Absorption of x rays.

8 Nanophysics:

Nanoscale, Surface to volume ratio, Electron confinement, Nanoparticles, nanomaterials, Unusual properties of nano-materials, Synthesis of nanomaterials, Ball milling and sol-gel techniques, Carbon nano tubes, Applications of nanomaterials.

References Books:

1. Griffths, D.J.(1999).*Introduction to Electrodynamics*. PrenticeHall.
2. Singh, R.B. (2010).*Introduction to Modern Physics*. New Age Internationals.
3. Dogra, R.(2011). *Essentials of Physics*.S.K. Katariaand Sons.
4. Kittle, C. (1951). *Solid State Physics*. John Wiley and Sons Inc

Course Name

Fundamentals of Computer Programming and Information Technology

Course Code: 102101

Semester: 2nd

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT - I

1. **Introduction to Computers**

   Define a Computer System, Block diagram of a Computer System and its working, Associated peripherals, Memories, RAM, ROM, Secondary storage devices, Computer Software and Hardware.

2. **Working Knowledge of Computer System**

   Introduction to the operating system, Its functions and types, Working knowledge of GUI based operating system, Introduction to word processors and its features, Creating, Editing, Printing and saving documents, Spell check, Mail merge, Creating power point presentations, Creating spreadsheets and simple graphs, Evolution of Internet and its applications and services.

3. **Problem Solving and Program Planning**

   Need for problem solving and planning a program; program design tools – algorithms, flow charts, and pseudo code; illustrative examples.

UNIT - II

4. **Overview of C++Language**

   Introduction to C++ language, Structure of a C++ program, Concepts of compiling and linking, IDE and its features; Basic terminology - Character set, Tokens, identifiers, Keywords, Fundamental data types, Literal and symbolic constants, Declaring variables, Initializing variables, Type modifiers, Operators in C++, precedence and associatively of operators, Expressions and their evaluation, Type conversions.

5. **Beginning with C++program**

   Input / output using extraction (>>) and insertion (<<) operators, Writing simple C++ programs, Comments in C++**,** Stages of program execution.

6. **Control Structures**

   Decision making statements: If, Nested if, If – else. Else if ladder, Switch, Loops and

iteration: While loop, For loop, Do – while loop, Nesting of loops, Break statement, Continue statement, Go to statement, Use of control structures through illustrative programming examples.

UNIT - III

7. **Functions**

Advantages of using functions, Structure of a function, Declaring and defining functions, Return statement, Formal and actual arguments, Const argument, Default arguments, Concept of reference variable, Call by value, Call by reference, Library functions, recursion, Storage classes. Use of functions through illustrative programming examples.

8. **Arrays and Strings**

Declaration of arrays, Initialization of array, Accessing elements of array, I/O of arrays, Passing arrays as arguments to a function, Multidimensional arrays. String as array of characters, Initializing string variables, I / O of strings, String manipulation functions (strlen, strcat, strcpy, strcmp), Passing strings to a function. Use of arrays and strings through illustrative programming examples.

9. **Concepts of Object Oriented Programming**

Introduction to Classes, Objects, Data abstraction, Data encapsulation, Inheritance and polymorphism.

UNIT - IV

10. **Classes andObjects**

Defining classes and declaring objects, Public and private keywords, Constructors and destructors, Defining member functions inside and outside of a class, Accessing members of a class, Friend function. Use of classes and objects through illustrative programming examples.

11. **Basics of FileHandling**

Opening, reading, and writing of files, Error handling during files operation

ReferencesBooks:

1. Balaguruswamy, E. (2008).*Object-Oriented Programming with C++*. Tata McGrawHill.
2. Sinha, P. K. &Sinha, P. (2010).*Computer Fundamentals*.BPBPublications.
3. Lafore, R.(1995).*Object Oriented Programming in C++*.WaiteGroup.
4. Stroustrup, B. (2011).*The C++ Programming Language*.AddisonWesley.
5. Lippman, F. B.(2012).*C++ Primer*.Addison Wesley.

Course Name

Basic Electronics and Communication Engineering Lab

Course Code: 104102

Semester: 2nd

L T P

Credit: 01 **0 0 2**

Course Contents

1. Familiarization of electronics component and equipments like C.R.O., Function Generator and power suppliesetc.
2. To study the V-I characteristics of PN-Junction diode and determine static resistance and dynamic resistance.
3. To study the characteristics of zener diode and hence determine the dynamic resistance form the characteristics
4. Determine the voltage regulation of zener diodestabilizer.
5. To study and plot the wave form of half wave and full wave rectifier with and without capacitorfilter.
6. To study and plot the input and output characteristics of common emitter transistor and calculate its input and output resistance.
7. To study and plot the input and output characteristics of common base transistor and calculate its input and output resistance.
8. To study the characteristics of FET (Field effect transistor) and hence calculate dynamic (r_d), mutual conductance (g_m) and amplification factor.
9. To study the frequency response of single stage CE amplifier and hence calculate the band width(1dbBW).
10. To study the transistorresponse.
11. To analysis the truth tables of various basic digital gates.

Course Name: Manufacturing Practices

Course Code: 105104

Semester: 2nd

L T P

Credits: 03 **0 0 6**

Course Contents

UNIT - I

1. **Carpentry and Pattern Making:**
   Various types of timber and practice boards, Defects in timber, Seasoning of wood;

tools, Wood operation and various joints; Exercises involving use of important carpentry tools to practice various operations and making joints.

2. **Foundry Shop:**
   Introduction to moulding materials; Moulds; Use of cores; Melting furnaces; Tools and equipment used in foundry shops; Firing of a cupola furnace; Exercises involving preparation of small sand moulds and castings.

UNIT - II

3. **Forging Practice:**
   Introduction to forging tools; Equipments and operations; Forgeability of metals; Exercises on simple smithy; Forging exercises.
4. **Machine Shop:**
   Machines, Grinders etc; Cutting tools and operations; Exercises involving awareness.

UNIT - III

5. **Welding Shop:**
   Introduction to different welding methods; Welding equipment; Electrodes; Welding joints; Welding defects; Exercises involving use of gas /electric arc welding.
6. **Electrical and Electronics Shop:**
   Introduction to electrical wiring; Preparation of PCBs involving soldering applied to electrical and electronic applications; Exercises preparation of PCBs involving soldering applied to electrical and electronic applications.

UNIT - IV

7. **Sheet Metal:**
   Shop development of surfaces of various objects; Sheet metal forming and joining operations, Joints, Soldering and brazing; Exercises involving use of sheet metal forming operations for small joints.
8. **Fitting Shop:**
   Introduction of fitting practice and tools used in fitting shop; Exercise involving marking, Cutting, Fitting practice (Right Angles), Male-Female mating parts practice, trapping practice.

ReferencesBooks:-

1. Raghuwanshi, B.S.(2009*). A Course in Workshop Technology, Vol 1 and II*.DhanpatRaiandSons.
2. Jain, R.K.(2010*).Production Technology*.Khanna Publishers.
3. Singh, S.(2001).*Manufacturing Practice*. SKKatariaandSons.

Course Name: Applied Thermodynamics-I

Course Code: 105301

Semester: 3rd

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT - I

1. **Combustion:**

   Combustion problems in boiler and IC Engines, Stoichiometric (or Chemically) air fuel ratio, analysis of products of combustion, conversion of volumetric analysis into gravimetric analysis and vice-versa, actual weight of air supplied, combustion problems and their solutions.

2. **Properties of Steam and Steam Generators**:

   Pure substance constant pressure formation of steam, steam tables , constant volume, constant pressure and isentropic processes, Steam Generators Classification, Fire and water tube boilers; Description of Cochran, Locomotive, Lancashire, Babcock and Wilcox boilers, Stirling Boiler, mountings and accessories,. Modern high pressure boilers. Characteristics of high pressure boilers, Types of circulation, Boiler performance-equivalent evaporation, boilerefficiency.

UNIT - II

1. **RankineCycle:**

   Simple Rankine cycle, Feed water heating (Bleeding), method to improve the efficiency of rankine cycle, Ideal working fluid – Binary vapour cycle.

2. **Nozzle:**

   Types and utility of nozzles, Flow of steam through nozzles, Critical pressure and discharge, Area of throat and exit for maximum discharge, Effect of friction, Nozzle efficiency, Supersaturated flow.

UNIT - III

3. **Impulse Steam Turbines:**

   General description, Pressure and velocity compounding, Velocity diagram and work done, Effect of blade friction on velocity diagram, Stage efficiency and overall efficiency, Reheat factor and condition curve.

4. **Reaction Turbines:**

   Degree of reaction, velocity diagrams; Blade efficiency and its derivation; calculation of blade height; back pressure and extraction turbines and congeneration; Economic assessment. Methods of attachment of blades to turbine rotor; losses in steam turbines; Governing of steam turbines; Labyrinth packing.

UNIT - IV

5. **Condensers:**

   Function Elements of condensing plant. Different types, Dalton‟s law of partial pressures applied to condenser problems; condenser and vacuum efficiencies. Cooling water calculations. Effect of air leakage, Methods to check and prevent air infiltration.

6. **Reciprocating Air Compressors**

   Use of compressed air in industry. Classification of air compressors, Operation of single stage reciprocating compressors, Work input and the best value of index of compression, Isothermal and polytropic efficiency without and with clearance volume. Description of air pump and calculation of itscapacity.

Reference Books:

1. Yadav,R.(2011).*Applied Thermodynamics*.Central PublishingHouse.
2. Rajadurai, J.S.(1985).*Thermodynamics and Thermal Engineering*.New Age International (P) Ltd. Publishers.
3. Nag, P.K.(2008).*Basic and Applied Thermodynamics*. Tata McGraw Hill.
4. Kumar,D.S. &Vasandani,V.P.(1979).*Heat Engineering*. Metropolitan Book Co. Pvt.Ltd.
5. Soman,K.(2010).*Thermal Engineering*. PHI Learning Pvt.Ltd.
6. Rogers,G. &Mayhew,Y.(1992).*Engineering Thermodynamics*.Pearson.
7. Keartan,W.A.J.(2004).*Steam Turbine: Theory and Practice*.ELBSSeries.

Course Name: Metallurgy and Heat Treatment

Course Code: 105302

Semester: 3rd

	L T P
Credits: 03	**3 0 0**

Course Contents

UNIT - I

1. Atomic structure and crystal structure of metals, crystal lattice of (i) body centered cubic (ii) face centered cubic (iii) closed packed hexagonal structure, miller Indices, polymorphism and allotropy, isotropy andanisotropy
2. Solidification: concept of free energy, degree of super cooling, homogeneous (spontaneous) or self-nucleation, heterogeneous nucleation, critical size of

nucleus, rate of nucleation and crystal growth, grain size, Inoculation, dendrites, equiaxed (globular) and columnar grains, introduction to lattice imperfections, various defects in crystals, solid solutions, intermediate alloy phases, phenomenon of slip and twinning, theory of dislocation, theories of plastic deformation, recovery, re-crystallization and grain growth, hot working and cold working

UNIT - II

3. General principles of phase transformation in alloys, phase rule and binary equilibrium diagrams, equilibrium diagrams in which two elements are completely soluble in liquid and solid state (isomorphous system), equilibrium diagrams in which two components are completely soluble in liquid state but completely insoluble in solid state (eutectic system) forming mechanical mixture, equilibrium diagrams in which components are completely soluble in the liquid state and limited solubility in the solid state and in which the solid state solubility deceases with decrease in temperature, equilibrium diagrams for alloys forming limited solubility solid solution and undergoing a peritectic transformation, equilibrium diagrams of a system whose components are subject to allotropicchange.
4. Iron carbon equilibrium diagram, components and phases of the iron–carbon system, iron–carbon equilibrium diagram, development of microstructures in iron – carbon alloys, hypo-eutectoid, hyper-eutectoid and eutectoidalloys.

UNIT - III

5. diagram for steels, factors affecting the position and shape of TTT diagram, pearlite transformation, mechanism of the martensite and intermediate (bainite) transformations, properties of martensite and bainite transformations, possible microstructure of steel by continuous cooling at different rates, critical cooling rate, modification of properties through change in microstructure
6. Introduction of heat treatment and various heat treatment processes, Principles and applications of annealing, normalizing, hardening, tempering, possible defects, causes and their remedies in heat treatment,Hardenability:differencebetweenhardnessandhardenability,significance and determination of hardenability, critical diameter, Jominy end quench test, estimate of hardness from chemical composition.

UNIT - IV

7. Introduction to chemical heat treatment for case (surface) hardening, mechanism and applications of carburizing, cyaniding, nitriding, introduction to flame hardening, induction hardening, laser and electron beam hardeningprocesses.
8. Effects produced by various alloying elements (Si, S, Cu, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel, composition of alloysteels

Reference Books:

1. Avner, S. H.(1974*).Introduction to Physical Metallurgy*.McGraw Hill BookCompany.
2. Raghavan,V.(2015*).Physical Metallurgy: Principles and Practice*. Prentice Hall ofIndia.
3. Wadhwa,A. S. &Dhaliwal, H. S.(2008).*Engineering Materials and Metallurgy*. Laxmi Publications Pvt. Ltd.
4. Callister,W. D.(2010).*Material Science and Engineering*.John WileyandSons.

Course Name: Machine Drawing

Course Code: 105303

Semester: 3rd

	L	T	P
Credits: 04	**1**	**0**	**6**

Course Contents

UNIT - I

1. Principles of drawing, requirements of production drawing, sectioning and conventional representation, dimensioning, symbols of standard tolerances, machining symbols, Introduction and familiarization of the code IS 296.
2. Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints.
3. Assembly of the following manually

   Solid or rigid Coupling, Protected type flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, cone friction clutch, free hand sketch of single plate friction clutch.

   Knuckle and cotter joints

   Pipe fittings, pipe flanged joints, spigot and socket joint, union joint, hydraulic and expansion joint

   IC Engine Parts like Piston, Connecting rod.

Boiler Mountings like Steam Stop Valve, Feed check valve, Safety valve, Blow off cock. Bearings like Swivel bearing, Plummer block, Angular plumber block

Miscellaneous Screw Jack, Drill Press Vice, Crane hook, Punch and Die

Note: -

Drawing Practice is to be done as per IS 296 code.

Drawings should contain bill of materials and should illustrate finish.

Reference Books:

1. Gill,P.S.(2011).*Machine Drawing*.S.K. Katariaand Sons.
2. Bhatt,N.D.(2014).*Machine Drawing*.Charotar Publishing House.
3. Sidheshwar,N.(2011).*Machine Drawing*.Charotar Publishing House.
4. Behl,R.C.,&Goel,V.K.(1982).*Machine Design*.Standard Publishers,Distributors.

Course Name: Manufacturing Processes –I

Course Code: 105304

Semester: 3rd

	L	T	P
Credits: 03	**3**	**0**	**0**

Course Contents

CASTING PROCESSES: -

1. Introduction to metal casting types of patterns, their materials and allowances. Moulding materials: Moulding sand compositions and moulding sand properties, sand testing types of moulds, moulding machines cores core sands, types of cores, core banking elements of gating system, and risers and their design. Cupola and its operation charge calculations types offurnaces,
2. Casting processes: sand casting, shell mould casting investment casting, permanent mould casting, full mould casting, vacuum casting. Die casting. Centrifugal casting, continuous casting. Casting defects, their causes and remedies. Metallurgical considerations in casting, Solidification of metals and alloys, directional solidification, segregation, nucleation and grain growth, critical size of nucleus, casting of copper alloys. Cleaning and finishing of castings, Testing and Inspecting of castings.

WELDING PROCESSES: -

3. Welding introduction and classification of welding, processes, welding terminology, general principles, welding positions, filler metals. Gas welding and gas cutting, principle, oxyacetylene welding equipment ox hydrogen welding. Flame cutting. Electric arc welding. Principle, equipment, types- MIG, TIG submerged arc and others. Welding electrodes, classification and selection of electrodes, welding arc and its characteristics, arc stability, arc blow. Thermal effects on weldment. Heat affectedzone
   grain size and its control.
4. Resistance welding- principle and their types i.e. spot, seam, projection, upset and flash Thermit welding, electro slag welding, friction welding, plasma arc welding electron beam welding, atomic Welding defects, their cases and remedies. Brazing, braze welding andsoldering.

Reference Books:

1. Heine, R.W.,Loper, C.R.,&Rosenthal,P.C.(1967).*Principles of metal casting*. McGrawHill.
2. Parmar,R.S.(1996).*Welding Technology*. KhannaPublishers.
3. Kalpakjian,(2014).*Manufacturing Engineering and Technology*. Pearson Education IndiaEdition.
4. Sharma,P.C.(2014).*Production Technology*. S. Chand and Co. Ltd.

Course Name: Strength of Materials – I

Course Code: 105305

Semester: 3rd

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. **Simple Stresses andStrains:**

   Concept of stress and strain, St. Vernants principle, stress and strain diagram, Hooke‟s law, Young‟s modulus, Poisson ratio, stress at a point on a plane, stress and strains in bars subjected to axial loading, Modulus of elasticity, stress produced in compound bars subject to axial loading, constitutive relation between stress and strain, Thermal stress and strains in single and compound bars,

Compound stress and strains in two dimensional system, stress at a point on a plane, principal stresses and principal planes, Generalized Hook's Law, principal stresses related to principal strains, elongation of bars due to its ownweight

2. **Bending Moment and Shear ForceDiagrams:**

S.F and B.Mdefinitions,

BM and SF diagrams for cantilevers, simply supported beams with or without overhangs and calculation of maximum BM and SF and the point of contra flexure under the followingloads,

Concentratedloads,

Uniformity distributed loads over the whole span or part ofspan,

Combination of concentrated loads (two or three) and uniformly distributedloads,

Uniformity varyingloads,

Application ofmoments,

Relation between rate of loading, shear force and bendingmoment

UNIT – II

3. **Theory of B ending S tresses in Beams Due to Bending**

Assumptions in the simple bending theory, derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections

4. **Torsion**

Derivation of torsion equation and its assumptions, Applications of the equation to the hollow and solid circular shafts, torsional rigidity, polar modules, power transmitted by shafts, combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion

UNIT – III

5. **Thin cylinders andspheres**

Derivation of formulae and calculation of hoop and longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume, principal stresses in sphere and change in diameter and internal volume

6. **Stability ofColumns**:

Behavior of axially loaded columns under different conditions and empirical relations for axial loadedcolumns(Euler‟sandRankine‟sFormula),Gordon‟sformula,johnson‟sform

ula,andtheir applications.

UNIT - IV

7. Slope and deflection

Relationship between moment, slope and deflection, Moment area method, method of integration, Macaulays method. Use of these methods to calculate slope and deflection for cantilever and simply supported beam with or without overhang under concentrated load, uniformly distributed load and combination of concentrated and uniformly distributedload.

Reference Books:

1. FerdinandP.B.,&Johnston,E.R.(2009).*MechanicsofMaterials*.McGraw Hill.
2. Popov,E.P.(1976).*Mechanics of Materials,SI (2nd Edition)*.Prentice HallIndia.
3. Shames,D.H.(1999).*Introduction to Solid Mechanics*.Prentice HallInc.
4. Lehri,R.S.,&Lehri,A.S.(1978).*Strength of materials*. S.K Kataria andSons.

Course Name: Theory of Machines-I

Course Code: 105306

Semester: 3rd

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. Definitions and BasicConcepts:

Link, mechanism, kinematic pair and chains, Inversion, inversion of a four bar chain, slider- crank-chain, double slider-crank chain and their inversions, Degrees of freedom, Kutzbach's equation. Grubler criterion and Numerical problems.

2. Velocity and Acceleration ofMechanism:

Graphical (relative velocity vector and instantaneous center methods) and Analytical methods for finding: Displacement, velocity, and acceleration of mechanisms with diagrams.

UNIT – II

3. LowerPairs:

Universal joint, calculation of maximum torque, steering mechanisms including Ackerman and Davis approximate steering mechanism, engine indicator,

Pentograph, Straight line mechanisms

4. **Belts, Ropes andChains**:

Material, types and study of drives, idler pulley, intermediate or counter shaft pulley, angle and right angle drive, quarter turn drive, velocity ratio, crowning of pulley, loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack sided of belts, Power transmitted by belts including consideration of creep and slip, centrifugal tensions and its effect on Power transmitted. Use of gravity, idle, flat, V-belts and rope materials. Length of belt, rope and chain drives.

UNIT – III

5. **Cams:**

Types of cams and followers, definitions of terms connected with cams, displacement velocity and acceleration diagrams for cams and followers. Calculation of pressure angle. Cams with specified Contours. Analysis of follower motion for circular convex, tangent camprofiles.

6. **FrictionDevices**:

Concepts of frictions and wear related to bearing and clutches.

7. **Brakes andDynamometers**:

Types of brakes, principle of function of brakes of various types. Braking of front and rear tyres of a vehicle, Problems to determine braking capacity, Types of dynamometers, (absorption, transmission).

UNIT - IV

8. **Flywheels and turning momentdiagrams:**

Turning moment and crank effort diagrams for reciprocating machines Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of flywheel mass and dimensions for engines and Punching Machines, Simple problems on turning momentdiagrams.

9. **Governors**:

Function, types and characteristics of governors, Watt, Porter and Proell governor. Hartnell and Willson-Hartnell, spring loaded governors. Numerical problems on governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power controlling force curve, effect of sleeve friction.

Reference Books:

1. Ballaney,P.L.(1965).*Theory of Machines*.KhannaPublications.
2. Shigley. S. (2011).*Theory of Machines*. McGrawHill.
3. Rattan,S.S.(1972).*Theory of Machines*. Tata McGrawHill.
4. Ghosh &Mallick.(2008).*Theory of Mechanisms and Machines*.Affiliated East West Pvt.Ltd
5. Singh,V.P. (2004)*Theory of Machines*. Dhanpat Rai and CompanyPvtLtd.

Course Name: Metallurgy and Heat Treatment Lab

Course Code: 105307

Semester: 3rd

L T P

Credit: 01 **0 0 2**

Course Contents

1. Study of Inverted metallurgicalmicroscope.
2. Specimen Preparation and Metallographic study of mildsteel.
3. Study the etching methods for Mild Steel, Stainless Steel and CastIron.
4. Study the Hardenability of steel by Jominy's End quenchtest.
5. Find out the hardness of heat treated (normalized or annealed) and untreated mildsteels.
6. Identification of ferrite and pearlite constituent in a given prepared specimen of mildsteel.
7. Study of the Micro Structures of CastIrons.
8. Study of the Micro structures of Heat treatedsteel.
9. Annealing the steel and study the effect of annealing time and temperatures on hardness ofsteel.
10. Hardening the steel and study the effect of quenching medium on hardness ofsteel.

Course Name: Manufacturing Process – I Lab

Course Code: 105308

Semester: 3rd

L T P

Credit: 01 **0 0 2**

Course Contents

Casting Practicals:

1. To study ingredients of molding sand and coresand.
2. To determine clay content in a moulding sandsample.
3. To determine moisture content in a mouldingsample.
4. To find shatter index of moulding sandsample.
5. To conduct hardness test for mould andcore.
6. To test tensile, compressive, transverse strength of moulding sand in drycondition.
7. Determination of permeability of a moulding sandsample.
8. Measurement of grain finances number.
9. To study various features of cupola furnace and its chargescalculations.
10. Prepare a green sand mould for any stable engg.component.

Welding Practicals:

1. Specimen preparation and making of lap joint, Butt, T- joints with oxy- acetylene gaswelding.
2. Making of lap, Butt, T- joints etc. with electric arcwelding.
3. Study of MIG welding equipment and making a weld joint in thisprocess.
4. Study of TIG welding equipment and making a weld joint in thisprocess.
5. Study of different process parameters in Friction welding and preparing a weld joint by this process.
6. To study various welding equipments namely generators welding torchetc.
7. To study the resistance welding processes and prepare weldedjoint.

Course Name: Strength of Materials Lab

Course Code: 105309

Semester: 3rd

L T P

Credit: 01 **0 0 2**

Course Contents

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on C.I. and to determine ultimate compressivestrength.
3. To perform shear test on different materials and determine ultimate shearstrength.
4. To perform any one hardness test (Rockwell, BrinellandVicker"s test) and determine hardness of materials.
5. To perform impact test to determine impactstrength.
6. To perform torsion test and to determine various mechanicalproperties.
7. Study of performance of Fatigue and Creeptests.
8. To perform bending test on beam (wooden or any other material) and to determine the Young's modulus and Modulus ofrupture
9. To perform Torsion test and close coiled helical spring in tension and compression and to determine modulus ofrigidity/stiffness
10. Determination of Bucking loads of long columns with different endconditions.

Course Name: Engineering Mathematics – III

Course Code: 100301

Semester: 4th

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT – I

1. **Fourier Series** Periodic functions, Euler's formula. Even and odd functions, half range Expansions.
2. **Laplace Transforms** Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constantcoefficients.

UNIT – II

1. **Partial Differential Equations** Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations

with constant coefficients Applications: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation, solution by the method of separation ofvariables.

UNIT – III

1. **Functions of Complex Variable** Limits, continuity, derivative of complex functions, analytic function, Cauchy-Riemann equation, conjugate functions, harmonic functions; Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (withoutproof),

UNIT - IV

3. **Residues and Contour integration** singular points, poles, residue, complex integration using the method of residues, evaluation of real integrals by contourintegration.

Reference Books:

1. Thomes, G. B. & Finney, R.L.(1998).*Calculus and Analytic Geometry*.Addison Wesley.
2. Kreyszig, E.(1998).*Advanced Engineering Mathematics*. Eighth edition, JohnWiley.
3. Grewal, B.S.(1965).*Higher Engineering Mathematics*. Khanna Publishers, NewDelhi.
4. Babu, R.(2009).*Advance engineering Mathematics*.PearsonEducation.

Course Name: Applied Thermodynamics – II

Course Code: 105401

Semester: 4th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **IC Engines:**

Classification. Two stroke and four stroke engines, rotary engines and their comparison, Principle of Carburation, Essential requirements for petrol and

diesel fuels ; R.A.C. rating of petrol engines, Theory of combustion in SI and CI engines, pressure time diagram, various phenomenon such as turbulence squish and swirl, dissociation and pre ignition, Theory of detonation (knocking) for SI and CI engines, effect of engine variables on Delay period in SI and CI Engines, effect of various engine parameters on knock (detonation) in SI and Diesel engines ; effect of detonation on engine performance and methods employed to reduce detonation. Octane and Cetane rating of fuels, octane and cetane number knockmeter and doping of fuels. Combustion chambers and cylinder heads for SI and CI engines. Methods of governing and cooling of IC Engines. Performance curves of SI and CI engines, performance maps, effect of compression ration and of air fuel ratio on power and efficiency of an engine. supercharging its advantages and application ; supercharging of IC engines ; types of superchargers. Logarithmic plotting of PV diagrams

UNIT – II

1. **RotaryCompressors:**

   Introduction and general classification of rotary compressors; comparison of rotary compressors with reciprocating processors; operation of positive displacement type of rotary compressors like roots blower, Lysholm compressor and Vane type Blower. Applications of Steady Flow Energy Equation and thermodynamics of Rotary compressors; stagnation and static values of pressure, temperature and enthalpy etc. for flow through rotary machines. Complete representation of compression process on T-S coordinates with detailed description of areas representing total work done and Polytropic work done, area representing energy lost in internal friction, energy carried away by cooling water etc. on T-S coordinates for uncooled and cooled compression.

2. **CentrifugalCompressors:**

   Complete thermodynamic analysis of centrifugal compressor stage, polytropic, isentropic and isothermal efficiencies; complete representation of compression process starting from ambient air to flow through suction pipe, impeller, diffuser and finally to delivery pipe on T-S coordinates; preguide vanes and prewhirl; Slip factor, power input factor; various modes of energy transfer in impeller and diffuser; Degree of reaction and its derivation; energy transfer in backward, forward and radial vanes; pressure coefficient as a function of slip factor,

efficiency and out coming velocity profile from the impeller. surging and choking in centrifugal compressors

UNIT – III

1. **Axial FlowCompressors:**

Different components of axial flow compressors and their arrangement; discussion on flow passages and simple theory of aerofoil blading; angle of attack; coefficients of lift and drag; turbine versus compressor blades; velocity vector diagrams, thermodynamic analysis and power calculations; modes of energy trasfer in rotor and stator blade flow passages. Detailed discussion on work done factor; Degree of reaction and Blade efficiency and their derivations; Isentropic, polytropic and Isothermal Efficiencies. Surging, choking and stalling in axial flow compressors, characteristics curves for axial flow compressor, flow parameters of axial flow compressor like pressure coefficient, flow coefficient, work coefficient and temperature rise coefficient specific speed etc. Comparison on axial flow compressor with centrifugal compressor; field of application of axial flow compressors.

2. **GasTurbines:**

Comparison of open and closed cycles; comparison of gas turbine with a steam turbine and IC engine. Fields of application of gas turbine. Position of gas turbine in power industry; classification on the basis of system of operation (open and closed cycles). Thermodynamics of constant pressure gas turbine cycle (Brayton cycle); calculation of net output, work ratio and thermal efficiency of ideal and actual cycles; cycle air rate, temperature ratio; effect of changes in specific heat and of mass of fuel on power and efficiency; Operating variables and their effects on thermal efficiency and work ratio. Thermal refinements and their effects on gas turbine cycle i.e. gas turbine cycle with regeneration, intercooling and reheating; multistage compression and expansion; Dual Turbine system; Series and parallel arrangements, closed and semi closed gas turbine cycle; requirements of a gas turbine combustion chamber. Blade materials and selection criteria for these materials and requirements of blade materials. Gas turbine fuels.

UNIT - IV

3. **Jetpropulsion**

Principle of jet propulsion, description of different types of jet propulsion system

like Rockets and thermal jet engines like (I) athodyds (ramjet and pulsejet), (ii) turbojet engine, (iii) turboprop engine. Thermodynamics of turbojet engines components; development of thrust and methods for its boosting/augmentation; thrust work and thrust power, propulsion energy, propulsion and thermal (internal) efficiencies, overall thermal efficiency. Specific fuel consumption. Rocket propulsion, its thrust and thrust power; propulsion and overall thermal efficiency, types of rocket motors (e.g. solid propellant and liquid propellant systems); various common propellant combinations (i.e. fuels) used in rocket motors; cooling of rockets Advantages and disadvantages of jet propulsion over propulsion systems; Brief introduction to performance characteristics of different propulsion systems; fields of application of various propulsion units.

Reference Books:

1. Yadav,R. & Raja, S.Y.(2011).*Applied Thermodynamics*. Central PublishingHouse.
2. Nag, P.K.(2010).*Basic and Applied Thermodynamics*.Tata McGrawHill.
3. Kumar,D.S. &Vasandani,V.P.(1985).*Heat Engineering*. Metropolitan Book Co. Pvt.Ltd.
4. Soman,K.(2010).*Thermal Engineering*. PHI Learning Pvt.Ltd.
5. Rogers,G. &Mayhew,Y.(2002).*Engineering Thermodynamics*.Pearson.
6. Yadav,R.(1989).*Thermodynamic and Heat Engines-Vol. II*.Central PublishersHouse.
7. Shephered, D.G.(1961).*Principles of Turbo machinery*.Macmillan.
8. Cohen,H., Rogers,G.F.C.,&Sarvan,M.(1951).*Gas Turbine Theory*.Longmans.
9. Mattingly,J.D.(1996).*Elements of Gas Turbine Propulsion*.McGrawHill.

Course Name: Fluid Mechanics

Course Code: 105402

Semester: 4th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. **Fundamentals of FluidMechanics:**

   Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids.

2. **Fluid Statics:**

   Concept of static fluid pressure; Pascal‟s law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and center of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subjected to : (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation.

UNIT – II

1. **Fluid Kinematics:**

   Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.

2. **Fluid Dynamics:**

   Derivation of Euler‟s equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli‟s equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes influidsystem(hydraulicandenergy gradient lines);Impulsemomentumequation;

   Kinetic energy and momentum correction factors; Flow along a curved

streamline; Free and forced vortexmotions.

UNIT – III

1. **Dimensional Analysis andSimilitude:**

   Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh‟s and Buckingham‟s π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws.

2. **InternalFlows:**

   Laminar and turbulent flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody‟s chart.

UNIT - IV

3. **Pressure and Flow Measurement:**

   Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters.

Reference Books:

1. Kumar,D.S.(2012).*Fluid Mechanics and Fluid Power Engineering*. S.K. Kataria and SonsPublishers.
2. Som,S.K., Biswas,G.,&Chakraborty,S.(2012).*Introduction to Fluid Mechanics and Fluid Machines*. Tata McGrawHill.
3. Ojha,C.S.P., Berndtsson,R.,&Chandramouli,P.N.(2010).*Fluid Mechanics and Machinery*. Oxford UniversityPress.
4. Cengel,Y.A.,&Cimbala,J.M.(2011).*Fluid Mechanics - Fundamentals and Applications*.Tata McGraw Hill.
5. Munson,B.R., Young,D.F., Okiishi,T.H.,&Huebsch,W.W.(2011).*Fundamentals of Fluid Mechanics*.John Wiley andSons.
6. Douglas,J.F.,Gasiorek,J.M., Swaffield,J.A.,&Jack,L.B.(2005).*Fluid Mechanics*.Pearson.

Course Name: Manufacturing Processes-II

Course Code: 105403

Semester: 4th

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT – I

1. **Metal Forming**:

Rolling: Classification of rolling processes, rolling mills, products of rolling and main variables, rolling defects. Drawing of rods, wires and tubes, Various Method of tube drawing, Draw benches, main variables in drawing operations. Forging: Open and closed die forging, forging operations, hammer forging, press forging and drop forging, forging defects, their causes and remedies. Extrusion: Classification of extrusion processes, extrusion equipment, variables in extrusion process, extrusion defects. Introduction to press working: Types of presses, press working operation, Press working tools, metal forming operations: Spinning, deep drawing, bending. Introduction to powder metallurgy: methods of producing powders, briquetting and sintering, sizing and finishing operations.

UNIT – II

2. **Metal Cutting and MachineTools:**

Cutting tool materials, high carbon steels, alloy carbon steels, high speed steel, cast alloys, cemented carbides, ceramics and diamonds, CBN etc. Geometry of single point cutting tools, Twist Drill and milling cutter, cutting speeds and feeds Coolants: Classification, purpose, its effect on speed and feed

UNIT – III

3. Lubricants Principal, Function and properties
4. Lathe, Machine and its accessories, Lathe operations, Turning, Taper Turning and Thread cutting, kinematic scheme of lathe, shaping and planning Machine, Drive Mechanisms, slotting machine, cutting speeds and feeds Milling machine and its classification, up milling and down milling
5. Indexing Simple compound and differential
6. Sawing Machine and Drilling Operation

UNIT - IV

7. Boring Operation and Boring Machines
8. Grinding Cylindrical, surface and Centre less grinding, material of grinding wheel.

9. Composition and Nomenclature of Grinding Wheels
10. Introduction to Broaching Machine.

Reference Books:

1. Rao (2011).*Manufacturing Technology: Foundry, Forming and Welding*.Tata McGrawHill.
2. Campbell,J.S.(1982).*Principles of Manufacturing Materials and Processes*.Tata McGrawHill.
3. Hajra& Choudhury.(2008).*Elements of Workshop Technology, Vol. I and II*. Media Promoters Pvt.Ltd.
4. Sharma, P.C.(2014).*A text book of production technology*. S Chand and Company.

Course Name: Strength of Materials-II

Course Code: 105404

Semester: 4th

	L	T	P
Credits: 03	**3**	**0**	**0**

Course Contents

UNIT – I

1. **Strain energy:** energy of dilation and distortion, Expression for strain energy stored in a body when (Gradual, Sudden, Impact) load is applied, Castiglianos theorem, Maxwell"s theorem of reciprocaldeflection
2. **Theories of Failure:** Maximum principal stress theory, maximum shear stress theory, Total strain energy theory, shear strain energy theory, graphical representation of theories for two dimensional stress systems, energy ofdistortion.

UNIT – II

3. **Leaf spring:** deflection and bending stresses, open coiled helical springs, close coiled helical springs, derivation of formula and application for deflection and rotation of free end under the action of axial load and axial couple, flat spiral springs derivation of formula for strain energy, maximum stress androtation.

UNIT – III

4. **Thick Cylinders:** Derivation of Lame"s equations, calculation of radial longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, and hub shrunk on solidshafts

5. **Bending of curved beams:** Assumptions made in derivation of stresses in a curved bar, Calculation of stresses in crane or chain hooks, rings of circular section and trapezoidal section and chain links with straight sided, determination of factor h^2 for various sections

UNIT - IV

6. Shear stress distribution in rectangular, circular, I.T and channel section and the compression with bending stresses, Importance of shear center
7. Rotational stresses in discs and rims of uniform thickness, discs of uniform strength

Reference Books:

1. Crandell, D.& Lardner.(1978).*Introduction to Mechanics of Solids*. Mc GrawHill
2. Singh, K. (2001).*Mechanics of Materials*. Standard Publishers and Distributors.
3. Lehri ,R.S.(2010).*Strength of Materials* .S.K Kataria and Sons.
4. Beer,F. P.& Johnston,E. R. (2016).*Mechanics of Materials* .McGraw Hill ,India.

Course Name: Theory of Machines – II

Course Code: 105405

Semester: 4th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. **Static Force Analysis:**

   Static equilibrium of mechanism, concept of force and couple, free body diagram, condition of equilibrium, methods of static force analysis of simple mechanisms and power transmission elements, considerations of frictional forces.

2. **Determination of Forces and Couples in Reciprocating Parts:**

   forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four bar linkage.

UNIT – II

3. **Balancing:**

Classifications, need for balancing, balancing of single and multiple rotating masses, static and dynamic balancing, primary and secondary balancing for reciprocating masses, partial balancing of locomotives, swaying couple, hammer blow, variation in tractive effort, balancing of V-engine, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.

UNIT – III

4. **Gears and Gear Trains:**

   Toothed gears and spur gears, types of toothed gears, definitions and nomenclature of gears, conditions for correct gearing, forms of teeth, involute and its variants, interference and methods of its removal. Calculation of minimum no of teeth on pinion/wheel for involute rack, helical/spiral/bevel/worm gears. Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel.

UNIT - IV

5. **Gyroscopic Motion and Gyroscopic Couples:**

   Effect on supporting and holding structures of machines, Effect on 2 and 4 wheeled vehicles.

6. **Kinematic Synthesis of Mechanism:**

   Freudenstien equation, Function generation errors in synthesis, two/three point synthesis, Transmission angles, least square technique.

Reference Books:

1. Ballaney,P.L.(1965).*Theory of Machines*.KhannaPublications.
2. Shigley.(1980).*Theory of Machines*. McGrawHill.
3. Singh, V.P.(2005).*Theory of Machines*.Dhanpat Rai and Company,P.Ltd.
4. Rattan, S.S.(2009).*Theory of Machines*. Tata McGrawHill.
5. Ghosh &Mallick.(2008).*Theory of Mechanisms and Machines*.Affiliated East West Pvt.Ltd.

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Course Name: Applied Thermodynamics Lab

Course Code: 105406

Semester: 4th

	L	T	P
Credit: 01	**0**	**0**	**2**

Course Contents

1. Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.
2. To plot actual valve timing diagram of a 4 stroke petrol and diesel engines and study its impact on the performance of engine.
3. Study of working, construction, mountings and accessories of various types ofboilers.
4. To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.
5. Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian"sline.
6. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (MorseTest).
7. Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.
8. Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emissioncurves.

Study of construction and operation of various types of steam condensers and coolingtowers

Course Name: Fluid Mechanics Lab

Course Code: 105407

Semester: 4th

	L	T	P
Credit: 01	**0**	**0**	**2**

Course Contents

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venture meter/ orifice meter)
4. To determine the discharge coefficient for a V- notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
8. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/bend.
9. To determine the velocity distribution for pipeline flow with a pitot static probe.

Course Name: Manufacturing Processes-II Lab

Course Code: 105408

Semester: 4th

	L	T	P
Credit: 01	**0**	**0**	**2**

Course Contents

1. Study of constructional features of following machines through drawings/sketches:-
Lathe
Capstan and TurretLathe
Radial drillingmachine
Universal millingmachine
Shaper andplaner
Plastic mouldingmachine
Grinding machines (Surface,cylindrical)
Gear cutting machinesetc.
HydraulicPress
Draw Bench

Drawing, ExtrusionDies
RollingMills

2. Study of lubrication system in the machinetools.
3. Advanced exercises on Lathe where the students will work within specified tolerances, cuttingof V- threads and square threads (internal as well as external).
4. Production of machined surfaces on shaper andplanner.
5. Exercises on milling machines, generation of plane surfaces, production of spur gears andhelical involute gears, use of end millcutters.
6. Grinding of single point cutting tool, cutter anddrills.
7. Study of recommended cutting speeds for different tool- work materialcombinations.
8. Identification of different cutting tool and workmaterials.

Course Name: Theory of Machines Lab

Course Code: 105409

Semester: 4th

L T P

Credit: 01 **0 0 2**

Course Contents

1. Study of constructional features of following machines through drawings/sketches:-
2. Study of various links and mechanisms.
3. Study and draw various inversions of 4- bar chain and single slider crank chain.
4. Draw velocity and diagram of engine mechanism using graphical methods.
5. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
6. Determination of gyroscopic couple (graphical method).
7. Balancing of rotating masses (graphical method).
8. Cam profile analysis (graphical method).
9. Determination of gear- train value of compound gear trains and Epicyclical gear trains.
10. Study of pressure distribution in a full journal bearing.

Course Name: Automobile Engineering

Course Code: 105501

Semester: 5th

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT – I

1. **Introduction**

Components of an automobile, classification of automobiles, General layout of conventional motor vehicle chassis.

2. **Fuel Supply System:**

Air cleaner and fuel pumps, Air fuel requirements and carburation, Modifications in a Simple carburetor to meet different starting, running, idling, and accelerating conditions and fuel injection system used in Indian make vehicle,

UNIT – II

1. **Automobile Emission and Air Pollution:**

Pollution due to vehicle emission and exhaust emission ,Hydro Carbon(HC) carbon monoxide (CO), Oxides of nitrogen (NOX) othere missions.

4. **Lubri cationand Cooling Systems:**

Necessity of lubrication, Desirable properties of lubricants, various types of lubricants and oil additives, different systems of lubrication oil filters, oil pumps and oil pressure indicator, crank case ventilation and dilution. Purpose of cooling, air and water cooling systems, radiator, thermostat, pump and fan.

UNIT – III

5. **Chassis construction and suspension:**

Conventional constructions sub frames, defects in frames, frameless construction and suspension system, shock absorbs

5. **TransmissionSystem**

Basic requirements and standard transmission systems, constructional features of automobile clutch, gear box, differential, front and rear axles,

overdrives, propeller shaft, universal joint and torque tube drive, Rear wheel v/s front wheel drive, principle of automatic transmission.

UNIT – IV

6. **Steering System**

Requirement and steering geometry, castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears, wheel alignment, power steering.

7. **Braking System:**

General braking requirements, Mechanical, hydraulic, vacuum power and servo Brakes.

8. **Automotive Electronics and Electrical Equipment:**

The automotive electrical systems, starting system, control point ignition, electrical ignition system, and automotive battery.

Reference Books:

1. Crouse & Anglin,(2006).*Automotive Mechanics*.Tata McGrawHill.
2. Singh,K. (2009).*Automobile Engineering(Vol. I and II)*. StandardPublishers.
3. Newton, Steeds, andGarrett.(1996).*The Motor Vehicle*.ButterworthInternational.
4. Heitner, J.(2004).*Automotive Mechanics*.East WestPress.
5. Gupta,R.B.(2016).*Automobile Engineering*. SatyaPrakashan.

Course Name: Heat Transfer

Course Code: 105502

Semester: 5th

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT – I

1. **Basic Concepts of Heat Transfer:**

Introduction and concept of heat transfer, Heat transfer Mechanism, Steady state

and Unsteady state heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics", Relationship with Thermodynamics, Modes of heat transfer conduction, convection, radiation, Application of Heat Transfer in diverse field of engineering.

UNIT – II

2. **Conduction:**

Fourier's law of heat conduction, Coefficient of thermal conductivity, Effect of temperature and pressure on thermal conductivity of solids, liquids and gases and its measurement.

3. **Fundamental Equation of Conduction:**

Three-dimensional general conduction equation in rectangular, cylindrical and spherical coordinates involving internal heat generation and unsteady state conditions. Derivation of equations for simple one dimensional steady state heat conduction from three dimensional equations for heat conduction though walls, cylinders and spherical shells (simple and composite), electrical analogy of the heat transfer phenomenon in the cases discussed above, Equivalent areas, shape factor, Conduction through edges and corners of walls and critical thickness of insulation layers on electric wires and pipes carrying hot fluids, Internal generation cases along with some practical cases of heat conduction like heat transfer through underground electrical cables, Simple model of heat conduction through piston crown and case of nuclear fuel rod with cladding.

UNIT – III

4. **Heat Transfer from Extended Surface(Fins):**

Concept of Fins, Straight rod type of fins of uniform cross-section, e.g. of circular, rectangular or any other cross-section), Fin configuration, Heat dissipation from Fin: Insulated at the tip, Losing heat at the tip, Having infinitely long ($L \rightarrow \infty$), Fin effectiveness and fin efficiency for straight rod fins of rectangular and circular cross-section, Application of fins in temperature measurement of flow through pipes and determination of error in its measurement.

5. **Free Convection and ForcedConvection:**

Derivation of three-dimensional mass, momentum and energy conservation equations (with introduction to Tensor notations), Boundary layer formation,

laminar and turbulent boundary layers (simple explanation only and no derivation), Theory of dimensional analysis as applied to free and forced convective heat transfer. Analytical formula for heat transfer in laminar and turbulent flow, Flow over vertical and horizontal tubes and plates.

UNIT – IV

6. **HeatExchanger:**

Newton's law of cooling, Overall coefficient of heat transfer, Different design criterion for heat exchangers, Log mean temperature difference for evaporator and condenser tubes, and parallel and counter flow heat exchangers, Calculation of number and length of tubes in a heat exchanger.

7. **Radiation**

Process of heat flow, definition of emissivity, absorptivity, reflectivity and transmissivity, Concept of black and grey bodies, Plank's law of nonchromatic radiation. Kirchoff's law and Stefan Boltzman"slaw.

Derivation formula for radiation exchange between two bodies using the definition of radiosity and irradiation and its application to cases of radiation exchange between three or four bodies (e.g. boiler or other furnaces), Simplification of the formula for its application to simple bodies like two parallel surfaces, concentric cylinders and a body enveloped by another body etc.

Reference Books:

1. Kumar,D.S.(2011).*Fundamentals of Heat and Mass transfer*. SK Kataria and SonsDelhi.
2. Domkundwar,S.(2007).*A Course in Heat and Mass Transfer*.Dhanpat Rai and Sons,Delhi.
3. Rajput,R.K.(2015).*Heat and Mass Transfer*. S. Chand and CompanyLtd.
4. Holmans,J.P.(1997).*Heat transfer*. McGraw Hill,London.

Course Name: Machine Design-I

Course Code: 105503

Semester: 5th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **Fundamentals of MachineDesign:**

   Concept of design with special reference to machine design, definition and understanding of various types of design, elaborated design process, design principle, various manufacturing process

2. **Design and Creativity:**

   Systematic design conceptualization, product design, ergonomic and aesthetic consideration in design, free body diagram for components design. Standard and preferred numbers.

3. **General Design Consideration:**

   Factors consideration in machine design, selection of material, basic criteria of selection of material, their designation, mechanical properties of those materials, concept of tearing, bearing, shearing, crushing, bending etc. factor of safety under different loading conditions.

UNIT – II

4. **Basic Design:**

   Design for static loading, design for dynamic loading for finite and infinite life, Study of Stress concentration, concept of fatigue and endurance limit.

5. **Design ofJoints:**

   Riveted Joint: types of riveted joints, mode of failure, designing of rivets for boiler joints, lozenge joints (uniform strength joint), eccentrically loaded rivetedjoints.

   ScrewedJoint:Differenttypesofbolts,screws,studsandthreadforms,understandingthevarious stresses/ failure in screw joints, design of cylindrical covers, basic and eccentrically loaded bolts.

   Welded Joints: Stress in welded design, design for various loading conditions in torsion, shear or direct load, eccentrically loaded weldedjoints.

   Cotter And Knuckle Joints Design of spigot and socket cotter joint, gib and Cotter joint and knuckle joint.

UNIT – III

6. **Design of Shaft:**

   Design of both solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for critically speed, Design of shaft for rigidity and Design of stepped shafts for assembly.

7. **Design of Keys and Coupling:**

   Design of sunk keys under crushing and shearing, design of spines, design of sleeve and solid muff coupling, clamp or compression coupling, rigid and flexible flangecoupling.

UNIT – IV

8. **Lever Design:**

   Basic lever design, design of foot and hand lever, cranked lever, bell crank lever, safety valve lever and shoe brake lever.

9. DESIGN OF PIPEJOINTS

   Stresses in pipe joints, design of circular flange pipe joint, oval flanged pipe joints, square flange pipe joint.

Reference Books:

1. Shigley, S.S.(2001).*Machine Design*.Tata McGrawhill.
2. Juvinal, B.C. (2011).*Machine Design*.John-WileyPublishers.
3. Spotts, T.C.(2001).*Machine Design*.Pearson.
4. Norton, M.K.(2010).*Machine Design*.PrenticeHall.
5. Khurmi,R.S.(2011).*Machine Design*.S.K. KatariaandSons.

Note: Design data book is not allowed inexamination.

Course Name: Mechanical Measurement and Metrology

Course Code: 105504

Semester: 5th

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT – I

1. **General Concepts:**

   Need and classification of measurements and instruments, basic and auxiliary functional elements of a measurement system, mechanical, electrical, electronic instruments.

2. **Static and Dynamic Characteristics ofInstruments:**

   Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution, speed of response, lag, fidelity

and dynamic error, dead time and dead zone.

UNIT – II

3. **Errors in Measurement**:

   Sources of errors, systematic and random error, statistical analysis of test-data, curve fitting, error propagation.

4. **Metrology:**

   Line, end and wavelength standards, linear measurements - vernier scale and micrometer, vernier height gauge and depth gauge, Angular measurements, Sin bar, Clinometers, Measurement of geometric forms like straightness, flatness, roundness comparators -their types, relative merits and limitations, Measurement of major diameter, minor diameter, effective diameter, pitch, angle and form of threads for internal and external threads, measurement of tooth thickness, pitch and checking of profile for spur gears, angle gauge.

UNIT – III

5. **Functional Elements:**

   Strain measurement, Types of strain gauges and their working, temperature compensation, strain rosettes, calibration, application of strain gauges for direct, bending and Torsional loads. Introduction to amplifying, transmitting and terminating devices

6. **Speed, Force, Torque and Shaft Power Measurement**:

   Mechanical tachometers, vibration reed tachometer and stroboscope, proving ring, hydraulic and pneumatic load cells, torque on rotating shafts, Absorption, transmission and driving dynamo meters

UNIT – IV

7. **Pressure and Temperature Measurement:**

   Bourdon tube, diaphragm and bellows, vacuum measurement - McLeod gauge, thermal conductivity gauge and ionization gauge, Dead weight gauge tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer, flow visualization techniques. Temperature measurement, Thermometers, Thermistors and Pyrometer, thermo-electric sensors, common thermocouples.

Reference Books:

1. Doebelin, E.O.(1990).*Measurement System*:*Application and Design*.McGraw Hill Publishing Company.

2. Holman, J.P.(2004).*Experimental Methods for Engineers*.McGraw Hill PublicationCompany.
3. Kumar, D.S.(2012).*Mechanical Measurement and Control*.Metropolitan Book Co Pvt.Ltd.
4. Jain, R.K.(1984).*Engineering Metrology*. Khannapublishers.
5. Kuo, B.C.(2000).*Automatic Control systems*. Prentice Hall.

Course Name: Numerical Methods in Engineering

Course Code: 105505

Semester: 5th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. **Errors in Numerical Calculations:**
   Errors in arithmetic operations and functions, Round-off error, truncation error, Absoluteerror, Relative error, Percentage error, errors in series approximation..
2. **Solution of Algebraic and Transcendental Equations**:
   Conditions for the convergence of the iteration method, rate of convergence of the interactive method, comparison of bisection method, iteration method false position, Newton-Raphson and secant method, conversion of a divergent functional iteration scheme into a convergent one.
3. **Interpolation Methods:**
   Errors in polynomial interpretation, finite difference, forward, backward and central difference, Difference of polynomial, Newton‟s formulae for interpolation, central difference interpolation formulae, Interpolation with unevenly spaced points, Newton's general interpolation formula, and interpolation by iteration

UNIT – II

6. **Curve Fitting:**
   Cubic splines and approximation: introduction, Least square curve fitting, Procedures fitting a straight line, non linear curve fitting, curve fitting by a sum of exponentials, Data fitting with cubic splines-derivation of governing equation, endconditions

7. **Numerical Differentiation and Integration:**

Numerical differentiation- cubic spline method: maximum and minimum values of a tabulated function, Numerical Integration- trapezoidal rule, Simpson1/3 rule, Simpsons 3/8 rule, Newton- cots integration formulae, Euler-McLaren formula, Gaussian integration(One dimensional only)

UNIT – III

8. **Matrices and Linear Systems of Equations:**

Introduction, Inverse of Matrix, Solution of linear systems, Matrix inversion method, Gaussian Elimination method (fall and banded symmetric and unsymmetrical systems), Eigen value problems

9. **Numerical Solution of Ordinary Differential Equations:**

Solution by Taylor's series, Prediction -correction method, Boundary value problems, Prediction corrector method, Euler's and modified Euler's method, Runge- Kutta method, finite difference methods.

UNIT – IV

10. **Numerical Solution of Partial Differential Equations:**

Finite difference approximation to derivatives, Solution to Laplace‟s equation- Jacobi's method, Gauss-Siedel method, S.O.R method, Parabolic equation and their solution using iterative methods

11. **Application of Numerical Method:**

Application in heat and mass transfer equations, application in solving fluid dynamic equations

Reference Books:

1. Raman, V. R. (1993). *Computer Oriented NumericalMethods*.PHI Learning
2. Conte, S.D.& de Boor, C.(1980) .*Elementary Numerical Analysis.* Tata Mc GrawHill.
3. Comahan, B.(1969). *Applied Numerical Methods*. John Wiley.
4. Gerald, C.F. &Wheatly, P.O.(2002).*Applied Numerical Analysis*. Pearsons Education.
5. Jain, M.K.&Jain, R.K. (2003).*Numerical Methods for Science and Engineering*.New Age International.

Course Name: Automobile Engineering Lab

Course Code: 105506

Semester: 5th

L T P

Credit: 01 **0 0 2**

Course Contents

6. Valve refacing and valve seat grinding and checking for leakage ofvalves.
7. Trouble shooting in cooling system of an automotivevehicle.
8. Trouble shooting in the ignition system, setting of contact breaker points and spark pluggap.
9. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicleperformance.
10. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and itstesting.
11. Fault diagnosis in transmission system including clutches, gear box assembly anddifferential.
12. Replacing of ring and studying the method of replacing piston afterrepair.

Course Name: Computer Aided Drafting Lab

Course Code: 105507

Semester: 5th

L T P

Credits: 01 **0 0 2**

Course Contents

1. Learn the basic initial setting and viewing of the drafting software'sinterface.
2. Learn the basic options of drawing aids like grid, snap, ortho etc. and other aids for distance and mass propertiescal culations.
3. Learn and draw the basic entities in2D.
4. Learn and use the various modify commands of the draftingsoftware.
5. Learn and use the layers and blocks in drafting software.
6. Use hatching and dimensioning to detail out a componentdrawing.
7. Understand different coordinate system and do a exercise on drafting software usingthis.
8. Draw the different types of 3D modeling entities using viewing commands to viewthem.
9. Draw the different Surface model with different editingcommands.

10. Learn and use shading and rendering techniques for better visualappearance.

Course Name: Heat Transfer Lab

Course Code: 105508

Semester: 5th

L T P

Credit: 01 **0 0 2**

Course Contents

1. Determination of thermal conductivity of a solid insulating material by slabmethod.
2. Determination of coefficient of heat transfer for free/forced convection from the surface of a cylinder / plate whenkept:
   i) Along the direction offlow
   ii) Perpendicular to the direction offlow
   iii) Inclined at an angle to the direction offlow.
3. To determine total resistance and thermal conductivity of compositewall.
4. Determination of heat transfer coefficientfor
   i) Filmcondensation
   ii) Drop-wisecondensation.
5. Determination heat transfer coefficient by radiation and hence find the Stefan Boltzman's constant using two plates/two cylinders of same size by making one of the plates/cylinders as a blackbody.
6. To determine the emissivity of non black platesurface.
7. Evaluate the performance of a heatpipe.
8. To study the rate of heat transfer through different types of fins (1-4) under free convection heat transfer.

Course Name: Machine Design -1 Practice

Course Code: 105509

Semester: 5th

L T P

Credits: 01 **0 0 2**

Course Contents

1. Determination of thermal conductivity of a solid insulating material by slabmethod.
2. Select a daily use product and design the conceptual design by applying the design process talking the controllingparameters
3. Make a list of mechanical components and know their materials and suggest some alternative materials for the each on ofthem
4. Design a wall bracket, which is being used in real life by actual measurement ofload
   i) Welded joints
   ii)Riveted

and
bolted
joints
And
justify
yourfindi
ngs

5. Find a flange coupling in the college laboratory and justify its design by actualmeasurements
6. Design a shaft used in some practical application, by actual working and loadingconditions
7. Select a braking system lever (both hand and foot lever) and justify the designparameters
8. Justify the design of single plate clutch of a engineassembly
9. Design a software in some high level language or excel sheets for design of acomponent

Course Name: Mechanical Measurement and Metrology Lab

Course Code: 105510

Semester: 5th

L T P

Credit: 01 **0 0 2**

Course Contents

1. Measurement with the help of vernier caliper and micrometer
2. Measurement of an angle with the help of sinebar
3. Measurement of surface roughness
4. Measurement of gear elements using profileprojector
5. Three wire method to determine effective diameter of externalthreads
6. Measurement of thread element by Tool makersmicroscope

7. Calibration of a pressure gauge with the help of a dead weight gauge tester
8. Use of stroboscope for measurement of speed ofshaft
9. Use of pilot tube to plot velocity profile of a fluid through a circularduct
10. Preparation of a thermocouple, its calibration and application for temperature measurement

Course Name: Numerical Methods in Engineering Lab

Course Code: 105511

Semester: 5th

L T P

Credit: 01 **0 0 2**

Course Contents

1. To develop computer program to determine roots of a given equation using method of a). Falseposition
   b). Newton -Raphson method,
2. To develop computer programs for solution of system of simultaneous linear equationsusing:
   a) Gauss Elimination Technique, without and with specified boundary conditions, for full as well as bounded symmetric and unsymmetricalmatrices
   b) Gauss Shield iterative technique Successive over Relaxation (S.O.R)Technique
3. Linear and Non-Linear curve fittingtechnique
4. Numerical Integration with Simpson's rule and Gaussian Integration
5. Solution of ordinary differential equations by (i) Euler Method (ii) Runge-Kutta Method (iii) Taylor SeriesMethods
6. Solution of partial differential equations using S.O.R. Technique with special reference to heat conclusion equation.

Course Name: Environmental Science

Course Code: 100302

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **Introduction:**

   Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

2. **NaturalResources:**

   Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

UNIT – II

3. **3. Ecosystems:**

   Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity

4. **EnvironmentalPollution:**

   Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management : Floods, earthquake, cyclone and landslides.

UNIT – III

5. **5.** Social Issues and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement

of environmental legislation Publicawareness.

UNIT – IV

6. Human Population and the Environment, Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies

References Books:

1. Agarwal, K. C. (1987). *Environment Biology*. Nidi Publ. Ltd.Bikaner.
2. Jadhav, H, &Bhosale, V.M. (1995).*Environment Protection and Laws*. Himalaya Pub House,Delhi
3. Rao, M. N. &Datta, A.K. (2008).*Waste Water Treatment*. Oxford and IBH Publ. Co. Pvt.Ltd

Course Name: Fluid Machinery

Course Code: 105602

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Introduction Impulse and reaction forces due to fluid on stationary and moving system of vanes, jetpropulsion.
2. Basic components of turbo machine and its classification on the basis of purpose, fluid dynamic action operating principle, geometrical feature, path followed by the fluid. Euler equation for energy transfer in turbo machine and specifying the energy transfer in term of fluid in rotor kinetic energychange.

UNIT – II

3. Pelton Turbine Component parts and operation, velocity triangles for different runners, work output, Effective head, available power and efficiency, design aspects such as mean diameter of wheel, jet ratio, number of jets, number of buckets with workingproportions.
4. Francis and Kaplan Turbines Component parts and operation velocity triangles and work output, working proportions and design parameters for the runner,

Degree of reaction, Draft tubes -its function and types. Function and brief description of commonly used surgetanks.

UNIT – III

5. Centrifugal Pumps Layout and installation, Main elements and their functions, Various types and classification, Pressure changes in a pump -suction, delivery and manometric heads, vane shape and its effect on head-capacity relationships, Departure from Euler's theory and losses, pump output and efficiency, Minimum starting speed and impeller diameters at the inner and outer periphery, Priming and priming devices, Multistage pumps -series and parallel arrangement, submersible pumps. Construction and operation, Axial and mixed flow pumps, Troubleshooting - field problems, causes andremedies.
6. Similarity Relations and Performance Characteristics Unit quantities, specific speed and model relationships, scale effect, cavitation and Thoma's cavitation number, Concept of Net Positive Suction Head (NPSH) and its application in determining turbine / pumpsetting.

UNIT – IV

7. Reciprocating Pumps:--Components parts and working, pressure variations due to piston acceleration, acceleration effects in suction and delivery pipes, work done against friction, maximum permissible vacuum during suction stroke, Airvessels.
8. Hydraulic Devices and Systems Const., operation and utility of simple and differential accumulator, intensifier, fluid coupling and torque converter, Air lift and jet pumps, gear, vane and pistonpumps.

Reference Books:

1. Daughaty, R.L (1920). *Hydraulic Turbines*. McGraw Hill BookCo.
2. Lal, J. (1994).*Hydraulic Machines*. Metropolitan Book Co Pvt. Ltd.
3. Kumar, D.S. (2010).*Fluid Mechanics and Fluid Power Engineering*. SK Kataria andSons

Course Name: Industrial Automation and Robotic

Course Code: 105603

Semester: 6th

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT – I

1. **Introduction:**

   Concept and need of automation, types of automation: Socio economic consideration: Low cost automation.

2. **Fluid PowerControl:**

   Fluid power control elements and standard graphical symbols. Construction and performance of fluid power generators, Hydraulic and pneumatic cylinders - construction, design and mounting, Hydraulic and pneumatic valves for pressure, flow and direction control: Servo valves and simple servo systems with mechanical feedback, governing differential equation and its solution for step position input.

UNIT – II

3. **Pneumatic LogicCircuits:**

   Design of pneumatic logic circuits for a given time displacement diagram or sequence of operations Basic hydraulic and pneumatic circuits.

4. **Fluidics:**

   Logic Gates, Introduction Boolean algebra, Truth tables, Conda effect, Fluidic elements - their

   Construction working and performance characteristics: Elementary fluidic circuits.

UNIT – III

5. **Transfer Devices andFeeders:**

   Their Classification: Construction details and application of transfer devices and feeders (vibratory bowl feeder, reciprocating tube and centrifugal hopperfeeder).

6. **Electrical and ElectronicControls:**

   Introduction to electrical and electronic controls such as electromagnetic controllers – transducers and sensors, microprocessors, programmable logic controllers (PLC), Integration of mechanical systems with electrical, electronic and computer systems.

UNIT – IV

7. **Robotics:**

   Introduction, classification based on geometry, devices, control and path movement, End effectors - types and applications: Sensors - types and applications. Concept of Robotic/Machine vision, Teach pendent.

8. **Industrial Applications** of Robots for material transfer material handling, processing, operations, assembly andInspection.

Reference Books:

1. Esposito, Anthony (2009).*Fluid Power withapplications*.Pearson Prentice Hall.
2. Majumdar, S.R. (1996).*PneumaticControl*.Tata McGraw-Hill Education
3. Deb, S.R. & Dev, S.(2001). *Robotics and FlexibleAutomation*.Tata McGraw-Hill Education.
4. Goyal, K.&Bhandari, D. (2011).*IndustrialAutomationandRobotics*S.K. Katariaand Sons.
5. Gupta, A.K.,&. Arora,S.K.(2009).*Industrial Automation and Robotics*, Laxmi Publications.

Course Name: Machine Design-II

Course Code: 105604

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **BeltDrives:**

   Introduction to Belt drives,Design of Flat belt, V-belt and rope (steel wire), Design of the pulley for the same

2. **Chain:**

   Selection of Chain Drive

UNIT – II

3. **Gear:**

   Design of spur, helical, straight bevel gears, worm and worm wheel

4. **Bearings:**

   Bearing Selection, Types of lubrication, Heat generation and thermal equilibrium,

Design of sliding and rolling type of bearings, Fluid Film bearings, Detailed of bearing housing

UNIT – III

5. **Flywheel:**

   Fly wheel basic concepts -design requirements, Design of Flywheel for different operation

6. **Springs:**

   Introduction to Springs, Design of Close-coil, Helical and Leaf springs

7. **Clutch and Brakes:**

   Need and functioning, Design of Contact clutches i.e. Plate and cone types, Band, Block, Band and block brakes

UNIT – IV

8. **Design of Lubrication in Transmission System**
9. **Computers in Design**:

   Basic Theory of CAD Software, structure of CAD software, Design Philosophy, Structure of CAD Software, Designing a CADS of ware

Reference Books:

1. Shigley&Mischke (2008). *Machine Design*, Tata McGraw hill.
2. Sharma, P.C. &Aggarwal, D.K.(1999). *A Textbook of Machine Design.*Kataria Publishers.
3. Goyal, V.K. &Bahl, R.C.(2010).*Machine Design*, Standard Publishers.
4. PSG College of Engg and Tech, (2002). *Design Data Book*. Coimbatore
5. Jadon, V.K. (2010). *Machine Design Data Book.*IK International Publications.

Note: Design data book by "*Design Data Book compiled by PSG Coimbatore*

Or

Machine Design Data Book by V.K.Jadon (IK International Publications) is allowed to be used in the examination."

Course Name: Refrigeration and Air Conditioning

Course Code: 105605

Semester: 6th

L T P

Credits: 05 **4 1 0**

Course Contents

UNIT – I

1. **Basic Concept:**

   Natural and Mechanical refrigeration, Application of Refrigeration, Units of refrigeration and Coefficient of performance, Refrigeration effect, cooling capacity and COP of a refrigerator, Heating effect, Heating capacity and COP as heat pump, Reversed Carnot cycle and its limitations

2. **Bell Coleman Cycle and Aircraft Refrigeration:**

   Bell Coleman Cycle and its analysis, optimum COP and pressure ratio, Necessity of air craft refrigeration - air cycle refrigeration systems and their comparison.

3. **Vapour Compression Refrigeration Cycle:**

   Vapour compression cycle on P-V, P-H and T-S diagrams, Deviation of actual cycle from theoretical cycle, Compressor capacity and volumetric efficiency, Analysis of theoretical and actual vapour compression cycles, Effect of suction pressure, Discharge pressure, Subcooling, super heating and pressure drop in valves on performance and cooling capacity.

UNIT – II

4. **Vapour Absorption Refrigeration Cycle (No MathematicalAnalysis):**

   Principle of absorption system, components of the system, Desirable properties of absorption system refrigerant and absorbent, Aqua - ammonia absorption refrigeration system, Lithium Bromide - water absorption system, Theory of mixtures, temperature concentration and enthalpy concentration diagrams, Comparison between absorption and compression systems, Electrolux refrigeration system.

5. **Refrigerants:**

   Classification and nomenclature of refrigerants, Desirable thermodynamic, chemical and physical properties of refrigerants, Comparative study of commonly used refrigerants and their fields of application, Azeotropes, Effect of moisture and oil miscibility, Refrigerants dying agents and antifreeze solution, Leak detection and charging of refrigerants, Environmental aspects of

conventional refrigerants, Ecofriendly refrigerants and action plan to reduce ecological hazards.

6. **Non - Conventional Refrigeration Systems (No MathematicalAnalysis):**
   Steam Jet Refrigeration, Cascade Refrigeration System, Mixed Refrigeration Systems, Vortex Tube Refrigeration, Thermoelectric cooling, Linde and Claude cycles, Cryogenics and its engineering applications.

UNIT – III

7. **Air Conditioning Concept andApplications:**
   Psychometric properties of air, Dry bulb, wet bulb and dew point temperatures, Relative and specific humidity, Degree of saturation adiabatic saturation temperature, Enthalpy of air and water

   vapours, Psychometric chart. Human requirement of comforts, Effective temperature and comfort charts, Industrial and comfort air conditioning.
8. **Psychometric Processes:**
   Sensible heating and cooling, Cooling with dehumidification, Heating with dehumidification, by- pass factor, chemical dehumidification, adiabatic mixing, air washer.
9. **Calculations for Air –conditioning Load and for Rate and state of SupplyAir:**
   Sources of heat load, sensible and latent heat load, sensible heat factor, apparatus dew point temperature,
   Rate and state of supply - air for air- conditioning of different types of premises

UNIT – IV

10. **Refrigeration Controls:**
    General aspects, Hand expansion valve, Automatic expansion valve, Thermostatic expansion valve, Capillary tube, Low side float, High side float, Solenoid valves.
11. **Measurement Instruments - AirConditioning:**
    Measurement of humidity, Measurement of infiltration, Measurement of pressure, Measurement of air flow, Measurement oftemperature.
12. **Application of Refrigeration and AirConditioning:**
    Food preservation, Cold storage, Refrigeration method for trucks and trailors, Water coolers, Desert cooler, Ice system of air conditioning, Air conditioning of theatres

Reference Books:

1. Arora, C.P. (200).*Refrigeration and Conditioning.* Tata McGraw Hill.
2. Prasad, Manohar. (2011)*Refrigeration and Conditioning.* Wiley EasternLimited.
3. Jordon, R.C.&Priester, G.B. (1956).*Refrigeration and Conditioning.* Prentice Hall ofIndia.
4. Stoecker, W.F. (2014). *Refrigeration and Conditioning*.Tata McGraw Hill.
5. Rajput, R.K. (2010). *Refrigeration and Conditioning*. KhannaPublications.

Course Name: Internal Combustion Engines

Course Code: 105901

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **INTRODUCTION:** Review of Otto, Diesel, Dual and Stirling Cycle, Comparison of Cycles, Actual Cycles and their Analysis, Classification of IC Engine, Two Stroke and Four Stroke cycle Engines, Difference between C.I. and S.I. Engines, Engine Design and OperatingParameters.
2. **COMBUSTION IN S.I. ENGINES:** Combustion in S.I. Engines, Flame Front Propagation, Flame Speed, Ignition Delay, Abnormal Combustion, Combustion Chambers for S.I.Engines.

UNIT – II

3. **COMBUSTION IN C.I. ENGINES:** Combustion in C.I. Engines, Ignition Delay, combustion Knock, Combustion Chamber for C.I. Engines, Fuel InjectionTesting.
4. **TESTING AND PERFORMANCE** Parameters, Engine Power, Engine Efficiencies, Type Of Tests And Characteristic Curves, Variables Affecting Performance Characteristics, Methods of Improving EnginePerformance.

UNIT – III

5. **CARBURETTION, LUBRICATION, COOLING AND IGNITION SYSTEMS:** Simple and Complex Carburettors, Gasoline Injection, Combustion Design For S.I. Engines, Friction And Lubrication, Types Of Lubrication Systems, Engine Cooling, Ignition Systems, Magneto And Battery Ignition Systems, Ignition Timing.

UNIT – IV

6. **EMISSION:** Engine Economy, Air Pollution Due To IC Engines, Engine Emissions, Particulates, Emission Control Methods, EGR (Exhaust GasRecirculation),
7. **FUELS:** Fuels and Their Properties, Stoichiometric and Actual Air Requirements, Flue Gas Analysis.

Reference Books:

1. Heywood, B.J. (1988).*Internal Combustion Engine Fundamentals*. McGraw Hill Book Co.
2. Richard, Stone. (1985).*Introduction to Internal Combustion Engines*.Palgrave Macmillan.
3. Pulkrabek, W.W. (2004).*Engineering Fundamentals of the Internal Combustion Engine*. Prentice Hall International, Inc.
4. Somasundaram, S.L. (1996).*Thermal Engineering*. New Age International Publishers.
5. Kumar, D.S. &Vasandhani, V.P. (1996).*Heat Engineering*.New Delhi Metroplitan Book Co. Pvt. Ltd.
6. Mathur, R.P. & Sharma,M.L. (1994). *A Course in I.C.Engine*, Dhanpat Rai and Sons. NDelhi.
7. Ganesan, V. (2003). *Internal Combustion Engine*. Tata McGraw Hill.

Course Name: Non Conventional Energy Resources

Course Code: 105902

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **Introduction:** Renewable and non-renewable energy sources, their availability and growth in India: energy consumption as a measure of Nation,s Development: strategy for meeting the future energyrequirements.
2. **Solar Energy:** Solar radiations-beam and diffused radiations; earth sun angles, attenuation and measurement of solar radiations; Optical properties of materials and selectivesurfaces.

UNIT – II

3. **COMBUSTION IN C.I. ENGINES:** Combustion in C.I. Engines, Ignition Delay, combustion Knock, Combustion Chamber for C.I. Engines, Fuel InjectionTesting.
4. **TESTING AND PERFORMANCE** Parameters, Engine Power, Engine Efficiencies, Type Of Tests And Characteristic Curves, Variables Affecting Performance Characteristics, Methods of Improving EnginePerformance.

UNIT – III

5. **Direct Energy Conversion Systems:** i) Magneto Hydrodynamic (MHD) Generators; Operating principle, types and working of different MHD system – their relative merits; MHD materials and production of magnetic fields ii) Thermo-Electric Generators; Thermo-electric effects and materials; thermoelectric devices and types of thermo-electric generators; thermo-electric refrigeration iii) Thermionic Generators; Thermionic emission and materials; working principle of thermionic convertors iv) Fuel Cell; Thermodynamic aspect; types, components and working of fuel cell. Performance, applications and economic aspects of above mentioned direct energy conversionsystems.
6. **Bio-Mass:** Concept of bio-mass conversion, photo-synthesis and bio-gasification; bio gas generators and plants, their types constructional features and functioning; fuel properties of bio gas and community bio gasplants.

UNIT – IV

7. **Geothermal:** Sources of geothermal energy types, constructional features and associated prime movers.
8. **Tidal and Wave Energy:** Basic principles and components of tidal and wave energy plants; single basin and double basin tidal power plants; conversion devices, Advantages/disadvantages and applications of above mentioned

energysystems.

Reference Books:

1. Prakash, Jai&Garg, H.P.(1997).*Solar Energy: Fundamentals and Applications*. TataMcGraw-Hill.
2. Sukhatme, S.P.(1996).*SolarEnergy: Principles of thermal collection and storage*. Tata McGraw- Hill.

Course Name: Energy Conservation and Management

Course Code: 105903

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Need for Energy Conservation, Its Potentials, Fiscal Incentives, Primary Energy Sources Such As Coal, Gas, Oil, NuclearFuel

UNIT – II

2. Optimum Use of Prime Movers for Power Generation Such As Stteam Turbines, Gas Turbines, Diesel and Gas Engines, Energy Intensive Industries i.e. Iron and Steel, Aluminum, Pulp and Paper, Textile and Oil Refineries and Their Energy UsagePattern.

UNIT – III

3. Plant: Good Housekeeping, Measures in Air Conditioning, Boilers, Combustion System, Steam, Furnaces and General Awareness, Energy Audit, Methodology And Analysis, Energy Conservation Case Studies In Air Conditioning, Boiler AndBurners

UNIT – IV

4. Waste Heat Recovery Systems i.e. Recuperates, Economizers Waste Heat Boilers, Heat Pipe Heat Exchangers, Regenerators etc. Energy Storage Systems Thermal Storage, Insulation, Refractory, Specialized Processes such As Dielectric and Micro Wave Heating, Electronic Beam Welding, Fluidized Bed Technology, Laser as a Welding Tool, Alternative Sources ofEnergy.

Reference Books:

1. Reay, D.A. (1977*). Industrial Energy Conservation Handbook.*Pergamon Press

2. Greene, Richard.(1982). *Process Energy Conservation (Chemical Engineering)*. McGraw-Hill Publication Co.

Course Name: Solar Energy Engineering and Design

Course Code: 105904

Semester:6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Solar Flux and Weather Data : Introduction, Solar Constant, Spectrum of sun, Diurnal Variation of Direct Sunlight, Height variation of direct sunlight. Standard Atmosphere, Zenith Distance Flux Variation, Geographical distribution of sun-shine and effects of weather on Solar Flux. Introduction to solar Flux observation, Instruments such as pyranometer, Phyrheliometer and Sunshine Recorder, Correlation between direct and total Insulation, Solar flux variation dynamic, Correlation of sunshine with Wind Velocity, Environmental Thermal Infrared Flux and ETIR Model.

2. Solar Availability: Introduction, Zenith Distance Vs time, Time of sunrise and sun-set fully Tracking collector, Variation of flux curves with latitude and geometry, Introduction toFixed

Flat plate (horizontal, latitude Tilted, fixed latitude + 15°, Vertical South-facing, Seasonally Tilted) N-S and horz, east west tracking and N-S polar east west tracking, East west horz and N-S tracking, Comparison of theoretical curves with observation, Comparison of daily output; Peak flux Vs Averageflux,

UNIT – II

3. Heat Transfer in Solar Collectors: Introduction, Heat Losses in a Distributed Collector system. The Liquid Transfer Module System, Solar Heat Availability, Fluid Mechanics, Fluid Properties, Temperature Rise, Solar Flux, Pressure Drop Relations, Reynolds Number, Ratioof

Power Expended to Power Generated, Magnitude of Power Output/Input Ratio, Parametric Relationships for Fluid Transfer, Variation of Output/Input Ratio with Solar Flux. Air-Transfer Systems.

4. Flat-Plate Collectors: Introduction, Basic Collector Configurations, Diurnal Temperature, Profile, Thermal Inertia U-Factor, Collector Heat Balances. Sample Calculation, Surface Temperature. Efficiency versus-Temperature Curves, General Properties of efficiencyVs

Change and Temperature, The Bare Collector; Single –Window Collector, Double Window Collector Improvement of Performance, Geometrical Suppression of Convection, Window Temperature. Effect of Selective Absorber Surface, Selective Windows Facing Selective Surface Combination of Absorber and selective windows,Problems.

UNIT – III

5. Energy Storage: Introduction, Basic System Diagram, Peaking Effect of Back up Demands, Energy Storage, Hydro storage, Chemical Batteries, Flywheels, Chemical Storage, Compressed Air, Biological Storage, Thermal Storage, Sensible-Heat Storage, Latent-Heat Storage, Salt Eutectics, Zoned Thermal Storage Fluid Tank, Rock Thermal Storage Tank, Farm Thermal StorageTank.

6. Application of Solar Energy: (History and Survey Application) Community Heating and Cooling system, Solar Water pumping, solar gas absorption refrigeration, MEC Cooling system, Two stage evaporative coolingetc.

UNIT – IV

7. Direct Conversion to Electricity: Introduction, Direct conversion by Means of Solar Cells, Silicon Cells, Manufacture of Silicon Cells, Ribbon Silicon Cells, Polycry silicon cells, Cadmium sulfide Solar Cells, Manufacture of Cadmium Sulfide Cells Gallium Arsenide Solar Cells, Thermal Behaviors of Solar Cells Cooled Solar Cells for Concentrating System. Thermo-electric Solar Cells, Thermonic Solar Cells, Phase-Change Thermal Direct Conversion,Problems.

Reference Books:-

1. Meinel, A.B.andMeinel M.P.(1976). *An Introduction to Applied Solar Energy*.Addison-Wesley.
2. Kreider J. F. andKreith, F.K.(1981).*Hand Book of Solar Energy*. McGraw Hill

Course Name: Heat Exchanger and Design

Course Code: 105905

Semester: 6th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Introduction: Classification, types and applications of heat Exchangers, Heat Exchanger Design methodology, Selection of Heat Exchangers.

2. Single Phase Heat Exchangers: LMTD and NTU methods, Rating and sizing methods, design criteria, geometry, process parameters, pressure drops and applications.

UNIT – II

3. Two Phase Heat Exchangers: Types of Boiling, Boiling mechanisms, two phase flow boiling pressure drop.

4. Condensation Mechanism, types of condensers and design procedures, Evaporators, Multiple effect evaporators, Design procedures, Liquid chillers, kettle, thermosyphen and forcedcirculation.

UNIT – III

5. Augmented surface heat exchangers, Heat transfer coefficients, pressure drops, compactheat exchangers and air coolers, plate heat exchangers and plate fine heat exchangers.

6. Heat Pipe Heat Exchangers: Types and design procedure and applications Installation, Operation and Maintenance: Fouling factors, type of fouling and cleaningmethods.

UNIT – IV

7. Mechanical Considerations: Codes and Standards, Mechanical design requirements and materials.

Reference Books:-

1. Saunders, E.A.D.(1989).*Heat Exchangers Selection Design and Construction*.

Longman Scientific and Technical John Wiley and Sons Inc. NewYork

2. Kern, D.Q.(1965).*Process Heat Transfer*. Mc Graw HillBook Company.
3. Holman, J.P.(1997).*Heat Transfer*.Mc.Graw Hill Book CompanySingapore.
4. Gupta, J.P.(1986).*Fundamentals of Heat Exchangers and Pressure Vessels Technology*. Hemisphere Publishing Corporation.

Course Name: Fluid Machinery Lab

Course Code: 105606

Semester: 6th

L T P

Credit: 01 **0 0 2**

Course Contents

1. Determination of various efficiencies of HydraulicRam
2. To draw characteristics of Francisturbine
3. To study the constructional features of reciprocating pump and to perform test on it for determination of pumpperformance
4. To draw the characteristics of Pelton Turbine
5. To draw the various characteristics of Centrifugalpump
6. Determine the effect of vane shape and vane angle on the performance of centrifugalfan

Course Name: Industrial Automation and Robotics Lab

Course Code: 105607

Semester: 6th

L T P

Credits: 01 **0 0 2**

Course Contents

1. Design and assembly of hydraulic / pneumaticcircuit.
2. Study of power steering mechanism using cut piecemodel
3. Study of reciprocating movement of double acting cylinder using pneumatic directioncontrol valves
4. Use of direction control valve and pressure control valves clamping devices for jig andfixture

5. Study of robotic arm and itsconfiguration
6. Study the robotic endeffectors
7. Study of different types of hydraulic and pneumaticvalves

Course Name: Machine Design -II Practice

Course Code: 105608

Semester: 6th

L T P

Credit: 01 **0 0 2**

Course Contents

1. Review of principles of retainment, alignment and assembly, of various components of machines, various types of oil seals: friction lock and its applications in reciprocating cam-followers, assembly and linkmotions.
2. Study the layout of some existing transmission system design and suggest a new conceptual design by removing the shortcomings of the existingdesign
3. Find an assembly containing the belt and pulley mechanism and do the complete design calculations and then justify the existingdesign.
4. Calculation of the velocity ratios required in a gear box and then design the gearbox in practical application (gearbox application must involve different types of gears like bevel, spur and helical gears)
5. Find a transmission system involving the worm an worm wheel and then find out the inputs required for its design and justify thedesign.
6. Design the shafts required to support the assembly and design it for manufacturing and assembly.(with actual calculations of the loads and the endconditions)
7. For a press of your machine shop, study the process and suggest the design parameters of the flywheel required. Justify the design if flywheel is alreadythere.
8. Design springs for practical application for the given conditions and constraints and find its practicalavailability.

Select a mechanical component or system, convert its design procedure into an algorithm and write a code for its design or with the help of application software.

Course Name: Refrigeration and Air Conditioning Lab

Course Code: 105609

Semester: 6th

	L T P
Credit: 01	**0 0 2**

Course Contents

1. Study of various elements of a mechanical refrigerator system through cut sections models / actualapparatus.
2. Study and performance of domesticrefrigerator.
3. Study the performance of and Electroluxrefrigerator.
4. Study of an Ice plant and visit to a cold storage forstudy.
5. Calculation/ Estimation of cooling load for largebuilding.
6. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning.
7. Study and performance of window type room airconditioner

Course Name: CAD/CAM

Course Code: 105801

Semester: 8th

	L T P
Credits: 04	**3 1 0**

Course Contents

UNIT – I

1. **Fundamentals of CAD/CAM:**
   Introduction to CAD and CAM, Definition of CAD and CAM tools, Applications of CAD/CAM, Design process and application of computers in design, Creating Manufacturing database, Benefits of CAD/CAM.
2. **CADHardware:**
   Input devices: Keyboard, Touch panel, Light pens, Graphic tablets, Joysticks, Trackball, Mouse, Voice systems, Output devices: Storage, Tube graphics display, Raster refresh graphics display, Plasma panel displays, Liquid crystal displays. Central Processing Unit (CPU).
3. **CAD Software and Database Management:**

Graphic Standards: GKS, IGES, Data Structure and Database Management of a Graphics System, Coordinate Systems:, Software modules: Operating System, Graphics, Application, geometric modeling:

UNIT – II

4. **Geometric Transformations**:

   Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of Transformation matrices. Application of geometric transformations.

5. **Representation of curves andsurfaces**:

   Polygon, parametric equations, meshed and ruled surfaces: Bezier curves; B-spline curves.

UNIT – III

6. **Geometric Modeling: Wireframemodel**:

   Solid modeling: representation, volumetric properties, surface modeling, concepts of hidden-line removal and shading: Kinematics analysis and simulation. Application of CAD techniques to finite Element Mesh Generation. Computer Aided Manufacturing (CAM)

7. **NC/CMNC MachineTools**:

   NC machine tools- basic components, coordinate systems; featuresof NC machine tools. Computerized Numerical Control (CNC): Tooling for NC machines - tool presetting equipment, flexible tooling, tool length compensation, tool path graphics; NC motion control system; Manual part programming, fixed/floating zero. Block .DNC and Adaptive Control: Direct numerical control: Adaptive control in machining system; Combined DNC/CNCsystem

UNIT – IV

8. **Group Technology(GT):**

   Part families; part classification and coding system: Group technology machine cells: Advantages of GT.

9. **Computer Aided ProcessPlanning:**

   Introduction and benefits of CAPP. Types of CAPP systems, machinability data selection systems in CAPP.

10. **Flexible Manufacturing System (FMS) and Computer integrated manufacturing system:**

FMS and its advantages, components of a FMS system. Introduction to CIMS.

Reference Books:

1. Groover, M.&Zimmers, E. (1984).*CAD/CAM*. Prentice Hall ofIndia
2. Groover, M.P. (1980).*Automation: Production Systems and CAM*.Englewood Cliffs, New Jersey
3. Chang, T.C.&Wysk, R.A. (1985).*An introduction to Automated Process Planning*.Longman Higher Education
4. Singh,Nanua. (1995).*System approach to Computer Integrated Design and Manufacturing*.Wiley.
5. Pable, B.S.&Adithan, M.(1994). CNC Machines.New Age International (P) Ltd.
6. Dalela, Suresh &Jain, P.K. (2000).*CAD/CAM*.S Chand and Company Pvt Ltd.
7. Ibraham, Zeid (2009).*CAD/CAM - theory and Practice.* Tata McGraw Hill Pub Co.

Course Name: Industrial Safety and Environment

Course Code: 105802

Semester: 8th

L T P

Credits: 03 **3 0 0**

Course Contents

UNIT – I

1. **Meaning and need for safety**.

Relationship of safety with plant design, equipment design and work environment. Safety measures in a manufacturing organization, safety and economics, safety and productivity. Employees participation in safety. Safety standards and legislation

UNIT – II

2. **Industrial accidents:**

Industrial accidents, their nature, types and causes. Assessment of accident costs;

prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis.

3. **Planning for safety**:

Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Policy formulation and implementation of safety policies.

UNIT – III

4. **Environment and need for environmental** :

Meaning of environment and need for environmental control. f factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Measurement and mitigation of physical and mental "fatigue" Basics of environment design for improved efficiency and accuracy at work.

5. **Ventilation, Lighting and heat Control** :

Ventilation and heat Control Purpose of ventilation. Physiology of heat regulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures: control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief. Industrial Lighting: Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation. Maintenance standards relating to lighting and colour.

UNIT – IV

6. **Noise and Vibrations**:

Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise isolation. Noise absorption techniques. Silencers vibrations: Effect, measurement and control measures.

7. Environment Standards:

Introduction to ISO 14000; Environment standards for representative industries.

Reference Books:

1. Joselin, E.L. (1934).*Ventilation.* EdwardArnold.
2. Beranek, L.L.(1960).*Noise Reduction*.Mcgraw Hill
3. DeReamer, R. (1980). *Modern Safety and health Technology*. R.Wiley
4. Heinrich, H.W.(1959).*Industrial Accident Prevention.* McGraw Hill

Course Name: Mechanical Vibrations

Course Code: 105803

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Introduction:

Basic concepts and its cause, Scope of vibration, degree of Freedom, Methods of vibration analysis, Types of vibration, Periodic andHarmonic vibrations .Beats and Beat Phenomena. Fourier analysis

For Single degree of freedom system

2. Undamped freevibrations:

Torsional Vibration of rotor shaft system, compound Pendulum, Beam with several masses.

UNIT – II

3. Damped freevibrations:

Types of damping, Differential equations of damped free vibration, Use of Critical damping

4. Damped forcevibrations

Source of excitation, Equation of motion with harmonic Force, magnification Factor, Response of rotating and reciprocating unbalance system. Support motion vibration

isolation transmissibility.

UNIT – III

5. Vibration measuring instruments:- Vibrometer, Accelerometer, Frequency measuringdevice

:-Frahm tachometer and Fullarton tachometer,Critical Speed

6. Two degrees of Freedomsystems:

a) Principal modes of vibrations, natural frequencies, amplitude ratio, forced harmonic vibration combined rectilinear and angularmodes.

b) Application; Vibration absorber - principle, centrifugal pendulum vibration absorber, torsional vibration damper, unturned viscous damper, dry friction dampers, torsional vibration of two rotor systems.

UNIT – IV

7. Multi-degree of freedomsystems:

Undamped free vibrations, influence coefficients, generalised coordinates, orthogonality principal, matrix alteration methods,: Rayleigh and Dunkerley, Holzer's , stodola method, Eigen values andeigen vector

8. Continuoussystems:

Vibration of a string, longitudinal vibrations of bars, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts

Reference Books:

1. Grover, G.K. (2009). *Mechanical Vibrations*. Nem Chand and Bros Roorkee.
2. Purjara, K. &Pujara, R.S. (1984). *Vibrations for Engineers*. Dhanpat rai and sons Delhi
3. Singh,V.P.(2015).*MechanicalVibrations*.Dhanpat rai and sons Delhi
4. Rao, S.S. (2003). *MechanicalVibrations*.Pearson
5. Thompson, W.T. (1961). *MechanicalVibrations*.Prentice Hall Press
6. Srinivasan, P. (1996). *Mechanical Vibrations and Analysis*.John Wiley and Sons Inc.

Course Name: Operations Research

Course Code: 105804

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

7. **Introduction**:

Origin and development of OR and its role in solving industrial problems: General approach for solving OR problems. Nature and characteristic feature of OR. Use and limitation of OR. Classification of mathematical models:

8. **Deterministic**Models:

Formulation of deterministic linear mathematical models : Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis : transportation models, test for optimality, degeneracy in transportation. Assignment problems (Hungarian method) travelling salesman problems, and sequencing models; Introduction to goal programming; Solution techniques of linear goal programmingproblems.

UNIT – II

9. ProbabilisticModels:

Decision making: various decision making environments. Maximum and minimum models; Introduction to decision tree. Game theory: Solution of simple two person zero-sum games: Examples of simple competitive situation.

10. **Simulation**:

Concept general approach and application. Use of Monte-Carlo simulation technique to queuing and inventory problems.

11. Dynamic Programming:

Introduction to deterministic and probabilistic dynamic programming. Solution of simple problems. Advantages of dynamic

UNIT – III

12. Queuing theory:

Types of queuing situation: Queuing models with Poisson's input and exponential

service, their application to simple situations.

13. **Replacement Models**:

Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy.

UNIT – IV

14. Inventorymodels:

Classification of inventory control models: Inventory models with deterministic demand, inventory models with probabilistic demand, and inventory models with price breaks. Advantages and disadvantage of inventory

15. Networkmodels:

PERT and CPM introduction, analysis of time bound project situations, construction of net works, identification of critical path, slack and floats, crashing of network for cost reduction, resource leveling and smoothening.

Reference Book:

1. Wagner, H.M.(1980). *Principles of Operations Research.* PrenticeHall.
2. Gupta, P.K.&Hira, D.S.(1976).*Operations Research.* S. Chand andCo.
3. Taha, H.(1999). *Introduction to OperationResearch*. Pearson.
4. Hillier, F. S. & Lieberman, G. J. (1967). *Introduction to Operations Research*. San Francisco: Holden-Day

Course Name: CAD/CAM Lab

Course Code: 105805

Semester: 8th

L T P

Credits: 01 **0 0 2**

Course Contents

1. CAD exercises using Auto Cadsoftware
2. Draw the different type of 3D modelling entries using viewing commands to view them (Isometricprojection).

3. Sanctioning of solid primitives and rendering in3D.
4. Part-programming on CNCmachines
5. Execution of part programme for machining givenprofile.
6. Part modeling using some of the modelingtechnique
7. Component assembly in CAD and generating and modifying drawings

Course Name: Mechancial Vibration Lab

Course Code: 105806

Semester: 8th

L T P

Credit: 01 **0 0 2**

Course Contents

1. Determine the viscosity of given fluid by single wire torsionalpendulum.
2. Determine the natural frequencies of a coupled pendulum.
3. Find out the fundamental natural frequency of a cantileverbeam
4. Determine the modulas of elasticity from free vibrationtest
5. Study of forced vibration of a two degree of freedom system under harmonicexcitation
6. Study of a dynamicabsorber

Course Name: Metal Forming

Course Code: 105906

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Classification of Metal Forming Processes: Elementary theory of plasticity, stress / strain / strain- rate characteristics of materials, yield criteria of

metals,formability.

2. Mechanics of Forming Process: Rolling, process parameters, pressure distribution and roll separating force, rolling pressure, driving torque and powerrequirements.

UNIT – II

3. Forging: Determination of forces in strip forging and disc forging, defects in forgedcomponents.
4. Drawing: Drawing stresses, limiting draw ratio, factors affecting drawability determination of force and power in wire drawing, determination of maximum allowable reduction, deep drawing force analysis. defects in drawncomponents

UNIT – III

5. Bending: Bendability, determination of work load and springback.
6. Extrusion: Process, parameters, determination of work load from stress analysis and energy considerations, power loss, hydrostatic extrusion, pressure required to extrude, variables affecting theprocess

UNIT – IV

7. Punching and Blanking: Two-dimensional deformation model and fracture analysis, determination of workingforce.
8. High Energy Rate Forming: Classification, comparison of conventional and high speed forming, Introduction to High Energy Rate Forming Processes(HERF).

Reference Books:

1. Rowe, J.W. (1977) .*AnIntroductiontothePrinciplesofIndustrialMetalWorking*.Edward Arnold,London
2. Juneja, B.L. (2010).*FundamentalsofMetalFormingProcesses.*NewAgeInternationalPublishers.
3. Avitzur, B. (1968). *Metal Forming Analysis.* McGraw Hill. NewYork.
4. Ghosh, A. &Malik, A.K. (2010). *Manufacturing Science.* Affiliated East-West Press, NewDelhi.
5. Narayan, S.R. (200). *Metal Forming Technology*, Ahuja Book Publishers, NewDelhi

Course Name: Non-Traditional Machining Processes

Course Code: 105907

Semester: 8th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. **Modern Machining Processes**: An Overview, trends in Manufacturing machining, transfer machining, flexible machining system, computer integratedmanufacturing

UNIT – II

2. **Advanced Mechanical Processes:** Ultrasonic machining and Abrasive Flow Machining- elements of process, Applications andlimitations

UNIT – III

3. **Electrochemical and Chemical Removal Processes:** Principle of operation, elements and applications of Electrochemical Machining, Electrochemical grinding, Electrochemical deburring, Electrochemical honing, ChemicalMachining:

UNIT – IV

4. **Thermal Metal Removal Processes:** Electric Discharge Machining, Mechanism of metal removal, electrode feed control, die electric fluids flushing, selection of electrode material, applications. Plasma Arc, Machining- Mechanism of metal removal, PAM parameters, Equipment's, safety precautions and applications. Laser Beam machining- Material removal, limitations and advantages. Hot machining- method, Applications and limitations. Electron-Beam Machining-, Generation and control of electron beam, process capabilities andlimitations
5. **Hybrid Machining Processes**: concept, classification, application, Advantages

Reference Books:

1. Panday, P.C. &Shan, H.S.(1980).*Modern Machining Processes*, Tata Mc GrawHill
2. Boothroyd, G.& Knight, W.A.(2005).*Fundamentals of Machining and Machine Tools.* CRC Press Inc.
3. Benedict, G.F.(1981).*Non Traditional Manufacturing Processes*. Marcel DekkerInc.

Course Name: Mechatronics

Course Code: 105908

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1 **INTRODUCTION TO MECHATRONICS:** Definition and approach ofMechatronics, Measurement and Control Systems, Microprocessor based controllers and Mechatronics Approach.

UNIT – II

6. SENSORS AND TRANSDUCERS: Performance Terminology, Displacement, velocity, Position, Proximity, force, fluid pressure, liquid level, temperature, light sensors, procedure for selection

7. SIGNAL CONDITIONING: Operational Amplifier, Protection, digital signals, Multiplexes and digital signal processing, pulsemodulation

UNIT – III

2 **PNEUMATIC AND HYDRAULIC SYSTEMS:** Actuation systems, Directions, pressure and process control valve, Pneumatic and hydraulicsystems

3 **ELECTRICAL ACTUATION SYSTEM:** Mechanical Switches, Solid State Switches, Solenoid, DC/AC Motors, StepperMotors

UNIT – IV

4 **MICROPROCESSOR AND ITS APPLICATION:** Architecture of Microprocssor 8085, Instruction set, Embedding a microprocessor into a Mechatronicssystem

5 **MICROPROCESSOR BASED PROJECT:** Assemble a suitable system using microprocessor kit for itscontrol

Reference Books:-

1. Bolton, W. (2010).*Mechatronics*. Pearson Education
2. Rafiquzzaman. (2016).*Microprocessors*.Pearson Education India.
3. Boennett, S. (1988).*Real time computer controls*.Longman Higher Education
4. Kuo, C.B. (1990).*Automatic Control Systems.* Prentice Hall , New Delhi

Course Name: Computer Aided Manufacturing

Course Code: 105909

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. INTRODUCTION: Historical background, role of computers in manufacturing, automation, Types of automation, Automationstrategies.

UNIT – II

2. NUMERICAL CONTROL IN CAM: Introduction, fundamentals of NC, Need of NC machine tool, Elements of NC machine tools, Axes of NC machines, NC machine tools, tooling for NC machines, Steps in NC manufacturing, advantages of NC system, applications of NC systems, economics of NC manufacturing, machiningcenters.

3. COMPUTER INTEGRATED MANUFACTURING SYSTEM: Types of manufacturing systems, machine tools and related equipment, material handling systems, computer control systems, human labor in manufacturing systems, CIMS benefits. Robots: anatomy, configuration and control. Conveyor system, automated guided vehicle (AGV), automated storage and retrieval systems (AS/RS), flexible manufacturing systems (FMS)..

UNIT – III

4. RECENT TRENDS IN CAD/CAM: Concurrent Engineering: concept, emerging technologies, Collaborative design. Deign for =X,,, Design for Manufacturing, Reverse Engineering. Agile Manufacturing, Lean Manufacturing, Rapid Prototyping(RP).

5. COMPUTER AIDED QUALITY CONTROL (CAQC): Use of computers in QC, Computer aided inspection (CAI): contact inspection methods, non-contact inspection, in process gauging, online inspection and quality control, Machine Vision system, Computer aided testing(CAT).

UNIT – IV

6. FLEXIBLE MANUFACTURING SYSTEM: Introduction to FMS (building blocks of FMS), different types of flexibilities in FMS, type of FMS, Machining system of FMS, Tool management systems, work piece handling system, FMS Control, Lay out considerations in FMS, Advantages of FMS. Introduction to computer integrated manufacturing systems (CIMS), the future automated factory; trends in manufacturing, human factors in future automated factory, the socialimpact.

References Books:

1. Groover, M.P.(1980).*Automation: Production Systems and CAM*.Englewood Cliffs, New Jersey
2. Chang, T.C.&Wysk, R.A. (1985).*An introduction to Automated Process Planning*.Longman Higher Education
3. Singh,Nanua.(1995).*System approach to Computer Integrated Design and Manufacturing*.Wiley.
4. Pable, B.S.&Adithan, M. (1994). CNC Machines.New Age International (P) Ltd.
5. Dalela, Suresh &Jain, P.K. (2000).*CAD/CAM*.S Chand and Company Pvt Ltd.

Course Name: Jigs Fixtures and Die Design

Course Code: 105910

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Jigs and Fixtures: Elements of jigs and fixtures, costs calculations. Locating element, clamping elements, procedure in designing. Jig and fixtures: Fits and tolerancesanalysis.
2. Non-Standard clamping devices, centerlizers, equalizers, actuators (Pneumatic, hydraulic electric andelectronic.)

UNIT – II

3. Automatic loading and unloadingdevices.

4. Transfer line jigs and fixtures for the operation of Multi-drilling, boring, milling andgrinding.

UNIT – III

5. Universal Jigs andFixtures.Transfer-devices, transfer machines, modulation-design concept, in processgauging

UNIT – IV

6. Design of Dies: Elements of Dies and Punch. Types and design procedure, progressive dies, drawing die, bending die,Analysis

Reference Books:-

1. Jones, F.D. (1920).*Jigs and Fixtures Design*. The machinery Publishing Company. London.
2. Colvin, F. H. & Hass, L. L.(1978). *Jigs and Fixtures*. McGraw-Hill Publ. Co. Ltd
3. The Industrial Press 1972). *Jigs and Fixtures Design.* Allied Publishers Pvt. Ltd.
4. Town, H. C. (1980). *Manufacturing Technology*.Batsford H.

Course Name: Modeling and Simulation

Course Code: 105911

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **Fundamentals:** Introduction and Simulation Examples: Types of transport phenomenon-based model, mathematical-based simulation model. Uses of Mathematical model, Principles of formulation, fundamental Laws, continuity equitation, Energy equation, equation of motion, transport equation, Equation of state, Equilibrium, ChemicalKinetics.

UNIT – II

2. **Examples Of Mathematical Models Of Chemical Engineering Systems**: series of isothermal constant hold up CSTR,,s, CSTR,,s with variable hold ups, Two heated tanks, Gas Phase pressurized CSTR, non-isothermal CSTR, single

component, Multi component flash vaporizer drum, Batch distillation with hold up, Ph system, equilibrium constant, Titration curvemethod

UNIT – III

3. **Numerical Methods (Iterative Convergence Methods):** Interval halving, Newton Raphson method, False Position, Explicit convergence method, Muller method, Numerical integration algorithm; Euler method, Runga-Kutta Algorithm, Implicitmethods

UNIT – II

4. **Simulation Examples**: Gravity flow tank, Three CSTRs in series, Non-isothermal CSTR, Binary distillation column, Multi-component distillation column, Batch reactor, Biochemical reactors and absorption

Reference Books:

1. Bequette, B.W. (1998).*Process Dynamics. Modeling, Analysis, and Simulation*. Prentice Hall International.
2. Leuben, W.L. (1973).*System Modeling and Simulations Control for Chemical Engineers*. PHI.
3. Pitarch,,J.L.,Palacín,C.G. Merino, A., and Prada,C.(2013).Process Modeling and Simulation. McGrawHill

Course Name: Industrial Tribology

Course Code: 105912

Semester: 8th

	L	T	P
Credits: 04	**3**	**1**	**0**

Course Contents

UNIT – I

1. **Introduction:** Friction, wear and lubrication, Types of Engg. Contacts: conforming and non-conforming. Types of Motion, rubbing, sliding, oscillating, Rolling and surface of interactions, elastic and plastic deformations, properties of materials, surface energy and flash temptheory

UNIT – II

2. **Friction:** Law of sliding friction, concept of adhesion, Taylor‟s model of friction, Measurement offriction.

3. **Wear:** Laws of wear, types of wear such as adhesive, declamation, abrasive, fatigue, corrosive, fretting erosive, electrical and oxidative. Measurement of wear in dry atmosphere and different environments control of wear, wear of cutting tool and dies, study of abrasion in grinding, lapping and honing

UNIT – III

4. **Lubricants:** Mechanisms of lubricants, boundary, squeeze film hydrodynamic and elasto hydrodynamic and hydrostatic lubricants plasto hydrodynamic lubricants, solution of Reynolds equation in two and three-dimensional flow. Pressure distribution, load carrying capacity, friction forces in oil film and coefficient of friction in journal bearing. Solid lubricant types and applications

5. **Bearing Design:** Design of bearing, Clearance in journal bearing, minimum film thickness, field number, oil grooves and flow of oil in axial and circumferential grooves, cavitations and turbulence in oil bearings, Heat generation and cooling or bearing hydrostatic and dynamic and their applications in machine tools, Design of air bearing ad other gasbearing

UNIT – II

6. **Rolling friction:** Reynolds‟s slip, concept, selection of roller bearings and their methods of lubrication, design aspects and modes of bearing failures and also hydrodynamic lubrication

7. **Solid Lubricants:** Solid lubricants and its applications in metal forming processes

Reference Books:

1. Sharma, P.C. & Agarwal, A.K. (2010). *Machine Design.*S K Kataria and Sons.
2. Shigley, J.E. &C. R. Mischke. (2004).Standard Handbook of Machine Design. McGrawHill.
3. Prabhu, B.S.(1999).*Industrial Tribology.* McGrawHill.

Course Name: Product Design and Value Engineering

Course Code: 105913

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. INTRODUCTION: Introduction to Product Design, Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumptioncycle.

UNIT – II

2. FUNCTIONAL and AESTHETICS CONSIDERATION: Basic design considerations, Role of Aesthetics in product design, Basic concept and elements of Visual design, Functional design practice.

UNIT – III

3. MANUFACTURING CONSIDERATION: Producibility Requirements in the design of machine components, Forging design, Pressed component design, Design for machining, Ease of location and Clamping, Some additional aspects of production design, Design of powder metallurgical parts, Redesigning on basis of productionconsideration.

UNIT – II

4. VALUE ENGINEERING: Concept of value, cost and price, customer and value, philosophy and objectives of value analysis, types of value, areas of application of value engineering, limitations of value analysis, difference between value engineering and cost reduction techniques; Tool of technology in value analysis, method and engineering, cause and effect diagram, SWOT analysis, break even analysis, systems approach; Job plan for value analysis approach: Information phase, Function Phase, Creation Phase, Evaluation Phase, Recommendation Phase, Implementation Phase, Audit Phase; Value Engineering Cell, value manual, composition of cell, Cost cutting, various cost cutting techniques; Case studies in value engineering and analysis from manufacturing and serviceindustries.

Reference Books:-

1. Ulrich, K. T. &Steven, D. (2019).*Product Design &Development*.McGraw-Hill Higher Education
2. Chitale, A.K.&Gupta, R.C. (2011).*Product Design &Engineering*.PHI Learning Private Limited.
3. Niebel, B.W.&Draper, A.B. (1976).*Product Design and Process Engineering*. McGraw-Hill Education.
4. Middendorf , W.H. (1989).*Design of Systems and Devices*.Marcel Dekker Inc.
5. Mudge, A.E. (1971). *Value Engineering*. McGraw-Hill Education
6. Miles, L.D. (2015).*Techniques of Value Analysis and Value Engineering*. Lawrence D. Miles Value Foundation.

Course Name: Finite Element Method

Course Code: 105914

Semester: 8th

	L T P
Credits: 04	**3 1 0**

Course Contents

UNIT – I

1. **Introduction:** Historical Background, Stresses and equilibrium, Boundary Conditions, Strain-Displacement Relations, Stress-Strain Relations, Temperature Effects, Vectors and Matrices
2. **Introduction and Fundamental Concepts:** Classification of Differential Equations, Rayleigh- Ritz Method, Galerkin‟s Method, Point Method, Least Square Method, Weighted Residual Method, Variational Formulation

UNIT – II

3. **1-D FE Modeling:** Finite Element Modeling, Coordinates and Shape Functions, Generalized Coordinates, Natural Coordinates in 1D, 2D and 3D, Coordinate Transformation, Assembly of Global Stiffness matrix and Load vector, Properties of Stiffness Matrix, Treatment of Boundary Conditions and Temperature Effects. Truss and BeamElements
4. **2-D FE Modeling:** Finite Element Modeling, Constant Strain Triangle (CST) , The Four Node Quadrilateral, Numerical Integration, Higher Order Elements; Nine Node Quadrilateral, Eight Node Quadrilaterals, Six NodeTriangle

UNIT – III

5. **Truss:** Introduction, Plane Trusses, Assembly of Global Stiffness Matrix and loadvector
6. **Higher-Order Elements:** Plate Bending, C0 and C1 Elements, Non-conforming Elements and PatchTest
7. **Scalar Field Problems:** Introduction, Steady-state heat transfer, Potential Flow, Fluid Flow in Ducts

UNIT – II

8. **Dynamic Considerations:** Element Mass Matrices, Evaluation of Eigen Values and Eigen Vectors. (Introductiononly)
9. **Computer Implementation:** Introduction; Computer Program Organization for Calculation of SystemMatrices

Reference Books:

1. Chandrupatla, T. &Belegundu, A. (2011). *Introduction to Finite ElementsinEngineering*. PHILearning Pvt. Ltd.
2. Bathe, K.J. (1996). *Finite Element Procedures.* PHILearning Pvt. Ltd.
3. Reddy, J. (2005).*An Introduction to Finite Element Method*.McGraw Hill Education.
4. Huebner, K.H. Dewhirst, Donald L. Douglas E. Smith. Byrom, Ted G. (2001).*The Finite Element Methods for Engineers*. JohnWiley
5. Zienkiewicz, O.C. (2007).*The Finite Element Method.* TMH.

Course Name: Non Destructive Testing

Course Code: 105915

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **Introduction:** Weld quality, Introduction to NDT, industrial importance of NDT,

comparison between destructive and non-destructivetesting.

2. **Quality Concept and NDT:** NDT as a quality tool, benefits from NDT, visual examination, liquid penetration and magnetic particletests

UNIT – II

3. **Ultrasonic Examination:** Principles of wave propagation, ultrasonic fields and their characteristics, generation of US waves, piezoelectric and magnetostrictive effects, calibration and control of ultrasonic testing equipment, ultrasonic testing of materials, pulse echoes, through-transmission and resonance methods oftesting.

UNIT – III

4. **Radiography:** X-ray and Gamma ray sources, equipments and accessories, radiography techniques, image quality indicators and screens, X-ray films, film processing and interpretation, radiation safety, fluoroscopy,Xero-radiography.
5. **Recent Methods used in the NDT:** Principles of acoustics emission, instrumentation and application, optical and acoustical holography, neutron radiography, thermography, and real time imaging.

UNIT – II

6. **Failure Analysis:** Material failure and failure due to the environmental effects, common causes of failure in metals and alloys, failure due to the improper heat treatment (e.g. overheating, burning, improper quenching, decarburizing etc.), embrittlement of metals, residual stresses in metals and their effects, defects in production/manufacturing e.g. segregation, blow holes etc., fundamentals of crack propagation.

References Books:

1. Das, A.K. (1997).*Metallurgy of Failure Analysis*, Tata McGrawHill.
2. Colangelo, V.J. and Heisler,F.A. (1974).*Analysis of Metallurgical Failures.*John Wiley and Sons, New York.

Course Name: Production and Planning Control

Course Code: 105916

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

INTRODUCTION: Types and Characteristics of Production Systems – (i) Continuous or Process Production (ii) Mass Flow Line Production. PPC Phases – Planning Phase, Action Phase, Control Phase, Implications for Production planning and InventoryControl

UNIT – II

1. FORECASTING: Definition and Concept, Purpose of Sales Forecasting, Basic elements of sales forecasting, Techniques of Forecasting – Time Series Analysis ; Delphi Method, Forecasting by moving average, Weighted Moving Average, Exponential Smoothening, Correlation Analysis and Linear RegressionAnalysis.

2. INVENTORY CONTROL and MANAGEMENT: Inventory Control, Types Of Inventory, objectives of Inventory Control, Economic Order Quantity (EOQ) Inventory Models, ABC Analysis – Need and Procedural Steps: Material Requirement Planning (MRP) – Function – Inputs to MRP, Bill of Material(BOM).

UNIT – III

3. PROCESS PLANNING: Introduction and Concept, Information Required to Process Planning, Process Planning Procedure, Make or Buy decisions, Process Analysis, Process chart – Outline and Symbols, Automated Process Planning – Computer Assisted Process Planning (CAPP), Group Technology(GT).

4. PRODUCTION SCHEDULING: The Production Environment, Controlling Continuous Production, Sequencing and Line Balancing Methodologies, Master Production Schedule(MPS)

– Managing the Master Production Schedule, Maintenance of MPS – Scheduling in Manufacturing Systems – Conventional and FlexibleSystems.

UNIT – II

5. SUPPORTING PPC ACTIVITIES: Enterprise Resource planning (ERP) – Objective and Advantages of ERP, Supply Chain Management (SCM) – Definitions, Need, SCM Models, Concept of Lean Manufacturing (LM) and Just in time (JIT) in ProductionSystems.

ReferenceBooks:-

1. Seetharama, L.Narasimhan, Dennis. W. &Billinton, Peter. J. (1996).Production Planning and Inventory Control.Prentice Hall India Learning Private Limited.
2. Dryden, N. G. (1992). Production and Operation Management. Dryden Press.
3. Brown, R.J. (1977). Material Management System.John Wiley and Sons, New York.

Course Name: Product Design and Development

Course Code: 105917

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. VISUAL DESIGN: - Basic elements and concept of visual design-line color, Balance proportion, Size shape mass, unity and variety, Special relationships and composition in two and threedimensions.

UNIT – II

2. FORM and COLOR: - Elementary forms their characteristics and significance in design. Form transition, Form in relation to ergonomics, material and manufacturing process, color as an element of design, color clarification dynamics, interrelation of colors, colors and traditions; Psychological use of color form andmaterial.

UNIT – III

3. PRODUCT GRAPHICS:- Meaning and objectives of product graphics. Basic principles of graphic design, Visual communication aspects of product graphics, Graphics of displays and control panels,

4. PRODUCT DETAILING: - Standard fastening and joining details in different materials; Temporary and permanent joints: Detailing for plastic products, Detailing for fabricated products in sheetmetal.

UNIT – II

5. PRODUCT DEVELOPMENT:- Definition and objective, Role of designer in product development. Manufacturing and economic aspects of product development, Product promotions, productdevelopments.

Reerence Books:

1. Mayall, W.H. (1967).*Industrial Design for Engineers,* London life Books Ltd.
2. Huchingson, D.R. (1981). *New Horizons for Human Factors in Design*.McGraw-Hill College

Course Name: Total Quality Management

Course Code: 105918

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. Quality and Total Quality Management, Excellence in manufacturing/service, factors of excellence, relevance of TQM. Benefits ofTQM.
2. Concept and definition of quality, total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality ManagementModels,
3. Just-in-time (JIT): Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation, Role of JIT in lean manufacturing.

UNIT – II

4. Customer Satisfaction: data collection and complaint, redressalmechanism.
5. Planning Process: Policy development and implementation, plan formulation andimplementation.
6. Process Management: Factors affecting process management, Quality function development (QFD), and quality assurancesystem.

UNIT – III

7. Total Employees Involvement (TEI): Empowering employees: team building, quality circles, reward and Recognition, education and training, Suggestionschemes.
8. Problems solving Defining problem, Problem identification and solving process, QCtools.
9. Benchmarking definition, concept, process and types ofbenchmarking.

UNIT – II

10. Quality Systems: Concept of quality system standards: relevance and origin of ISO 9000, Benefits, Elements of ISO 9001, ISO 9002, ISO9003.
11. Advanced techniques of TQM: Design of experiments: failure mode effect analysis: Taguchi methods

BOOKS:

1. Raju, Sunder. (2008)*Total Quality Management.* Tata McGrawHill.
2. Zairi, M. (1991)*TQM for Engineers.*Woodhead Publishing.
3. Hradeskym, J.L. (1944)*Total Quality Management Handbook.*Tata McGrawHill
4. Dalela, Saurabh. (1999). *ISO 9000 quality System.* StandardPublishers Distributers.

Course Name: Maintenance Engineering and Management

Course Code: 105919

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. **INTRODUCTION**: Introduction to maintenance concepts: Corrective maintenance, Preventive maintenance, predictive maintenance, Total Productive maintenance, Maintenance economy and operation research (OR) techniques, Maintenanceorganization.
2. **CONDITION MONITORING and MAINTENANCE MANAGEMENT**: Introduction, Machine condition diagnosis Techniques, The economics of condition based maintenance, Formalized assessment of monitoring techniques; Condition based maintenance Policy, development in practice of MaintenanceManagement.

UNIT – II

3. **RELIABILITY CENTRED MAINTENANCE**: Changing world of maintenance, maintenance and Reliability Centred Maintenance (RCM), Reliability Centred Maintenance (RCM), seven Basic questions, applying the Reliability Centred Maintenance process, Reliability Centered Maintenance(RCM).
4. **TOTAL PRODUCTIVE MAINTENANCE**: Basic concept of Total productive maintenance (TPM), Maximizing Equipment effectiveness, twelve steps of TPM development, Preparation for introducing TPM Development Activities, Master plan for TPM Promotion, Basic policies and objectives of TPM.

UNIT – III

5. **SPARE PART MANAGEMTNT**: Strategies for spare parts management, ABC and XYZ analysis, just in time (JIT) lean manufacturing, Introduction to newapproaches.
6. **ROLE OF COMPUTERS IN MAINTENANCE**:- Role of computer in Preventive maintenance program, computerized trouble shooting, computerized maintenance management system, Functions of CMMS, Implementation of computerized maintenance managementsystems.

UNIT – II

7. **EQUIPMENT MANAGEMENT AND EVALUATION SYSTEM**: Approaches to equipment management, integrated approach of TPM, Participative approach of TPM, 5-Ps approach to equipmentmanagement.
8. **FAILURE STASTISTICS/ANALYSIS**: Failure Analysis of Mechanical Components and Troubleshooting, Failure Mode Effects and Critical Analysis, Weibull Analysis, Fault Tree Analysis,FRACAS.

Reference Books:-

1. Nakajima, S. (1988*). Introduction to TPM*.Productivity Pr.
2. Higgins, L. (1994). *Maintenance Engineering Handbook*.McGraw-Hill Education.
3. Kelly, A. (1986). *Maintenance Planning and Control*.Butterworth-Heinemann Ltd
4. Khanna, O. P. (1985).*Industrial Engineering and Management*. OP Khanna Pub.

Course Name: Management Information System

Course Code: 105920

Semester: 8th

L T P

Credits: 04 **3 1 0**

Course Contents

UNIT – I

1. INTRODUCTION: Organization and management, Management classification and Functions, Organizational structure, scalar point, span of control, Unity of command. Organizational systems, Open and Closed system, Application of systems concept to an organization, Information system, characteristics ofMIS.

UNIT – II

2. INFORMATION SYSTEM AND CONTROL: Definition of information, Components of Information system, Evolution of Information systems Technology – The First generation, The Second generation, The Third generation, The fourth generation and Information systems today, Computer Hardware, A sample program, Data Representation, File processing and database processing. Case studies. Enterprise Information systems – Applications and goals. Information systemcontrol.

UNIT – III

3. DECISION MAKING: Phases in Decision making process, Behavioral models of decision maker classical Economic model, Administrative Model. Methods for decisions among alternatives, optimization techniques, pay off matrices, decision trees, Utility and Inference curves, statistical Technologies, Mini casestudies.

UNIT – IV

4. DECISION SUPPORT SYSTEMS: Characteristic of DSS, classes of DSS, Expert system cases, computer based decision support system, developing and implementing

applicationsystem

– life cycle approach, [prototyping approach, Quality assurance and evaluation of Information systems. Future development and Impact of Information Technology on organization and Society.

ReferenceBooks:-

1. Mudrick, Ross &Clagget.(1971).*Information systems for Modern Management*.Prentice Hall.
2. Davis and Olson.(1985). *Management Information systems*.McGrawHill.
3. Lucas,H.C. (1983). *Information systems for management.* McGrawHill.
4. Kanter, J. (1983). *Jerome,Management Information System*.Prentice Hall.
5. Davis, G.B. andOlson, M.H. (1985).*Management Information System*.McGraw-Hill Inc.
6. Kroenke andHatch, (1993).*Management Information System*.McGraw-Hill Publishing Co.

Total Number of Courses	**70**
Number of Theory Courses	**39**
Number of Practical Courses	31
Total Number of Credits	**214**

Annexure-3

Academic Instructions

Attendance Requirements

A student shall have to attend 75% of the scheduled periods in each course in a semester; otherwise he / she shall not be allowed to appear in that course in the University examination and shall be detained in the course(s). The University may condone attendance shortage in special circumstances (as specified by the Guru Kashi University authorities). A student detained in the course(s) would be allowed to appear in the subsequent university examination(s) only on having completed the attendance in the program, when the program is offered in a regular semester(s) or otherwise as per the rules.

Assessment of a course

Each course shall be assessed out of 100 marks. The distribution of these 100 marks is given in subsequent sub sections (as applicable).

	Internal (50)						**External (50)**	**Total**
Components	**Attendance**	**Assignment**			**MST 1**	**MST2**	**ETE**	
		A1	A2	A3				
Weightage	10	10	10	10	30	30	50	
Average Weightage	10	10			30		50	100

Passing Criteria

The students have to pass both in internal and external examinations. The minimum passing marks to clear in examination is 40% of the total marks.