UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

V SEMESTER

MECHANICAL ENGINEERING

SCHEME -2013

V SEMESTER

MECHANICAL ENGINEERING (M)

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/P				
13.501	Engineering Mathematics - IV (BCHMPSU)	4	3	1	-	50	3	100	150
13.502	Theory of Machines (MP)	4	3	1	-	50	3	100	150
13.503	Industrial Electronics (MP)	3	2	1	-	50	3	100	150
13.504	Mechanics of Materials (M)	4	3	1	-	50	3	100	150
13.505	Machine Tools (MN)	4	3	1	-	50	3	100	150
13.506	ELECTIVE I	4	3	1		50	3	100	150
13.507	Production Engineering Lab (M)	3	-	-	3	50	3	100	150
13.508	Electrical & Electronics Lab (MP)	3	-	-	3	50	3	100	150
	Total	**29**	**17**	**6**	**6**	**400**		**800**	**1200**

13.506 ELECTIVE I

13.506.1	Professional Ethics and Human Values (MPU)
13.506.2	Advanced Welding Technology (MPU)
13.506.3	Foundry Technology (MPU)
13.506.4	Advanced Fluid Mechanics (MPU)
13.506.5	Composite Materials Technology (MPU)
13.506.6	Non Destructive Testing (MPU)
13.506.7	Powder Metallurgy (MPU)
13.506.8	Human Aspects of Management (MP)
13.506.9	Environmental Science (MP)
13.506.10	Environmental Pollution Control (MP)
13.506.11	Disaster Management (MP)

13.501 ENGINEERING MATHEMATICS - IV (BCHMPSU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To provide a basic understanding of random variables and probability distributions.*
- *Mathematical programming techniques are introduced as a part of this course. These techniques are concerned with the allotment of available resources so as to minimize cost or maximize profit subject to prescribed restrictions.*

Module – I

Random Variables -Discrete and continuous random variables and their probability distributions-Probability distribution (density) functions - Distribution functions - mean and variance-simple problems-
Binomial distribution, Poisson distribution, Poisson approximation to Binomial, Uniform distribution, Exponential Distribution, Normal distribution - mean and variance of the above distributions(derivations except for normal distribution) - Computing probabilities using the above distributions.

Module – II

Curve fitting - Principle of least squares - Fitting a straight line – Fitting a parabola-Linear correlation and regression - Karl Pearson's coefficient of correlation - Sampling distributions - Standard error –Estimation - Interval estimation of population mean and proportions(small and large samples)- Testing of hypothesis - Hypothesis concerning mean - Equality of means - Hypothesis concerning proportions- Equality of proportions.

Module – III

Linear programming - Formation of LPP - General linear programming problem - Slack and surplus variables - Standard form - Solution of LPP - Basic solution - Basic feasible solution - Degenerate and non-degenerate solutions - Optimal solution - Solution by simplex method - Artificial variables - Big-M method.

Module – IV

Duality in LPP - Properties of primal and dual optimal solutions - solution using duality- Transportation problem and Assignment problem.

References:

1. Veerarajan, T., *Probability, Statistics and Random Processes,* 3/e, Tata McGraw Hill, 2002.

2. Papoulis A. and S. U. Pillai, *Probability, Random Variables and Stochastic Processes*, 3/e, Tata McGraw Hill, 2002.
3. Koneru S. R., *Engineering Mathematics*, 2/e, Universities Press (India) Pvt. Ltd., 2012.
4. Bali N. P. and M. Goyal, *Engineering Mathematics*, 7/e, Laxmi Publications, India, 2012.
5. Kreyszig E., *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
6. Swarup, K., P. K. Gupta and Manmohan, *Operations Research*, 6/e, Sulthan Chand and Sons, 1978.
7. Sharma S. D. and H. Sharma, *Operations Research: Theory, Methods and Applications*, 13/e, Kedar Nath and Ram Nath, 1972.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of this course, the students will be familiar with the large scale applications of linear programming techniques which require only a few minutes on the computer. Also they will be familiar with the concepts of probability distributions which are essential in transportation engineering.

13. 502 THEORY OF MACHINES (MP)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To provide basic knowledge on kinematics of mechanisms and machines, synthesis of mechanisms, synthesis of cams, theory of gears and gear trains, belt rope drives and clutches.*
- *The knowledge of these topics are essential for students to develop their skills to solve practical design problems in the area of mechanisms and machines in the future courses.*

Module – I

Introduction: Terminology, basic definitions and concepts –Kinematics – Links-Kinematic pairs- Kinematic chains-mechanism and machine-degrees of freedom and mobility-Grubbler's criterion -Kinematic inversions-Grashoff's law.

Straight line motion mechanisms – Watts mechanism, Paucellier mechanism, Hart mechanism - Automobile steering mechanisms- Davis and Ackermann steering mechanisms

Intermittent motion mechanism - Geneva mechanism.

Synthesis-Kinematic synthesis of planar mechanisms: Type synthesis, number synthesis, dimensional synthesis-Function generation and path generation-Precision points-Chebyshev's spacing-two and three position synthesis of four bar and slider cranks mechanisms-Analytical method -Freudenstein's equation.

Module – II

Kinematic analysis of planar mechanisms-Velocity and acceleration analysis –Instantaneous centre method - Aronhold Kennedy theorem-Locating I-centres (upto 6 link mechanisms) Velocity and acceleration diagrams using relative velocity method (Graphical approach only)- Coriolis component of acceleration-Velocity and acceleration analysis of slider crank mechanism.

Module – III

Cams: Classification of followers and cams- cam nomenclature -description of follower movement- construction of displacement diagrams: uniform velocity, simple harmonic motion, parabolic or uniform acceleration motion, cycloidal motion-synthesis of cam profile-graphical approach.

Gears: Classification-Helical, spiral, bevel and worm gears (description only).

Spur gear: terminology-law of gearing-gear tooth forms-path of contact-arc of contact-interference and under cutting – minimum number of teeth-gear standardization.

Gear trains: Types of gear trains - analysis of simple, compound, reverted and epicyclic gear train-torque in epicyclic gear train.

Module – IV

Applications of friction: Pivot and collar thrust bearings-uniform pressure and uniform wear theory-friction clutches-single and multi-plate clutches.

Brakes: Shoe Brake, Band brake.

Belt drives: types of belt drive-law of belting-slip and creep of belt-length of belt-ratio of belt tensions-centrifugal tension-condition for maximum power transmission-effect of initial tension on power transmission-V-belt-ratio of belt tensions, Rope drives (description only).

References

1. Shigley J. E. and J. J. Uicker, *Theory of Machines and Mechanisms*, McGraw–Hill, 1980.
2. Bevan T., *Theory of Machines- A Text Book for Engineering Students,* Pearson, 2011.
3. Wilson C. E. and J. P. Sadler*, Kinematics and Dynamics of Machinery*, Pearson, 2003.
4. Rattan S. S., *Theory of Machines*, McGraw Hill, 2009.
5. Ambekar A. G., *Mechanism and Machine Theory*, PHI Learning, 2007.
6. Gosh A. and A. K. Mallick, *Theory of Machines and Mechanisms*, Affiliated East West Press, 1988.
7. Ballaney P. L., *Theory of Machines and Mechanisms*, Khanna Publishers, 2005.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

- *The students will understand the various aspects of mechanisms and machines.*
- *The students will have the basic knowledge to solve design problems in the area of mechanisms and machines.*

13.503 INDUSTRIAL ELECTRONICS (MP)

Teaching Scheme: 2(L) - 1(T) - 0(P) **Credits**: 3

Course Objectives:

- *To learn industrial electronics in applied manner with perspective of mechanical engineering.*
- *To introduce the design philosophy for mechanical processes control based on analog and digital electronics*

Module – I

Fundamentals of Digital Electronics: Number systems - binary, octal and hexadecimal and their conversions. Signed numbers. Transition table of D and T flip-flops. Concepts of registers and counters, 3 stage register using D flip-flop and 3 stage counter using T flip-flop. Principle of operation of SCR, IGBT, Photo transistor and LDR. TFT display.

Module – II

Industrial Applications of optoelectronic devices– smoke detection, level detection and counting of moving objects. Data acquisition system - block diagram and explanation of each block. Dielectric heating and Induction heating - principle and applications. Resistance welding and sequence timer. Measurement of pressure, displacement, level, flow, thickness, viscosity and PH.

Module – III

Micro controllers: Architecture of Intel 8051, pin functions, addressing modes. Instruction sets of 8051, Programming examples (addition, subtraction, 8 bit multiplication, 8 bit division, largest and smallest among an array of 8 bit numbers). Interface with seven segment LED, LCD and ADC. Temperature control using 8051 based system.

Module – IV

Control systems: Open loop and closed loop control systems, Transfer function - Principles of P, I, D, PI, PD, PID controllers, Electrical and mechanical systems. Second order systems - response to impulse and step input. Time domain specifications - rise time, delay time, peak time and peak overshoot. Stability of a system: definition, stability analysis using Routh Hurwitz criterion, stability analysis in frequency domain using Bode plot.

References:

1. Rai H. C*., Industrial and Power Electronics*, 10/e, Umesh Publications, 2009.

2. Mazidi M. A., *The 8051 Microcontroller and Embedded Systems*, 2/e, Pearson, 2009.
3. Jain R. P., *Modern Digital Electronics*, 9/e, TMH, 2006.
4. Kuo B. C., *Automatic Control Systems*, 7/e, PHI, 2013.
5. Kishore, *Electronic Measurements and Instrumentation*, Pearson, 2012.
6. Storey N., *Electronics: A System Approach*, Pearson, 2011.
7. Paul B., *Industrial Electronics and Control*, 3/e, PHI, 2014.
8. Nagabhushna S., *Lasers and Optical Instrumentation*, I K International, 2010.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of the course, the students will be familiar with the use of electronic devices and systems in the field of mechanical engineering.

13.504 MECHANICS OF MATERIALS (M)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objective:

- *To impart concepts of stress and strain analysis in a solid.*
- *To study the methodologies in theory of elasticity at a basic level.*
- *To acquaint with energy methods to solve structural problems.*

Module – I

Stress at a point – symmetry of stress components - normal and tangential components of stresses on an oblique plane - stress tensor - Cauchy's equations - Stress transformation - principal stresses and planes - strain at a point - strain tensor - analogy between stress and strain tensors - strain-displacement relations. Compatibility conditions – Stress-strain relations for isotropic materials – Lame's constants – Relationship between elastic constants.

Module – II

2-D problems in elasticity: Plane stress and plane strain problems – Airy's stress function – solutions by polynomials – solutions of elastic problems for given polynomial functions
Equations in polar coordinates - Axisymmetric problems – stresses in thick cylinders – Lame's thick cylinder problem - interference fit – stresses in rotating discs.

Module – III

Energy methods in elasticity: Strain energy of deformation - special cases of a body subjected to concentrated loads, due to axial force, shear force, bending moment and torque – reciprocal relation -Maxwell reciprocal theorem - Castigliano's first and second theorems - Principle of virtual work - minimum potential energy theorem - complementary energy.

Module – IV

Special problems in bending: Unsymmetrical bending – curved beams with circular and rectangular cross section – shear centre.

Torsion : Saint Venant's theory - Prandtl's method - solutions for circular and elliptical cross-sections - membrane analogy - torsion of thin walled open and closed sections- shear flow.

References:

1. Sreenath L. S., *Advanced Mechanics of Solids*, Tata McGraw Hill, 2009.

2. Jose S., *Mechanics of Materials*, Pentagon, 2012.
3. Timoshenko S. P. and J. N. Goodier, *Theory of Elasticity*, McGraw Hill, 1951.
4. Hartog J. P. D., *Advanced Strength of Materials*, Courier Corporation, 2014.
5. Wang C. K., *Applied Elasticity*, McGraw Hill. 1953.
6. Kazimi S. M. A., *Solid Mechanics*, Tata McGraw Hill, 2001.
7. Ugural A. C., *Mechanics of Materials*, Wiley, 2007.
8. Hibbeler R.C., *Mechanics of Materials*, Pearson, 2005.
9. Popov E.P., *Mechanics of Materials*, Prentice Hall, 1991.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of the course,

- *The student should be able to understand how mathematical modelling of problems on stress analysis are formulated.*
- *To equip the student with an ability to use different methodologies in theory of elasticity at a basic level.*

13.505 MACHINE TOOLS (MN)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits:** 4

Course Objectives:

- *To impart the fundamental knowledge of mechanical machining processes that are now widely used in industries.*
- *To impart knowledge about various machine tools, machining processes, cutting tools, selection of these and the forces in these processes.*
- *To outline the widely used unconventional machining processes.*

Module – I

Fundamentals of Metal cutting: Orthogonal and Oblique cutting – Chip formation, Types of chips – Tool Geometry – Tool Signature – Machinability – Tool wear, wear measurement – Factors affecting tool life. Analysis of orthogonal cutting – Cutting forces – Merchant's theory (simple problems). Economic of Machining.

Cutting Tools: Materials, Characteristics, Selection for different work piece materials and cutting speeds. Tool inserts – Specification. Cutting Fluids.

Module – II

Lathe: Types, Working, Size specification. Feeding Mechanisms – Apron mechanism. Work piece holding in lathe – Lathe attachments. Machining operations with lathe. Measurement of cutting forces in lathe. Semi-automatic Machine Tools – Turret and Capstan Lathes. Automatic Lathe – Single spindle and Multi-spindle machines.

Shaper: Machine, Mechanism – Mechanical, hydraulic. Shaper operations – Cutting tools used – Calculation of cutting speed.

Module – III

Milling: Types of machines – Principal parts – Types of milling cutters – Elements of plain milling cutters – Up milling, Down milling – Types of milling operations – Indexing – Simple Indexing, Differential indexing, Simple problems. Measurement of cutting forces in milling.

Grinding: Types of machines – Classification – Working. Features of Centreless and Tool post grinder. Grinding Operations. Grinding wheels – Fabrication, Specification, Selection – Glazing and Loading of Wheels – Dressing and Truing of Grinding wheels. Measurement of cutting forces in grinding.

Module – IV

Unconventional machining: Features of processes and machines – EDM, Wire cut EDM, ECM, LBM, USM, AJM, AWJM, EBM and Chemical Machining.

High energy rate forming: Concept, Processes – Explosive forming, Hydro forming, Electromagnetic forming.

Transfer machines: Concept, Mechanisms.

References:

1. Kalpakjian S., *Manufacturing Engineering and Technology*, 6/e, Pearson Education, 2009.
2. DeGarmo E. P., J. T. Black and R. A. Kohser, *Materials and Processes in Manufacturing*, John Wiley and Sons, 2011.
3. Ghosh A. and A. K. Mallik, *Manufacturing Science*, Affiliated East West Press, 2002.
4. Rao P. N., *Manufacturing Technology*, - *Metal Cutting and Machine Tools*, Vol. 2, Tata McGraw Hill, 2009.
5. HMT, *Production Technology*, Tata McGraw-Hill, 2001.
6. Youssef H. A. and H. El-Hofy, *Machining Technology: Machine Tools and Operations*, CRC Press, 2008.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After completing the studies of the content of this syllabus, students must be able to identify and select the machine, the machining process and the cutting tool when a particular product is to be manufactured

13. 506.1 PROFESSIONAL ETHICS AND HUMAN VALUES (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To facilitate the development of a holistic perspective among students towards life, profession and happiness, based on a correct understanding of human reality and the rest of existence.*

Module – I

Human values: Morals, Values and Ethics – Integrity – Work Ethic –Service – Learning – Civic Virtue – Respect for Others – Living Peacefully – Caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self Confidence – Character – Spirituality.

Engineering ethics: Senses of "Engineering Ethics"– Variety of moral issues. Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of Professionals Roles – Theories about right action – Self interest – Custom and religion – Uses of ethical theories.

Module – II

Engineering as social experimentation: Engineering as experimentation - Engineering as responsible experimenters – Codes of ethics – A balanced outlook on law – The challenger case study.

Safety, responsibilities and rights: Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – The Three Mile Island and Chernobyl case studies.

Module – III

Harmony in the family and Society – Understanding values in human-human relationship – foundational values of relationship, Trust and respect – Difference between intention and competence- Difference between respect and differentiation

Collegiality and loyalty – Respect for authority – collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual property Rights (IPR) – Discrimination.

Module – IV

Global issues: Multinational Corporation – Environmental ethics – Computer ethics Weapons development – Engineers as managers – Consulting engineers and engineers as expert witness and advisor – Moral leadership.

Sample code of ethics like ASME, ASCE, IEEE – Institution of engineers (India) – Indian Institute of Materials Management – Institution electronics and telecommunication engineering (IETE) India etc.

References

1. Suresh J. and B. S. Raghavan, *Human Values and Professional Ethics*, S. Chand & Co., 2009.
2. Martin M. W. and R. Schinzinger, *Ethics in Engineering*, 4/e, McGraw Hill, 2005.
3. Roth J. K., *International Encyclopaedia of Ethics*, S. Chand &Co, 2000.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

- *The students will be able to see that their practice in living is not in harmony with their natural acceptance most of the time, and all they need to do is to refer to their natural acceptance to remove this disharmony.*

13. 506.2 ADVANCED WELDING TECHNOLOGY (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To impart knowledge regarding various advanced welding practices in industries*
- *To understand the various parameters and requirements for welding processes.*
- *To know the comparative merits and demerits of various welding processes*
- *To understand the right kind of welding technique suitable for various joints.*
- *To learn about the joint designs adopted in different types of welding techniques*

Module – I

Radiant Energy welding processes: Electron Beam Welding- Background of the Process, Guns, Weld Environment, Welding in Different Degrees of Vacuum non vacuum electron beam welding. Equipment and Safety, Joint Design, Applications, Laser Beam Welding-Laser sources, Process Parameters, Applications, Advantages and Limitations.

Plasma arc welding: Plasma Arc Welding- theory and Principles, Transferred arc and Non-Transferred arc Techniques, Equipment and Tooling, Joint Design Advantages, Disadvantages, Economics, Materials and Applications.

Module – II

Needle Arc Micro Plasma Welding - Characteristics of Process, Operating Characteristics, Fixturing and Joint Design Shielding, Weld Penetration and Shape, Applications.

MIG welding-Basic principle Process Parameters, Applications, Advantages, Limitations and Recent developments, TIG welding- Basic principle, Process Parameters, Applications, Advantages, Limitations and Recent developments.

Adhesive Bonding- theory and Key Parameters, Physical Characteristics, Metal Adhesive, Equipment, Design, Economics of Process, Materials and Applications.

Module – III

Explosive Welding- theory and Key Variables, Parameters, Weld Quality, Equipment and Tooling, Advantages and Limitations, Joint Design, Materials and Applications.

Friction Welding- Basic Principles, Process Variants, Different Stages, Mechanism of Bonding, Influence of Process Parameters, Weld Quality and Process Control, Joining of Dissimilar Materials, Advantages, Limitations, Applications. Friction stir welding, Basic Principle, Process Variants and Applications.

Module – IV

Diffusion Welding- theory and Principle of Process, Key Variables, Intermediate Materials, Deformation Welding, Equipment and Tooling, Joint Design, Economics, Advantages and Limitations, Materials and Applications. Vacuum brazing: Vacuum Brazing- theory,

mechanisms and Key Variables, Equipment and Tooling, Stop-Off and Parting Agents, Advantages, Limitations, Economics, Materials and Applications. Fusion bonding - Basic Principle, Process Variants and Applications. Ultrasonic welding- Basic Principle, Process Variants and Applications.

References

1. Schwartz M.M., *Metals Joining Manual*, McGraw-Hill Inc., 1979.
2. *ASM Metals Hand Book - Welding and Brazing*, Vol. 6, ASM, Ohio, 1988.
3. Amar R.S., *Welding Processes and Technology*, Khanna Publishers, Delhi, 1998.
4. Rossi B. E., *Welding Engineering*, McGraw Hill, 1954.
5. Udin H., E. R. Funk and J. Wuff, *Welding for Engineers*, Wiley, 1954.
6. Teo Goisky, *The electric welder*.
7. Welding Engineers Hand Book- ASHE Vol . I, II, III and IV.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

- *Students are introduced to various advanced welding techniques which make them interested to choose a career in the field of welding.*
- *Students will understand the advanced welding practices in Industries and their comparative merits and demerits.*
- *Students will be able to choose the right kind of welding techniques for joining raw materials of various thicknesses.*
- *Students will be able to choose appropriate welding technique suitable for joining various types of metals.*

13. 506.3 FOUNDRY TECHNOLOGY (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To impart knowledge regarding various moulding techniques.*

Module – I

Introduction to casting process and its potential, Chronology of the art of founding -Pattern making-pattern materials, Factor effecting the choice of pattern materials ,pattern allowances, types of pattern, colour codes of pattern , pattern design.

Different types of moulding boxes – Green sand moulds, dry hand moulds, Loan moulds, plaster moulds, cement bonded moulds – bench moulding, floor moulding and pit moulding.

Module – II

Moulding sands : Natural sand , synthetic sand , sand mixing – General properties of moulding sand – Moulding materials-, moulding sand composition ,Testing sand properties, ingredients and the properties of moulding sand, Sand preparation, sand conditioning and reclamation, Indian sands and other sands.

Cores and core making – Purpose of cores – core prints – Types of cores – Core sand and ingredients – Requirements of core sands – Core sand mixtures – Binding materials – Core boxes – Types of core boxes – Process of core making – Core baking , core creating , core reinforcing – core venting.

Module – III

Gating system design-Pouring time, choke area, sprue, other gating elements, Gating ratios, slag trap system.

Risering design-Caine's method, modulus method, Naval research laboratory method, Feeding distances, chills, feeding aides.

Product design for sand casting-design for economical moulding, designing to eliminate defects, features to aid handling

Solidification of castings: mechanism of dendrite growth, solidification rate and time, Chvorinov's rule.

Module – IV

Special casting process: Permanent mould casting, shell moulding, CO_2 process, Expandable pattern casting (lost form). Precision investment casting, centrifugal casting, die casting, die casting alloys.

Melting and pouring : Types of furnaces used for cast irons , steels and non ferrous metals – Composition , size and charge calculations – Mechanisation in foundry – Elementary ideas of machines used for sand conditioning, sand supply , moulding , core making . knock out and fettling.

References

1. Heine R. W., C. R. Loper and P. C. Rosenthal, *Principles of Metal Casting*, Tata McGraw Hill, New Delhi, 2004.
2. Rao P. N., *Manufacturing Technology – Foundry, Forming and Welding (Vol 1)*, Tata McGraw Hill, 1992.
3. Khanna O. P., *Foundry Technology*, 15/e, Dhanpath Rai Publications, New Delhi, 2008.
4. Jain P. L., *Principles of Foundry Technology*, McGraw Hill, 2003.
5. Campbell J. S., *Principles of Manufacturing Materials and Process*, McGraw Hill, 1961.
6. Jain R. K. and S. C. Gupta, *Production Technology*, Khanna Publishers, 1972.
7. Lal M. and Khanna, *A Text Book of Foundry Technology*, Dhanpath Rai Publications, New Delhi, 1984.
8. Polukhin P., Grinberg B., S. Kantenik, V. Zhadan and D. Vasilyev, *Metal Process Engineering*, Mir Publishers, 1973.
9. Lindberg R. A., *Processes and Materials of Manufacture*, Prentice Hall, 1990.
10. Kalpakjian S., Schmid and R. Steven, *Manufacturing Engineering and Technology*, Pearson Education, 2005.
11. *ASM Handbook – Metals Handbook (Vol 1.)*, ASM International, 1990.
12. Campbell J., *Castings*, Butterworth Heinemann, Oxford, 2005.
13. Beeley P. R., *Foundry Technology*, CBS publishers, New Delhi, 2001.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

Students are introduced to various advanced moulding techniques and practices in Industries and their comparative merits and demerits.

13. 506.4 ADVANCED FLUID MECHANICS (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To provide the student with some specific knowledge regarding fluid-flow phenomena observed in mechanical engineering systems, such as potential flow, vortex flow, boundary-layer flows, etc.*
- *To undertake sustained learning in fluid mechanics to advance their knowledge of this field.*
- *To enhance the understanding of fluid mechanics, including the equations of motion in differential form and turbulence.*

Module – I

Basic Concepts and Fundamentals: Fluid statics, Cartesian Tensors, Fluid Kinematics, and Description of fluid motion – Lagrangian and Eulerian approaches. Types of motion of fluid elements, Vorticity and circulation – Concept of rotational and irrotational flows. Equation of motion of forced and free vortex flow, acceleration, temporal acceleration, convective acceleration.

Stream function and Potential function. Stream function and its relation with velocity field. Relation between stream function and stream lines - Relation between stream function and velocity potential for a 2-D irrotational and incompressible flow. Relation between stream lines and lines of constant potential. Sketching of stream lines. Reynolds transport theorem, derivation of continuity and momentum equations using Reynolds transport theorem. Problems on the application of momentum equation.

Module – II

Potential flow: Uniform flow, source flow, sink flow, free vortex flow and super imposed flow-source and sink pair, doublet, plane source in a uniform flow(flow past a half body), source and sink pair in a uniform flow(flow past a Rankine oval body), doublet in a uniform flow(flow past a circular cylinder). Pressure distribution on the surface of the cylinder. Flow past a cylinder with circulation, Kutta-Juokowsky's law. Complex flow potential, complex flow potentials for source, sink, vortex and doublet. Potential flow between two parallel plates, potential flow in a sector. Introduction to conformal transformation, conformal mapping.

Module – III

Incompressible viscous flow. Concepts of laminar and turbulent flows . Stokes viscosity law. Navier Stoke's equation and significance (Derivation not necessary).Simplification of Navier Stoke's equation for steady incompressible flows with negligible body forces. Parallel flow

through straight channel and couette flow. Hagen - Poiseuille flow. Derivation of Hagen Poissuille equations for velocity and discharge through a pipe, derivation of friction factor for laminar flow, Couette flow for negative, zero and positive pressure gradients, flow in a rotating annulus, Viscometer based on rotating annulus.

Module – IV

Boundary layer theory, Boundary layer thickness, Displacement thickness, momentum thickness, Energy thickness and their calculation. Laminar Boundary Layers, Prandtl Boundary layer equations; Boundary layer on a flat plate, Blasius solution for flow over a flat plate, Von- Karman momentum integral equations, Pohlhausen approximation solution of boundary layer for non-zero pressure gradient flow, favorable and adverse pressure gradients, Entry flow into a duct, flow separation and vortex shedding.

Turbulent Flow: Introduction to turbulent flow, Governing equations of turbulent flow, Turbulent boundary layer equation, Flat plate turbulent boundary layer, Fully developed Turbulent pipe flow for moderate Reynold's number, Prandtl mixing hypothesis, Turbulence modeling. Boundary layer control.

References

1. Muralidhar K., G. Biswas, *Advanced Engineering Fluid Mechanics*, Alpha Science International limited, 2005.
2. Schlichting H., K. Gersten, *Boundary Layer Theory*, 8/e, Springer 2000.
3. Streeter V. L. and E. B. Wylie, *Fluid Mechanics*, McGraw-Hill, 1979.
4. Shames I. H., *Mechanics of Fluids*, 4/e, McGraw-Hill, 2002.
5. Kumar D. S., *Fluid Mechanics and Fluid Power Engineering*, S. K. Kataria & Sons, 1987.
6. Rama D. D., *Fluid Mechanics and Machines*, New Age International, 2009.
7. Bansal R. K., *A Text Book of Fluid Mechanics and Machines*, Laxmi Publications, 2010.
8. Douglas J. F., *Fluid Mechanics*, Pearson Education, 2005.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

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

- *Recognize the particular flow regime that is present in a typical engineering system.*
- *Demonstrate the concept of stream function, potential function and boundary layer.*
- *Calculate the vorticity of a given velocity field and analyze the vorticity in idealized vortices: forced vortex and free vortex.*
- *Choose the appropriate fluid mechanics principles needed to analyze the fluid-flow situations.*
- *Recognize how fluid flow theory can be employed in a modern mechanical engineering design environment.*

13. 506.5 COMPOSITE MATERIALS TECHNOLOGY (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

To provide a sound understanding of

- *composite materials used for engineering applications*
- *manufacturing methods and properties of MMCs, PMCs and CMCs*
- *micro mechanics of laminated composites.*

Module – I

Composite Materials:- Definition, characteristics, Classifications based on structure reinforcement and matrices, Structural, functional and smart composites, Advantages and limitations, History, Industrial scene, Applications.

Reinforcement – fibres – Glass fibre, Aramid fibre, Carbon fibre, boron fibre – fabrication – properties, applications – comparison of fibres – particulate and whisker reinforcement.

Matrix materials Wettability- - Interfacial bonding, Rule of mixtures.

Module – II

Introduction to orthotropic materials, generalized Hook's Law, Lamina and laminate, Introduction to micro-mechanics of laminated composites:-terminology and notation-nomenclature for defining stacking sequences –coordinate system.

Mechanics of laminated composites-Definition of strain and displacement – Definition stress and moment resultants- Constitutive Equations for a Laminate- Physical Meanings of the [A], [B], and [D] matrices.

Toughening mechanisms of composites, failure modes.

Module – III

Metal Matrix Composites (MMC): Metals. Inter-metallics and alloys used for MMC and their properties, Manufacturing methods of MMC: Stir Casting, Compocasting, powder metallurgy route, osprey method, in-situ - their properties-characteristics and applications.

Polymer matrix composites (PMC):- Thermo set, thermoplastic and elastomeric polymers, their properties, characteristics and utilisation as matrices, fiber performs.

Manufacturing methods:–autoclave/compression molding, filament winding, pultrusion, Properties and applications.

Module – IV

Ceramic Matrix Composites (CMC):- Classification of ceramics and their potential role as matrices. Manufacturing methods: slurry and hot pressing, sol-gel processing and Lanxide process, properties and applications of CMC using fine ceramics and glass as matrices.

Post processing operations: Machining, cutting, polishing. Welding of thermoplastic PMC. bonding and riveting . Advanced post processing methods like ultrasonic welding, waterjet cutting and laser machining.

Advances in composites: -Carbon / carbon composites – Advantages and limitations of carbon matrix, Introduction to nanocomposites.

References

1. Matthews F. L. and R. D. Rawlings, *Composite Materials, Engineering and Sciences* , Chapman & Hall, London, 1994.
2. Mallick P. K., *Fiber-Reinforced Composites: Materials, Manufacturing and Design*, CRC Press, 2007.
3. Jones R. M., *Mechanics of Composite Materials*, CRC Press, 1998.
4. Lubin G., *Hand Book of Composites*, Van Nostrand Reinhold Co., 1982.
5. *International Encyclopedia of Composites* (6 volumes), Ed. Lee S. M., VCH, New York, 1991.
6. Tsai S.W., *Introduction to Composite Materials*, Technomic Publishing Company, 1980.
7. Chawla K. K., *Ceramic Matrix Composites*, Chapman & Hall, 1993.
8. Schwartz M.M., *Composite Material Handbook*, McGraw Hill, 1984.
9. Gibson R., *Principles of Composite Material Mechanics*, Tata McGraw Hill, 1994.
10. Hyer M., *Stress Analysis of Fiber - Reinforced Composite Materials*, Tata McGraw Hill, 1998.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

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

- gain knowledge of commonly used matrix materials and reinforcements in composites.
- understand the manufacturing and post processing methods of composites.
- select suitable composite materials for applications based on property requirements.
- do micro mechanics based analysis of laminates.

13. 506.6 NON DESTRUCTIVE TESTING (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

To provide a sound understanding of

- *the basic principles of various non-destructive testing (NDT) methods.*
- *the importance applications and limitations of NDT.*

Module – I

Introduction: Visual methods: Optical aids, In-situ metallography, Optical holographic methods, Dynamic inspection.

Penetrant flaw detection: Principles, Process. Penetrant systems: Liquid Penetrant materials: Emulsifiers, cleaners, developers, sensitivity Advantages, Limitations, Applications.

Module – II

Radiographic methods and Limitations: Principles of radiography: sources of radiation, Ionising radiation - X-rays sources, generation and properties. Gamma-ray sources. Recording of radiation: Radiographic sensitivity, Fluoroscopic methods, special techniques, Radiation safety. Principle and application of in-motion and flash radiography.

Module – III

Ultrasonic testing of materials: Advantages, disadvantages, Applications. Generation of Ultrasonic waves, general characteristics of ultrasonic waves: methods and instruments for ultrasonic materials testing: special techniques.

Magnetic methods: Advantages, Limitations, Methods of generating fields: magnetic particles and suspending liquids Magnetography, field sensitive probes: applications. Measurement of metal properties.

Module – IV

Electrical methods: Eddy current methods: potential-drop methods, applications.

Electromagnetic testing: Magnetism: Magnetic domains: Magnetization curves: Magnetic Hysteresis: Hysteresis-loop tests: comparator - bridge tests Absolute single-coil system: applications.

Other methods: Acoustic Emission methods, Acoustic methods: Leak detection: Thermal inspection.

References

1. Halmshaw R., *Introduction to the Non-Destructive Testing of Welded Joints*, 1997.
2. *Metals Handbook – Non-destructive Inspection and Quality Control* (V. II), ASM, 1976.
3. McGonagle W. J., *Non-Destructive Testing*, McGraw Hill, 1961.
4. Raj B., T. Jayakumar and M Thavasimuthu, *Non-Destructive Testing*, Narosa Publishing House, 2002.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

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

- *Gain knowledge of the basic principles, techniques, applications and limitations of basic NDT methods.*
- *Use their knowledge in the selection of appropriate NDT methods*.

13. 506.7 POWDER METALLURGY (MPU)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To enable the student to understand the basic principles of Powder Metallurgy processes and the issues to be considered during design of parts*
- *To make the students to understand the various aspects of manufacturing of P/M components and the potential application.*
- *The objective of this course is to learn how to apply fundamental principles to the modern manufacturing processes.*
- *The course includes a detailed overview of science and technology of modern materials processing technique.*

Module – I

Manufacture of metal powders: Conventional methods and modern methods of metal powder manufacture. Purity of metal powders. Blending techniques.

Powder characterization: problem of size determination. Method of size analysis and surface area assessment. Apparent density and flowability measurement.

Module – II

Powder blending techniques, additives used, Influence of additives on the material properties .Powder compaction: Mechanical, thermal and thermomechanical compacting processes. Presses used for transmission.

New methods of consolidation. E.g. Powder rolling, Powder forging, Isostatic pressing. Advantages and limitations of these methods. Pressureless powder shaping techniques.

Module – III

Theories of sintering: Sintering mechanism, Roll of diffusion, Recrystallization, Pore emigration, Pore-growth and coalescence. Liquid phase sintering and related processes.

Effect of compacting pressure, sintering temperature and time on sintered properties. Types of sintering furnaces. Sintering atmospheres. Secondary treatments. E.g. Sizing, coining, Machining, Heat treatment, Joining.

Module – IV

Manufacturing and application of important P/M components: Porous bearing, Electrical contact materials, Metallic filters, Cemented carbides, magnets, Friction materials and Composites.

Application of P/M products: Structural applications in automobiles and aerospace, Power generation applications based on nuclear fuels, Bio-implants. Advantages and limitations of P/M process and products.

References

1. *Metals Handbook: Powder Metallurgy* (Vol. 7), ASM, 1984.
2. Sands R. L. and C. R. Shakespeare, *Powder Metallurgy*. CRC Press, 1966.
3. Upadhyaya G. S., *Powder Metallurgy Technology*, Cambridge International Science Publishing, 1998.
4. Upadhyaya G. S., *Cemented Tungsten Carbides: Production, Properties and Testing*, Elsevier Science, 1998.
5. Upadhyaya A. and G. S. Upadhyaya, *Powder Metallurgy: Science, Technology and Materials*, Universities Press, 2011.
6. German R. M., *Powder Metallurgy Science*, Metal Powder Industries Federation, Princeton, 1994.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

- *The student will be aware of the various ways of achieving the desired geometry of a part or component produced through powder metallurgy, with adequate defect control.*
- *The student will acquire an understanding of the method of developing a controlled microstructure to yield the desired properties and in-service performance of powder metallurgy products.*
- *The student will be able to optimize economic aspects of production of components using powder metallurgy, including the conservation of materials and energy*.

13. 506.8 HUMAN ASPECTS OF MANAGEMENT (MP)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

- *To teach how an organization acquires, rewards, motivates, uses, and generally manages its people effectively.*
- *To Impart ability to manage human resources in a competitive world for survival is discussed. Use of innovative techniques to build up human relations is also dealt with.*

Module – I

Introduction to management-efficiency Vs. effectiveness- functions of management-social responsibility –green management- Dimensions of human behaviour: self development, perception, motivation- Motivation of people across culture. Case studies.

Module – II

Personality and leadership - concepts, theories and applications. Modes of values, beliefs, attitudes and intelligence in determining human behaviour. Group dynamics-nature of groups and group decision making. Interactive conflict and negotiation skills. Transactional Analysis. Case studies.

Module – III

Organizational development, Concepts of QWL-strategies for improved QWL, Organizational change, Resistance to change, Goals of organizational change and organizational development, Organizational culture- nature and characteristics, types, impact of culture in organizational behaviour, , Managerial leadership across cultures, Case studies.

Module – IV

Human Resource Management –Concepts and objectives. Man power planning, Recruitment and selection, Training and development. Performance appraisal, Wage and salary administration, Grievance handling, Compensation policies, Safety and health maintenance, Case studies.

References

1. Robbins S. P., M. Coulter and N. Vohra, *Management*, Pearson Education, 2010.
2. Luthans F., O*rganizational Behaviour*, McGraw Hill, 2003.
3. Robbins S. P., *Organizational Behaviour*, Pearson Education, 2009.
4. Sekaran U., *Organizational Behaviour-Text and Cases*, Tata McGraw Hill, 1989.

5. Dessler G., *Human Resource Management*, Pearson Education, 2005.
6. Scott W. D., R. C. Clothier and W. R. Spriegel, *Personnel Management*, Tata McGraw Hill, 1977.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

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

- *Understand fundamentals of management and different functions of it.*
- *Understand the various dimensions of human behavior to build up the personal relationship and to avoid personal conflict.*
- *Understand the need of the organizational change and organizational culture for the development of organizations.*
- *Understand the concepts of Human Resources Management to manage people in organizations to meet organizational objectives.*

13. 506.9 ENVIRONMENTAL SCIENCE (MP)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

The course is intended to provide a general insight in acquiring and applying scientific knowledge about environmental issues so as to understand the underlying scientific concepts and to develop a deeper understanding of environmental issues by relating scientific knowledge with other perspectives.

Module – I

Meaning, scope and interdisciplinary nature of Environmental Science, Environmental factors; The Global environment and its segments; Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere.

Weather and climate: Weather Elements and their variations; Heat balance of the earth atmosphere system, Earth as a heat engine Major climatic zones of the world, Climates of India, Climate and vegetation, Climatic extremes – environmental implications, Global climate change and its impact on environment.

Module – II

Need For Public Awareness towards environmental science- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development.

Module – III

Natural Resources- Water Resources- Availability and Quality aspects. Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur Cycles.

Energy – Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Biogas.

Hydrogen as an alternative future source of Energy.

Module – IV

Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management.

Current Environmental Issues of Importance: Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution.

Acid Rain, Ozone Layer depletion, Animal Husbandry.

Environmental Protection- Role of Government, Legal aspects, Initiatives by Nongovernmental Organizations (NGO), Environmental Education, Women Education.

References

1. Joseph B., *Environmental Studies*, Tata McGraw Hill, 2006.
2. Manjunath D. L., *Environmental Studies*, Pearson Education, 2007.
3. Rajagopalan R., *Environmental Studies: From Crisis to Cure*, Oxford University Press, 2011.
4. Reddy M. A., *Textbook of Environmental Science and Technology*, BS Publication, 2014.
5. Rao P. V., *Textbook of Environmental Engineering*, Prentice Hall of India, 2002.
6. Meenakshi P., *Elements of Environmental Science and Engineering*, Prentice Hall India, 2005.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

At the end of this course the students will be able to understand the importance of protecting environment for future developments and also need for preserving natural resources for future generations.

13. 506.10 ENVIRONMENTAL POLLUTION CONTROL (MP)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

The course is intended to provide a general insight in acquiring and applying scientific knowledge about environmental pollution caused by industries.

Module – I

Environmental aspects - Impact of environment - Environmental quality – Role of environmental engineer. Air quantity - Definition, Characteristics and prospective - Types of our air pollutants - effect of air pollution on men and environment - Formation of air pollutants from combustion of fossil fuels and parameters controlling the formation.

Module – II

Water pollution from tanneries and other industries - Engineered systems for waste water treatment and disposal - Control systems and instrumentation for pollution control. Definition, characteristics - Types and sources of solid waste - Solid waste management - generation, collection, storage and processing techniques -Solid waste disposal.

Module – III

Methods and equipment's for industrial waste treatment - Pollution thermal power plants and nuclear power plants - Sources and control methods Control of air pollution by equipment, objectives of using control equipment, objectives of using control equipment, settling chambers, inertial separators, cyclones, Principle of electroscopic precipitators.

Module – IV

Emission from SI and CI engines - Evaporative emission control –Exhaust treatment devices - Noise pollution and their control, Environmental Laws & Acts, Air pollution indices, definition of air pollution index, type and use of air pollution indices, criteria for a standardized index, acid rain, causes of acid rain and its remedy, green house and its effect, air pollution legislation and regulations, constitution of the Board, functions of the central board and state boards, classification of pollution sources under Air Act 1981 and 1986.

References

1. Peavy H. S., D. R. Rowe, and G. Tchobanoglous, *Environmental. Engineering*, McGraw Hill, 1985.
2. A.C. Stern, R. W. Boubel C. B. Turner and D. L. Fox, *Fundamental of Air Pollution* , Academic Press, 1984.
3. Ikken P. A., R. J. Swart and S. Zwerves. *Climate and Energy*, McGraw Hill, 2008.

4. Metcalf & Eddy Inc., *Waste Water Engineering Treatment and Disposal*, McGraw Hill, 2013.
5. Wark K., C. F. Warner and W. T Davis, *Air Pollution: its Origin and Control*, Addison Wesley, 1998.
6. Tchobanoglous. G, H. Theisan and R. Elaisen, *Solid Water: Engineering Principles and Management Issues*, McGraw Hill, 1977.
7. Bethea R. M., *Air Pollution Control Technology*, Van Nostrand ReinHold, 1978
8. Krishna K. V. S. G. M., *Air Pollution and Control*, Kaushal & Company, 1995.
9. Anjaneyulu Y., *Air Pollution and Control Technologies*, Allied Publishers, 2002.
10. Mehta M. C., *Water & Air Pollution & Environmental Protection Laws*, Vol. II. Delhi Law House, 2000.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

At the end of this course the students will be able to understand the importance of protecting environment for future developments.

13. 506.11 DISASTER MANAGEMENT (MP)

Teaching Scheme: 3(L) - 1(T) - 0(P) **Credits**: 4

Course Objectives:

The course is intended to provide a general insight in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human developmental activities.

Module – I

Earth processes and natural disasters-significance of earth processes, natural hazards, risks and disasters. Basic principles of disaster management. Case histories of important natural disasters. Vulnerability assessment for earthquakes, floods, tsunamis, landslides and volcanoes. Human induced disasters-War and Chemicals-Mining. Industrial disasters, Epidemics.

Module – II

Preparedness and mitigation measures for earthquakes, floods, tsunamis, landslides and volcanoes with special reference to construction of residential buildings and public utility buildings. Disaster mitigation planning of human settlements and townships for earthquakes, floods, tsunamis, landslides and volcanoes.

Module – III

Droughts : Droughts, causes, vulnerability, types, famines, deserts and desertification.

Biodiversity Extinction and Deforestation: Biodiversity, species at risks, loss of biodiversity, management of species diversity, deforestation its causes & adverse effects.

Green House Effects and Global Climate Changes: Green house gases, effects, global warming & its effects, ozone depletion, changes in carbon-dioxide; impact on ecosystem.

Mining: Mining and environment, land & environment degradation and management, mined land reclamation.

Module – IV

Issues in the prediction of natural disasters, land use practices and disaster mitigation. Integration of rural development programmes with natural disaster mitigation and planning. Information systems and decision making tools in disaster management. Disaster management in India.

References

1. Abbott P. L., *Natural Disasters*, 3/e, McGraw Hill, 2002.

2. Bryant E. A., *Natural Hazards*, Cambridge University Press, 1991.
3. Murty, C. V. R., Earthquake Tips: Learning Earthquake Design and Construction, NICEE, IIT Kanpur, 2005.
4. Gaur R., Disaster Management, GNOSIS, New Delhi, 2004.
5. World Disasters Report 1993 and 2013, International Federation of Red Cross.

Internal Continuous Assessment *(Maximum Marks-50)*

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course outcome:

At the end of this course the students will be able to understand the various reasons for natural and man-made disasters and the need for proper management system at the time of such issues.

13.507 PRODUCTION ENGINEERING LAB (M)

Teaching Scheme: 0(L) - 0(T) - 3(P) **Credits**: 3

Course Objective:

- *To acquaint the basics of lathe and accessories, shaping and slottng machine, planning machines*
- *To learn the different tools used for various operations of machines.*
- *To impart training on plane turning, groove cutting, form turning, taper turning, facing and thread cutting.*

List of Experiments:

1. General study of Lathe and Accessories, Tools used for different operations.
2. Exercises involving plane turning, Groove cutting, form turning, taper turning, facing and thread cutting.
3. Study of shaping and slotting machines, and planning machines, exercises involving production of flat surfaces, grooves and key ways.

Note: Students should do all the exercises mentioned above.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test
40% - Class work and Record
20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the list of experiments prescribed.

80% - Procedure, calculations if any, working/machining, accuracy.

20% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

At the end of the course, the students will be familiar with the various operations using lathe, shaping, slotting and planning machines.

13 .508 ELECTRICAL AND ELECTRONICS LAB (MPU)

Teaching Scheme: 0(L) - 0(T) - 3(P) **Credits**: 3

Course Objective :

- *To give a practical knowledge on the working of electrical machines including dc machines, transformers, induction motors and synchronous motors. It also gives the basics about design and implementation of small electronic circuits.*

List of Experiments:

1. OCC on a dc shunt generator, determination of critical resistance, critical speed, additional resistance required in the field circuit
2. Load characteristics of DC Shunt generator
3. Load characteristics of DC Compound generator
4. Load test on DC Series motor
5. Load test on DC Shunt motor
6. Load test on single phase transformer
7. Starting of three phase squirrel cage induction motor by star delta switch, load test on three phase squirrel cage induction motor
8. Load test on three phase slip ring induction motor
9. Load test on single phase induction motor.
10. OC and SC test on single phase transformer
11. V-I Characteristics of diodes and Zener diodes
12. Input and output characteristics of CE configuration of BJT S. Determination of β, input resistance and output resistance.
13. Half wave and full wave rectifiers with and without filters- Observe the waveforms on CRO.

Internal Continuous Assessment *(Maximum Marks-50)*

40% - Test

40% - Class work and Record

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

Questions based on the list of experiments prescribed.

75% - Theory, Procedure, Circuit and design (30%);

Conducting experiment, Observation, Tabulation (30%)

Results and inference (15%)

25% - Viva voce

Candidate shall submit the certified fair record for endorsement by the external examiner.

Course Outcome:

At the end of this course the students will be able to test and validate DC generators, DC motors and Transformers. Students will have the basic knowledge on working of semiconductor devices.