UNIVERSITY OF KERALA

B. TECH. DEGREE COURSE

(2013 SCHEME)

SYLLABUS FOR

V SEMESTER

MECHANICAL - STREAM - AUTOMOBILE ENGINEERING

SCHEME -2013

V SEMESTER

MECHANICAL - STREAM - AUTOMOBILE ENGINEERING (U)

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	Electrical Technology (U)	4	3	1	-	50	3	100	150
13.503	Automotive Transmission (U)	4	4	-	-	50	3	100	150
13.504	Mechanics of Machinery (U)	4	3	1	-	50	3	100	150
13.505	Auto Electrical / Electronics (U)	3	3	-	-	50	3	100	150
13.506	Elective I	4	3	1	-	50	3	100	150
13.507	Fluid Mechanics & Machines Lab. (U)	3	-	-	3	50	3	100	150
13.508	Machine shop II (U)	3	-	-	3	50	3	100	150
	Total	**29**	**19**	**4**	**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	Automotive Fuels & Alternate Fuels (U)
13.506.9	Vehicle Transport & Fleet Management (U)
13.506.10	Two And Three Wheeled Vehicles (U)

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 ELECTRICAL TECHNOLOGY (U)

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

Course Objectives:

To make the students familiar with the DC machines, Motors, transformers and electrical drives. Also provide the idea of application of the above electrical components.

Module – I

DC Machines-principle of operation- emf equation- types of excitations. Separately excited, shunt and series excited DC generators, compound generators. General idea of armature reaction, occ and load characteristics- simple numerical problems.

Principles of dc motors-torque and speed equations-torque speed characteristics- variations of speed, torque and power with motor current. Applications of dc shunt series and compound motors. Principles of starting, losses and efficiency – load test- simple numerical problems.

Module – II

Transformers – principles of operations – emf equation- vector diagrams- losses and efficiency – OC and SC tests. Equivalent circuits- efficiency calculations- maximum efficiency – all day efficiency – simple numerical problems. Auto transformers constant voltage transformer- instrument transformers. Three phase induction motors- slip ring and squirrel cage types- principles of operation – rotating magnetic field- torque slip characteristics- no load and blocked rotor tests. Circle diagrams- methods of starting – direct online – auto transformer – star delta and rotor resistance starting.

Module – III

Single phase motors- principle of operation of single phase induction motor – split phase motor – capacitor start motor- stepper motor- universal motor Synchronous machines- types – emf equation of alternator – regulation of alternator by emf method.

Module – IV

Principles of operation of synchronous motors- methods of starting- V curves- synchronous condenser. Electric traction – systems of power supply – functional schematic of ac electric locomotives- types of motors used in traction systems. Methods of speed control – methods of braking.

References

1. Theraja B. L. and A. K. Theraja, *A Text Book of Electrical Technology*, Vol. 2, S. Chand and Co., 2006.

2. Partab H., *Art and Science of Utilization of Electrical Energy*, 2/e, Pritam Surat Bros., 1975.
3. Mehta V.K., *Principles of Electrical and Electronics*, S. Chand and Co., 1998.
4. Gupta B. R. and S. Vandana, *Fundamentals of Electric Machines*, New Age International, 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 the course students will be familiar about the working principle of various electrical accessories and their applications.

13.503 AUTOMOTIVE TRANSMISSION (U)

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

Course Objectives:

To know about the construction and working of components related to both Manual and Automatic Transmission.

Module – I

Clutches: Necessity of clutch in a automobile, different types of clutches, friction clutches, cone clutch, Single plate - multi coil & diaphragm spring clutches, multi plate clutch, centrifugal clutches, electromagnetic clutches, hydraulic clutches, torque capacity of clutches, clutch facing, materials, clutch adjustments, over running clutches, necessity and field of application, sprag and roller clutches, locking devices.

Module – II

Gear box: Need for a gear box, types of gear transmission, number of gear ratios, 3 speed and 4 speed transmission, determination of gear ratios for vehicles, performance curves in different gears, Types of gearboxes- Selective & progressive types, sliding mesh, constant mesh, synchromesh gear box, gear types & materials, gearbox oil seals- static & dynamic seals.

Hydrodynamic drive: Advantages and limitations, fluid flywheel- constructional details, working, merits and demerits, slip performance characteristics, constructional details of typical torque converters - single and dual stator, matching of torque converters, torque converter lockup.

Module – III

Epicyclic transmission: Principle of planetary gear transmission, Fundamental laws, Typical 2 speed and three speed planetary gear box, Simpson and Revangnaux planetary transmission, Wilson planetary transmission, over drives, Electric control system for overdrive.

Hydrostatic drives & CVT: Advantages and limitations, principles of hydrostatic drive systems: construction and working of typical drives, comparison of hydrostatic with hydrodynamic drives, Continuously variable transmission (CVT) –mechanical and hydrostatic, Relative merits and demerits.

Module – IV

Automatic transmission: General description of working of typical automatic transmissions and their control system, components and parts of Automatic transmission, comparison

with conventional transmission. Three speed and reverse Transaxle automatic Transmission, ECTi Automatic transmission with intelligent electronic control system.

Electrical drives-Types- advantages and limitations.

References:

1. Garrett T. K., K. Newton and W. Steeds, Motor Vehicle, Butterworth Heinemann, 2000.
2. Crouse W. H. and D. L. Anglin*, Study Guide for Automotive Mechanics*, McGraw Hill, 1993.
3. Rayat H. S., The Automobile, S. Chand and Co., Delhi, 2000.
4. Thomson W., Fundamentals of Automotive Transmission, Pitman, 1974.
5. Narang G. B. S., Automobile Engineering, Khanna Publications, New Delhi, 2014.
6. Judge A. W., *Modern Transmission Systems*, Chapman and Hall, 1990.
7. SAE Transactions 900550 & 930910.
8. *Hydrostatic Transmissions for Vehicle Applications*, I Mech E Conference, 1981-88.
9. Crouse W. H. and D. L. Anglin*, Automotive Transmission and Power Trains Construction*, McGraw Hill, 1976.

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:

At the end of the course students will be familiar with the construction and working of the components of manual and automatic transmission.

13.504 MECHANICS OF MACHINERY (U)

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

Course Objective:

To provide knowledge on

- *kinematics of selected mechanisms, Velocity and acceleration of Mechanisms*
- *Static and Dynamic Force analysis, Vibration analysis*
- *Balancing masses and its applications*
- *Cam Profiles and follower motion with displacement diagrams*

Module – I

Introduction to kinematics: Terminology, definitions and assumptions. Mobility, Grashof's law, kinematic inversion, concepts of mechanical advantage, transmission angle, coupler curve etc. Straight line mechanisms, steering mechanism, Hooke's joint, Quick return mechanisms, intermittent motion mechanisms-Geneva mechanism, pawl and ratchet. Velocity and acceleration of mechanisms - Analytical and graphical methods.

Module – II

Static force analysis-introduction, Free body diagrams-Conditions for equilibrium. two and three force members, four force members, Analysis of mechanisms without considering friction, Analysis with sliding and pin joint friction. Method of virtual work. Dynamic force analysis: introduction, inertia and D'Alemberts principle, analysis of mechanisms, principle of superposition, kinetically equivalent systems, shaking forces and moments.

Module – III

Balancing: Static and Dynamic unbalance. Balancing of masses distributed on the shaft, balancing a single cylinder engine, balancing multi-cylinder engines including V-Engines. Balancing machines.

Gyroscopes: Principle, analysis of gyroscopic action on vehicles-two wheelers, four wheelers, air planes and ships, Principle of gyroscopic stabilization of ships, and inertial guidance.

Module – IV

Cams: Introduction, classification of cams and followers, displacement diagrams, graphical layout of cam profiles, derivations of follower motion, standard cam motions, matching derivatives of displacement diagrams, plate cam with reciprocating or pivoted flat-face follower or roller follower. Description of Tangent cam and circular arc cams.

Vibration Analysis: Undamped free vibrations, different methods of analysis, free vibrations with viscous damping, logarithmic decrement, forced vibrations, isolation and transmissibility, vibrometers and accelerometers and their characteristics. Critical speed of a shaft, Transverse vibration, Dunkerley's method. Torsional vibrations.

References:

1. Uicker J. J., G. R. Pennock and J. E. Shigley *Theory of Machines and Mechanisms*, McGraw Hill, 2003.
2. Rao J. S. and R. V. Dukkipatti, Mechanism and Machine Theory, New Age Publishers, 2008.
3. Ramamurti V., *Mechanics of Machinery*, Narosa, 2010.
4. Wilson C. E. and J. P. Sadler, *Kinematics and Dynamics of Machinery*, 3/e, Pearson Education, 2013.
5. Rattan S. S., *Theory of Machines*, Tata McGraw Hill, 2009.
6. Holowenko A. R., Dynamics of Machinery, Wiley, 1955.

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 will develop the design and practical problem solving skills in the area of Mechanisms which can be applied in the future courses.

13.505 AUTO ELECTRICAL / ELECTRONICS (U)

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

Course Objectives:

To make the students to understand

- *The basic principles of Electrical and Electronic components.*
- *Construction and working principles of various electrical and electronic components used in new generation vehicles.*

Module – I

Electrical & Electronic principles – Current, Voltage & Resistance and measurements, common circuit symbols used in automobiles, series and parallel circuits, applications of electromagnetism, Inductance & capacitance.

Thyristor, Diodes & LEDs, vehicle circuits & systems, sizes and current ratings of wires used in automobile wiring harnesses, cable color coding, terminals & connectors, Multiplex wiring systems.

Basic concept of Controller Area Network (CAN), basic vehicle circuits. Storage battery: Cell Electro chemical action, Principle of lead acid battery & constructional details, effect of temperature on electrolyte, Battery characteristics-capacity & efficiency of battery, cold cranking Amperes, battery charging methods.

Tubular batteries, Maintenance free batteries, alkaline battery, Choosing the correct battery, Battery tests and battery maintenance.

Module – II

Starting & charging systems: Starter motor- Principle, condition at starting, series motor and its characteristics, types of drives, types of starter switches. Principle of generation of DC generator, constructional details, armature reaction, third bush control, voltage & current regulators, construction and working, construction of A.C. generators (alternators), advantages.

Module – III

Lighting and electrical accessories: Principle of automobile illumination, head lamp, mounting and construction, sealed beam, composite headlights, auxiliary lighting, horn, wind screen wipers, signaling devices, electrical gauges - analog fuel gauge, oil gauge, temperature gauges, electronic speedometers, electronic fuel gauge.

Ignition system: Types of ignition, magneto and coil ignition, constructional details, distributor, spark plugs, ignition coil, ignition timing, TAC (transistor assisted contact) ignition system, CD Ignition system, DTSi, Electronic / solid state ignition system,

Microprocessor controlled ignition system, advantages, simplified operational diagram of a distributor less ignition system.

Module – IV

Electronic / Microprocessor control systems: Concept of CPU and computer memory used in automobiles, sensors- Pressure sensor, Throttle position sensor, fuel flow sensor, thermistor sensor, oxygen sensor, speed sensors, knock detecting sensor, actuators solenoids and stepper motor.

Electronic dash board instruments - Onboard diagnosis system, security and warning system.

Electronic fuel injection system: Types of gasoline fuel injection system, TBI, MPFI - L Jetronic and D jetronic systems, GDI, electrical fuel pump, electronically controlled fuel supply system, electronically controlled exhaust gas re-circulation system, Electronic fuel supply system in diesel engines - CRDI.

References:

1. Young A.P. and L. Griffiths, *Automotive Electrical Equipment*, ELBS & New Press, 1999.
2. Riddens W. B., Understanding Automotive Electronics, 5/e, Butterworth Heinemann, 1998.
3. Bechhold, *Understanding Automotive Electronics*, SAE, 1998.
4. Crouse W. H., *Automobile Electrical Equipment*, 3/e, McGraw Hill, 1986.
5. Judge A. W., *Modern Electrical Equipment of Automobiles*, Chapman & Hall, London, 1992.
6. Kholi P. L., *Automotive Electrical Equipment*, Tata McGraw Hill, 1975.
7. Bosch R., Automotive Hand Book, 5/e, SAE, 2000.

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:

At the end of the course the students would be familiar with construction and working electrical and electronic components of the new generation vehicles.

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

9. Muralidhar K., G. Biswas, Advanced Engineering Fluid Mechanics, Alpha Science International limited, 2005.
10. Schlichting H., K. Gersten, *Boundary Layer Theory*, 8/e, Springer 2000.
11. Streeter V. L. and E. B. Wylie, *Fluid Mechanics*, McGraw-Hill, 1979.
12. Shames I. H., *Mechanics of Fluids*, 4/e, McGraw-Hill, 2002.
13. Kumar D. S., *Fluid Mechanics and Fluid Power Engineering*, S. K. Kataria & Sons, 1987.
14. Rama D. D., *Fluid Mechanics and Machines*, New Age International, 2009.
15. Bansal R. K., *A Text Book of Fluid Mechanics and Machines*, Laxmi Publications, 2010.
16. 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

- 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 AUTOMOTIVE FUELS & ALTERNATE FUELS (U)

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

Course Objectives:

To provide a sound understanding of

- *The fundamentals of combustion in SI and CI Engines.*
- *Use of Alternate fuels and the properties of such fuels, suitability to engines and modification required in engines for the use of alternate fuels*.

Module – I

Physical, chemical & combustion properties of IC engine fuels, structure of petroleum, petroleum refining process-thermal cracking, catalytic cracking, polymerisation, alkylation, Isomerisation, reforming & blending, products of refining process, Indian standard for gasoline, gasoline blends, non- petroleum fuels, fuel additives.

Module – II

Fuels for SI engines: Requirements of an Ideal gasoline, volatility of liquid fuels, effect of volatility on engine performance-ASTM distillation curve, winter and summer gasoline, knock rating of SI engine fuels, octane number and octane number requirement, sensitivity & performance number, numerical examples- volumetric and gravimetric analysis, a/f ratio, air requirement.

Module – III

Diesel engine fuels: Requirements for diesel fuel, handling & storage-properties of diesel, smooth and efficient burning – volatility, ignition quality, cetane number, diesel index, cleanliness, diesel blends, Indian standard for diesel.

Gaseous fuels: LPG as an IC engine fuel, natural gas – CNG and LNG, advantages of gaseous fuels, biogas, producer gas, engine modifications to run on gaseous fuels, dual fuel and multi fuel application.

Module – IV

Alternate fuels: Alcohols for SI engines- manufacture of methanol, manufacture of ethanol, comparison of properties of alcohols and gasoline as SI engine fuels, engine performance with pure alcohols, alcohol gasoline fuel blends-gasohol- E85.

Alternate fuels for Diesel engines: Alcohols as diesel fuels, vegetable oils as diesel fuels, straight vegetable oils and biodiesels, performance properties of engines with biodiesel, Indian specification for biodiesel.

References

1. Mathur M. L. and R. P. Sharma, *A Course in Internal Combustion Engines*, Dhanpat Rai Publications, 1998.
2. Giri N. K., *Automobile Technology*, Khanna Publishers, 2004.
3. Garrett T. K., *Automotive Fuels System*, SAE, Warrendale, 1991.
4. Powell J. D. and R. P. Brennan, *The Automobile Technology and Society*, Prentice Hall, 1988.
5. Owen K. and T. Colley, *Automotive Fuels Reference Book*, SAE, 1995.
6. Bechtold R. L., *Alternative Fuels Guidebook*, SAE, 1997.
7. Energy Research Group- Alternative Liquid Fuels, Willey Eastern, 1992.
8. Veziroglu T. N., Alternative Energy Sources, Hemisphere Publishing Corporation, 1978.

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 have sufficient knowledge on Alternate fuels used in SI Engines and CI Engines and the modifications needed for the use of alternate fuels.

13. 506.9 VEHICLE TRANSPORT & FLEET MANAGEMENT (U)

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

Course Objectives:

To make the student understand about

- *The organizational structure of fleet organizations*
- *The various functionalities in Transport Department and Fleet Organizations.*
- *Fundamentals of Motor Vehicle Act – important Schedules and sections.*

Module – I

Introduction to various transport systems. Advantages of motor transport. Organization and management- Forms of ownership, principle of transport, management, internal organization, centralized & decentralized condition (Engineering, traffic and administration), administration, recruitment and training, welfare, health and safety.

Management Training and Operations- Basic principles of supervising, Organising Time and people, Job instruction training - Training devices and techniques - Driver and mechanic hiring - Driver checklist - Lists for driver and mechanic - Trip leasing.

Module – II

Route planning and Scheduling: Sources of traffic, town planning, turning points, stopping places, survey of route, factors affecting frequency, direction of traffic flow, estimated traffic possibility. time table layout, use of flat graph method, preparation of vehicle and crew schedules, duty roaster, use of vehicle running numbers, determination of vehicle efficiency, checking efficiency of crew, duty arrangements, duty of drivers and conductors.

Motor vehicle act: Importance of motor vehicle act, Schedules and sections - Registration of motor vehicles - Licensing of drivers - Control of permits - Limits of speed - traffic signs - Constructional regulations - types of driving licenses, procedure for obtaining driving license, registration of vehicle, types of permits, procedure for obtaining permits, third party insurance.

Module – III

Vehicle maintenance, supply management and budget: Scheduled and unscheduled maintenace - Planning and scope - Evaluation of PMI programme – Work scheduling - Overtime - Breakdown analysis - Control of repair backlogs - Cost of options. Cost of inventory - Balancing inventory cost against downtime - Parts control - Bin tag systems – Time management - Time record keeping - Budget activity - Capital expenditures - Classification of vehicle expenses.

Module – IV

Fleet Management, Data Processing And Fare Structure : Fleet management and data processing - Data processing systems - Software Model – Computer controlling of fleet activity - Energy management, Basis of fares, effect of competition and control, calculating average charge, zone systems, straight and tapered scales fare structure - Methods of fare collection - Preparation of fare table.

Principal features of operating costs for transport. Fare structure and method of drawing up of a fare table. Various types of fare collecting methods. Basic factors of bus scheduling. Problems on bus scheduling.

References

1. Faulks R. W., *Road and Coach Operation,* Butterworth, 1987.
2. Dolu J., *Fleet Management*, McGraw-Hill, 1984.
3. *The Motor Vehicle Act- 1988,* Goverment Publications, 1989.
4. Kitchin L. D., *Bus Operation*, 3/e, lliffe and Sons Ltd., London, 1992.
5. Kadiyali L. R., *Traffic Engineering and Transport Planning*, Khanna Publishers, 1983.

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 the course the student will have suitability to adopt himself for a role of managing fleet organization as well as transport department.

13. 506.10 TWO AND THREE WHEELED VEHICLES (U)

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

Course Objectives:

To make the students understand the various systems of two and three wheeled vehicles with the construction and operational details of each component

Module – I

General Introduction: Motor cycles, scooters, mopeds and three wheeled vehicles, classification, different arrangement of cylinders, carburetion system and operation.

Power plants in two and three wheelers: Two stroke and four stroke, arrangements, engine ports, reed valves, valves and valve actuating mechanisms, valve timing, Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pump.

Rotary valve engine lubrication and fuel supply systems in two wheelers, constructional features and types of oil seals, mufflers & silencers, Catalytic converters.

Module – II

Power transmission: Clutches, necessities, centrifugal clutch, multiple disc clutch, selective and progressive gear boxes, different types of synchronizers.

Belt Drive, Chain drive, gear drive, shaft drive and variable drive mechanisms and their constructional aspects.

Module – III

Electrical systems: Magneto ignition system, high tension and low tension magneto ignition, comparison with battery ignition system, electronic ignition systems like CDI, microprocessor controlled ignition system etc, starting motor, accessories horn, lighting system.

Module – IV

Body: Constructional details of frames and front fork suspension systems, shock absorber systems, body manufacturer, Paints and Painting methods

Brakes, Wheels and tyres: Drum brakes, Disc brakes, Front and rear brake links layouts. Spoked wheel, cast wheel. Disc wheel. Disc types.

Tyres and tubes -Different types, constructional aspects, bearing system.

Case study of two and three wheelers: Salient features of modern two wheelers, Three wheelers – different types, layouts, transmission.

References

1. Irving P. E., *Motor Cycle Engineering*, Temple Press Book, London, 1992.
2. *The Cycle Motor Manual*, Temple Press Ltd., London, 1990.
3. *Encyclopedia of Motor Cycling*, 20 Volumes, Marshall Cavensih, New York and London, 1989.
4. Bryant R. V., Vespa: *A Practical Guide Covering All Models- Maintenance and Repair Series*, S. Chand, 1973.
5. Broad R., *Lambretta: A practical Guide to Maintenance and Repair*, Pearson, 1967.
6. *Service Manuals* of Popular Indian two and three wheeled vehicles.

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 the course the students should be familiar with the various systems in two and three wheeled vehicles.

13.507 FLUID MECHANICS & MACHINES LAB (U)

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

Course Objective :

To demonstrate the applications of the basic fluid mechanics and hydraulic machines and to provide a more intuitive and physical understanding of the theory.

Preliminary study:

1. Study of flow measuring equipments - water meters, venturimeter, orifice meter, current meter.
2. Study of gauges - pressure gauge, vacuum gauge, manometers.
3. Study of valves - stop valve, gate valve and foot valve.
4. Study of pumps – Centrifugal, Reciprocating, Rotary, Jet.
5. Study of Turbines - Impulse and reaction types.
6. Study of Hydraulic ram, accumulator etc.

List of Experiments:

1. Determination of Coefficient of discharge and calibration of Notches, Orifice meter, Nozzle and Venturimeter.
2. Determination of Chezy's constant and Darcy's coefficient on pipe friction apparatus
3. Determination of Hydraulic coefficients of orifices
4. Determination of Metacentric Height and Radius of gyration of floating bodies.
5. Performance test on Rotodynamic and Positive displacement pumps
6. Performance test on Impulse and Reaction turbines
7. Speed variation test on Impulse turbine
8. Determination of best guide vane opening for Reaction turbine.

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 in Part II.

75% - Theory, Procedure and tabular column (30%);

Conducting experiment, Observation, Tabulation with Sample calculation (30%)

Graphs, Results and inference (15%)

25% - Viva voce (Based on Part I and Part II)

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

Course Outcome:

At the end of this course the student is expected to:

- *gain a fundamental physical and mathematical understanding of Bernoulli's equation, and apply it in flow measurement (orifice, Nozzle and Venturimeter), and to a variety of problems.*
- *determine the efficiency and plot the characteristic curves of different types of pumps and turbines.*

13 .508 MACHINE SHOP II (U)

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

Course Objective :

- *To provide knowledge about the operations carried out on milling grinding, drilling, EDM, and CNC Machines*
- *To make the students familiarized with making models using the operations on the above specified machines.*

List of Experiments:

1. Study of Milling Machines and Milling Cutters
2. Study of Grinding machines, Surface Grinding and Cylindrical grinding machines – study of Drilling machines
3. Study of EDM.
4. Exercise on Milling machines-face milling, end milling – spur and helical gear cutting – milling of keyways
5. Exercise on Grinding and Drilling Machines.
6. Exercise on working with EDM.
7. Study of CNC machining (turning and milling) and exercises on using trainer kits/ CNC machines.

Note: *At least 8 Models to be completes using the above machineries*

Internal Continuous Assessment *(Maximum Marks-50)*

20% - Test

60% - 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% - Theory, Procedure, (30%);

Conducting experiment, Observation, Tabulation (30%)

Results and accuracy (20%)

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 preparation of models using the machineries specified.