RTM Nagpur University- Mechanical Engineering
5TH SEM-Heat Transfer-BEME501T
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	**Heat Transfer**	3	1	0	04	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	This course is designed to learn the different modes of heat transfer like conduction, convection & Radiation and formulation of problem based on required application.
2	It will help students to distinguish between steady and unsteady state heat transfer and their applications will enable to calculate heat transfer rate from different geometry of the system under free and forced convection.
3	It also aims to impart knowledge to analyse radiation with and without radiation shield. In addition, it also discusses methods to analyse & design heat exchangers.
4	In all to generate interest in learning to develop in depth understanding in Heat Transfer.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Students will be able to define and compare the different modes of heat transfer and calculation of thermal resistance and heat transfer through plane and composite wall, cylinder and sphere with and without thermal contact resistances.
CO2	Students will be able to apply the concept of internal heat generation for the calculation of heat transfer for plane wall, cylinder and sphere and also learn about various types of fins and their significance in steady state conduction heat transfer calculations. It will also help them to understand the concept of unsteady state heat transfer.
CO3	Students will be able to select and apply appropriate empirical correlations to estimate forced convection and free convection heat transfer, for internal and external flows.
CO4	Students will be able to evaluate heat transfer rate by radiation from ideal and actual surfaces and enclosures of different geometries.
CO5	Students will be able to evaluate heat exchanger performance for the given geometry and boundary conditions and design suitable heat exchanger geometry to deliver a desired heat transfer rate.

SYLLABUS- Heat Transfer	
Contents	No of hours
Unit I Introduction, Basic modes of Heat Transfer, Conduction, Convection & Radiation. Laws of Heat transfer , General heat conduction equation in Cartesian, Cylindrical and Spherical coordinates. One dimensional steady state heat conduction equation for the plane wall, cylinder and sphere, Overall heat transfer coefficient. Thermal resistance of composite structure, contact resistance, variable thermal conductivity, critical thickness of insulation. ,	10
Unit II Conduction with internal heat generation for plane wall, Cylinder and Sphere, Extended surface, Types of Fins, Fins of uniform cross section area, temperature distribution and their heat transfer rate, Fin efficiency & Effectiveness. Unsteady state heat transfer, lumped heat capacity analysis, Heisler's charts. Biot's Number, Fourier's Number & its significance. Approximate solution to unsteady state conduction heat transfer by the use of Heisler's chart	09
Unit III Forced convection, Concept of hydrodynamics & thermal boundary layer thickness, local and average heat transfer coefficient. Empirical co-relations for external, internal flows, laminar & turbulent flow through conduits. Free or Natural Convection, Grashof's number, Rayleigh number, flow over horizontal and vertical plate, Empirical co-relations for cylinders and sphere. Introduction to cooling of electronic devices. Heat transfer enhancement using nano fluids. Boiling and Condensation heat transfer: Pool boiling curve and regimes of pool boiling, Film and Drop wise condensation	09
Unit IV Radiation, spectrum of radiation, black body radiation, radiation intensity, Laws of radiation-Kirchhoff, Planck's, Wien's displacement law, Stefan Boltzmann & Lamberts Co-sine law. Emissivity, Absorbtivity, Transmisivity, Reflectivity, Radiosity, Emissive power, Irradiation. Radiation exchange between surfaces, shape factor & its laws, radiation between parallel plates, cylinder & spheres. Radiation shields	09

Unit V Heat exchanger: Detail Classification, Overall Heat Transfer Coefficient, Fouling Factor, LMTD & Effectiveness -NTU method of heat exchanger analysis for parallel, counter flow & cross flow arrangement, Introduction to compact heat exchanger, Heat Pipe. ,	09

Books Recommended:

Text Book

1. Fundamentals of Heat & Mass Transfer, Incropera, F.P., Dewitt, D. P., John Wiley & Sons .
2. Heat Transfer, J.P. Holman, McGraw Hill Book Company, New York.
3. Fundamentals of Heat and Mass Transfer, K. N. Seetharam & T.R. Seetharam, Willey.
4. Engineering Heat and Mass Transfer, M.M. Rathor, Laxmi PublicationsPvt. Ltd.

Reference Book

1. Fundamentals of Heat and Mass Transfer, Venkanna B.K., PHI Publication.
2. Principles of Heat Transfer, Frank Kreith, Harper and Row Publishers, New York.
3. Heat Transfer - A Practical Approach, Yunus A. Cengel, Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Heat & Mass Transfer, M.N. Ozisik, Tata McGraw Hill Publishing Company Ltd., New Delhi.
5. Heat & Mass Transfer, R.K. Rajput, Laxmi Publication.

DATA BOOK: 1. Heat & Mass Transfer, Domkundwar, Dhanapat Rai & Sons Publication.
2. Heat & Mass Transfer, C.P.Kothandaraman,PHI publishers.

Sr. No.	List of Tutorials
01	Calculation of thermal resistance and heat transfer through plane and composite wall, cylinder and sphere with and without thermal contact resistances.
02	Calculation of critical thickness of insulation and change in heat transfer for cylindrical and spherical wall.
03	Calculation of heat transfer coefficient and heat transfer rate from plane wall, cylinder and duct subjected to internal and external flow under forced convection.
04	Calculation of heat transfer coefficient and heat transfer rate under free convection
05	Calculation of shape factor for different configuration of grey bodies.
06	Calculation of overall heat transfer coefficient using LMTD and NTU methods

RTM Nagpur University- Mechanical Engineering
5TH SEM -Heat Transfer Lab (BEME501P)
Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
B.Tech 5th Sem Mechanical	**Heat Transfer Lab**	-	-	02	1	25	25	50

Sr. No.	Course Objective The objective of this course is–
1	To demonstrate and perform basic principles finding thermal conductivity of various materials like asbestos, brass etc.
2	To demonstrate basic method for determination of overall heat transfer coefficient of composite slabs.
3	To perform experimentation for determination of heat transfer coefficients in free and forced convection.
4	To demonstrate basic method for determination of emissivity of grey body and Stefan Boltzmann's constant.
5	To perform experimentation for determination of heat transfer coefficients, effectiveness and heat transfer rates in Heat Exchangers

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Students will be able to determine the heat transfer rates through various cross-sections and mediums in different modes.
CO2	Student will be able to acquire, tabulate, analyze experimental data, and draw interpretation and conclusions
CO3	Student will be able to calculate radiation heat transfer and utilize that knowledge in designing any heat transfer application .
CO4	Student will be able to understand heat exchanger analysis.

Sr. No.	List of Practical's -Heat Transfer Lab
01	To determine the thermal conductivity of insulating material.
02	To determine the thermal conductivity of metal bar.
03	Determination of thermal conductivity of composite wall.
04	Determination of Stefan Boltzmann constant.
05	Determination of heat transfer coefficient in natural convection for vertical tube.
05	To determine heat transfer coefficient in forced convection for fluid flowing through a duct
06	Determination of temperature distribution & heat transfer rate from fin under free and forced convection.
07	Determination of emissivity of non-black body.
08	To determine the effectiveness of a concentric tube heat exchanger.
09	To determine the critical heat flux.
10	Determination of heat transfer rate in unsteady state heat transfer.
11	To determine the heat transfer coefficient in filmwise and dropwise condensation.
12	Determination of performance of shell and tube heat exchanger using computer-based setup
12	Minimum 2-3 virtual experiment to be conducted.
13	Study of various types of Heat Exchangers.
14	Study of Heat Pipe.

Note : At least 8 practicals from the above list are expected.

RTM Nagpur University- Mechanical Engineering
5TH SEM-Energy Conversion -I -BEME502T
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	**Energy Conversion-I**	3	1	-	4	30	70	100	03

Sr. No.	Course Objective The objective of this course is–
1	To expose the students to the practical applications of engineering thermodynamics & working of steam power plants.
2	To gain the knowledge of various components of the thermal power plant like boiler, nozzles, turbines and condensers and will be able to evaluate the performance parameters of these components.
3	To understand the concept of utilizing residual heat in thermal systems
Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Explain, classify, analyze layout of power plant, cogeneration principle of steam generators (i.e. Boilers), boiler mountings & accessories and evaluate performance parameters of boiler.
CO2	Explain the concepts of fluidized bed boilers and various draught system and evaluate performance parameters of natural draught system(i.e. chimney)
CO3	Explain the importance of steam nozzle and determine its throat area, exit area, exit velocity. Also compare impulse and reaction steam turbines and explain the concept of governing of steam turbine
CO4	Explain the methods of compounding of steam turbine, various energy losses in steam turbine and able to draw velocity diagrams of steam turbine blades to analyze the angles of the blades, work done, thrust, power, efficiencies of turbine.
CO5	Explain, classify steam condensers, cooling towers and evaluate performance parameters of surface condenser.

Syllabus- Energy Conversion–I (Theory) , Mechanical Engineering, V Sem	
Contents	No of hours
Unit I Introduction to layout of thermal power plant, Coal handling system and ash handling systems. Classification of steam generators (i.e. Boilers), comparison of fire tube & water tube boilers, high pressure boilers, boiler mountings and accessories. Principle of steam generation, necessity of water treatment, Performance of steam generators: Evaporation capacity, equivalent evaporation, boiler efficiency and preparation of Heat balance sheet of boiler. Cogeneration: Introduction to cogeneration, its need, working principle and applications. Topping cycle and bottoming cycle.	12
Unit II Draught and its classification, calculations for chimney height, chimney diameter & efficiency. Condition for maximum discharge. Fluidized bed boiler: Bubbling fluidized bed boilers, circulating fluidized bed boilers (Elementary treatment expected)	8
Unit III Steam nozzles: Adiabatic expansion in nozzles, maximum discharge, critical pressure ratio and effects of friction, calculation of throat, exit areas and exit velocity of nozzle, supersaturated flow, Wilson Line. Steam turbines: Working principle of steam turbines, classification of steam turbines, and comparison of impulse and reaction turbine, governing of steam turbines. ,	8
Unit IV Compounding of steam turbines, Energy losses in steam turbines, flow of steam through turbine blades, reheat factors, velocity diagrams, graphical and analytical methods, work done, thrust and power, dimensions and proportioning of the blades, steam turbine efficiencies, condition for maximum efficiencies. (Analytical Treatment on Impulse turbine, Reaction turbine and two stage impulse turbine is expected) ,	8
Unit V Steam condensers: Classification of condensers, quality and quantity of cooling water required, calculations for surface condenser, Dalton's law of partial pressure, sources of air leakages and air removal, air ejectors. Cooling towers: Natural draught and forced draught cooling towers, cooling ponds ,	8
TOTAL HOURS	44

Sr. No.	List of Tutorials- Energy Conversion –I
01	Two problems on determination of factor of evaporation, equivalent evaporation and boiler efficiency of steam generators (i.e. boilers.)
02	Two problems on preparation of Heat balance sheet of boilers.
03	Two problems on determination of height and diameter of chimney.
04	Two problems on calculation of throat, exit areas and exit velocity of nozzle.
05	One problem on metastable or supersaturated flow through nozzle
06	Two problems on determination of blade angles, work done, thrust, power, efficiencies of Impulse turbine.
07	Two problems on determination of work done, thrust, power, efficiencies of Reaction turbine.
08	One problem on determination of power and efficiencies of two stage Impulse turbine
09	Two problems on calculation of performance parameters of surface condenser.

References:

Text Books Recommended:

1. A Course in Power Plant Engineering, Arora & V.M. Domkundwar, Dhanpat Rai & Sons
2. Thermal Engineering, P.L. Ballaney, Khanna Publications.
3. Thermal Engineering, R. K. Rajput, Laxmi publications.
4. Thermal Engineering, M.M. Rathode, TMH publication.
5. A Course in Thermal Engineering, Anand Domkundwar, C.P. Kothandaraman, S.Domkundwar, Dhanpat Rai & Sons.

.**Reference Books Recommended:**

1. Thermal Engineering, Mathur & Mehtra, Jain Brothers Publications, New Delhi.
2. Heat Engineering, V.P. Vasandani & D.S. Kumar, Metropolian Book Publishers.
3. Power Plant Engineering, A.K. Raja, Shrivastava and Dwivedi, New age International Publishers.
4. Fluidized Bed Combustion, S. Oka and E. Anthony, Marcel Dekker Inc.
5. Power Plant Engineering, M. M. EI- Wakil, McGraw Hill International.
6. Charles H Butler: Cogeneration" McGraw Hill.
7. Donald Q. Kern, "Process Heat Transfer", Tata Mc Graw Hill.
8. Sydney Reiter "Industrial and Commercial Heat Recovery Systems" Van Nostrand Reinhols.

RTM Nagpur University- Mechanical Engineering
5th Semester
Design of Machine Elements –(BEME503T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	**Design of Machine Elements**	3	1	-	4	30	70	100	3 Hours

Sr. No.	Course Objective The objective of this course is–
	To study the basic principles of mechanical components design based on strength and rigidity using design data, various standards, codes, etc. and prepare component drawings.

Course Outcomes

After successful completion of this course the student will be able to:

CO1	Apply principals of static loading for design of Cotter joint, Knuckle joint
CO2	Design bolted, welded joints, power screws & pressure vessels
CO3	Design the power transmission shaft & coupling
CO4	Design components subjected to fatigue or fluctuating stresses. Also, will be able to apply principles for determining bending stresses for desing of curved beams e.g. crane hook, C-Frame.
CO5	Design clutches, brakes and springs

Syllabus- Design of Machine Elements (Theory,) 5th Semester , Mechanical Engineering	
Contents	No of hours
Unit I Mechanical Engineering Design, Design methods, Aesthetic and Ergonomics consideration in design, Material properties and their uses in design, Manufacturing consideration in design, Design consideration of casting and forging, Basic principle of Machine Design, Modes of failures, Factor of safety, Design stresses, Theories of failures (Selection in the process of designing), Standards, I.S. Codes, Preferred Series and Numbers **Design of Joints against static loads**: Cotter joint and Knuckle joint ,	**[10 hrs]**
Unit II Design of bolted and welded joints under axial and eccentric loading conditions. Design of power screw: Thread forms, multiple threaded screws, terminology of power screw, design of screw jack. Design of Cylinder & Pressure Vessels: Types of pressure vessel, stresses induced in pressure vessel, Lame's, Clavarino's and Bernie's equations. Design of cylindrical & spherical pressure vessels. Design of nut, bolt, gasket & covers for pressure vessel.	**[10 hrs]**
Unit III **Design of shaft** for power transmission, static and fatigue criteria for shaft design, ASME codes for shaft design, Design of keys. Design of rigid and flexible coupling.	**[10hrs]**
Unit IV: **Design against fluctuating loads:** variables stresses, reversed, repeated, fluctuating stresses. Fatigue failure: static and fatigue stress concentration factors, Endurance limit- estimation of endurance limit, Design for finite and infinite life, Soderberg and Goodman design criteria, Fatigue design under combined stresses. **Curved Beams:** Assumptions made in the analysis of curved beams, Design of curved beams, bending stresses in curved beams, such as crane hook, C-frame, etc.	**[8 hrs]**
Unit V: **Design of clutches and brakes:** Single and multiple plate clutch, constant wear and constant pressure theory for plate clutches, Internal and external shoe brakes and band brakes. Introduction to disc brakes and its design concepts. **Design of Springs:** Spring material, Helical compression & tension springs under static and variable loads, Leaf spring, Laminated Springs.	**[10hrs]**

Sr. No.	List of Tutorials
01	Numerical on Design against static loads: Cotter joint and Knuckle joint
02	Numerical on design of bolted and welded joints
03	Numerical on design of power screw
04	Numerical on design of Cylinder & Pressure Vessels
05	Numerical on design of shaft, keys and coupling
06	Numerical on design of coupling
07	Numerical on Design of clutches and brakes
08	Numerical on Design of springs under static and variable loads.

Assignment (Guidelines)

1. Design exercise in the form of design calculations with sketch and or drawings on following machine components
   a) Bolted and welded joints
   b) Design against fluctuating loads (finite and infinite life)
   c) Shaft and coupling design
   d) Screw Jack
2. Comparative study and analysis of disc brakes used in motorcycles of different makes (at least 4)

References:

Text Books Recommended:

1. Design of Machine Elements, B.D. Shiwalkar. Central Techno publications
2. Design of Machine Elements, V. B. Bhandari., McGraw Hill education.
3. Design of Machine Elements, Sharma & Purohit, PHI.
4. Design Data book, B.D. Shiwalkar, Central Techno publications.
5. Mechanical Engg. Design, Shigley J E, TMH.
6. Design Data Book, PSG.

Reference Books Recommended:

1. Mechanical Design Analysis, M. F. Spotts, Prentice-Hall.
2. Machine Component Design, Robert C. Juvinall, Kurt M. Marshele, Wiley.
3. Machine Design, Maleev& Hartman, CBS publishers.
4. Hand book of Machine Design, Shigley&Mischke, McGraw Hill.
5. Machine Design, Robert L.Norton, Pearson.
6. The Principles of Design, Nam P. Suh, McGraw Hill

RTM Nagpur University- Mechanical Engineering
5th Semester
Design of Machine Elements –(BEME503T)
Syllabus (Practical)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
B.Tech 5th Semester Mechanical	**Design of Machine Elements**	-	-	2	1	25	25	50

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Design Cotter joint / Knuckle joint / Turn buckle/ crane hook, C-frame
CO2	Design bolted and welded joints, power screw and Cylinder & Pressure Vessels
CO3	Design the shaft, coupling, clutches and brakes
CO4	Design the spring under static and variable loads

Sr. No.	Syllabus- Design of Machine Elements (Practical),5th Sem, Mechanical Engineering
01	Design of Cotter joint, Knuckle joint
02	Design of bolted joints under axial and eccentric loading conditions.
03	Design of welded joints under axial and eccentric loading conditions
04	Design of power screw
05	Design of Cylinder & Pressure Vessels.
06	Design of power transmission shafts.
07	Design of Couplings
08	Design of crane hook, C-frame
09	Design of clutches and brakes.
10	Design of springs under static and variable loads..
NOTE: **Design problems (at least 8 problems should be included in the Journal)**	

Suggested References:

1. Design Data book, B.D. Shiwalkar, Central Techno publications
2. Design Data Book, PSG
3. Design of Machine Elements, V.B.Bhandari, McGraw Hill.

RTM Nagpur University- Mechanical Engineering
5TH SEM-Industrial Economics & Management-BEME504T
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	Industrial Economics & Management	3	-	-	03	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
01	This course is designed to familiarize the learners with important economic terminologies and key industrial concepts and to create awareness about functions of Industrial management and the concept of marketing and financial management.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Understand the concept of demand and supply and its relationship with the price
CO2	Relate various factors of production with reference to different economic sectors
CO3	Analyze the causes and effects of inflation and understand the market structure
CO4	Acquire knowledge of various functions of management and marketing management
CO5	Perceive the concept of financial management for the growth of business

SYLLABUS- Industrial Economics & Management-BEME504T	
Contents	No of hours
Unit I Industrial Economics: Law of demand, Demand analysis, Types of demand, Determinants of demand, Supply, Law of diminishing marginal utility, Elasticity of demand, Types of elasticity of demand. ,	08
Unit II Factors of production, Firm and Industry, Law of return, Cost concepts, Fixed variable, Average, Marginal and Total cost, Depreciation and methods for depreciation, direct and indirect taxes	08
Unit III Inflation, effect of inflation, Monetary and fiscal measures to control inflation, deflation, Market and market structures, Perfect competition, Monopoly, Monopolistic competition, Oligopoly, Concept & overview of share market, Effect of share market on economy, Share market terminologies	08
Unit IV Definition, nature and scope of management, functions of management, Meaning and concepts of Marketing management, Marketing Mix, Channels of distribution, Advertising and sales promotion.	08
Unit V Meaning, nature and scope of financial management , Brief outline of profit and loss account, balance sheet, Budgets and their importance, Types of budgets- Rigid and flexible budgets.	08

Books Recommended:

Text Books

1. Modern Economics, H. L. Ahuja, S.Chand Publishers
2. Modern Economic Theory, K. K. Dewett., S. Chand Publishers
3. Engineering Economics, D. N. Dwivedi, A. Dwivedi, Vikas Publishing House
4. Industrial Management I.K. Chopde, A.M. Sheikh
5. Business Organization and Management S.A. Sherlekar

RTM Nagpur University- Mechanical Engineering
5TH SEM- Organizational Behaviour and Entrepreneurship Development -BEME505T
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	Organizational Behavior and Entrepreneurship Development	3	-	-	03	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
01	The objective of the course is to create awareness among learners about the various essential aspects of organizational behavior and to impart know how on entrepreneurship development.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Understand the concept and importance of organizational behaviour
CO2	Acquire the knowledge of interpersonal behaviour and transaction analysis
CO3	Know different traits and theories of personality
CO4	Acquire a know-how on entrepreneurship development and its ecosystem
CO5	Get the knowledge of various sources of finance

SYLLABUS- Organizational Behaviour and Entrepreneurship Development	
Contents	No of hours
Unit I Concept of organization behavior, Importance of organization behavior, Key elements of organization behavior, scope of organizational behaviour.	08
Unit II Nature and meaning of interpersonal behavior, concept of transaction analysis, benefits and uses of transaction analysis, Johari window model.	08
Unit III Definition and meaning of personality, importance of personality, theories of personality, personality traits.	08
Unit IV Concept of entrepreneurship, characteristics of an Entrepreneur, types of Entrepreneurship, Functions of Entrepreneurs, factors affecting the growth of entrepreneurship, Women entrepreneurship in India, Problems and challenges of women entrepreneurs, Government's support system to develop women entrepreneurship.	08
Unit V Sources of financing the enterprise, Concept of fixed and working capital, factors influencing the requirement of working capital, Concept of start-up and start-up echo system, Concept of product life cycle.	08

Books Recommended:

Text Books

1. Organizational behaviour by MN Mishra, published by S.Chand.
2. The human side of organization by Michale Drafke, published by Pearson education.
3. Management and Organizational behaviour by Laurie.J. Mullins, published by Pearson education.
4. Organizational behaviour by K. Aaswathappa, Published by Himalaya publications.
5. Entrepreneurial Development By, S. S. Khanka S. Chand & Co. Ltd. New Delhi, 1999.
6. Entrepreneurial Development. By, S.Anil Kumar. New Age International.
7. Small- Scale Industries and Entrepreneurship, By, Dr. Vasant Desai, Himalaya Publication.
8. Management of Entrepreneurship. By, N.V.R. Naidu, I.K. International Pvt Ltd.

RTM Nagpur University- Mechanical Engineering
5TH SEM-(Open Elective –I)
Automobile Engineering -I -BEME505T
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	**Open Elective - I Automobile Engineering**	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course are–
1	To make the students conversant with fundamentals of automobile systems
2	To develop competencies in the performance analysis of vehicle.
3	To understand the emerging trends in electric vehicles, Hybrid vehicles and fuel cell vehicles
4	To make the students conversant with Automobile Safety Considerations Electrical Systems and Modern Developments in Automobiles.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Demonstrate the vehicle construction, chassis, fuel supply system, lubrication system and cooling system in automobile.
CO2	Illustrate the principle and working of Transmission system and clutch, gear box, rear axle drives, fluid flywheel, torque converter.
CO3	Identify the steering, suspension system and brake system.
CO4	Understand the applications of electrical/electronic system of automobile and wheels, tyres.
CO5	Explain the concept of electric vehicles, Hybrid vehicles, fuel cell vehicles and vehicle pollution norms. Appraise the automobile safety system and recent development in automobiles.

Syllabus- Automobile Engineering- Open Elective - I	
Contents	No of hours
Unit I: **Introduction:** Classification of automobiles, Major components and their functions. Chassis, different vehicle layouts. **Engine Power Plant:** Constructional features of different types of engines used in automobiles. Fuel supply systems, cooling systems, lubrication systems.	7
Unit II **Transmission system:** **Gear Box:** Necessity of transmission, principle, types of transmission, sliding mesh, constant mesh, synchromesh, transfer gear box, gear selector mechanism. Torque converter, semiautomatic and automatic transmission. Propeller shaft, universal joint, Hotchkiss drive, torque tube drive. Differential and its need. Rear axles and Front axles. **Clutch:** Necessity, requirements of a clutch system. Types of Clutches, centrifugal clutch, single and multi-plate clutch, fluid clutch.	8
Unit III **Steering systems:** Principle of steering, steering geometry and wheel alignment, Power Steering. Under steer, Over-steer. electronic power steering **Suspension systems:** Need, Function of spring and shock absorber, conventional suspension, Independent, suspension System, Active suspensions. **Brakes:** Function, Classification, Basic Components. Drum Brakes, Disc Brakes, Hydraulic brakes, Air Brakes, ABS.	8
Unit IV **Electrical Systems:** Battery, magneto and electronic ignition systems, horn, side indicator and wiper Automobile air-conditioning. Automotive Llighting circuit, Importance, types and specifications, LEDs, Reflectors. **Automotive Electronics:** Dashboard instrumentation, Sensors used in automobiles, ECU. **Wheels and Tyres:** Types of wheels, wheel dimensions, tyre, desirable tyre properties, types of tyres, comparison of radial and bias-ply tyres, factor affecting tyre life.	7

Unit V Electric vehicles, components of EV, EV Batteries, EV Chargers. Hybrid vehicles, types of hybrids and Fuel cell vehicles. Alternative energy sources, CNG, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles. **Vehicle Pollution Control:** cause and types of Emissions from Vehicle, Euro and Bharat Stage norms, Methods to reduce vehicular pollution, after treatment devices, EGR and Catalytic Converter. **Automobile Safety Considerations and Modern Developments in Automobiles:** Requirements of automobile body, Vehicle Safety Necessity, active and passive safety, Restrain Systems (seatbelts), Air Bags, crash worthiness. Recent advances in automobiles such as, collision avoidance, intelligent lighting, intelligent highway system, navigational aids, Automatic Cruise Control and Parking Assistance system.	8

References:

Text Books Recommended:

1. Automobile Engineering Vol. I & II, Kirpal Singh, Standard Publishers, Delhi
2. Automobile Engineering, R.K.Rajput, Luxmi Publications, New Delhi
3. Automobile Engineering R.B. Gupta, Satya Prashan, New Delhi
4. Course in Automobile Engineering, Sharma R. P, Dhanpat Rai and Sons, New Delhi, 1998.

Reference Books Recommended:

1. Automobile Mechanics, Crause, W.H., Tata McGraw Hill, New Del hi, 2007.
2. Vehicle and Engine Technology, Heinz Heisler, Arnold, London, 1999.
3. Automotive Engines, Srinivasan S., Tata McGraw Hill, New Delhi, 2001.

RTM Nagpur University- Mechanical Engineering
5th Sem- Open Elective-I
Project evaluation and Management –(BEME505T)
Syllabus (Theory)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	Open Elective-I Project evaluation and Management	3	-	-	3	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To develop an understanding towards a structured approach for every unique project undertaken in the industrial context about its need, concept, tools and techniques of project management approach
2	To develop working knowledge of the technical and financial aspects of project management decisions. Increase awareness and strengthen skills in applying participatory methods to project management.
3	Understand the project management lifecycle and be knowledgeable on the various phases from project initiation through closure.
4	Develop detailed project plan to include: Defining a project's scope and tasks, estimating task resource needs, assessing project risk and response strategies, a communications plan, and more.
5.	Understanding the critical role of an strong project manager played in project success.

Course Outcomes	
After successful completion of this course the student will be able to:	
CO1	Utilize the use of a structured approach for each and every unique project undertaken including utilizing project management concepts, tools, and techniques.
CO2	Apply participatory methods to project management.
CO3	Do network scheduling and network planning
CO4	Manage lifecycle on the various phases from project initiation through closure.
CO5	Do estimation of project Costs, Earned Value Analysis, Monitoring Project Progress, Project Appraisal.

Syllabus-Project evaluation and Management (Open Elective -I) 5th Sem ,Mechanical Engg	
Contents	No of hours
Unit I Definition & Characteristics of Project Performance Parameters: Time, Cost & Quality. Classification of Projects: Sector based, Investment based, Technology based, Cause based, Need based - Balancing, Modernization, Replacement, Expansion & Diversification. Project Life Cycle Phases – Concept/Initiation Phase: Parameters Involved in Project Identification. Sources of New Project Ideas. Governmental Framework for Identification of Opportunities, Incentives from state & central govt.; Import-substitution projects. ,	9
Unit II Project Conceptualization & Feasibility Analysis Project Definition Phase: Project Formulation & Feasibility. Types of Feasibility Studies – Pre-feasibility, Support/Functional Feasibility Study. Preparation of Project Feasibility Report & Specification; Aspects of Project Feasibility Managerial/Organization: Promoters Background, Criteria of Evaluation, Marketing/Commercial: Demand & Supply, Competition, Market Survey, Porter's 5 Forces, Operational/Technical: Process, Technology, Location, Capacity, Labour, Raw Material & Utility Availability. Financial: Cost of Project, Means of Finance, Financial Projections – Profit & Loss Account, Balance Sheet, Funds Flow Statement, Cash Flow Statement, Schedule of Fixed Assets, Schedule of Term Loans. Socio-Economic: Socio-Cost Benefit Analysis. Effective Rate of Protection, Domestic Resource Cost. ,	9
Unit III Project Planning- Development of Project Network; Project Representation; Consistency and Redundancy in Project Networks; Project Scheduling- Basic Scheduling with AO-A Networks; Basic Scheduling with A-O-N Networks; Project Scheduling with Probabilistic Activity Times. Planning & Organization Phase: Project Planning, Scheduling & Monitoring, Statement of Works, Project Specifications, Work Breakdown Structure, Network Analysis & Duration Estimating Network Diagrams – PERT/CPM, Estimate Activity Times, Milestone Scheduling. Resource Leveling, Resource Smoothening, Project Crashing. ,	9

Unit IV Project Cost Estimation: Need, Causes of Cost & Time Overruns. Nature of Cost Estimates, Types of Project Cost Estimates, Estimation of Manpower & Utilities. Project Budgeting & Control, Earned Value Management System: Concept of AC, PV, EV, Variances, etc. Contract Management: Responsibility Sharing Matrix, Types of Contract Payments, Risk Factors in Contracts – Contractor & Owner. Project Management Information System and Control, Management Pitfalls. ,	9
Unit V Project Implementation & Control Implementation Phase: Activities Involved: Erection & Commissioning, Installation, Trial Runs & Commencement of Commercial Production. Cleanup/Shutdown Phase: Handover to Client, Settlement of Accounts. Project Risk Management, Responsibility Sharing Matrix, Critical Chain Project Management – Critical Path vs Critical Chain, Concept of Buffers – Project buffer, resource buffer, feeding buffer. ,	9

Sr. No.	List of Tutorials
01	Writing an Exercise with Latest Software.(Ms Project) a complete project step by step on any one industry.

References:

Text Books Recommended:

1 Narendra Singh; Project Management & Control; Himalaya Publishing House, Mumbai
2 S. Choudary, Project Management, Tata McGraw Hill
3. Prasanna, C; Projects: Preparation, Appraisal, Budgeting & Implementation, Tata Mc-Graw Hill, New Delhi, (1987).
4 Chas R.B., Aqulino, N.J. and Jacob,F.R., Production and Operations Management: manufacturing and services, Tata McGraw Hill, New Delhi (1999).

Reference Books Recommended:

1. Maylor H, Project Management, Pearson Education Asia, New Delhi, (2009).
2. Cleland D , Project Management, Tata Mc-GrawHill, New Delhi, (2007).

RTM Nagpur University- Mechanical Engineering
5th Semester
Industrial Visit –(BEME506P)

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech 5th Sem Mechanical	**Industrial Visit**	-	-	2	1	50	--	--	1hr

Sr. No.	Course Objective The objective of this course is–
1	Industrial visits provide the students with an opportunity to learn practically through interaction, working methods and employment practices. It gives the students an exposure to current work practices as opposed to theoretical knowledge being taught at their college classrooms

Course Outcomes	
After the successful completion of this course the students are able to:	
CO1	Opportunity to interact with Industry Experts
CO2	Learning experience.
CO3	Enhanced employability and PPO's.
CO4	Interpersonal skills enhancement.
CO5	Day off from the usual melancholy.

Contents
A student pursuing a certain degree will be taken to companies or industries related to their field for a visit and there the students will be exposed briefly to the procedures, processes, work environment, management efforts taking place in that industry
Students should meet industry leaders, professionals, entrepreneurs, policymakers, and corporates who share their wisdom, learning, and experiences. Through these interactions students should develop leadership qualities, management skills, and learn about the industry working. Industry interaction can be helpful in updating the curriculum when there are significant changes in prevalent technologies; also, the faculty members get to know about the industry's latest trends.
Educational tours to industries provide an opportunity for students to see and experience real workstations, plants, machines, systems, assembly lines, and interact with highly trained and experienced personnel. Students should present a report on the industry he/she visits.
For students, such trips open many doors for corporate training and internships, which in turn increase the students' employability.
During the industrial visits, the students get an opportunity to experience how professionals live, learn about various management concepts like Just In Time or Lean manufacturing and how they are put into action. It is not easy to manage hundreds of skilled and unskilled workers at the same time and meet the stringent quality norms and production targets of the company. How managers, production engineers, employees work in tandem to achieve a common target is a management lesson in itself. Students are supposed to understand them.
Industrial trips help students to enhance their interpersonal, communication skills, and teamwork abilities. These visits have, time and again, proved to be an excellent platform for networking as the students interact and connect with the corporates via official social media platforms like Facebook, Linked In, and Twitter. These educational/ industrial trips also help the students identify their learning towards a branch and decide their future work areas like marketing, finance, operations, IT, HR, etc.

Checklist

For Teachers:

1. Have you given the student some background about the organization?
2. Have you clearly defined the learning objectives to the organization and the students?
3. Have you ensured the plan for the day with the students and the learning procedure including the timings?
4. Have you elaborated the risk assessments to the students and the safety procedure along with the behavior to be followed?
5. Have you ensured the permission from the Parents and the Guardians regarding the visit?
6. Prepared the students on the personal objectives?
7. Have you helped students form questions to be asked in the industry?
8. Have you introduced the students to the scientific topics that they will encounter on the visit?

Checklist for Students:

1. How conducive is the working environment
2. What type of organization is this?
3. Hierarchical structure in the organization
4. Products handled
5. Where is the workplace located?
6. How are the desks arranged?
7. Is it an open office or a closed office?
8. What is the noise level in this industry or factory?
9. What are the staff benefits?
10. Do the employees appear happy and engaged?
11. What are the age level and the gender balance?
12. What are the various departments and the varied availabilities?
13. Commutation mode to employees?

14. Are the employees challenged by their work?
15. What is the company culture followed?
16. The dress code maintained by the employees of both the genders?
17. Could you see yourself as a prospective employee of the company in the future?
18. Does this sector of education fascinate you?

Checklist for Organizing Team:

• Ensure that the college and the company are well aware of the Number of students', their age.
• Purpose of the visit is made clear to both the parties and MOU is signed by the company and the school to comply with the rules of the organizing team.
• Do you understand the learning outcomes for the students and have a clear idea of how the visit will meet these?
• Have you carried out a risk assessment and undertaken any other health and safety responsibilities
• Have you got a clear understanding of the plan for the day and the timings of activities?

NOTE

1. Students FEEDBACK form and Report must be collected and kept for reference during committee visits

2. A detailed report of all industries visited by the students must be prepared and kept for reference during committee visits

3. Minimum 70% of total teaching staff should have visited at least one company with students

RTM Nagpur University- Mechanical Engineering
5TH SEM-Performing Art (BEME507P)
Syllabus (Theory)- Mandatory Course

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
B.Tech . 5th Sem Mechanical	**Performing Art**	00	00	03	00	-	-	-	-

Sr. No.	Course Objective The objective of this course is–
1	A short course in art is at the heart of this course and is intended to open the way for students to "think outside the square" – or more precisely, through art to find themselves in that challenging but potentially wonderful place outside their own personal square.

Course Outcomes

An Arts and Science course helps the students to empower themselves with problem solving skills. The ability to analyze things and communicate them in the right way is taught. These skills are very much essential to get employed in reputed companies and most of the companies prefer candidates with the mentioned skills. The students also have a variety of career options to choose for the future

Performing Art –Suggested Activities. However Institutes are free to design their own course as per their convenience

LEVEL -1

Music	Dance	Drama
1. Raga studies	1. History of Dance	1. Acting
2. Western music	2. Choreography	2. Basic vocal practice
3. Hindustani music	3. New media	3. Communication skills
4. Study of Tala	4. Performance Practice	4. Yoga
5. Shastra	5. Indian Culture	5. Direction
6. Rabindra sangeet	6. Techniques of Dance	6. Event management
7. Folk music	7. Movement Techniques	7. Computer skills
8. World music	8. Dance on Camera	8. Indian theatre
		9. History of theatre
		10. Western theatre
		11. Camera, light, sound
		12. Filming concepts
		13. Projects on short films
		14. TV production
		15. Film Theories

LEVEL -2

Music	Dance	Drama
1. Analytical study of raga 2. Raga classification system 3. Indian aesthetics 4. Comparative aesthetics 5. A critical study of specified raga 6. Composition forms of Indian vocal music	1. History of dance 2. Dance and sculpture 3. Kathak 4. Bharatnatyam 5. Rasa & Nayak Nayika Bheda 6. Traditional folk dance 7. Dance and Sanskrit treaties	1. Theatre game & physical exercises 2. Voice speech 3. Acting on stage 4. Play production 5. Classical Indian theatre 6. Direction zones 7. Stage management 8. Acting on camera 9. TV and film production 10. Children's theatre 11. Folk performances 12. Play production 13. Improvisation, Mime and choreography