IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Mechanical Engineering Department

B. Tech, VIII Sem

Scheme

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work Lab Work & Sessional		L	T	P	
1.	ME 801	DC	Refrigeration & Air Conditioning	70	20	10	30	20	150	2	1	2	4
2.	ME 802	DE	Departmental Elective	70	20	10	-	-	100	3	1	-	4
3.	ME 803	OE	Open Elective	70	20	10	-	-	100	3	-	-	3
4.	ME 804	D/O/E Lab	Simulation and Modeling	-	-	-	30	20	50	-	-	6	3
5.	ME 805	P	Major Project-II	-	-	-	70	30	100	-	-	8	4
6.	Additional Credits[#]	*[#]Additional credits can be earned through successful completion of credit based MOOC's Courses available on SWAYAM platform (MHRD) at respective UG level.*											
Total				**210**	**60**	**30**	**130**	**70**	**500**	**8**	**2**	**16**	**18**

*MST: Minimum of two mid semester tests to be conducted. L: Lecture T: Tutorial P: Practical

Departmental Electives	Open Electives
802(A) Automobile Engineering	803(A)Data analytics
802 (B) Tribology & Maintenance Engineering	803(B) Energy Conservation, Management& Audit
802 (C) Machine Tool Design	803(C) Entrepreneurship and Management Concepts
802 (D)Production Planning and Control	803 (D) Management Information System

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Syllabus

ME-801	Automobile Engineering	3L:1T: 2P (05 hrs)	Credits:04

Course Content:

Unit I **(07 Hrs)**

Chassis, Frame & Body Engg: Types, Technical details of commercial vehicles, types of chassis, lay out, types of frames, testing of frames for bending & torsion on unutilized body frame, vehicle body and their construction, drivers visibility and methods for improvement, safety aspects of vehicles, vehicle aerodynamics, optimization of body shape, drivers cab design, body materials, location of engine, front wheel and rear wheel drive, four wheel drive.

Unit II **(08 Hrs)**

Steering and Front Axle: Front axle beam, stub axle, front wheel assembly, principles of types of wheel alignment, front wheel geometry viz. camber, Kingpin inclination, castor, toe-in and toe out, condition for true rolling motion, centre point steering, directional stability of vehicles, steering gear, power steering, slip angle, cornering power, over steer & under steer, gyroscopic effect on steering gears.

Unit III **(09 Hrs)**

Transmission System: Function and types of clutches, single plate, multi-plate clutch, roller & spring clutch, clutch lining and bonding, double declutching, types of gear Boxes, synchronizer, gear materials, determination of gear ratio for vehicles, gear box performance at different vehicle speed, automatic transmission, torque converters, fluid coupling, principle of hydrostatic drive, propeller shaft, constant velocity universal joints, differential gear box, rear axle construction.

Unit IV **(10 Hrs)**

Suspension system and Brakes: Basic suspension movements, Independent front & rear suspension, shock absorber, type of springs: leaf spring, coil spring, air spring, torsion bar, location of shackles, power calculations, resistance to vehicle motion during acceleration and breaking, power & torque curve, torque & mechanical efficiency at different vehicle speeds, weight transfer, braking systems, disc theory, mechanical, hydraulic & pneumatic power brake systems, performance, self-energisation, air bleeding of hydraulic brakes, types of wheels and tyres, tyre specifications, construction and material properties of tyres & tubes.

Unit V **(08 Hrs)**

Electrical and Control Systems: Storage battery, construction and operation of lead acid battery, testing of battery, principle of operation of starting mechanism, different drive systems, starter relay switch, regulator electric fuel gauge, fuel pump, horn, wiper, Lighting system, head light dazzling, signaling devices, battery operated vehicles, importance of maintenance, scheduled and unscheduled maintenance, wheel alignment, trouble Shooting probable causes & remedies of various systems, microprocessor based control system for automobile, intelligent automobile control systems.

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Unit VI **(08 Hrs)**

Emission standards and Pollution control: Indian standards for automotive vehicles, Bharat & Euro norms, fuel quality standards, environmental management systems for automotive vehicles, catalytic converters, fuel additives, and modern trends in automotive engine efficiency and emission control

Course Outcomes: Students will be able to

1. Define the vehicle body aesthetics and appropriate location of engine.
2. Apply & identify the geometry of steering system and the parameters on which its performance depends.
3. Define & Compare the different types of gearboxes and their applications.
4. Judge the importance of suspension system and brakes.,
5. Apply knowledge about electrical system of automobiles and proper handling of battery, emission standards and pollution control.
6. Explain various automotive vehicle environmental management norms and how to control emission.

Text Books:

1. Kripal Singh, Automotive Engineering Khanna Pub.
2. R.B Gupta, Automative Engineering Satya Prakashan
3. Gupta HN; Internal Combustion Engines; PHI

Reference Books:

1. David Crolla, Encyclopedia of Automotive Engineering Wiley
2. Crouse, Automotive Mechanics TMH.
3. Joseph Heitner, Automotive Mechanics, Principles and Practices, CBS Pub.
4. Newton & Steeds , Automotive Engineering
5. Emission standards from BIS and Euro Norms

List of Experiment:

Study of chassis, suspension, steering mechanisms, transmission, gear-box, differential systems, and electrical systems of various light and heavy automotive vehicles,recent technologies in Automobile Industry.

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ME-802	**Refrigeration & Air Conditioning**	**3L:1T: 2P (05 hrs)**	**Credits:04**

Course Content:

Unit I **(08 Hrs)**

Introduction: Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Unit II **(09 Hrs)**

Vapour Compression System: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion & compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system.

Unit III **(08 Hrs)**

(a) Vapour Absorption System: Theoretical and practical systems such as aqua ammonia, Electrolux & other systems;

(b) Steam Jet Refrigeration: Principles and working, simple cycle of operation, description and working of simple system,

(c) Refrigerants: nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

Unit IV **(09 Hrs)**

Psychrometric: Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body

Unit V **(09Hrs)**

Air Conditioning Loads: calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

Course Outcomes: Students will be able to

1. To make students familiar with the design and operating characteristics of Basic Refrigeration System.
2. To study the Vapour Compression Refrigeration system and their effect.

3. To study the Vapour Absorption Refrigeration system and their effect.
4. To introduce students to the Psychometric Chart & Table and Process.
5. To introduce about Air Conditioning System.

Text Books:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI

Reference Books:

1. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
2. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
3. Ameen; Refrigeration and Air Conditioning; PHI
4. Pita ; Air conditioning Principles and systems: an energy approach; PHI
5. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
6. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA

List of Experiment:

1. To determine the COP of split air conditioning System.
2. To determine the COP of Cascade refrigeration system
3. To compare the performance of different heat pipe
4. To determine the COP of Vapour compression refrigeration system.
5. To determine the COP of Vapour absorption refrigeration system
6. To determine the COP of window air conditioning system.
7. To determine the COP of Mechanical Heat Pump
8. To determine the COP of Ice Plant
9. To determine the COP of Ejector Expansion Refrigeration System.
10. Visit at any HVAC Plant

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ME-803 (A)	**Tribology**	**3L:0T: 0P (03 hrs)**	**Credits:03**

Course Content:

Unit I **(06 Hrs)**

Introduction: History of tribology, early scientific studies of - friction, Wear Lubrication. Tribo-Surface preparations and characteristics. Surface contacts, Hertz contact stresses, residual stress, surface fatigue, creep, stress relaxation, fracture mechanics, elastic, visco elastic and plastic behavior of materials. Choice of materials.

Unit II **(08 Hrs)**

Friction: laws of friction, rolling/sliding friction, theory of adhesion and abrasion, different mechanisms of friction , stick slip characteristics, interface temperature, thermal analysis, Molecular mechanical theory of friction, operating conditions and system parameters, calculations of coefficient of friction, design of friction devices.

Unit III **(08 Hrs)**

Wear: different types of wear mechanisms, adhesive, abrasive impact, percussion erosion, fretting wear calculations of wear rate, two body/ three body wear, wear prevention, wear of metal cutting and metal forming tools, wear mapping of materials, cavitation, surface fatigue, corrosion, performance levels classifications and specifications of lubricants.

Unit IV **(08 Hrs)**

Lubrication: lubricants and additives, composition and properties of lubricants, maintenance of oil and emulsions, industrial hygiene aspects, technical regulations for lubricants. boundary/ mixed and fluid film lubrication, industrial methods of lubrications, SAE,BIS, ASTM, IP, DIN Standards.oil testings. wear and chemistry of lubricants.

Unit V **(08 Hrs)**

Nano Tribology: Instrumental tests,. Bearings, clutches and brakes, slide units, dynamic seals, Automobile applications, machine tools/ press machines applications. Other applications and case studies.

Course Outcomes: Students will be able to

1. Illustrate mechanical behavior of materials of contacting surfaces.
2. Evaluate coefficient of friction for different material with different boundary conditions.
3. Classify wear mechanisms and classifications and specifications of lubricants.
4. Explain different types of lubrication method, lubricating material and standards.
5. Analyze tribological case studies and tribological behaviors of different machines.

Reference Books:

1 Principles and applications of tribology, Bharat Bhushan, John Wiley& sons, ISBN 0 471 59407 5

2 Tribology,, - lubrication ,friction and wear, I V Kragelsky and V V Alisin, Mir publication, ISBN 1 86058 288 5

3. Applied Tribology,M M Khonsari and E. R. Booser, John Wiley, ISBN 0 471 28302 9

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ME-803 (B)	**Failure analysis & Trouble Shooting**	**3L:0T: 0P (03 hrs)**	**Credits:03**

Course Content:

Unit I **(06 Hrs)**

Failure data and statistical distributions analysis. Reliability, The component's life cycle. The equipment's life cycle. Mechanical mechanisms associated with the components. Forces and vibration analysis. Safety factors, Different applications and case studies.

Unit II **(06 Hrs)**

Failure analysis from the Tribological considerations: Friction, wear and lubrication analysis, wear maps, lubricants and alternatives. Surface compatibility and elastic matching, Methods of friction reduction, Geometrical accuracy assembly requirements.

Unit III **(06 Hrs)**

Failure analysis from material selection and subsequent treatments: Alloying elements, heat/ mechanical treatments. Mechanical elastic and plastic behavior of materials. Alternative newer materials. Microscopic/ macroscopic analysis.

Unit IV **(06 Hrs)**

Failure analysis from the production methods and maintenance procedures considerations: Faulty methods, fittings, assembly and disassembly problems, faulty maintenance methods, reconditioning, reverse engineering, Hand tools and preparation of inspection procedure.

Unit V **(06 Hrs)**

Failure analysis and trouble shooting: with specific processes and subsequent testing of individual components. Make or buy decisions, value analysis. NDT method of testing. BIS and other specifications.

Reference Books:

1. Machinery failure analysis and trouble shooting, H.P. Block and F.K.Geitner, Gulf publishing co., ISBN 0-87201-872-5.

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ME-803 (C)	**Design of Heat Exchanger**	**3L:0T: 0P (03 hrs)**	**Credits:03**

Course Content:

UNIT I

Introduction: Types of heat exchangers heat transfer laws applied to heat exchangers convection Coefficients, resistance caused by the walls and by fouling, overall heat transfer coefficient.

Unit II

Thermal & hydraulic design of commonly used heat exchangers : LMTD & NTU Methods, correction factors, Double pipe heat exchangers , shell and tube heat exchangers, condensers , Evaporators ,Cooling and dehumidifying coils ,cooling towers, evaporative condensers ,design of air washers, desert coolers**.**

Unit III

TEMA standard: Tubular heat exchangers TEMA standard heat-exchanger nomenclature, selection criteria for different types of shells and front and rear head ends; geometrical characteristics of TEMA heat exchangers.

Unit IV

Review of mechanical Design, Materials of Construction, corrosion damage, testing and inspection.

Unit V

Heat Pipe: Basics & its mathematical model, micro Heat Exchangers, Use of Software in heat exchanger design**.**

Course Outcomes: Students will be able to

1. Study and Analyse different heat exchangers
2. Design different heat exchangers for various flow.
3. Learn various TEMA standards used for heat exchangers.
4. Explain various materials of construction for heat exchangers.
5. Understood the working of heat pipe and micro heat exchangers.

Reference Books:

1. Kern D Q, Kraus A D; Extended Surface Heat Transfer; TMH.
2. Kays, Compact Heat Exchangers and London, TMH.
3. Kokac, Heat Exchangers- Thermal Hydraulic fundamentals and design; TMH.
4. Tubular Exchanger Manufacturer Association (TEMA), and other code

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ME-804 (A)	Project Management	3L:0T: 0P (03 hrs)	Credits:03

Course Content:

Unit I **(08 Hrs)**

Concepts of project management: Meaning, definition and characteristics of a project, technical and socio-cultural dimensions; project life cycle phases, project planning and graphic presentation; work breakdown structure, manageable tasks; size of network; blow down NW; identity and logic dummy activity; Fulkerson rule for numbering NW; time-scaled NW**.**

Unit II **(08 Hrs)**

NW analysis: PERT network; mean time and variances; probability to complete PERT project in specified time; CPM network; Event Occurrence Time (EOT); activity start/ finish times; forward and reverse path calculations, concept and calculation of floats; resource allocation and critical-chain; overview of MS-project-2000.

Unit III **(10 Hrs)**

Project duration and control: Importance and options to accelerate project completion; time cost tradeoff; fixed variable and total costs; use of floats and cost optimization; project performance measures; project monitoring info and reports; project control process; Gant chart and control chart; cost-schedule S-graph; planned cost of work schedule (PV), budgeted/ earned cost of work completed (EV) and actual cost of work completed (AC); schedule and cost variances (SV, CV) forecasting final project costs.

Unit IV **(08 Hrs)**

Project organization, culture and leadership: projects within functional organization; dedicated project/ task-force teams; staff, matrix and network organization; choosing appropriate project organization; Organization culture; ten characteristics; cultural dimensions supportive to projects; social network and management by wandering around (MBWA); different traits of a manager and leader; managing project teams; five stage team development model; shared vision; conflicts; rewards; rejuvenating project teams; project stakeholders; concept of project partnering.

Unit V **(06 Hrs)**

Strategic planning and project appraisal: Capital allocation key criteria; Porters competitive strategy model; BCG matrix; Strategic Position Action Evaluation (SPACE); time value of money; cash flows; payback period; IRR; cost of capital; NPV; social cost benefit analysis; UNIDO approach; project risks and financing.

Course Outcomes: Students will be able to

1. Define project management and its methodology.
2. Understand the concept of PERT & CPM
3. Learn about project duration & Control.
4. Understanding the project organization culture and leadership.
5. Learn about strategic planning and project appraisal.

Reference Books:

1. Prasana Chandra: Projects: planning Implementation control; TMH.
2. Gray Clifford F And Larson EW; Project The managerial Process; TMH
3. Panneerselven and Serthil kumar; Project management, PHI
4. Burke ; Project Management-Planning and control technics; Wiley India
5. Kamaraju R; Essentials of Project Management; PHI Learning
6. Jack R. Meredith, Project Management: a managerial approach, Wiley.
7. Choudhary ;Project Management; TMH
8. Srinath LS; PERT And CPM Principles and Appl; East West Press
9. Richman L; Project Management: Step By Step; PHI Learning
10. United Nations Industrial Development Organisation, Guide to practical project appraisal - social benefit cost analysis in developing countries, oxford & ibh.

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ME-804 (B)	**MIS, ERP & E Business**	**3L:0T: 0P (03 hrs)**	**Credits:03**

Course Content:

Unit I **(08 Hrs)**

Management Information System (MIS): Definition, Objectives and benefits, MIS as strategic tool, obstacles and challenges for MIS, functional and cross functional systems, hierarchical view of CBIS, structured and unstructured decision, Operation and mgt support, Decision process and MIS, info system components and activities, Value chain and MIS support.

Unit II **(10 Hrs)**

System concepts: types, definition, characteristics, feedback (Pull) and feed-forward (Push) control, system stress and entropy, computer as closed system, law of requisite variety, open and flexible (Adaptive) systems, work system model and comparison with input-process output model, five views of work system: structure, performance, infrastructure, context and risk and their effect on product performance.

Unit III **(08 Hrs)**

Info Concepts: define data, info, knowledge, intelligence and wisdom, Information characteristics and attributes, info measurement and probability, characteristics of human as info processor.

Unit IV **(08 Hrs)**

Planning and Control Concepts: terminologies, difficulties in planning, system analysis and development plan-purpose and participants, info planning, (SDLC) system development life cycle for inhouse and licensed sw, system investigation, analysis of needs, design and implementation phases, training of Operational personnel, evaluation, Control and Maintenance of Information Systems.

Unit V **(06 Hrs)**

E-business components and interrelationship: Evolution of Enterprise Resource Planning (ERP) from MRP, Supply chain management (SCM) and Customer relationship management (CRM), Integrated data model, strategic and operational issues in ERP, Business Process Re-Engineering (BPR), significance and functions, information technology and computer NW support to MIS.

Course Outcomes: Students will be able to

1. Understand the concept of MIS.
2. Learn basics of systems and its application.
3. Define information concepts and its various aspects.
4. Conceptualize the planning and control concepts.
5. Understand concepts of E business.

Reference Books:

1. Davis and Olson, Management Information Systems, TMH
2. James O Brian, Management Information Systems, TMH
3. Oz, Management Information Systems, Cengage
4. Alter Stevenson, Information Systems: Foundation of E-Business; (Prentice-Hall,USA)
5. Jayaraman, Business Process Re-Engineering, TMH.
6. Garg. V.K.; ERP, PHI
7. Kelkar SA; Management Information Systems A Concise Study; PHI Learning.
8. Radhakrishnan R and Balasuramanian S; Business Process Reengineering; PHI Learning.
9. Alex Leon ; ERP, TMH 10. Jawadekar WS; MIS- text and cases; TMH 11. Jaiswal M and Mital M; MIS; Oxford higher Edu Indi

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ME-804 (C)	**Maintenance Management**	**3L:0T: 0P (03 hrs)**	**Credits:03**

Course Content:

Unit I **(06 Hrs)**

Introduction: Maintenance, definition, preventive, corrective, on- line off- line maintenance, window maintenance, emergency, reconditioning, design out maintenance. "product- item- machine – plant structure characteristics. Design , cost and safety aspects.

Unit II **(06 Hrs)**

Production- maintenance system, Maintainability, Maintenance procedures, guidelines for matching procedures to items, universal maintenance procedures. shutdown programs**.**

Unit III **(08 Hrs)**

Maintenance organization: work load, resource characteristics, administrative structure, work planning, scheduling and control strategy, feedback, combinations of manpower, tools and spares. Documentations. Network planning, computer based management information systems..

Unit IV **(08 Hrs)**

Restoration of Components: assembly, disassembly bush bearing, housings, Ball and roller bearings, key-splines, couplings shafts- lead screw fittings, clutches- brakes, belt pulley, chain sprocket, guide ways, machine hydraulics, pneumatics, electrical works and motors, seals, and packing's. Fasteners, welding, machining, repair cycles, repair complexities, maintenance stages. Lubrication, accuracies and technological test charts.

Unit V **(06 Hrs)**

Failure statistics: Failure data, failure patterns/ statistical models, Failure analysis, applications of different models, Depreciation and average machine life, case studies.

Course Outcomes: Students will be able to

1. Define the concepts of Maintenance.
2. Explore the knowledge of production maintenance.
3. Learn about maintenance organization.
4. Get knowledge about restoration.
5. Understand concept of failure statistics

Reference Books:

1. Maintenance management – Hand book, Higgins
2. Maintenance planning and control, Anthony Kelly

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ME-805	**Major Project-II**	**0L:0T: 6P (06 hrs)**	**Credits:03**

Course Objective's:

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
- To give students an opportunity to do something creative and to assimilate real life work situation in institution.
- To adapt students for latest development and to handle independently new situations.
- To develop good expressions power and presentation abilities in students.

The focus of the Major Project is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report. The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any)

Working Schedule: The faculty and student should work according to following schedule: Each student undertakes substantial and individual project in an approved area of the subject and supervised by a member of staff. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty.

Course Outcome's: The students will be able to

1. Identify methods and materials to carry out experiments/develop code.
2. Reorganize the procedures with a concern for society, environment and ethics.
3. Analyze and discuss the results to draw valid conclusions.
4. Prepare a report as per recommended format and defend the work.
5. Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.