GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2020-21
B.TECH. THIRD YEAR, V SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP05TPC08	Design of Machine Elements	3	1	-	30	70	100	4
2.	IP05TPC09	Metal Cutting	3	0	-	30	70	100	3
3.	IP05TPC10	Statistical Quality Control	3	0	-	30	70	100	3
4.	IP05TPE01	Professional Electives-01	3	0	-	30	70	100	3
5.	IP05TPE02	Professional Electives-02	3	0	-	30	70	100	3
6.	IP05THS04	Electives from Humanity Science-03	3	0	-	30	70	100	3
		Total	**18**	**1**	**-**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP05PPC05	Metal Cutting Lab	-	-	2	30	20	50	1
2.	IP05PSC01	Seminar	-	-	2	50	-	50	1
		Total	**-**	**-**	**4**	**80**	**20**	**100**	**2**

Total Credits: **21**

Total Contact Hour: **23**

Total Marks: **700**

INTERNAL ASSESSMENT: - Two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP05TPE01 Professional Electives-01
IP05TPE11 Industrial Engineering
IP05TPE12 Work Study and Ergonomics
IP05TPE13 Employee Relation
IP05TPE02 Professional Electives-02
IP05TPE21 MEMS & Nanotechnology
IP05TPE22 I. C. Engine
IP05TPE23 Mechatronics
IP05THS04 Electives from Humanity Science-03
IP05THS41 Financial Management
IP05THS42 Managerial Economics
IP05THS43 Financial Accounting and Costing

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPC08	Design of Machine Elements	3	1	-	15	15	70	100	4

COURSE LEARNING OBJECTIVES:

1. To familiarize the various steps involved in the design process.
2. To evaluate the shape and dimensions of a component by considering various principles.
3. To satisfy functional and strength requirements.
4. To learn to use standard practices, catalogues, standard data and standard machine components.
5. To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
6. To develop an ability to identify, formulate, and solve engineering problems.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Describe the design process, material selection, calculation of stresses and selection of theory of failure.
CO2: Design the solid, hollow shafts and to finding the critical conditions and effective use of key in shaft.
CO3: Analyze riveted and bolted joints in eccentric loading.
CO4: Examine the welded joints for structural applications.
CO5: Demonstrate knowledge on brakes, clutches and belt drive used in different application under static loading.
CO6: Analyze the bending and wear conditions in spur gear and knowledge to summarize the failure criteria.

COURSE CONTENT:

Module - I

Basic design concepts and design against static loading: Objective and scope of mechanical engineering design, design considerations, review and selection of materials and manufacturing processes, codes and standards, modes of failure, design/allowable stress, factor of safety (FoS), theories of failure – maximum normal stress theory, maximum shear stress theory, distortion energy theory, choice of failure criteria.

Module - II

Design of shafts and keys: Shaft subjected to twisting moment, bending moment, combined twisting moment and bending moment, fluctuating loads, design of shaft on the basis of rigidity. Flat and square keys, woodruff keys.

Module - III

Design of riveted, bolted and welded joints: Failure of riveted join, strength and efficiency of riveted joint, eccentrically loaded riveted joint. Bolted joint in tension, torque requirement for bolt tightening, bolted joint under fluctuating load. Eccentrically loaded joint in shear, bolted joint with combined stresses. Stresses in butt and fillet welds, strength of welded joints, eccentrically loaded joint, welding joint subjected to Bending moment.

Module - IV

Design of clutches and brakes: Friction clutches, friction materials, torque transmitting capacity, single & multiple plate clutches, centrifugal clutches. Band and block brakes.

Design of belt drive: Flat and V-belts, belt constructions, geometrical relationships for length of the belt, analysis of belt tensions, condition for maximum power.

Module - V

Design of spur gears: Spur gears, gear drives, classification of gears, selection of type of gears, law of gearing, force analysis, gear tooth failures, selection of material, number of teeth, face width, beam strength of gear tooth, effective load on gear tooth, estimation of module based on wear strength, Lewis equation.

TEXT & REFERENCE BOOKS:

1. Design of Machine Elements – V. B. Bhandari, TMH, New Delhi.
2. Mechanical Engineering Design - Shigley, J.E., Charles, R.M. and Richard, G.B., McGraw Hill, 2004.
3. Machine Design – Spott, TMH.
4. Machine Design – Khurmi& Gupta, Khanna Publisher.
5. Machine Design – Sharma &Agrawal, DhanpatRai Publications.
6. Design of Machine Elements – Sharma &Purohit, PHI.
7. Design Data: Data Book of Engineers, PSG College of Technology.
8. Machine Design - T.V. Sundararajamoorthy and N. Shanmugam, Anuradha Agencies, 2003.
9. Machine Design Data Book - V. B. Bhandari, TMH, New Delhi.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPC09	Metal Cutting	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To study the basics of metal machining and mechanics of metal machining
2. To study the different cutting tool materials and types & geometry of cutting tools
3. To learn introductory concepts of various advanced machining processes
4. To study various super finishing processes.

COURSE OUTCOMES:

After completion of the course, the students will be able to:

CO1: The students have learned the basics of metal machining

CO2: Understand and apply the principles of mechanics to metal cutting process and develop analytical relation between input and output process parameters.

CO3: Understand, analyze and apply the concept of shear deformation of materials in metal cutting.

CO4: Understand the models of the machining economics and optimization, tool wear and its measurement.

CO5: Apply the fundamentals of abrasive machining to develop theoretical relations for different types of grinding and honing operations

CO6: The students have also studied the introductory concepts of various advanced machining processes

COURSE CONTENTS:

Module -I

Introduction: Definition and classification of metal cutting and tools, geometry of single point and multipoint cutting tool, various angles of cutting tool and their functions, factors affecting tool geometry, orthogonal and oblique cutting ,cutting tool signature, types of chips,their formation and factors. Merchant's force diagram.

Mechanism of chip formation: Forces on the chips, methods of chip breaking, Design principal of simple step type chip breaker, working principle of chip breakers, effect of chip breaking, Merchant theory and other theories of metal cutting, stresses and strain in chips, shear and strain rate, Power and energy calculation.

Module -II

Heat generation and cutting temperature in machining: Causes and sources of heat in cutting, heat distribution, their measurernent, tool dynamometer and their types and working.

Tool failures and tool life, mechanism of tool failure, types of tool failure, tool wear and types, Taylors tool life Equations, relationship between tool life, cutting speed, feed, depth of cut, factors affecting tool life.

Machinability -Definitions, evaluations, factors affecting machinability, machinability index.

Module - III

Cutting fluids- functions characteristics and types of cutting fluids and their application, criteria for selection of cutting fluids'

Cutting tool materials- requirements, types and characteristics of various cutting tool materials, comparison and selections of cutting tool.

Economics of machining - cost analysis and optimization of machining, various parameters for calculation of machining cost'

Module - IV

Grinding: Mechanics of grinding, cutting action, grit, Grain, Structure, Grinding Wheel Specification, Wheel Life; Balancing, Truing and Dressing of Wheels; Classifications of Abrasive Grinding Processes; wheel wear, mechanics of lapping and honing, Polishing and Buffing Chipping action in grinding,

Module - V

Unconventional Machining Processes: Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits.

Electro-chemical machining (ECM), process parameters, MRR and surface finish.

Abrasive jet machining and ultrasonic machining working principles and process parameters.

Mechanism of material removal, tooling and equipment, process parameter, surface finishing obtained by Laser beam machining (LBM) and Electron beam machining.

TEXT & REFERENCE BOOKS:

1. Metal Cutting Theory and Practice - A. Bhattachary, New Central Book Agency (P) Ltd.
2. Machining and Machine Tools - A. B. Chattopadhyay, Wiley India Publication.
3. Metal Cutting Principles - M. C. Shaw, Oxford University Press.
4. A Course in Workshop Technology, Vol II – B. S. Raghuwanshi, DhanpatRai& Co.
5. Production Technology- R. K. Jain, Khanna Publishers.
6. Fundamentals of Metal Machining and Machine Tools- G. Boothroyd, McGraw Hill.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPC10	Statistical Quality Control	3	0	-	15	15	70	100	3

COURSE LEARNING OBJECTIVES:

1. Define and understand various terms associated with quality control.
2. Enhance the students understanding of the complexity of statistical analysis and interpretation.
3. Provide an introduction to the fundamental concept of SPC, total quality management, six sigma, quality function deployment and applications of these concepts.
4. Analyze the philosophies of TQM in order to better evaluate the TQM implementation proposals.
5. Assess exactly where an organization stands on quality management with respect to ISO 9000 quality management.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Explain the importance of quality & role of statistical quality control.

CO2: Apply methods and techniques of statistical quality control, to studies and interpret the results in business.

CO3: Demonstrate motivation and responsibility to advocate for quality in business.

CO4: Develop quality management philosophies and frameworks.

CO5: Develop in-depth knowledge on various tools and techniques of quality management.

COURSE CONTENT:

Module - I

Basic concepts of quality: Inspection definition of quality, quality control cost of quality, value of quality, statistical quality control, need and advantages of SQC

Frequency distribution: Variables & attributes, quality characteristics, theory of control charts, control chart for variable X & R chart, control chart for attribution P, NP, C, chart & process capability.

Module - II

Quality assurance: Quality assurance manual, quality circle, characteristics of quality circle and the process of operation of quality circle, quality policy & procedure & objectives,

Acceptances sampling Concept of sampling, O-C curve & its construction, sampling plans, single, doubles & multiple sampling plans.

Module - III

Contribution of various quality management gurus: Jurantriology, Deming's 14 Points, P-D-C-A wheel, Taguchi's philosophy, design of experiment, old and new seven QC tool of quality, Philip Crosby's zero defect, seven types of waste, 5's, quality function deployment.

Module - IV

Introduction to ISO 9000: Various models of ISO 9000, clauses of 9000, total quality control, total quality management, tool for TQC & TQM, Kaizen, 6 sigma quality, procedure of six sigma; TQM and Six Sigma.

Module - V

Reliability: Definitions, bathtub curve, design for reliability, failures & causes of failures, FMECA, maintainability & availability, MTBF, reliability models, system with components in series & in parallel, mixed arrangement, fault–tree-technique.

TEXT & REFERENCE BOOKS:

1. Statistical Quality Control– Grant &Leowowworth, Tata Mc. Hill.
2. Quality Planning & Analysis–Juran&Gryana, Tata Mc. Hill.
3. Total Quality Control – A. Feigenbaum, Mcgraw Hill.
4. Statistical Quality Control–M. Mahajan, DhanpatRaiPublication.
5. Total Quality Management – Besterfield, Tata Mc. Hill.
6. Total Quality Management – PurnimaCharantimath , Low Pearson Education.
7. Total Quality Management – Krishnaiya, PHI.
8. Total Quality Management – Suganthi&Sannuel, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB - TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE11	Industrial Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To impart capability of successfully planning, controlling, and implementing projects.
2. To apply the principles of engineering science, maths, technology and human engineering, involving industry-relevant problems.
3. To contribute to the profitable growth of industrial economic sectors by using IE analytical tools, effective computational approaches and systems thinking methodologies.
4. To recognize the tools of efficiency, effectiveness and productivity for the resources of the plant and facility.
5. To implement the policy of wage administrations for making the labour more and higher productive in their work.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to apply mathematics and science in Industrial engineering.

CO2: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO3: Ability to identify, formulate and solve engineering problems.

CO4: Ability to use the techniques, skills, and modern engineering tools necessary for industrial engineering practice.

COURSE CONTENT:

Module-I

Introduction: History & development of industrial engineering. Productivity, means of increasing productivity, work study, productivity and work study, human factor in the fabrication, work of F. W. Taylor, Frank and Lillian Gilberth and their contribution.

Module-II

Method study: Definition & basic procedure, selection of jobs.Recording technique: micro motion study, Therbligs, cyclograph,chronocyclograph, principle of motion economy, design of work place layout, analysts in the form of chart, operation chart, flow process chart, flow diagram, string diagram, man machine chart, two hand chart, Simo chart.

Module-III

Work measurement: Definition, objectives, application, number of cycles to be timed, time study equipment, performance rating, allowance, lumber of cycle to be studied, determination of standard time, predetermined motion time system, conducting work sampling study & establishing standard time.

Module-IV

Wages & incentives: Characteristics of a good wage or incentive system, method of wage payment, concept of wage & incentive schemes, financial and non-financial: Taylor's differential piece rate, Halsey premium plane, Merric's multiple piece rate system, group incentive scheme.

Ergonomics: Work space dimension, design of work place, environmental stresses & impacts on human work.

Module-V

Value engineering: Introduction, concept of value, value analysis approaches, job plan, value tests.

Industrial safety: Analysis of cost of accident, hazards in various fields like fire, electrical shocks, chemical; organization for safety, plant safety, govt. legislation for safety, safety rules.

TEXT & REFERENCE BOOKS:

1. Introduction to work study–I.L.O, Oxford Press.
2. Motion and time study – Mundel, Prentices Hall India.
3. Motion and Time Study– Ralph M Barnes, John Wiley and sons.
4. Industrial Engineering – M. I. Khan, New Age International Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB - TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE12	Work Study and Ergonomics	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of interaction of man, machine and integration of their tools.
2. To apply the principles of math, science, technology and engineering, involving industry-relevant problems.
3. To provide the comfort ability in working environment of allthe employee, labour.
4. To apply the concept in the examination of human and work in all their contexts.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to design and conduct experiments, as well as to analyse and interpret data.

CO2: Ability to identify, formulate and solve engineering problems.

CO3: Ability to use the techniques, skills, and modern engineering tools necessary for work study practice.

CO4: Assess the effect of physical environment factors on comfort and performance.

CO5: Explain the influence of ergonomic principles on work organization and culture.

Module - I

Introduction to man machine systems and ergonomics, human factors in design and engineering, needs of ergonomics and aesthetic design, physiological aspects of work.

Module - II

Work measurement through physiological tests, work physiology, paced and unpaced work performance, data logging, data collection, data reduction and analysis techniques, gross human anatomy, anthropometry, bio mechanics, muscle strength and exertion potential of different limbs.

Module - III

Work capacity, environmental effects, exercises for evaluation of pastoral form and work spaces, environmental conditions including temperature, illumination, noise and vibration.

Module - IV

Perception and information processing, design of displays, hand control, typography, and readability, layout and composition.

Module - V

Exercises in evaluation of human response to product interface, product safety and product liability, design consideration for appearance, colour, texture and form.

TEXT & REFERENCE BOOKS:

1. Applied Ergonomics– D. C. Alexander, Taylor & Francis.
2. Ergonomics for Beginners– Jan Dul, Taylor & Francis.
3. The Nature & Aesthetics of Design–David Pye, Cambium Press.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE13	Employee Relations	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To develop the knowledge on trade unions and its formation, structure, functions and legal framework.
2. To gain insight into the process of collective bargaining, its origin and development.
3. To describe the activities, include annual employee reviews and the on-going development of employees through training and managerial guidance.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Ability to describe and critique the concept of employee engagement.

CO2: Ability to identify problems associated with both over-engagement and disengagement.

CO3: Ability to examine the extent to which emotional and aesthetic labour are positioned in some contemporary organizations.

CO4: Ability to critically evaluate the measurement of employee engagement.

CO5: Ability to align organizational and employee objectives for improved organizational effectiveness.

Module - I

Conceptual framework of employment relations: Concept, scope and approaches to industrial relations, evolution of industrial relations and current developments, constitutional and legal framework of industrial relations: conventions, id act, trade union act.

Module - II

Trade unionism: Trade union development and functions, trade union structure and recognition, managing trade unions, managerial unionism, employers' organisations.

Module - III

Collective bargaining: Nature and content of collective bargaining, negotiation skills, issues and trends in collective bargaining.

Module - IV

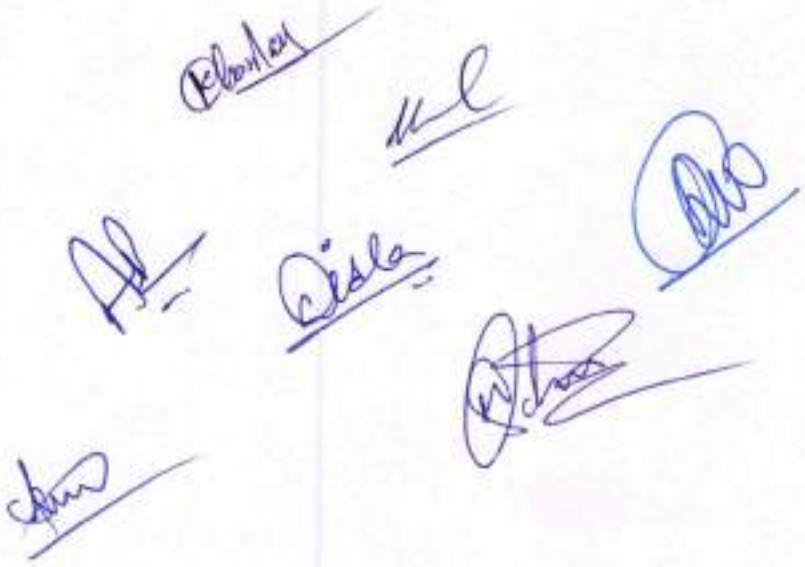
Employee involvement: Evolution, structure and process, design and dynamics of participative forums, strategies for implementing participation.

Module - V

Grievance handling and discipline: Grievance function in industrial relations, conciliation, arbitration and adjudication, discipline in industry.

TEXT & REFERENCE BOOKS:

1. Employee Relations Management– P. N. Singh, Pearson Education India
2. Personnel Management Theory And Practice– Arun Kumar, RachanaSharmam, Atlantic Publishers & Distribution
3. Industrial Relations and Personnel Management– A. Simon, M.V. PyleeGeorge, Vikas Publishing House Pvt Ltd.



Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE21	MEMS and Nanotechnology	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To explain students to basic concepts of nano devices and various sensors.
2. To provide knowledge about the applications of nanotechnology

COURSE OUTCOMES:

The after completion of the course the student will be able to

CO1: Understand the working of MEMS and NEMS

CO2: Understand the applications of nano sensors and detectors

COURSE CONTENT:

Module - I

Introduction of mems, micro sensor, micro actuators, microelectronic fabrications, mechanical thermal and magnetic mems, RF mems, MOEMS, mems design consideration.

Micromachining, photolithography, structural and sacrificial materials, methods of lithography. Thin film deposition, and its developments process, LPCVD, PECVD, impurity doping , etching ,problem with bulk micro machining, vapour bonding, LIGA.

Module - II

System modelling and properties of material: System types and basic modellingelements in mechanical,thermal, fluid system. Translational and rotational pure mechanical system, hybrid system, analogy between mechanical and electrical system.

Passive components and systems: System on a chip, passive electronics system, passive mechanical system.

Module - III

Mechanical sensors and actuators: Introduction,principals, micro plates, capacity impacts, piezoelectric materials, and their properties, mems gyroscope.

Thermal sensor and actuators: Introduction, thermocouple probe, micro hot plate gas sensors, mems thermo vessels, shape memory alloys.

Module - IV

Magnetic sensors and actuators: Different types and principals.

RF mems: introduction, RF based communication system, mems inductors, and tuner filter, Resonater.

Module -V

Nanotechnology: Introductions, nanotechnology materials, fullerenes, doping, CNT, SWCNT, MWCNT, development and application of CNT.

TEXT & REFERENCE BOOKS:

1. MEMS- Mahalik, McGrawHill
2. MEMS & MOEMS Technology & Application -Raichoudhary, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE22	I. C. Engine	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To study classifications of internal combustion engine.
2. To understand how and why actual cycles deviate from air standard cycle and fuel-air cycle.
3. To understand combustion in spark ignition engine and diesel engines.
4. To impart knowledge about carburetion, gasoline injection and diesel injection.
5. To impart knowledge about ignition, cooling, lubrication and governing systems.
6. To impart knowledge about various engine performance characteristics and its testing.

COURSE OUTCOME:

The after completion of the course the student will be able to

CO1: Demonstrate a basic understanding of engine design, function and performance.

CO2: Acquire knowledge and hands-on competence in the design and development of mechanical systems.

CO3: Work effectively with engineering and science teams as well as with multidisciplinary designs.

CO4: Demonstrate an understanding of the relationships between the design of the internal combustion engine and environmental issues.

COURSE CONTENT:

Module - I

Introduction of internal combustion engines: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, comparison of Otto, Diesel, and Dual cycles. Stirling cycle, Ericsson cycles, two and four-stroke engines, SI and CI engines, valve timing diagram, fuel air cycle, factors affecting it, actual cycle analysis, actual Cycle.

Module – II

SI Engines: Combustion in SI engine, flame speed, ignition delay, abnormal combustion and it's control, combustion chamber design for SI engines, Carburetion, mixture requirements, carburetor types, theory of carburetor, MPFI, Ignition system requirements, Magneto and battery ignition systems, Ignition timing and sparkplug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect.

Module – III

CI Engine: Combustion in CI engines, Ignition delay, Knock and its control, combustion chamber design of CI engines.

Fuel injection in CI engines: Requirements, types of injection systems, fuel pumps, fuel injectors, injection timings.

Module - IV

Engine Cooling: Different cooling systems, Radiators, and cooling fans.

Lubrication: Engine friction, Lubrication principle, type of lubrication, lubrication oils, crankcase ventilation.

Fuels: Fuels for SI and CI engine, important qualities of SI and CI engine fuels, rating of SI engine and CI engine fuels, dopes, additives, gaseous fuels, LPG, CNG, Biogas, Producer gas, alternative fuels for IC engines.

Module – V

Testing and Performance: Performance parameters, basic measurements, blow by measurement, testing of SI and CI engines.

Emission and Pollution: S. I. Engine and C. I. Engine emissions and its control and comparison. Effect of pollution on human health and biosphere.

TEXT & REFERENCE BOOKS:

1. A Course in IC Engines - M.L. Mathurand R.P. Sharma, Laxmi Publication.
2. Internal Combustion Engines –V. Ganesan, TMGH Publication.
3. Internal Combustion Engines: Theory and Practice - G.F. Taylor.
4. Introduction to IC Engine -Stone, Richard.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05TPE23	Mechatronics	3	1	-	15	15	70	100	4

COURSE OBJECTIVES:

1. To acquire the knowledge of basics of mechatronics and their scope.
2. To acquire the knowledge of sensors and transducers.
3. Analyse fundamental of hydraulic and electrical actuators.
4. To acquire the knowledge of data acquisition system and control system.
5. To develop the ability to analyse and design mechatronics system.

COURSE OUTCOMES:

The after completion of the course the student will be able to

CO1. Apply knowledge of mechatronics for understanding and solving engineering problems.

CO2. Acquire knowledge and hands-on competence in applying the concepts of mechatronics in the design and development of mechanical systems.

CO3. Demonstrate creativeness in designing new systems components and processes in the field of engineering in general and mechanical engineering in particular.

CO4. Identify, analyse and solve mechanical engineering problems useful to the society.

CO5. Work effectively with engineering and science teams as well as with multidisciplinary designs.

COURSE CONTENT:

Module -I

Introduction to mechatronics: Sensors and actuators type, selection and interfacing, digital electronics and microprocessors in mechatronic systems, mechatronic systems modelling, analysis and control of analogue, digital and hybrid systems, mechatronic systems design principles.

Module -II

Introduction to mechatronics systems: Measurement systems, control systems, mechatronics approach.

Sensors and transducers: Introduction, performance, terminology, displacement, position and proximity, velocity and motion-fluid, pressure-temperature, sensors-light, sensors-selection of sensors –signal processing.

Module -III

Microprocessor: Introduction, architecture pin configuration, instruction set-programming of microprocessor using 8085, instructions interfacing input and output devices, interfacing d/a convertors and a/d converter, applications, temperature control, steeper motor control, traffic light controller.

Module -IV

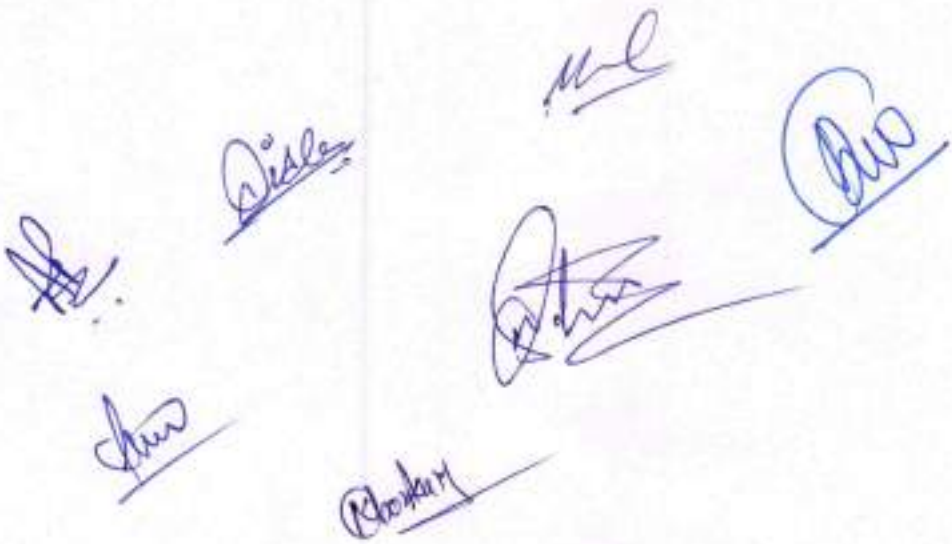
Programmable logic controller: Introduction, basic structure, input/output processing, programming, mnemonics timers, internal relays and counters data handling, analog input/output selection of a plc.

Module -V

Design and mechatronics: Stages in designing mechatronic systems, traditional and mechatronic design, possible design solutions, case studies of mechatronic systems, pick and place robot, automatic car park system, engine, management system.

TEXT & REFERENCE BOOKS:

1. Mechatronics–HMT Ltd.Tata McGraw Hill Publishing Co. Ltd., New Delhi.
2. Mechatronics–D.A Bradley, D. Dawson, N.C. Burn and A.J. Loader, Chapman and Hall.
3. Mechatronics– Singh & Joshi, PHI.



Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05THS41	Financial Management	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. The objective of this course is to inform the students about the basic concepts of financial management and contemporary theory and policy in order to master the concepts, theories and technique of financial management, which represents the condition of profitable business operations and survival respectively in the development of business subjects and the economy as a whole.
2. Students should acquire the basic knowledge by means of combining theoretical cognitions and practical attitudes to enable them the understanding of financial problems in business practice after completed the vocational studies.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Start and manage new business.

CO2: Evaluate and monitor short term and long-term investments.

CO3: Evaluate and monitor current asset.

COURSE CONTENT:

Module – I

Introduction: Scope and objective, organisation of finance function.

Time value risk and return and valuation of money: Valuation of long-term securities, various model of pricing.

Module –II

Statement of changes in financial position: Sources and uses of working capital, cash flow statement, balance sheet, profit loss account and its process.

Financial ratio analysis: Meaning, types, importance and limitations, calculation of various ratios.

Module –III

Capital budgeting: Principals, techniques, various methods of capital budgeting, concept and measurement of cost and capital, and various approaches for measurement of cost of capital and computation.

Analysis of risk and uncertainty: Various approaches for risk evaluation.

Module –IV

Theory of working capital management: Concept and definition of gross, working capital and net working capital, trade-off between profitability and risk.

Module –V

Operating, financial and combined leverage: Introduction, definition and concept and various approaches.

TEXT & REFERENCE BOOKS:

1. Financial Management–Khan and Jain, TMGH.
2. Financial Management –Kuchhal, Vikas Publication.
3. Financial Management–Paresh Shah, Willey India Pvt. Ltd.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05THS42	Managerial Economics	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To prepare engineering student to analyse cost/revenue data and carry out economic analyses in the decision making.
2. Justify the process or reject alternatives/projects on an economic basis.
3. To prepare engineering students to function in the business and management side of professional engineering practice.

COURSE OUTCOME:

After completion of the course, student will be able to

CO1: Be able to make intelligent comparisons of project alternatives during the planning and implementation phases.

CO2: Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.

CO3: Be able to perform and evaluate payback period and capitalized cost on one or more economic alternatives.

CO4: Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives

COURSE CONTENT:

Module- I

Introduction to managerial economics: Different area of managerial economics, micro and macroeconomics, nature and scope of managerial economics, demand analysis, law of demand and its exceptions, elasticity of demand: definition, types, measurement and significance of elasticity of demand, supply analysis, law of supply, elasticity of supply: definition, types, measurement and significance of elasticity of supply.

Module- II

Law of return: Revenue analysis, theory of production and cost analysis: production function, Cobb-Douglas production function, ACMS production function, investment function.

Cost analysis: Cost concept, opportunity cost, fixed vs. variable cost, explicit costs vs. implicit costs, out of pocket costs vs. imputed costs, break-even analysis (BEA), determination of break-even point (simple problem), managerial significance and limitation of BEA.

Module-III

Introduction to market & pricing policies: Element of market, types of market, concept of market, classification of market based on the nature of competition, types of competition, features of perfect competition, feature of imperfect competition, monopoly and monopolistic competition, price-output determination in case of perfect competition and monopoly.

Objectives and policies of pricing: Introduction, full cost or cost-plus pricing, differential pricing, going rate pricing, marginal cost pricing, trade association pricing, loss leadership pricing, administered pricing

Module- IV

Forms of business organization: Introduction, definition, essential element of good organization, principles of organization, formal and informal organisation, organisation structure, concept of ownership organization, types of ownership, partnership, joint stock company, types of joint stock company, co-operative organization, public sector organisation.

Capital and capital budgeting: Capital and its classifications, need of working capital and its assessment, factors affecting working capital, fundamental of accounting, types of capital, method and sources of raising finance, nature and scope of capital budgeting, features of capital budgeting proposals, method of capital budgeting: payback method, accounting rate of return (ARR) and net present value method (simple problems).

Module- V

Fundamental of financial accounting: Nature of accounting, important accounting terminology, accounts and types of accounts, rules of debit and credit, system of book keeping, book of accounts, journal, ledger, trial balance, final account, trading account, profit and loss accounts and balance sheet.

Financial analysis through ratios: Classification of financial ratios, liquidity ratios, leverage ratios, activity ratios, profitability ratios, current ratio, acid test ratio, debt equity ratio, assets coverage ratio, debt service coverage ratio, inventory turnover ratio, debtor velocity ratio, creditor velocity ratio, gross profit ratio, net profit ratio, return on equity ratio.

TEXT & REFERENCE BOOKS:

1. Managerial Economics –YogeshMaheshwari, PHI.
2. Managerial Economics – Joel Dean, PHI.
3. Managerial Economics–Craig H. Petersen, W. Cris Lewis, Sudhir K Jain.
4. Financial Accounting For Management –Ambrish Gupta, Pearson Eduction.
5. Managerial Economics – H. Craig Peterson & W. Cris Lewis, PHI.
6. Managerial Economics – Suma Damodaran, Oxford University Press.
7. Managerial Economics and Financial Analysis –Aryasri, TMH.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech. V Sem.	IP05THS43	Financial Accounting and Costing	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To ascertain the cost per unit of the different products manufactured by a business concern.
2. To provide a correct analysis of cost both by process or operations and by different elements of cost.
3. To disclose sources of wastage whether of material, time or expense or in the use of machinery.
4. Equipment and tools and to prepare such reports which may be necessary to control such wastage.
5. To provide requisite data and serve as a guide for fixing prices of products manufactured or services rendered.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Appreciate the need for negotiable instruments and procedure of accounting for bills honoured and dishonoured.

CO2: Differentiate trade bills from accommodation bills.

CO3: Understand the concept of consignment and learn the accounting treatment of the various aspects of consignment.

CO4: Distinguish joint venture and partnership and to learn the methods of maintaining records under joint venture.

CO5: Distinguish between single entry and double entry.

CO6: Know the ascertainment of profit under single entry system.

CO7: Understand the meaning and features of non-profit organisations.

COURSE CONTENT:

Module- I

Financial accounting: Introduction to book keeping, double-entry accounting, journal & ledger posting, financial statements &analysis, trial balance, preparation of trading and profit & loss account and balance sheet.

Module-II

Ratio analysis: Balance sheet ratios, current ratio, fixed asset ratio, liquidity ratio, capital gearing ratio, profit-loss account ratios, gross margin ratio, net margin ratio, combined ratios, return on investment ratio, net profit to total assets ratio, creditors turnover ratio.

Module-III

Costing: Objectives of costing, elements of costing, methods of costing, preparation of cost sheet, job costing, marginal costing, absorption costing, process costing and standard costing-material, labour, overhead cost variance, activity based costing and target costing, cost-profit-volume analysis and problems on cost-volume-profit analysis.

Module-IV

Working capital management: Introduction, concepts of working capital, operating and cash conversion cycle, permanent and variable working capital, balanced working capital position, determinants of working capital, estimating working capital needs, policies for financing current assets, issues in working capital management.

Module-V

Capital budgeting: Nature and scope of capital budgeting, features of capital budgeting, methods of capital budgeting, DCF, NON-DCF techniques, accounting rate of return, net present value, payback period, discounted payback period, profitability index.

TEXT & REFERENCE BOOKS:

1. Accounting for Management–T. Vijaya Kumar, 1/e, Tata McGraw-Hill.
2. Financial Management–I. M. Pandey9/e, Vikas Publishing House.
3. Cost Accounting–M.Y. Khan and P. K. Jain, 2/e, TMH.
4. Management Accounting–M.Y. Khan and P. K. Jain, Text, Problems and Cases, 6/e TMH.
5. Basic Financial Management–M.Y. Khan, P. K. Jain, 3/e, TMH.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech. V Sem.	IP05PPC05	Metal Cutting Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Operate machine tool equipment commonly found in industry like lath machine, milling machine and grinding machine.
2. Manufacture parts from various materials in accordance with sp blueprints, electronic drawings and shop sketches.
3. Apply safety principles in a work environment to minimize hazards a to productivity.

COURSE OUTCOMES:

After completion of the course, student will be able to

CO1: Apply cutting mechanics to metal machining based on cutting force and power consumption.

CO2: Operate lathe, milling machines, drill press, grinding machines, etc.

CO3: Select cutting tool materials and tool geometries for different metals.

LIST OF EXPERIMENTS:

1. Introduction of general purpose machine lath and drilling machine, shaping machine, milling and grinding machine.
2. Facing and plain turning on lathe machine.
3. V-groove cutting on shaping machine.
4. Step turning and taper turning on lathe machine.
5. To perform the surface grinding operation.
6. Thread cutting and knurling on lathe machine.
7. To verify the Merchant's force diagram.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP06PPC06	Measurement & Metrology Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Identify and classify different measuring tools related to experiments.
2. Identify, define and explain accuracy, precision and some additional terminology.
3. Conduct, analyze, interpret and present measurement data from measurements experiments.
4. Identify sources of variability, error and uncertainties.
5. Demonstrate excellent laboratory skills and techniques including the proper use of relevant instruments and related technology.
6. Enhance the ability to apply knowledge of mathematics, statics, physics and engineering sciences.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

LIST OF EXPERIMENTS:

1. To measure pressure using Bourdon pressure gauge.
2. To calibrate pressure gauge using Dead weight pressure gauge tester.
3. To measure temperature using thermister.
4. To measure flow rate using Rota meter.
5. To measure angle using Angular sensor.
6. To measure torque using Torque transducer.
7. To measure pressure using pressure transducer.
8. To measure temperature by thermocouple.
9. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier height gauge, Micrometers.
10. Measurement of various angles using Bevel protractor, Sine bar & Combination set.
11. Calibration of Vernier caliper, Micrometer, Height gauge, Depth micrometer using slip.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP06PPC07	Welding Engineering Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Availability of various manual and automated welding processes.
2. To provide information related to concepts, operating procedures of various welding processes.
3. To gain knowledge on practical aspects of different welding processes and apply effectively on various engineering applications.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: To acquire the knowledge and skills of modern welding techniques.

CO2: To develop the skills of conventional welding techniques.

CO3: To have a practical exposer various testing methods of welding joint.

LIST OF EXPERIMENTS:

1. To make a Lap joint, using the given two M.S pieces by arc welding.
2. To make a corner joint, using the given two M.S pieces by arc welding.
3. To prepare a butt joint with mild steel strips using brazing technique.
4. To prepare a butt joint with mild steel strip using GMAW technique.
5. To study and observe the welding and brazing techniques through demonstration and practice (Gas, MIG, TIG, Brazing).

GURU GHASIDAS VISHWAVIDYALAYA (A CENTRAL UNIVERSITY), BILASPUR, CG
SCHOOL OF STUDIES IN ENGINEERING & TECHNOLOGY
Department of Industrial & Production Engineering
CBCS-New, Study & Evaluation Scheme W.E.F. Session: 2020-21
B. TECH THIRD YEAR, VI SEMESTER

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	IP06TPC11	Operation Research	3	1	0	30	70	100	4
2.	IP06TPC12	Metrology & Measurement	3	0	0	30	70	100	3
3.	IP06TPC13	Welding Engineering	3	0	0	30	70	100	3
4.	IP06TPE03	Professional Elective-03	3	0	0	30	70	100	3
5.	IP06TPE04	Professional Elective-04	3	0	0	30	70	100	3
6	IP06TOE01	Open Elective-01	3	0	0	30	70	100	3
		Total	**18**	**1**	**0**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	IP06PPC06	Metrology & Measurement Lab	0	0	2	30	20	50	1
2.	IP06PPC07	Welding Engineering Lab	0	0	2	30	20	50	1
		Total	**-**	**-**	**4**	**60**	**40**	**100**	**2**

Total Credits: **21**

Total Contact Hour: **23**

Total Marks: **700**

INTERNAL ASSESSMENT: - Two class tests of 15 marks each will be conducted.

L-LECTURE, T-TUTORIAL, P-PRACTICAL, ESE –END SEMESTER EXAMINATION

IP06TPE03 Professional Electives-03
IP06TPE31 Material Management
IP06TPE32 Plant Layout& Material Handling
IP06TPE33 Maintenance & Reliability Engineering
IP06TPE04 Professional Electives-04
IP06TPE41 Automobile Engineering
IP06TPE42 Power Plant Engineering
IP06TPE43 Heat & Mass Transfer
IP06TOE01 Open Elective-01
IP06TOE11 Enterprise Resource Planning
IP06TOE12 Management Information System
IP06TOE13 Six Sigma and DOE

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPC11	Operation Research	3	1	-	15	15	70	100	4

COURSE OBJECTIVES:

1. To learn about the importance of decision making.
2. To design and analyze mathematical statement and equations.
3. To grasp importance of Network analysis, transportation problems.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Apply knowledge of optimization for formulating and engineering, decision problems in work culture

CO2: Work effectively with engineering departments.

CO3: Reflects towards resource optimization and allocation.

COURSE CONTENT:

Module -I

Introduction to linear programming: Graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, sack surplus & artificial, variable method, degeneracy problem.

Module-II

Mathematical statement of the transportation problem: Transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, traveling sales-man problem.

Module-III

Game theory: Rule of game, method of solving game, graphically & arithmetic, saddle point & without saddle point, dominance method, mixed strategies 2 X 2 game, 2 X N game, M X 2 game, 3 X 3 game (method of matrix's, method of linear programming etc).

Inventory: Introduction, classification, function, level, control techniques, models, various costs associated, EOQ, optimum lot sizing.

Module-IV

Introduction of queuing theory: Elements of queuing system, operating characteristics of a queuing system, Poisson arrivals & exponential service time, waiting time & idle time cost, single channel queuing theory.

Replacement problems: Requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods.

Module - V

Network analysis: Introduction of PERT & CPM, computation of PERT, time estimation, measure of deviation & variation , probability of completing project, arrow diagram & critical path method, scheduling , cost analysis & crushing of network.

TEXT & REFERENCE BOOKS:

1. Operation Reasearch Sharma & S D Kedarnath, Ramnath & Co Meerut.
2. Operation Research, Sasien Yaspan.
3. Operation Research – N. D. Vohra, TMH Publication.
4. Operation Research– Hira & Gupta, S. Chand & Co.
5. Operation Research – H. Gillette, TMH, New Delhi.
6. Operations Research – M. Taha, TMH, New Delhi.
7. Operations Research – Phillip Ravindran, Wiley Publications.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPC12	Metrology & Measurement	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To under standard, analyze the different measurement systems, Standards of Measurement, Measurement Errors.
2. To know about Limits, Fits, tolerance and gauges used in measurement and designing aspects for those.
3. To familiar with different types of comparators, optical metrology and their applications.
4. To enlighten students about various techniques of measurement of Screw threads, Gears, Geometric forms and Surface textures.
5. To accustom with various measuring devices for measurement of force, torque, strain, acceleration, online measurement and micro-nano measurements.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Distinguish between accuracy and precision, identify different measurement errors, able to select linear or angular measuring instrument for measurement of various components

CO2: Design limit gauges used for various components and purposes.

CO3: Explain principles and uses of comparators and optical instruments used in metrology.

CO4: Examine various screws threads and gears parameter using different methodology and explain capabilities of machining process by measuring surface finish.

CO5: Implement and analyse appropriate measurement methods for variables like force, torque, strain, acceleration and online measurement and micro-nano measurements.

COURSE CONTENT:

Module–I

Introduction: Historical development, Basics of Metrology, Need for Inspection, Accuracy and Precision, characteristic of measurement devices, calibration, concept of error, sources of error, analysis of error. standards of measurements, system of measurement, line, end & wavelength standards.

Linear metrology: Steel rule, callipers, Vernier calliper, Vernier height gauge, Vernier depth gauge, micrometres, universal calliper.

Miscellaneous measurements: Taper measurement, angle measurement, radius measurement, sine bar & Angle gauges

Module–II

Limit Fits and Gauge: Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Types of fit, Basic-Hole System, Basic-Shaft System, Problems, Tolerance grades, Metric fits, Indian standard system, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design, Taylor's principle of gauging, Wear allowance on gauges

Module–III

Comparator and Optical gauges: Principle and uses of mechanical, optical, Electrical, electronic and pneumatic Comparators

Principle of interferometer, concept of optical flat, projector, microscope, autocollimator and interferometer

Types of machine tool tests, alignment tests for lathe, milling and drilling machine tools

Module–IV

Form measurement: Terminology of screw threads, Measurement of minor, major, thread angle and effective diameter of screw threads by 2-wire and 3- wire methods, best size wire. Screw thread gauges, Tool maker's microscope.

Gear tooth terminology, gear tooth thickness & pitch measurement, involutes profile testing of gear

Straightness, flatness and squareness and circularity tests, numerical evaluation, measurement of surface finish, related instruments.

Automated inspection system, Introduction & applications of Co-ordinate Measuring Machine (CMM)

Module–V

Dynamic measurement: Sensors and Transducers: Types of Sensors, types of transducers and their characteristics

Force and Torque measurement: Direct methods and indirect method, force measuring instruments-load cells, Dynamometer, Power Measurements

Measurement of strain: types of strain gauges, gauge factors, theory of strain gauges and method of measurement, Wheatstone bridge circuit

Vibration and Noise Measurement: Piezoelectric Accelerometer and decibel meters concept of on-line inspection & Micro-nano Measurement tools.

TEXT & REFERENCE BOOKS:

1. Mechanical Measurement - Beckwith and Buch,
2. Instrumentation – R.K. Jain.
3. Automatic Control Engineering – H. Raven.
4. Automatic Process Control - Donal P Eckman.
5. Instrumentation Measurement & Analysis - Nakra & Choudhary.
6. Theory & Application of Automatic Controls – B.C Nakra.
7. Modern Electric Instrumentation - D. Albert Cooper, PHI
8. A Text book of Engineering Metrology, I. C. Gupta, Dhanpat Rai, New Delhi
9. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication(KATSON).
10. Engineering Metrology, M. Mahajan, Dhanpat Rai & Co. New Delhi.
11. Metrology and Measurement, N V Raghavendra and Krishnamurthy,Engineering, Oxford University Press.
12. Metrology and Measurement, Anand Bewoor,VinayKulkarni, McGraw-Hill

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPC13	Welding Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To impart knowledge about welding behaviour of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.
2. To impart knowledge on various advanced welding processes so that the students can apply them in engineering industry applications.
3. To develop the knowledge on the design of welded joints and the quality control of weldment.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: The difference between various welding processes and its industrial utilization

CO2: Apply the knowledge of solid state welding process for engineering applications.

CO3: Understand the principles of radiant energy metal joining process.

CO4: Understand the fundamental principles of special arc welding process

CO5: Understand the knowledge of plasma arc in metal joining and cutting process

CO6: Understand the knowledge of design principles in weld joints. Apply the concept of quality control and testing of weldment in industrial environment

COURSE CONTENTS

Module - I

Welding: Classifications, principle and equipments of gas welding and Arc Welding, different type of welding process and their equipments, features, Welding symbols, Positions of welding, types of Gas welding Flames, Welding Techniques, Gas welding Torches Submerged Arc Welding, TIG, MIG, Plasma Arc Welding and its Application

Physics of welding: weldability, weld thermal cycle, Heat affected zone, Arc efficiency, temperature distribution in the arc; arc forces, arc blow, electrical characteristics of an arc, mechanism of arc initiation and maintenance, role of electrode polarity on arc behaviour and arc stability, analysis of the arc.

Module - II

Arc Welding: Arc Welding Power Sources, Selection Factor for Power Sources, DC Generator, rectifiers, Constant Current & Constant Voltage Machines, welding Transformers, duty cycles

Welding Electrodes: Types, electrode coatings and its importance, selection of electrode, electrode coating ingredients and their functions, role of flux ingredients and shielding gases forces during metal transfer, modes of metal transfer in arc welding.

Module - III

Resistance welding process: Spot Welding, Seam, Projection, Butt welding, Flash Butt Welding, percussion welding.

Solid state welding process: Cold Welding, Diffusion Welding, Ultrasonic Welding, Explosive Welding, and Friction Welding'

Radiant energy welding process: Electrical Beam Welding, Laser Beam Welding.

Module - IV

Welding distortion: Distortion and Residual Stresses, Types, Control of welding Distortion, Various discontinuities in welds, Trouble shooting..

Brazing, Soldering and their Application:, Hydrogen Induced Cracking.

Module - V

Design of Weldment: Weld Geometry, Eccentric Loading Designing Torsion and bending, Designing welding fixtures.

Testing, Inspection and Specification: Destructive and Non-destructive methods of testing weldment, WPS, PQR, and ASME section IX Welding.

Robotics and Automation in Welding: Modes of Automation, Positioners, Welding Fixtures, and Arc Motion Devices, Under Water Welding'

TEXT & REFERENCE BOOKS:

1. Modern Arc Welding Technology - S.V. Nadkarni, Oxford IBH Publishers.
2. Welding and Welding Technology - R.L. Little, Tata McGraw-Hill.
3. Welding Technology - O.P, Khanna Dhanpat Rai & Sons.
4. Welding Processes & Technology- R.S. Parmar, Khanna Publishers.
5. Manufacturing Technology (Foundry, Forming and Welding Vol. 1) - P. N. Rao, Tata McGraw Hill.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE31	Material Management	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the concept of effective and efficient purchase, various inventory policies and models.
2. To provide the concept of effective and efficient store management by implementing modern techniques like JIT and MRP.
3. To provide the concept of various models of inventory control.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Develop an ability to perform the role of a materials manager in an organization.

CO2: Shall be able to manage the activities of materials manager like purchasing, inventory analysis, storage etc.in a scientific manner.

CO3: Shall be able to improve due date performance through use of MRP techniques with in capacity constraints.

CO4: Shall be able to practice material planning through modern materials management tools like JIT, DBR etc.

CO5: Understand ethical issues in purchasing and negotiations

COURSE CONTENT:

Module - I

Introduction: Definition and scope, concept of integrated materials management, materials research, materials planning and budgeting, codification, standardization.

Purchasing: Objective and function of purchasing department, purchasing procedure, negotiation and source-selection.

Module - II

Types of purchasing: Buying seasonal commodities, purchasing under uncertainty, purchasing of capital equipment, international purchasing, public buying, legal concept in buying, insurance buying, price forecasting.

Module-III

Stores management: Stores system and procedure, incoming material control, stores accounting and stock verification, obsolete, surplus and scrap management.

Module - IV

Basic inventory system: Concept of inventory, types of inventory, relevant costs of inventory, economic order quantity, inventory control techniques, basic models of inventory.

Spare parts management: Definition of spares and its classification, MUSIC-3D, view of spares, multi echelon spares inventory.

Module - V

Value analysis: Value importance, normal degree value analysis applied to purchase, organizing for value analysis, cost analysis and value analysis aid purchase research, material and process selection in VE design, material, process and supplier decisions.

TEXT & REFERENCE BOOKS:

1. Materials Management an integrated approach – P. Gopalkrishnan. & M Sundaresan (2002) Prentice Hall India Limited, New-Delhi.
2. Materials Management Text and Cases - A.K Chitlae & R..C. Gupta (2009) Prentice Hall India Limited, New-Delhi.
3. Maintenance and Spare parts Management – Pathak, Prentice Hall India Limited, NewDelhi.
4. Production and Operations Management - S.N. Chary, Tata McGraw Hill.
5. Material management: An integrated approach - Dutta.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE32	Plant Layout& Material Handling	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the basic concepts related to the interactions between the production system parameters and their impact on materials handling systems design.
2. To familiarize students with different methods available for the generation of plant layouts.
3. To provide students with information on materials handling systems design for various aspects of the manufacturing and service industry.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: To describe and determine the effect of product, process, and schedule design parameters on plant layout and materials handling systems design.

CO2: To identify the characteristics of product and process layouts and their needs in terms of materials handling.

CO3: To develop and analyze plant layouts using manual and computer aided software methodologies.

CO4: To identify and select various types of material handling equipment.

CO5: To design material handling systems for a variety of scenarios pertaining to manufacturing and service industry

Module - I

Plant facility locating: Concept of plant facility, its scope, importance and objectives nature of location decision, need for facility location planning, general procedures and factors influencing location decision, facility location models, economics and cost analysis, rural and urban location pattern in India.

Module - II

Layout designs: Industrial plant design consideration, types of production types of layout, factors affecting layout tools, techniques and procedure used in workstation and plant layout, quantitative technique in plant layout, developing product and process layout, comparing layouts, criteria for computerized facility layout, concept of computerized layout programs like CRAFT, CORELAP, ALDEP and PLANET.

Module - III

Flow pattern design: Overall system flow cycle, need and advantage of planned material flow, factors for consideration, designing flow pattern, flow patterns for production lines and assembly lines methods.

Module - IV

Material Handling: Scope and functions of material handling, manual mechanical handling ratio, principles of material handling, analysis of material handling problem, classification of material handling system, salient features and application of general purpose material handling equipment, material handling in stores and warehouses, automation in part handling and industrial robots, optimum allocation of material handling equipment.

Module - V

Automated material handling system: Concept of AGVs, AR/RS and methods to minimize cost of material handling, safety in material handling, evaluation of material handling process, design procedure of cranes, lifts.

TEXT & REFERENCE BOOKS:

1. Practical plant layout - Muther
2. Plant layout and design - James More
3. Manufacturing Management: A Quantitative approach - Robert Aolsem
4. Productions and Operation Management - Lockyer.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE33	Maintenance & Reliability Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
2. To provide the concept of various types of maintenance system used in industries.
3. To impart knowledge on reasons for failure and the corrective and preventive measure adopted to reduce them.
4. To make the students to be familiar with the concept of reliability engineering
5. To make the students to understand the various maintenance and logistics means or the execution of various services.
6. To impart knowledge on creating various tools for maintainability of mechanical system.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Application of concepts of the course leads to the optimization of equipment, procedures, and departmental budgets to achieve better maintainability, reliability and availability of equipment.

Module - I

Concept of reliability: Objectives, applications, area of use, use of reliability in industry, reliability functions, mean time between failures, hazard rate function, bath tub curve, conditional reliability, probability density function, failure rate, failure density, hazard rate, uncertainty measures.

Module - II

Constant and time dependent failure models: Exponential, Webull, normal and lognormal distributions, discrete distribution, binomial distribution, Poission distribution.

Reliability of systems: Series, parallel, mixed connected systems, K-out –of –M system concept of redundancy, objectives, applications, redundant standby systems, system structure functions, minimal cuts and minimal paths, common mode failures, three state devices.

Module – III

Determination of reliability (state dependent systems): Markov analysis, load sharing system, standby systems, degraded systems.

Failure analysis: Introduction to failure mode and effect analysis, FMEA and FMECA, criticality analysis, fault tree diagram, event tree.

Availability: Concept and definitions, types of availability model, system availability.

Module - IV

Introduction: Objectives and policies of maintenance, maintainability terms and definitions, maintainability organization functions and tasks, estimation of maintenance cost.

Types of maintenance: Breakdown, predictive, replacement, on-line, off-line, preventive maintenance, reconditioning and correction maintenance, preventive maintenances v/s. repair, reliability centered maintenance, condition-based maintenance, principals and level of CBM.

Module - V

Total productive maintenance: Goals objective benefits of TPM, component of TPM, calculation of OEE, training for maintenance personal, objective and level of training, types of training methodology, evaluation of maintenance department.

TEXT & REFERENCE BOOKS:

1. Principles of Planned Maintenance – R. H Clifton, McGraw Hill Publications.
2. An introduction to Reliability and Maintainability Engineering – C.E Ebling, Tata McGraw Hill.
3. Reliability Engineering - L. S Srinath, Affiliated East-West Press Limited, New Delhi.
4. Engineering Maintainability – B. S Dhillon Prentice Hall of India, New Delhi.
5. Maintainace and spare parts management - P. Gopalkrishnan, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE41	Automobile Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge of basic structure of an automobile.
2. To provide the knowledge of transmission system and its various elements.
3. To provide the knowledge of clutches and suspension system
4. To provide the knowledge of braking system.
5. To provide the knowledge of steering system and engine emissions.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.

CO2: Acquire knowledge and hands-on competence in the design and development of automobile.

CO3: Graduates will develop an ability to identify and solve automobile engineering maintenance problems.

COURSE CONTENT:

Module - I

Introduction of an automobile: Component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factors affecting tyre life.

Module - II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box, synchro mesh gear box, torque converter, propeller shaft, universal joint, hook joint, final drive, differential, performance of gear box.

Module - III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch and fluid fly wheel.

Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

Module - IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self-actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

Module - V

Front axle and suspension wheel alignment purpose: Factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection (MPFI), component of MPFI, different sensors of MPFI system, vehicle air conditioning.

TEXT & REFERENCE BOOKS:

1. Automobile Engineering - Kripal Singh Vol. I, II.
2. Automobile Mechanics - Joseph Heitner.
3. Automobile Engineering - N.K Giri
4. Automobile Engineering - Shrinivasan T.M.H.
5. Automobile Engineering - K.K. Jain, R.B. Asthana T.M.H.
6. Automobile Engineering - R.B. Gupta Tech India Publication Series.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE42	Power Plant Engineering	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the knowledge related to various sources of energy and steam power plant.
2. To provide the knowledge related to solar power plants and solar power plant.
3. To provide the knowledge related to nuclear power station.
4. To provide the knowledge related to geothermal power plant, wind energy and bio gas plant.
5. To provide the knowledge related to direct energy conversion systems.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Demonstrate a basic understanding of various types of power plants.

CO2: Acquire knowledge and hands-on competence in the design and development of mechanical systems associated with power plants.

CO3: Compare different energy resources and choose the most appropriate based on local conditions

CO4: Perform simple techno-economical assessments of energy resources

CO5: Design power plant that meet specific energy demands, which are economically feasible and have a minimal impact on the environment.

COURSE CONTENT:

Module - I

Sources of energy: Present power position in India, non-conventional energy and their application, steam power plant, high-pressure boilers and their classification and working, boiler accessories and mountings, condenser and their types.

Module - II

Solar Energy: Solar Insolation calculation, flat plates and concentrating collectors for liquid and gases, construction, collector area calculation, heat removal factor, efficiency.

Solar System: Power plants, low, medium and high temperature plants, solar dryers, solar cookers, solar refrigeration systems, solar panel.

Module - III

Nuclear Energy: Introduction to nuclear engineering, release of energy by nuclear reaction, chain reaction, moderation, components of nuclear reactor, types of reactor, pressured water reactor, CANDU reactor, gas cooled reactor, liquid metal cooled reactor, breeder reactor, nuclear materials.

Module - IV

Geothermal power plant, Wind energy: Sources of geothermal energy and its types, type of rotors, horizontal axis and vertical axis systems, system design and site selection blade material, wind power scenario in India.

Bio Gas Plant: Types, parameters affecting plant performance, plant design.

Module - V

Direct Energy Conversions: Fuel cells, thermo-electric, thermo ionic and MHD systems (magneto hydrodynamic system). Economic analysis of power plant tariffs.

TEXT & REFERENCE BOOKS:

1. Power Plant Engineering - Domkundwar & Arora, Dhanpat Rai Publication.
2. Solar energy - S.P. Sukhatme, TMH Publication.
3. Solar Energy Thermal Processes - Duffie and Beckman, John Wiley.
4. Power plant Engineering - P.K.Nag, TMH Publication.
5. Power Plant Enginering - Wakil, TMH.
6. Non-Conventional Energy Sources - B.H. Khan, TMH Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TPE43	Heat & Mass Transfer	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide the basic principles of heat transfer due to conduction, convection and radiation.
2. To provide the knowledge of fin design to enhance the heat transfer in real time situation.
3. To provide the fundamentals of convection process and distinguish between natural and forced convection.
4. To design novel heat exchangers for domestic and industrial use.
5. To provide the knowledge radiation heat transfer and the principles of mass transfer.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Classify and differentiate between various modes of heat transfer.

CO2: Design an extended surface for enhancing heat transfer for any device/equipment.

CO3: Calculate heat transfer through any substance for both steady and unsteady state conditions.

CO4: Identify the type of convection process and calculate heat transfer in any real time given situation.

CO5: Design an improved heat exchanger to maximize the heat transfer efficiently.

CO6: Explain the radiation heat transfer phenomenon and apply the knowledge to design a new engineering device.

COURSE CONTENT:

Module - I

Introduction: Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's law, combined modes of heat transfer, thermal diffusivity, overall heat transfer coefficient.

Conduction: Thermal conductivity of solids, liquids and gases, factors in influencing conductivity measurement, general differential equation of conduction, one dimensional steady state conduction, linear heat flow through a plane and composite wall, tube and sphere, critical thickness of insulation, conduction with heat generation in flat and cylinders.

Module - II

Fins: Conduction convection system, extended surfaces rectangular, triangular circumferential and pin fins, general conduction analysis, fins of uniforms cross section area, heat dissipated by a fin, effectiveness and efficiency of fin.

Transient (Unsteady state) heat conduction: Transient conduction in solids with infinite thermal conductivity, Transient conduction in solids with finite conduction and convective resistance.

Module - III

Forced Convection: Physical mechanism of forced convection, dimensional analysis for forced convection, velocity and thermal boundary layer, flow over plates, flow across cylinders and flow in tube, Reynolds analogy.

Natural Convection: Physical mechanism of natural convection, dimensional analysis of natural convection, empirical relationship for natural convection.

Module - IV

Boiling and Condensation: Boiling heat transfer, pool boiling, condensation heat transfer, film condensation.

Heat Exchangers: Different type of heat exchanger, determination of heat exchanger performance, heat exchanger transfer Module, analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method).

Module-V

Thermal Radiation: Introduction, absorption and reflection of radiant energy, emission, radiosity and irradiation, black and non-black bodies, Kirchhoff's law, intensity of radiation, radiation exchange between black surface, geometric configuration factors.

Introduction to Mass Transfer: Mass transfer processes: classification, concentrations, velocities and fluxes, molecular diffusion, eddy diffusion, convective mass transfer.

TEXT & REFERENCE BOOKS:

1. Heat transfer -S.P. Sukhatme, TMH.
2. Heat & Mass Transfer- P K Nag, TMH Publications.
3. Fundamentals of Heat and Mass Transfer - Frank P. Incropera, David P. Dewitt, Wiley.
4. Heat & Mass Transfer - Arora and Domkundwar, Dhanpat Rai Publications.
5. Heat Transfer - C.P. Arora, TMH.
6. Heat & Mass Transfer - R.C. Sachdeva, New Age Publications.
7. Heat Transfer - J.P. Holman, TMH.
8. Heat Transfer : A Practical Approach- Yunus A. Cengel, TMH Publications.
9. Heat & Mass Transfer Book – C P Kothandaraman S Subramanyan, New Age International Publishers.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TOE11	Enterprise Resource Planning	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. To provide and gain insight into process views of organizations and tools and techniques used to model both as-is and to-be models.
2. Apply the process modeling techniques in one or more modelling environments.
3. Summarize basic concepts, tools and techniques of enterprise resource planning (ERP).
4. Describe the key implementation issues of ERP.
5. Reorganize the current and future trends in ERP.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Capable to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods.

CO2: Understand key differences between the major ERP applications (such as SAP R/3).

CO3: Analyze a current architecture and perform an effective gap analysis before an ERP implementation

CO4: Be able to map enterprise architectural resources to a contemporary Enterprise Architecture mapping tool

COURSE CONTENT:

Module – I

Introduction to Enterprise resource planning: Evolution of ERP, MRP, MRP-II, e-ERP, generic business model with reference to ERP, structure of ERP: Two tier architecture client, server, three tier architecture, repository, RDBMS, operating systems, generic model of ERP system - design tree node structure, design of, role/activity diagrams, benchmarking, types of benchmarking, process of benchmarking.

Module – II

Introduction to Business Process Re-engineering: Procedure of BPR, principle of BPR, process improvement, process redesign.

Module – III

Analysis of risk and uncertainty: Various approaches for risk evaluation.introduction: supply chain management and ERP, understanding the supply chain with case examples, supply chain performance

with measures, achieving strategic fit and scope, supply chain drivers, supply chain obstacles, ERP vs SCM, benefits of supply chain improvement, introduction of logistics types of logistics, types of logistics, benefits of logistics.

Module – IV

Integrated SAP model: Integrated data, master data, transactional data, integrated processes, evolution electronic data interchange (EDI), use of EDI, and benefits of EDI, selection of ERP, introduction opportunities and problems in ERP selection, approach to ERP.

Module – V

Origins of SAP: SAP's markets, SAP architecture and integration, SAP business structure, customization of SAP, SAP R/3 material management, sales and distribution, production, plant maintenance, quality management, methodology for ERP implementation, implementation phases, implementation of life cycle implementation failure.

TEXT & REFERENCE BOOKS:

1. Enterprise Resource Planning: Theory and practice - V. Rahul, PHI Publication.
2. Enterprise Resource Planning: Concepts and practice - V.K. Garg, TMH Publication.
3. Enterprise Resource Planning - Alexis Leon, McGraw-Hill Publication.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TOE12	Management Information System	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. Describe the major technological, organizational, behavioral and ethical issues facing today's information systems professional.
2. Retain currency in the face of rapid technological change by reading and understanding technical literature.
3. Critically and comparatively evaluate technical descriptions of computer hardware and software products.

COURSE OUTCOME:

After completion of the course, the students will be able to

CO1: Summarize the foundation for design and analysis of supply chains and synthesize advanced and specialized concepts, principles and models for operational and strategic improvement.

CO2: Analytically examine the supply chain of organizations and measure performance improvement.

CO3: Summarize basic concepts, tools and techniques of enterprise resource planning.

COURSE CONTENT:

Module - I

Organization & types, decision making, cost & value of information, introduction to information in business, types of information system, need, importance, scope and characteristics of information system, component of information system, developing information system. MIS concept evaluation and characteristics structure of MIS, MIS v/s data processing, MIS and DSS.

Module - II

Solving business problems with information system, concept of balanced MIS, effectiveness & efficiency criteria, tool and techniques of MIS- dataflow diagram, flow chart etc.

Data base technology: Introduction, data base and enterprise management, data independence data base approaches, data base architecture, data models, DBMS SQL and working, 4GL, data administration.

Module - III

Business application of information technology, electronic commerce internet, intranet, extranet & enterprise solutions, information system for business operations, information system for managerial decision support, information system for strategic advantage.

Module - IV

Managing information technology, enterprise & global management, security & ethical challenges, planning & implementing change reports, various types of MIS reports, GUI & other presentation tools.

Module - V

Advanced concepts in information system, enterprise resource planning: introduction, various Modules like human resources, finance, accounting, production & logistics. Supply chain management, CRM, procurement, management system object oriented modeling case studies.

TEXT & REFERENCE BOOKS:

1. Introduction to Information System - O.Brian, TMH.
2. Management Information System - Rahul De, Wiley.
3. Management Information System - Louden and lauden, PHI.
4. Information System Analysis & Design - Bansal, TMH.
5. Management Information System - Jawadegar, TMH.
6. Information System for Modern Management - Murdick, PHI.
7. Management Information System - Sadagopan, PHI.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME				CREDITS
			L	T	P	INTERNAL ASSESSMENT		ESE	SUB-TOTAL	
						CT-I	CT-II			
B.Tech VI Sem.	IP06TOE13	Six Sigma and DOE	3	-	-	15	15	70	100	3

COURSE OBJECTIVES:

1. Improve the customer's satisfactions and quality of product and services.
2. Reduce the process cycle time and cost saving and developing staff scale.
3. Understanding the issue and principle of design of an experiment.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Explain the practical implications of Design of experiments.

CO2: Adopt ANOVA techniques to identify sufficient factors.

CO3: Apply Taguchi techniques to conduct experiments in research work.

CO4: Execute various phases of Six Sigma for real time projects.

COURSE CONTENT:

Module - I

Quality perception: Quality in manufacturing, quality in service sector, differences between conventional and six sigma concept of quality.

Probability distribution: Normal, binomial, poisson distribution.

Basics of Six Sigma: Concept of six sigma, defects, DPMO, DPU, attacks on X"S, customer focus, six sigma for manufacturing, six sigma for service, Z score, understanding six sigma organization, leadership council, project sponsors and champions, master black belt, black belt, green belts.

Module - II

Methodology of Six Sigma: DMAIC, DFSS, models of implementation of six sigma, selection of six sigma projects, introduction to software for six sigma, understanding minitab, and graphical analysis of minitab plots.

Module - III

Six Sigma tools: Project charter, process mapping, measurement system analysis, hypothesis testing, quality function deployment, failure mode effect analysis.

Module - IV

Design of experiments: Applications of experimental design, basic principles, design guidelines, statistical design and problems, experimental design, statistical analysis of data, loss function and its calculations.

Module - V

Comparative experiments: Statistical concepts, sampling and sampling distributions, inferences about the differences in means, randomized design and inference about differences in means paired comparison design, inferences about the variances of normal distributions, experiment with single factor: the analysis of variance (ANOVA), analysis of fixed effects models, model adequacy checking, practical interpretation of results, sample computer output, determining the sample size, discovering the dispersion effect, the regression approach to the ANOVA, and non parametric method in the ANOVA.

TEXT & REFERENCE BOOKS:

1. Lean Six Sigma Using Sigma XL and Minitab - Issa Bass, Barbara Lawton, 1/e, Tata Mc Graw-Hill, 2010.
2. Design of Experiments - Phillip Ross PHI.
3. What is Six Sigma, 1/e - P. Pande & L. Holpp, Tata McGraw-Hill.
4. The Six Sigma Way, 1/e - P. Pande, Tata McGraw-Hill.
5. What is Design for Six Sigma 1/e - R. Cavanagh, R. Neuman, P. Pande, Tata McGraw- Hill.
6. Six Sigma - K K Bhote Mc-Graw Hill.
7. Design and Analysis of Experiments - D.C. Montgomery, 8th Edition, John Wiley.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP06PPC06	Measurement & Metrology Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Identify and classify different measuring tools related to experiments.
2. Identify, define and explain accuracy, precision and some additional terminology.
3. Conduct, analyze, interpret and present measurement data from measurements experiments.
4. Identify sources of variability, error and uncertainties.
5. Demonstrate excellent laboratory skills and techniques including the proper use of relevant instruments and related technology.
6. Enhance the ability to apply knowledge of mathematics, statics, physics and engineering sciences.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: Student will become familiar with the different instruments that are available for linear, angular, roundness and roughness measurements they will be able to select and use the appropriate measuring instrument according to a specific requirement (in terms of accuracy, etc).

LIST OF EXPERIMENTS:

1. To measure pressure using Bourdon pressure gauge.
2. To calibrate pressure gauge using Dead weight pressure gauge tester.
3. To measure temperature using thermister.
4. To measure flow rate using Rota meter.
5. To measure angle using Angular sensor.
6. To measure torque using Torque transducer.
7. To measure pressure using pressure transducer.
8. To measure temperature by thermocouple.
9. Measurements of lengths, heights, diameter by Vernier Calipers, Vernier height gauge, Micrometers.
10. Measurement of various angles using Bevel protractor, Sine bar & Combination set.
11. Calibration of Vernier caliper, Micrometer, Height gauge, Depth micrometer using slip.

Course Name & Semester	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
B.Tech VI Sem.	IP06PPC07	Welding Engineering Lab	-	-	2	30	20	50	1

COURSE OBJECTIVES:

1. Availability of various manual and automated welding processes.
2. To provide information related to concepts, operating procedures of various welding processes.
3. To gain knowledge on practical aspects of different welding processes and apply effectively on various engineering applications.

COURSE OUTCOMES:

After completion of the course, the students will be able to

CO1: To acquire the knowledge and skills of modern welding techniques.

CO2: To develop the skills of conventional welding techniques.

CO3: To have a practical exposer various testing methods of welding joint.

LIST OF EXPERIMENTS:

1. To make a Lap joint, using the given two M.S pieces by arc welding.
2. To make a corner joint, using the given two M.S pieces by arc welding.
3. To prepare a butt joint with mild steel strips using brazing technique.
4. To prepare a butt joint with mild steel strip using GMAW technique.
5. To study and observe the welding and brazing techniques through demonstration and practice (Gas, MIG, TIG, Brazing).

Department of Mathematics

Guru Ghsidas Vishwavidyalaya, Bilaspur (CG)

Minutes of BOS Meeting held on March 12, 2021

The Following Members were Present:

1.	**Dr. P. P. Murthy,** Head	Chairman
2.	**Professor Ravi Prakash Dubey**	Subject Expert
3.	**Professor A. S. Ranadive**	Member
4.	**Dr. Sandeep Singh**	Member
5.	**Dr. J. P. Jaiswal**	Special invitee
6.	**Dr. Dhananjay Gopal**	Special invitee
7.	**Dr. M. K. Gupta**	Special invitee
8.	**Dr.K. N. V. V. Vara Prasad**	Special invitee
9.	**Dr. Uma Devi Patel**	Special invitee
10.	**Dr. Santosh Verma**	Special invitee
11.	**Dr. Brijendra Paswan**	Special invitee

Chairman of BOS welcome all the honourable members of **Board of Studies** and special invitees in this meeting. In the meeting, the following agenda approved unanimously. Most of the papers offered at Pre-Ph.D. Course level revised thoroughly and introduced new papers.

Pre-Ph.D. COURSE WORK in Mathematics

Examination Scheme

- There shall be a Course Work Examination for all provisionally admitted students after atleast six months from the commencement of classes of Pre-Ph.D. Course Work.
- For Pre-Ph.D. Course Work Examination, there shall be three papers of 100 marks each or such papers as mentioned in Ph.D. regulations/ Ordinances as amended from time to time.
- The duration of examination for each question paper shall be of three hours and there shall be two sections in each question paper in the following manner:

12/03/2021

12/03/2021

a. There shall be 10 (3 marks each) objective type or short-answer questions in first section/ part of the question paper for 30 marks.

b. There shall be 05 (14 marks each) descriptive / essay / interpretable type answer questions in second section/ part of the question paper for 70 marks.

- Examinee of Pre-Ph.D. Course Work has to score minimum 40 marks in each paper and overall, 55% marks in aggregate in examination in order to be eligible to continue in the program leading to the completion of Ph.D. thesis.
- Examinee of Pre-Ph.D. Course Work has to present a Seminar in the department. No marks shall be awarded for this Seminar presented by examinee; it can be assessed as Successful / Unsuccessful only. This qualifying seminar shall be evaluated by the concerned department only.

COURSE STRUCTURE

There should be **one compulsory paper**, **two optional papers** and **Seminar evaluations**. Students are required to choose any two (02) optional papers from the given list of Eleven (11) papers approved by BOS.

COMPULSORY PAPER

MaPhD01: RESEARCH METHODOLOGY

OPTIONAL PAPERS (ANY TWO):

MaPhD02: INTRODUCTORY FUZZY GROUP THEORY

MaPhD03: APPLIED FUNCTIONAL ANALYSIS

MaPhD04: CRYPTOGRAPHY

MaPhD05: DYNAMICAL SYSTEM

MaPhD06: GEOMETRY OF FINSLER SPACE

MaPhD07: STRUCTURES ON MANIFOLDS

MaPhD08: FIXED POINT THEORY AND APPLICATIONS

MaPhD09: MECHANICS OF SOLIDS AND WAVE PROPAGATION

MaPhD10: ADVANCED NUMERICAL ANALYSIS

MaPhD11: ITERATIVE METHODS FOR SOLVING NONLINEAR EQUATIONS

MaPhD12: FRACTIONAL CALCULUS

12/03/2021

MaPhD01: RESEARCH METHODOLOGY

Course Objectives:

This course is designed in such a manner which enables the students:

i. *to identify and discuss the role and importance of research in the Mathematical Sciences and its related areas.*

ii. *to identify and discuss the issues and concepts salient to the research process.*

iii. *to identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.*

iv. *to identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.*

v. *for Better presentation of the work in front of audience by using Latex.*

vi. *to understating MATLAB software for various implementation in the area of studies done by the candidate.*

Philosophy and Ethics: Introduction to philosophy, definition, nature and scope, concept, branches, Ethics, definitions, moral philosophy, nature of moral judgments and reactions.

Scientific conduct: Ethics with respect to science and research, Intellectual honesty and research integrity, scientific misconducts Falsification, Fabrication and Plagiarism (FFP), redundant publications, duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

Publication Ethics: definition, introduction and importance, Best Practices/standards setting initiative and guideline, COPE, WAME, etc. Conflicts of interest, Publication misconduct, definition, concept, problems that lead to unethical behavior and vice versa, types, Violation of publication ethics, authorship and contributor ship, Identification of publication misconduct, complaints and appeals, Predatory publishers and journals.

MATLAB: Basics of Mathematical calculations such as Integration, Solving Matrices, Drawing Graphs, Citation, etc.

Latex: Basics of Latex such as typing a research paper, Insertion of Table, Graphs, Pictures, etc.

Wring a review of at least 01 research paper suggested by supervisor (to his student who is allotted as a Pre-PhD Course Work student by the DRC as per university guidelines).

Learning Outcomes:

Students who successfully complete this course will be able:

i. *to explain key research concepts and issues*

ii. *to read, comprehend, and explain research articles in their academic discipline.*

MaPhD02: INTRODUCTORY FUZZY GROUP THEORY

Fuzzy Subsets, Fuzzy Subgroups, Normal Fuzzy Subgroups, Conjugate Fuzzy Subgroups Normalizer of a Fuzzy Subgroup, Left and Right Cosets of a Fuzzy Subgroup, Quotient Group of a Crisp Group relative to a Normal Fuzzy Subgroups Quotient Fuzzy Subgroup, Normal Fuzzy Subgroup of a Fuzzy Subgroup Homomorphism and Isomorphism of Fuzzy Subgroups, Fuzzy Order relative to Fuzzy Subgroup, Fuzzy order of an element of a Group, Fuzzy Order in a Cyclic Group.

Index of Fuzzy Subgroup, Fuzzy Characteristic Subgroup, Conjugate Fuzzy Subgroups, Fuzzy Cayley's Theorem and Fuzzy Lagrange's Theorem, Solvable Fuzzy Subgroup, Fuzzy Order of a Fuzzy Subgroup.

Normalizer of a Fuzzy Subset, Commutative Fuzzy Subgroup, Ascending Central Series of a Fuzzy Subgroup, Nilpotent Fuzzy Subgroups, Commutator of fuzzy Subsets, Descending Central Chain of a Fuzzy Subgroup, Central Chain of a fuzzy Subgroup, Descending Central Series of a fuzzy Subgroup, Derived Chain of a Fuzzy Subgroup, Solvable Fuzzy Subgroups, Solvable series for a Fuzzy Subgroup.

Reference Books:

1. Fuzzy Group Theory by J. N. Mordeson, K. R. Bhutani, A Rosenfield, Springer Publications.

MaPhD03: APPLIED FUNCTIONAL ANALYSIS

Open Mapping Theorem, Factor Spaces, Duality, Orthogonality, Applications of Open Mapping Theorem.

The Spectrum: The Gelfand-Mazur Theorem, The Gelfand Transform, C*-Algebras.

Compact and Fredholm Operators: Compact Operatos, Fredholm Operators and the Index, Spectral Theorem for Compact Operators, Applications to Integral Equations.

Reference Books:

1. Serg Lang: Real and Functional Analysis, Third Edition , Springer.

MaPhD04: CRYPTOGRAPHY

Course Objectives:

The ciphers remain a mystery while hiding a very rewarding treasure. The motivation to break these ciphers may simply lie in the wealth one could acquire if they cracked the ciphers. However, the human mind is very curious, and with each uncovered step, our curiosity increases. That the motivation behind the study of Cryptography and its applications in day-to-day life.

Foundations of Cryptography: History of Cryptography.

Encryption: Encryption system, Symmetric and Asymmetric Cryptosystems, Cryptanalysis, Alphabets and Words, Permutations, Block Ciphers, Multiple Encryption, The use of Block Ciphers, Stream Ciphers, The Affine Ciphers, Matrices and Linear Maps, Affine Linear Block Ciphers, Vigenere, Hill and Permutation Ciphers, Cryptanalysis of Affine Linear Block ciphers, Secre Cryptosystems.

Probability and Perfect Secrecy: Probability, Conditional Probability, Birthday Paradox, Perfect Secrecy, Vernam One-Time Pad, Random Numbers, Pseudorandom Numbers.

DES: Feistel Ciphers, DES Algorithm, Security of DES.

AES: Notation, Cipher, Key Expansion, InvCipher.

Prime Number Generation: Trial Division, Fermat Test, Carmichael Numbers, Miller-Rabin Test, Random Primes.

Public-Key Encryption: Idea, Security, RSA Cryptosystem, Rabin Encryption, Diffie-Hellman Key Exchange, ElGamal Encryption.

Reference Books:

1. Johannes A Buchmann, ***Introduction to Cryptography***, Springer International 2nd Edition (ISBN: 81-8128-232-9).

Learning Outcomes:

Students undergoing this course are expected:

i. *to learn fundamentals of cryptography and its application to network security. Understand vulnerability analysis of network security.*
ii. *to acquire background on hash functions; authentication; firewalls; intrusion detection techniques.*

12/03/2021

12/03/2021

MaPhD05: DYNAMICAL SYSTEM

Course Objectives:

The course aims to introduce the main features of dynamical systems, particularly as they arise from systems of ordinary differential equations as models in applied mathematics. The topics presented will include phase space, fixed points and stability analysis, bifurcations, Hamiltonian systems and dissipative systems. Discrete dynamical systems will also be discussed briefly, leading to the idea of a 'chaotic' dynamical system.

One Dimensional Maps: One-Dimensional Maps, Cobweb Plot: Graphical Representation of an Orbit, Stability of Fixed Points, Periodic Points, The Family of Logistic Maps, The Logistic Map $G(x) = 4x(1 - x)$, sensitive Dependence on Initial Conditions.

Two Dimensional Maps: Mathematical Models, Sinks-Sources and Saddles, Linear Maps, Coordinate Changes, Nonlinear Maps and the Jacobian Matrix, Stable and Unstable Manifolds, Matrix Times Circle Equal Ellipse.

Chaos: Lyapunov Exponents, Chaotic Orbits, Congjugacy and the Logistic Map, Transition Graphs and Fixed Points, Basins of Attaction.

Fractals: Cantor Sets, Probabilistic Constructions of Fractals, Fractals from Deterministic Systems, Fractal Basin Boundaries, Fractal Dimension, Computing the Box-Counting Dimension, Correlation Dimension.

Chaos in Two Dimensional Maps: Lyapunov Exponents, Numerical Calculation of Lyapunov Exponents, Lyapunov Dimension, A two-Dimensional Fixed Point Theorem, Markov Partitions, The Horseshoe Map.

Chaotic Attactors: Forward limit sets, Chaotic Attactors, Chaotic Attactors of Expanding Inerval Maps, Measure, Natural Measure, Invariant Measure for One-Dimensional Maps.

Reference Books:

1. Kathleen T. Alligood, Tim D. Sauer and James A. Yorke, ***Chaos: An introduction to dynamical systems***, Springer International Edition (ISBN: 978-81-8128-408-2).

Learning Outcomes:

Students are able to understand after the course:

i. *to describe the main features of dynamical systems and their realisation as systems of ordinary differential equations*
ii. *to identify fixed points of simple dynamical systems, and study the local dynamics around these fixed points, in particular to discuss their stability and bifurcations*

12/03/2021

iii. *to use a range of specialised analytical techniques which are required in the study of dynamical systems*

iv. *to describe dynamical systems geometrically and represent them graphically via phase plane analysis*

v. *to understand and predict the occurrence and consequences of bifurcations*

vi. *to explain and prove special properties of finite-dimensional Hamiltonian systems, in particular conservation laws, Liouville's Theorem and Poincare's Recurrence Theorem prove simple theoretical results about abstract dynamical systems*

vii. *to understand the origin of dissipation and its effect on the orbits of dynamical systems*

viii. *to find fixed points and period orbits of discrete dynamical systems, and find their stability*

ix. *to do graphical analysis of 1D discrete dynamical systems*

x. *to understand the basic properties of a chaotic dynamical system*

MaPhD06: GEOMETRY OF FINSLER SPACE

Course Objectives:

The objective of this course is to enable the students, concepts of Finsler geometry so that they can pursue research in this area.

Basic concepts of Finsler space

Berwald and Cartan covariant differentiation

Lie differentiation of a tensor, Lie differentiation of Berwald connection coefficients, different commutation formulae, Motion, affine motion and projective motion, Conformal tansformation.

Riemannian curvature, isotropic point, Shur's theorem, Szabo's theorem.

Reference Books:

1. H. Rund, The Differential Geometry of Finsler Spaces, Springer-Verlag, Berlin, 1959.
2. M. Matsumoto, Foundations of Finsler Geometry and Special Finsler Spaces, Kaisheisha Press, Otsu, 1986.
3. P. L. Antonelli (ed.), Handbook of Finsler Geometry, Kluwer Academic Publishers, Dordrecht, the Netherlands, 2003.
4. D. Bao, S.S. Chern and Z. Shen, An Introduction to Riemannian-Finsler Geometry, GTM, Springer, 2000.
5. S.S. Chern and Z. Shen, Riemannian-Finsler Geometry, World Scientific, 2004.
6. Z. Shen, Lectures on Finsler Geometry, Lectures on Finsler Geometry, World Scientific, 2001.

12/03/2024

Learning Outcomes:

After the completion of the course, students will be able to learn basic concepts of Finsler geometry. They may understand better the topics covered in allied courses like Riemannian geometry, Mathematical Physics and their applications in allied areas. They will be adequately prepared for pursuing research in Finsler geometry.

MaPhD07: STRUCTURES ON MANIFOLDS

Course Objectives:

The course develops the basic concept of Differentiable manifold and also gives concepts of different complex structures on manifolds.

Manifolds and Connection: Concepts of manifolds, Tangent vectors, Vector fields, Lie Brackets, Affine connections, Torsion tensor of an affine connection, Curvature tensor of an affine connection.

Complex and almost Complex Manifolds: Definition and example, Nijenhuis tensor, Eigen Values of an almost complex structure, Existence theorem and inerrability condition, contravariant and covariant almost analytic vector fields.

Almost Hermite Manifold: Nijenhuis tensor, Almost analytic vector fields, Curvature in almost Hermite manifold, Holomorphic Sectional Curvature, Linear connection in an almost Hermite manifold.

Koehler Manifold: Definition, Holomorphic Sectional Curvature, Bochner Curvature tensor, affine connection in almost Kaehler manifold.

Nearly Kaehler Manifold: Definition, Projective correspondence between two Nearly Kaehler manifolds, Curvature identities.

ParaKaehle Manifold: Definition, Curvature Identities and conformal flatness of ParaKaehler manifold.

Reference Books:

1. K. Yano and M. Kon, Structures on Manifolds, World Scientific, 1984.

2. D. E. Blair, Riemannian Geometry of Contact and Symplectic Manifolds, Progress in Mathematics, Vol. 203, Birkhäuser Inc., Boston, MA, 2002.

3. R. S. Mishra, Structures on Differentiable Manifolds and their Applications, ChandramaPrakashan, Allahabad, 1984.

4. U. C. De and A. A. Shaikh, Complex Manifolds and Contact Manifolds, Narosa.

Learning Outcomes:

12/03/2024

On completion of the course the student should have the capability to define all the basic terms related to manifold and also student should have capability to know all the complex structures defined on different manifolds.

MaPhD08: FIXED POINT THEORY AND APPLICATIONS

Course Objectives:

The objective of this paper aims to prepare students with a deep understanding of development of fixed-point theory and the research-oriented attitude and skill of application of mathematical iterative technique and computational tools.

Introduction to metric fixed-point theory, Contraction Mapping in a Metric Space, Linear Operators, Some generalizations of the Contraction Mappings, Approximate Iteration; A Converse of the Contraction Principle; Some Applications of the Contraction Principle. Examples and applications.

Brouwer's Fixed Point Theorem, equivalent Formulations; The Elementary Proof of Brouwer's Fixed Point Theorem; Examples and Applications.

The Schauder Fixed Point Theorem; Darbo's Generalization of Schauder's Fixed Point Theorem; Browder's and Fan's Generalizations of Schauder's and Tychonoff's Fixed Point Theorem.

Nonlinear Operators, Lipschitzian Mappings, Picard Iterative Method, Mann Iterative Method, Ishikawa Iterative Method, a few convergence theorems.

Reference Books:

1. Vasile I. Istratescu, Fixed Point Theory; D. Reidel Publishing Company; 90-277-1224-7.
2. VasileBerinde "Iterative Approximation of Fixed Points" Springer.
3. Saleh Almezel, Qamrul Hasan Ansari, Mohamed Amine Khamsi, Topics in Fixed Point Theory, Springer.

Learning Outcomes:

By the end of course work, students will be get knowledge of the contraction, Brower's and Schauders' fixed point theorem and their development. Also student get the knowledge about the convergence theorem by using Picard, Mann and Ishikawa iteration process.

MaPhD09: MECHANICS OF SOLIDS AND WAVE PROPAGATION

Course Objectives:

The prime objective of this paper is to develop the mathematical concept of solid mechanics with its applications to seismic wave propagation.

Introduction to Continuum Mechanics, Basic definitions of Solid Mechanics, Principles of Elasticity, Fundamentals of Tensor Calculus, Body and Surface forces, Effects of force: tension, compression and shear, Analysis of stress, principal stresses, principal planes, maximum shearing stresses, Computation of Traction Vector and Principal Axes.

Introduction to Strain, Affine Transformation, Infinitesimal Affine Deformation, Geometrical Interpretation of components of Strain, Principal Strains, Invariants, General Infinitesimal Deformation, Examples of Strain, Notations, Equations of Mohr's circle diagram, equations of deformation and strain, strain in form of displacement, compatibility concepts, need and physical significance.

Stress-strain relations, Generalized Hook's Law, different types of symmetry, density function, Airy's stress function, Poisson's ratio. Complementary Shear Stress, Shear Strain, Shear Modulus. Unit for elastic moduli, Relation between modulus of elasticity, modulus of rigidity and bulk modulus. Saint-Venant's Principle.

Wave equation, Solution of Wave equations, Seismic wave equation, Plane waves, Harmonic plane wave equation, Polarization of P and S waves, Wave propagation in unbounded elastic medium.

Study of propagation of waves in elastic, viscoelastic and poroelastic media, Waves in anisotropic medium, thermoelastic medium, study of surface waves (Rayleigh & Love waves) in elastic and viscoelastic medium including layered medium, Reflection and refraction of waves in elastic media.

Reference Books:

1. Love, A.E.H. *A Treatise on Mathematical Theory of Elasticity*, Cambridge University Press, New York.
2. Sokolnikoff, I.S., (1956) *Mathematical Theory of Elasticity*, McGraw Hill Book Co., NewYork.
3. Biot, M .A. (1965) *Mechanics of* Incremental Deformations, John Wiley & Sons , NewYork.
4. Ewing, W.M., (2018) *Elastic Waves in Layered Media*, Creative Media Partners,LLC.
5. Achenbach, J.D., (2012) *Wave Propagation in Elastic Solids*, North Holland,Elsevier.
6. Kazimi, SMA., (2013) Solid Mechanics, McGraw Hill Education (India) Pvt Ltd.

12/03/2021

Learning Outcomes:

After the completion of this course, students will be able to examine the characteristics of seismic wave propagation in a mathematical sense. This course will be helpful in dealing the problems on reflection/transmission phenomena, crack propagation and moving load in anisotropic elastic materials.

MaPhD10: ADVANCED NUMERICAL ANALYSIS

Course Objectives:

To know about various types of Errors. Calculate the error correction and get actual root of the equation. Understand different methods of solution of the equations and compare them. To get the detailed knowledge about different numerical methods which are used in real world problems, with emphasis on how to prepare program for different methods.

Errors and Approximations: Rate of convergence of an Iterative method, Efficiency index of an Iterative method

Extension of Newton-Raphson method for finding multiple roots and to solve system of non-linear equations. Mullers method, Chebyshev's methods.

System of linear equations: LD decomposition techniques and its complexity analysis.

Interpolation: Newton's Divided difference method. Hermite's interpolation. Cubic spline interpolation. Errors in interpolation.

Numerical Integration: Method of undetermined coefficients. Errors in integration formulae. Iterative solution of linear equations.

Eigen values & Eigen Vectors: Bounds on eigen values, method for finding eigen values of symmetric matrices, method for finding eigen values of arbitrary matrices, method for finding largest eigen values of matrices.

Reference Books:

1. Jain M K, Iyengar S R K and *Jain* R K, Numerical Methods for Scientific and Engineering Computation, 4th Edn, New Age International Pvt Ltd (2005)
2. Jain M K, Numerical Solutions of Differential Equations, 2nd Edn, John Wiley and Sons Ltd (1984)
3. S S Sastry, Introductory Methods of Numerical Analysis, 5th Edn. Prentice Hall of India.

Learning Outcomes:

After completion of this course, student will be able to be aware of the use of numerical methods in modern scientific computing. Be familiar with finite precision Computing. Be familiar with numerical solutions of nonlinear equations in a single variable. Be familiar with numerical

12/03/2024

interpolation and approximation of functions. Be familiar with numerical integration. Be familiar with calculation and interpretation of errors in numerical methods

MaPhD11: ITERATIVE METHODS FOR SOLVING NONLINEAR EQUATIONS

Course Objectives:

To know about various types of iterative methods, theoretical and computational order of convergence. Two-step without memory iterative methods for solving nonlinear equations. Two-step with memory iterative methods. To get the detailed knowledge about optimal & non-optimal iterative methods with improve them.

Errors and Approximations: Rate of convergence of an Iterative method, Efficiency index of an Iterative method

Classification of iterative methods, computational order of convergence (COC), R-order of convergence, computational efficiency of iterative methods, initial approximations, stopping criteria, one-point iterative methods for simple roots.

Two-point without memory IM: Traub's two-point IM, Owtrowski's fourth order IM & its generalization, Kung-Traub's multipoint IM, Jarratt's type IM, Non-optimal two-point IM for multiple zeros, optimal two-point IM for multiple zeros,

Two-point with memory IM: Secant like method, Steffensen like method, two-step method with memory of Neta's type.

Higher order IM: Non-optimal IM, optimal IM, with derivative IM, derivative free IM, Higher order without memory IM, higher order with memory IM.

Reference Books:

1. M. S. Petkovic, B. Neta, L.D. Petkovic, J. Dzunic (2013): Multipoint iterative methods for solving nonlinear equations, Elsevier, MA, USA.
2. J. F. Traub (1982): Multipoint iterative methods for solution of equations, Chelsea Publishing Company, NY, USA.

   C. T. Kalley (1995): Iterative methods for linear and nonlinear equations, SIAM, Philadelphia.

Learning Outcomes:

After completion of this course, student will be able to be aware of the use of iterative methods in modern real-world problems. Be familiar with fundamental iterative methods such as Newton-Raphson method, Secant method, Kung-Traub's method, Steffensen method etc. Be familiar with multipoint without and with memory iterative methods. Be aware about the importance optimal iterative methods and how to improve non-optimal to optimal.

12/03/2021

12/17

MaPhD11: FRACTIONAL CALCULUS

Course Objectives:

The objective of the paper is to develop the advanced concept of Fractional Calculus with the special interest recurrence relations and the time space fractional diffusion equations.

Advance concept of Gamma and Beta function, Bessel functions.

Hypergeometric and Generalized hypergeometric functions: Definition and some identities, Recurrence formulae and Expansion formulae.

Mittag-Leffler and Generalized Mittag-Leffler functions and its applications.

Introductions and definitions of Riemann-Liouville fractional differential and Riemann-Liouville fractional integral of order α. Basic properties of fractional integrals, The Weyl fractional: Basic properties of Weyl integral with its applications. Kober operators and generalized Kober operators.

Reference Books:

1. Special functions: Earl D. Rainville, Chelsea publishing Company, Bronx, New York.
2. The H-functions of one and two variables with applications: H. M. Shrivastava, K. C. Gupta and S. P. Goyal, South Asian Publishers Pvt. Ltd.
3. An introduction to the fractional calculus and fractional differential equation: Kenneth S. Miller and Bertram Ross, John Wiley & Sons, Inc. New York.
4. Special function for applied scientists: A. M. Mathai and Hans J. Haubold, Springer publishers.
5. The H-function with application in statistics and other disciplines; A. M. Mathai and R. K. Saxena, Publishing John Wiley & Sons, New York.
6. The H-function Theory and application, A. M. Mathai, Ram Kishore Saxena and Hans J. Haubold, Springer publishers.

Learning Outcomes:

Students will be able to solve differential equation of arbitrary order. This course will help to develop the extended mathematical modelling of fractional order in Science and Engineering.

12/03/2021

Note: The following papers at M.Sc. level modified slightly at M.Sc. III and M.Sc. IV semester. Implementation of the course will be from the session 2021-22 onwards.

M.Sc. III Semester

INFORMATION THEORY AND ITS APPLICATIONS

Course Objectives:

The main concern of information theory is to discover mathematical laws governing the system, design to communicate or manipulate information. It sets up quantitative measure of information and capacity of various systems to transmit, store and process the information. Coding is the application of the information theory which will be taught to the students in this paper

Introduction, communications, processes, a model for a communications system, a quantitative measure of information, a binary unit of information, discrete scheme without memory, Basic concepts of probability related to information theory, Basic concept of information theory, memory less finite scheme, elements of encoding, continuum without memory.

Books Recommended.

1. F. M. Reza, An introduction to information theory, Dover Publications Inc. New York.
2. Robert B Ash, Information theory, Inter Science Publishers New York.
3. John R. Pierce, An Introduction to information theory, Dover Publications Inc. New York.
4. John Avery, Information theory and evolution, World Scientific, New Jersey.

Learning Outcomes:

After successful completion of this paper the students will be able to explain the concepts of entropy and mutual information. The students will also be able to understand the concept of information theory and its usefulness in various fields such as in defence, in portfolio selection, in general election, in computer science, in pattern recognition and in image processing.

M.Sc. III Semester

SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

Course Objectives:

The main objectives of this paper is to study about the securities analysis and portfolio optimization which can be used in the analysis of stock market related entities.

Introduction, investment, securities market, stock exchanges, risks, share valuation, band valuation, portfolio analysis, portfolio selection, capital asset pricing model (CAPM).

Books Recommended

1. John C Hall, Options, features and other derivatives, Prentice- Hall of India Private Limited.
2. Sheldon M Ross, An introduction to Mathematical Finance, Cambridge University Press.
3. S. Kevin, Security analysis and portfolio management, PHI learning Private limited.

Learning Outcomes:

After successful completion of this paper the students will be able to analyze the various kinds of securities and they can decide to take the decision about to purchase the securities for the benefit of their own in future.

M.Sc. IV Semester

FINSLER GEOMETRY

Course Objectives:

The objective of this course is to enable the students, the basic concepts of Finsler geometry which are useful for further study.

Line element, degree of homogeneity, Finsler space, Euler's theorem, metric tensor, generalized Christoffel symbols, Cartan tensor, Minkowskian space, Tangent space, dual tangent space, length of a vector, Geodesic.

δ-differentiation, partial δ-differentiation, Berwald differentiation, commutation formulae, metrical connection, Landsberg space, Affinely connected space, Ricci commutation formula, Berwald curvature and torsion tensors, Berwald deviation tensor, Bianchi identities, Recurrent Finsler space, Symmetric Finsler space.

Projective change, projective deviation tensor, projective curvature and torsion tensors.

Cartan two processes of covariant differentiation, Cartan curvature and torsion tensors.

Books Recommended:

1. H. Rund, The Differential Geometry of Finsler Spaces, Springer-Verlag, Berlin, 1959.
2. M. Matsumoto, Foundations of Finsler Geometry and Special Finsler Spaces, Kaisheisha Press, Otsu, 1986.
3. P. L. Antonelli (ed.), Handbook of Finsler Geometry, Kluwer Academic Publishers, Dordrecht, the Netherlands, 2003.

Learning Outcomes:

After the completion of the course, students will be able to learn some basic concepts of Finsler geometry. They may understand covariant differentiation better.

12/03/2021

M.Sc. IV Semester

MATHEMATICAL MEASURE OF INFORMATION AND THEIR CHARACTERIZATIONS

Course Objectives:

The main objective of this paper is to study how to measure the information mathematically.

Introduction, entropy of a single event, functional equations, Shannon's measure of information, some desirable properties of entropy and their correlations, the HincinFaddeev characterization of Shannon Entropy, The fundamental equation of information.

Books Recommended.

1. J. Aczel and Z. Doroczy, On measure of information and their characterizations, Academic Press, New York.
2. F. M. Reza, An introduction to information theory, Dover Publications Inc. New York.

Learning Outcomes:

After successful completion of this paper the students will be able to measure the decay of information in communication channel during the transmission of information.

M.Sc. IV Semester

FINANCIAL MATHEMATICS AND ITS APPLICATIONS

Course Objectives:

The objectives of this paper is to study various types of financial instruments and their applications in various fields.

Financial Derivatives - Introduction, types of financial derivatives, forwards and futures. Options and its types and SWATS. Technical analysis and fundamental analysis.

Pricing contracts via arbitrage. The arbitrage theorem. The block scholes formula Cox-Ross Rubinstein model.

Books Recommended

1. John C Hall, Options, features and other derivatives, Prentice- Hall of India Private Limited.
2. Sheldon M Ross, An introduction to Mathematical Finance, Cambridge University Press.

12/03/2021

3. Sahil N. Nettci and Hirsa, An introduction to Mathematics of financial derivatives, Academic Press Inc.
4. Robert J Elliot and P. Ekkehard Kopp, Mathematics of financial markets, Springer-Verlag New York Inc
5. S. Kevin, Security analysis and portfolio management, PHI learning Private limited.
6. Steven Roman, Introduction to the mathematics of finance, Springer.

Learning Outcomes:

After successful completion of this paper the students will be able to explain various types of financial derivatives and they will be able to apply this concept in stock market analysis.

12/03/2021

Dr. P. P. Murthy | Prof. Ravi Prakash Dubey | Prof. A. S. Ranadive

Dr. Sandeep Singh | Dr. J. P. Jaiswal | Dr. Dhananjay Gopal

Dr. M. K. Gupta | Dr.K. N. V. V. Vara Prasad

Dr. Uma Devi Patel | Dr. Santosh Verma 12/03/2021 | Dr. Brijendra Paswan

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA(A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2020-2021

Year: B.Tech. 3rdyear

SEMESTER- V

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME05TPC07	**Fluid & Turbo Machinery**	3	0	-	30	70	100	3
2.	ME05TPC08	Internal Combustion Engine	3	0	-	30	70	100	3
3.	ME05TPC09	Machine Design – I	3	1	-	30	70	100	4
4.	ME05TPC10	Mechanics of Solid-II	3	1	-	30	70	100	4
5.	ME05TPE02	Professional Elective-02	3	0	-	30	70	100	3
		Total	**15**	**2**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME05PPC05	Fluid Machinery lab	-	-	2	30	20	50	1
2.	ME05PPC06	Internal Combustion Engine Lab	-	-	2	30	20	50	1
3	ME05PPE01	CAD / CAM Lab			2	30	20	50	1
Total			**0**	**0**	**4**	**90**	**60**	**150**	**3**

Total Credits: 20
Total Contact Hour: 21
Total Marks: 650
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME05TPE02 Professional Elective-02	
ME05TPE21 Innovation and Technology Management	
ME05TPE22 Innovation and Entrepreneurial Skills	
ME05TPE23 **CAD/CAM**	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Fluid and Turbo Machinery
3.	**L-T-P structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	**ME5TPC07**
6.	**Status** (*category* for *program*)	

7.	**Pre-requisites** (course no./title)	Thermodynamics, Fluid Mechanics
8.	**Status vis-à-vis other courses***(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Either sem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	

13	**Course objective:** • The course aims at giving an overview of different types of fluid machines used for energy transformation, such as hydraulic and steam turbines, gas turbines, compressors, and pumps. • It focuses on applications in power generation, transport, refrigeration. • The main purpose of implementing this course in the curriculum is to learn about how the power is transferred in a turbomachine.

14	**Course contents:** **Unit-1** **Fundamentals:** Classification, Applications of turbomachines, Performance

	parameters, Specific speed, Basic laws and equations, Velocity triangles. **Unit-2** **Hydraulic turbines:** Specific applications, types, construction, working, and performance of various types of hydraulic turbines (Pelton, Francis, and Kaplan turbines), Cavitation in turbines, and water hammer effects, Draft tube: Types, applications, and performance analysis. **Unit -3** **Centrifugal pumps:** Theory, types, components, and working characteristics, Cavitation, NPSH,Priming, Axial flow pumps, Practical problems, and remedies. **Unit-4** **Thermal turbines:** Steam turbine basic cycles, impulse and reaction turbines, Multistage turbines,Governing systems, Effects of reheating and regeneration, Application of Mollier diagram, Gas turbine basic cycle, Application of intercooling, reheating and regeneration, Introduction to wind turbines, Power and efficiency calculations. **Unit-5** **Air compressors:** Radial and axial compressors, Construction and performance analysis, Surging and stalling, Slip.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1.	Introduction to turbomachinery, Basic principles, Classification, Impulse and Reaction type, Fundamental equations, Euler's equation, Introduction to hydro-electric power plants, major components, Surge tanks, etc.	05
2.	Hydraulic Turbines: Classification of Turbine, Impulse Turbine, Pelton wheel, Construction and working, Work done, Head efficiency and Design aspects, Governing of Impulse turbine.	06
3.	Radial flow reaction turbine, Francis turbine: Construction and working, Work done, efficiency, Design aspect, Advantages and disadvantages over Pelton wheel.	05
4.	Propeller and Kaplan turbine, Bulb or Tubular turbine, Draft tube, Specific speed, Unit quantities, Cavitation, Degree of reaction, Performance characteristics, Surge tanks, Governing of Reaction turbine.	05
5.	Classification of Pumps, Centrifugal Pump, Construction, Working, Work Done, Heads, Efficiencies, Multistage Centrifugal Pump, Pump in Series and Parallel, Specific Speed, Characteristic, Net Positive Suction Head, Cavitation.	06
6.	Steam Turbines:Classification, Single-stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, Problems.Parson's turbine, condition for efficiency, reaction staging, Problems.	7
7.	Gas turbine: components, fuels, materials, Different cycle, analysis, Optimum pressure ratio for maximum specific output, the effect of modification on efficiency and output, Ideal and actual cycle.	05

8.	Centrifugal Compressors: Stage velocity triangles, slip factor, power input factor, Stage work,Pressure developed, stage efficiency and surging, and problems.	05
9.	Axial flow Compressors: Expression for pressure ratio developed in a stage, work done factor, efficiencies and stalling. Problems.	05
	COURSE TOTAL	49

16. Brief description of tutorial activities

Primarily numerical problem solving on different topics covered in the lectures.

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
1	Study of Pelton wheel turbine	03
2	Study of Francis turbine	03
3	Study of the Kaplan turbine	03
4	Study of centrifugal pump	03
5	Study of Velocity triangles for impulse steam turbine	02
6	Study of Velocity triangles for reaction steam turbine	02
7	Study of Velocity triangles for axial flow compressor	02
8	Study of Velocity triangles for centrifugal air compressor	02
9	Study of open cycle gas turbine	02
10	Study of open cycle gas turbine with reheat, regeneration	02
COURSE TOTAL		**12**

18. Suggested texts and reference materials

1. Jagdish Lal, Hydraulic Machines, S. K. Kataria& Sons
2. S. K. Som& G. Biswas, Introduction to Fluid Mechanics and Fluid Machines, TMH
3. C. P. Kotharaman& R. Rudramoorthy, Fluid Mechanics & machinery, New Age Pub
4. R. Yadav, Steam and Gas Turbine, C.P.H. Publication, Allahabad
5. S.M. Yahya,Turbine, Compressors and Fans,TMH.
6. P.K. Nag, Power Plant Engineering,3rd edition, Tata McGraw Hill.
7. V. Ganeshan, Gas Turbine, TMH.
8. D. G. Shepherd, Principle of Turbo Machinery, McMillan.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	MATLAB
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	
19.4	Laboratory	Fluid Machine Labs
19.5	Equipment	Various types of turbine and pumps
19.6	Classroom infrastructure	
19.7	Site visits	Thermal and Hydropower projects

20. Designcontentofthecourse *(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	10%
20.2	Open-ended problems	

20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**INTERNAL COMBUSTION ENGINES**
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	**ME5TPC08**
6.	**Status** (*category* for *program*)	CORE

7.	**Pre-requisites** (course no./title)	Thermodynamics
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supercedes any existing course	No

9		

10	**Frequency of offering**	Every sem☒ 1st sem☒ 2nd sem☒ Either sem☒
11	**Faculty who will teach the course**	
12	**Will the course require any visiting faculty?**	**No**

13 **Course objective:**

- To familiarize with the terminology associated with IC engines.
- To understand the basics of IC engines.
- To understand combustion and various variables affecting it in various types of IC engines.
- To learn about various devices used in IC engines and the type of IC engine required for various applications.

Course Outcome:

- At the end of this course, the students will be able to understand the working of an I. C. Engines (i.e. S. I. and C. I. engine) and their applications.
- To understand the combustion process in I. C engines and different type's fuels, their stoichiometric compositions.
- To understand and identify various systems (ignition, injection, and cooling and lubrication system) of an I.C. Engine.

	• To understand and analyze the performance characteristics of an I. C engine and their emissions from of I. C. engines.

14	**Course contents** **Unit 1** **Introduction of internal combustion engines**: Engine classification, Air standard cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel, and Dual cycles. Stirling cycle, Ericsson cycles, Two and four-stroke engines, SI and CI engines, Valve timing diagram, Fuel air cycle, factors affecting it, Actual cycle analysis, Actual Cycle. **Unit 2** **SI Engines -** Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, Combustion chamber design for SI engines, Carburetion, Mixture requirements, Carburetor types, Theory of carburetor, MPFI, Ignition system requirements, Magneto and battery ignition systems, Ignition timing and sparkplug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect. **Unit 3** **CI Engine - Combustion** in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. **Fuel injection** in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings. **Unit 4** **Engine Cooling -** Different cooling systems, Radiators, and cooling fans. **Lubrication -** Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation, **Fuels -**Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines. **Unit 5** **Testing and Performance -** Performance parameters, Basic measurements, Blow by measurement, Testing of SI, and CI engines. **Emission and Pollution:** S. I. Engine and C. I. Engine emissions and its control and comparison. Effect of pollution on Human health and biosphere.

15. Lecture Outline*(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	**Introduction to I.C Engines** - Engine classification, Air standard	09

	cycles, Otto cycle, Diesel cycle, Dual cycle, Comparison of Otto, Diesel and Dual cycles, Stirling cycle, Ericsson cycles, Actual cycle analysis, Two and four-stroke engines, SI and CI engines, Valve timing diagram, Fuel air cycle factors affecting it, Actual Cycle	
2	**SI Engines** - Combustion in SI engine, Flame speed, Ignition delay, Abnormal combustion and it's control, Combustion chamber design for SI engines, Carburetion, Mixture requirements, Carburetor types, Theory of carburetor, MPFI, Ignition system requirements, Magneto and battery ignition systems, Ignition timing and sparkplug, Electronic ignition, Scavenging in 2 Stroke engines, pollution and it's control, Supercharging and its effect.	12
3	**CI Engine - Combustion** in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines, **Fuel injection** in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings.	06
4	**Engine Cooling -** Different cooling systems, Radiators and cooling fans, **Lubrication -** Engine friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation, **Fuels -** Fuels for SI and CI engine, Important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Additives, Gaseous fuels, LPG, CNG, Biogas, Producer gas, Alternative fuels for IC engines.	06
5	**Testing and Performance -** Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines, S. I. Engine and C. I. Engine emissions and its control, S. I. Engine and C. I. Engine emissions comparison, Effect of pollution on Human health, Effect of pollution on biosphere.	07
	COURSE TOTAL	**40**

16. Brief description of tutorial activities

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
1	To study the cut models of I.C.Engine.	3
2	To study the actual valve timing diagram of 4-stroke petrol engine	3
3	To study the actual valve timing diagram of 4-stroke diesel engine.	3
4	To determine the calorific value of diesel by bomb calorimeter.	3
5	To prepare the heat balance sheet by conducting performance test on a single-cylinder 4-stroke diesel engine(with electrical brake dynamometer)	3
6	To determine the load test on a single-cylinder 4-stroke diesel	3

	engine(with rope brake dynamometer)	
7	To determine the morse test on a multi cylinder petrol engine.	3
COURSE TOTAL		21

18. Suggested texts and reference materials

Text Books:

1. Ganesan, I.C Engine, Tata McGraw Hill Publishers,4th edition, 2012 .
2. H.N. Gupta, Fundamentals of Internal Combustion Engines, Prentice Hall of India,PHI Learning Pvt. Ltd., 2nd edition, 2012.

Reference Books:

1. M.L. Mathur& R.P. Sharma, A Course in IC Engines, January 2014.
2. G.F.Taylor, Internal Combustion Engines, Theory, and Practice, Vol. 1 - 2nd Edition.
3. Stone & Richard, Introduction to IC Engine, 3rd Edition.
4. John B. Heywood, Internal combustion engine fundamentals,1 July 2017.

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aids (videos, etc.)	Video Projector Required for Explanation
19.4	Laboratory	ICE Laboratory Required
19.5	Equipment	1. Single-cylinder two-stroke petrol engine test rig. 2. Single-cylinder four-stroke petrol engine test rig. 3. Four strokes four-cylinder petrol engine test rig with the morse test. 4. MPFI multicylinder four-stroke petrol engine test rig 5. A variable compression ratio of petrol/diesel engine test rig. 6. Single-cylinder four-stroke diesel engine test rig. 7. Single-cylinder four-stroke water-cooled slow-speed diesel engine test rig (Kirloskar) with mechanical brake (rope brake) loading. 8. Two cylinders four-stroke diesel engine test rig. 9. Three cylinders four-stroke petrol engine test rig with morse test.
19.6	Classroom infrastructure	
19.7	Site visits	

20. Designcontentofthecourse *(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	15% Numerical
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	85 % Derivation and theory

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**Machine Design –I**
3.	**L-T-P structure**	4-0-0
4.	**Credits**	4
5.	**Course number**	ME05TPC09
6.	**Status** (*category* for *program*)	CORE

7.	**Pre-requisites** (course no./title)	Engg. Mechanics Mechanics of Solid-1
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	EveryOdd Sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Courseobjective***(about50words)***:** Provide students with the ability to apply design procedure with specificdesign tools representing empirical, semi-empirical and analytical approaches. Usinganalytical and computer aided design with real world problems.The detailed design of mechanical systems considers realistic examples from the mechanical Laboratories/workshop. Design a mechanical power transmission system given the power tobe transmitted, speed ratio, orientation and center distance of the shafts. Failure analysis, factor of safety, types of loading, selection of appropriate materials,lubrication, design for manufacturing, fits and tolerance will also be covered for the use in allthe above case based designs.	
13.	**Course Outcome:** At the end of this course, the students will be able to 1. Apply the various stress based theories to design machine components 2. Select appropriate design data from Design data book. 3. Design basic machine elements like Keys, joints, coupling and shafts. 4. Design and select power transmission systems- belt and chain drives. 5. Design various types of joints-threaded, riveted and welded.	

	6. Design different types of power screws- lead screw, screw jack and power screw.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** **UNIT – I General Considerations:** Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures. Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics. **UNIT – II Basic Elements Design:** Types of keys and Splines, Design of Socket-Spigot, Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines. **Couplings:** Types of couplings, Design of flange and flexible couplings, Compression coupling, Muff coupling. **Shaft and Axles:** Transmission shaft, Design against static load, Design for strength, Rigidity and stiffness, Design under continuous loading for fatigue. **UNIT- III Threaded fasteners:** Geometry of thread forms, Terminology of screw threads and thread standards, Specifications of steel bolts, Initial tension, Relation between bolt tension and torque, Design of statically loaded tension joints, Design of bolted joints due to eccentric loading. **Power Screws:** Power screws, Force analysis for square and trapezoidal threads, Collar friction, Stresses in screw, Coefficient of friction, Efficiency of thread, Design of power Screw. **UNIT – IV** **Riveted Joints:** Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, eccentrically loaded riveted joint. **Welded joint:** Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, Eccentrically loaded joint, Welded joint subjected to bending moment, Design procedure, Fillet welds under varying loads, Stress relieving techniques. **UNIT – V Pulley & Flywheel:** Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion. **Chain Drives:** Chain drives, Roller chains, Geometric relationships, Dimensions of chain components, Polygonal effect, Power rating of roller chains, Selection of Chain drives. **Belt & Rope Drive:** Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.

15. Lecture Outline *(with topics and number oflectures)*

Module no.	Topic	No. of hours
1	Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures.	3
2	Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics.	5
3	Types of keys and Splines, Design of Socket-Spigot,	3
4	Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines.	4
5	Couplings , Shaft and Axles	4
6	Threaded Fasteners	4
7	Power Screw	2

8	Riveted Joints	3
9	Welded Joints	5
10	Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion.	2
11	Chain Drive	4
12	Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.	3
COURSE TOTAL		42

16. Brief description of tutorialactivities

NA

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Machine Design by-J. E. Shigley -McGraw Hill Publications.
2. Design of Machine Elements from V. B. Bhandari, TMH Publications.

Reference Books:

3. Machine Design, Spott, TMH Publications.

4. Machine Design, Khurmi& Gupta, Khanna Publisher

19. Resourcesrequiredforthecourse*(itemized&studentaccessrequirements,ifany)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	LCD , OHP projectors
19.7	Site visits	

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE
TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Mechanics of Solid-II
3.	**L-T-P structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME05TPC10
6.	**Status** (*category* for *program*)	CORE

7.	**Pre-requisites** (course no./title)	Engg. Mechanics Mechanics of Solid-1
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	☐ Every sem ☐ 1st sem ☐ 2nd sem ☒ Either sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Course objective** *(about 50 words)***:** Mechanical behaviour of the body by determining the stresses, strains and deflections produced by the different types of loads and couple. Fundamental concepts related to deformation, strain energy, moment of inertia, and load carrying capacity, slope and deflection of beams, shear forces, bending moments, torsional moments, column and struts, principal stresses and strains and theories of failure.	
13.	**Course Outcome:** At the end of this course, the students will be able to 1. Visualize and apply mathematics to obtain analytical solutions in solid mechanics. 2. Interpret the principle of superposition, energy methods of determining the reaction and their applications for solving statically indeterminate structures. 3. Apply the basic concepts of stress and strain in dealing problems related to	

	unsymmetrical bending, fixed beams, continuous beams, curved beams, thick and thin pressure vessels. 4. Discover principles of solid mechanics by solving engineering problems. 5. Develop appropriate models for practical situations to formulate solutions.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** **UNIT - I Energy Methods**: Introduction, Principles of superposition, Strain energy, Reciprocal relations, Maxwell Betti theorem, Elastic strain energy in tension and compression, Strain energy in beams subjected to bending and shafts to torsion. Impact loading in tension and bending, first and second theorem of Castigliano and its applications. **UNIT - II Fixed Beams:** Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support. **Continuous beams**: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Clapeyron's theorem. Effect of sinking of supports. **UNIT – III Bending of curved bars:** Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings. **UNIT – IV Unsymmetrical Bending:** Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections. **Columns:** Struts and Columns, Stability of columns, Euler's formula for different end conditions,, Equivalent load, Eccentric loading, Rankine's formula. **UNIT – V Thin Pressure Vessel:** Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure, **Thick Pressure Vessel:** Stresses in thick and compound cylinders.

15. Lecture Outline *(with topics and number of lectures)*

S. No.	Topic	No. of hours
1	Introduction, Principles of superposition, Strain energy	2
2	Reciprocal relations, Maxwell Betti theorem	2
3	Elastic strain energy in tension and compression	2
4	Strain energy in beams subjected to bending and shafts to torsion.	2
5	Impact loading in tension and bending, first and second theorem of Castigliano and its applications	2
6	Fixed Beams	4
7	Continuous Beams	4
8	Bending of Curved Beams	5
9	Unsymmetrical Bending	5
10	Columns	2
11	Thin Pressure Vessel	4
12	Thick Pressure Vessel	4
COURSE TOTAL		38

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Mechanics of Material – J. M. Gere and S. P. Timoshenko – CBS publisher
2. 4. Strength of Material – Dr. Sadhu Singh – Khanna Publishers

Reference Books:

1. Advanced Mechanics of Materials–A. P. Boresi and O. M. Sidebottom–John Wiley & Sons
2. Strength of Materials – R. K. Rajput – S. Chand & Company
3. Mechanics of Material – F. P. Beer and E. E. Johnston – McGraw Hill
4. Strength of Material, Vol. I and II – S. P. Timoshenko – EWP Press
5. Strength of Materials – G.H. Rider – Macmillan

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	LCD , OHP projectors
19.7	Site visits	

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	10
20.2	Open-ended problems	10
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE
TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engg
2.	**Course Title**	Computer Aided Design & Manufacturing (CAD-CAM)
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME06TPE23
6.	**Status** (*category* for *program*)	Professional Elective

7.	**Pre-requisites** (course no./title)	Engineering Graphics Machine Drawing
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	Every even semesters
11.	**Will the course require any visiting faculty?**	No
12.	**Course objective** *(about 50 words)***:** • To introduce the student to CAD terminology & its capabilities. • To become familiar with CAD software, Graphical user interface & basic tools. • To recognize geometric and graphical elements of engineering design problems • To apply a "hands-on" understanding of the basic concepts of computer-aided manufacturing and prototyping through group and individual projects.	
13.	**Course Outcome** Upon completing the course, the student will be able to: 1. Perceive the concepts of CAD/CAM as well as be able to model analytic and synthetic curves, surfaces and solid models. 2. Compile the NC system and various part programming techniques. 3. Demonstrate group technology and data base management system. 4. Acquire the concepts of design and synthesis of planer mechanisms using computer based applications.	
14.	**Course content** **Basics of CAD**: Basics fundamental of Computer Graphics, Principle of computer graphics, Product life cycle, Concept of Computer Aided Design (CAD) and architecture, Hardware and software, Color management, Raster graphics, Graphics standard, Graphic primitives,	

	lines, and Circle Drawing algorithms, Software documentations, CAD standards GKS, OpenGL, Data exchange standards- IGES, STEP, CALS etc, Communication standards. Standards for vexchange images. **Geometric Modeling of Curves, Surface and Solid**: Basics representation of curves, Parametric and nonparametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves. Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces, Basic concept of solid modelling technique, CSG and B-rep method for solid generation. **Geometric Transformation**: Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation, Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, Concurrent Engineering. **Basics of CAM**: Basic concept of numerical control (NC) System, NC coordinate system, NC motion control, Application of NC, concepts of computer numeric control(CNC) system, problems with conventional, NC, CNC. **Part Programming**: Introduction to NC part programming, manual part programming, Computer assisted part programming, Automatically Programming Tool (APT) language, statements and code of APT, programming methods, advantages of CAD/CAM programming.

15. Lecture Outline *(with topics and number of lectures)*

S.No	Topic	No. of hours
1	**Basics of CAD**	7
2	Basics representation of curves, Parametric and nonparametric curves, Mathematical representation of curves, Hermite curves, Bezier curves, B-spline curves and rational curves.	6
3	Basic of Surface, Techniques of surface modelling, Plane surface, Rule surface, Surface of revolution and sweep, Coons and bi-cubic patches, concept of Bezier and B-spline surfaces	6
4	Basic concept of solid modelling technique, CSG and B-rep method for solid generation.	5
5	Computer Aided Design (CAD) methodology, Coordinate systems, Theory and applications, 2D and 3D geometric transformation, Homogeneous transformation, Concatenation,	5
6	Assembly modelling, interferences of positions and orientation, tolerance analysis, mass property calculations, Visual realism- hidden line-surface-solid removal algorithms, shading, coloring, computer animation, Concurrent Engineering.	6
7	Basics of CAM	5
8	Part Programming	5
COURSE TOTAL		45

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

19. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Book:

1. CAD/CAM Theory and Practice-Ibrahim Zeid-Tata McGraw Hill Publications.

2. CAD/CAM-Milkell P. Groover, Emory W. Zimmer-Pearson Education.

Reference book:

20. **Resources required for the course** *(itemized & student access requirements, if any)*

18.1	Software	Modeling software CATIA/Pro-E etc
18.2	Hardware	Desktops or personal laptops
18.3	Teaching aides (videos, etc.)	Videos, images and animations
18.4	Laboratory	CAD Lab
18.5	Equipment	
18.6	Classroom infrastructure	
18.7	Site visits	

21. **Design content of the course** *(Percent of student time with examples, if possible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	Modeling in any professional software:30
20.4	Open-ended laboratory work	
20.5	Others (please specify)	Theory-70

SCHOOL OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDHALAYA(A CENTRAL UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING
CBCS-NEW, STUDY & EVALUATION SCHEME
W.E.F. SESSION 2020-2021

Year: B.Tech. 3rd year

SEMESTER- VI

SN	Course No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	INTERNAL ASSESSMENT	ESE	SUB-TOTAL	
1.	ME06TPC11	Heat and Mass Transfer	3	1	-	30	70	100	4
2.	ME06TPC12	Manufacturing Science-II	3	0	-	30	70	100	3
3.	ME06TPE03	Professional Elective-03	3	0	-	30	70	100	3
4.	ME06TOE01	Open Elective-01	3	0	-	30	70	100	3
5.	ME06TOE02	Open Elective-02	3	1	-	30	70	100	4
6.	ME06TMC03	Essence of Traditional Knowledge	3	0	-	-	-	-	-
		Total	**18**	**2**	**-**	**150**	**350**	**500**	**17**
PRACTICALS									
1.	ME06PPC07	Heat and Mass Transfer Lab	-	-	3	30	20	50	1.5
2.	ME06PSC01	Seminar	-	-	2	50	-	50	1
3	ME06PPC08	Manufacturing Science Lab	-	-	3	30	20	50	1.5
Total			**0**	**0**	**6**	**110**	**40**	**150**	**4**

Total Credits: 21
Total Contact Hour: 26
Total Marks: 650
*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.
L-LECTURE,T-TUTORIAL,P-PRACTICAL, ESE –END SEMESTER EXAMINATION

ME06TPE03 Professional Elective-03	**ME06TOE01 Open Elective-01**
ME06TPE31 Measurement Metrology and Control	ME06TOE11 Enterprise Resource Planning
ME06TPE32 Industrial Automation	ME06TOE12 Decision Support and Executive Information System
ME06TPE33 Advanced Manufacturing System	**ME06TOE13 Operations Research**
ME06TOE02 Open Elective-02	
ME06TOE21 Machine Design-II	
ME06TOE22 Mechatronics	
ME06TOE23Robotics and Robot Applications	

Course Template

1.	**Department/Center proposing the course**	Mechanical Engineering
2.	**Course title**	**Heat & Mass Transfer**
3.	**L-T-P Structure**	3-1-0
4.	**Credits**	4
5.	**Course number**	ME06TPC11
6.	**Status (Category for program)**	Program Core

7.	**Pre-requisites**	Engineering Thermodynamics, Fluid Mechanics, Basics of Electrical Circuits (Ohm's Law)

7.1.	Overlap with any UG/PG course of the Dept./Centre	No
7.2.	Overlap with any UG/PG course of other Dept./Centre	Yes, Industrial & Production Engineering (IP6TPE53), Chemical Engineering (**CHPG1101,** **CH5TPC06**)
7.3.	Super cedes any existing course	No

8.	Not allowed for **(indicate program names)**	

9.	Frequency of offering	Odd Semester	
10.	**Faculty who can teach the course**	Fluid-Thermal Group	

11.	**Will the course require any visiting faculty**	No

12.	**Course objectives** *(about 50 words):* • To introduce students to fundamentals of heat and mass transfer processes with adequate application examples

13.	**Course outcomes** *(about 50 words):* • Graduates shall be able to apply, analyze and solve elementary problems of engineering interest involving heat transfer mechanisms

14.	**Course contents***(about 100 words) (include laboratory/design activities)*: • **Module-1**: Introduction to modes and mechanisms of heat transfer, Fourier's law, Electrical analogy, Overall heat transfer coefficient, Conduction heat transfer in rectangular, cylindrical and spherical solids, 1-D steady state heat transfer with & without heat generation, critical radius of insulation, Unified view of momentum, heat and mass transfer • **Module-2:** 1-D steady state heat conduction in Extended surfaces, Lumped Capacitance and 1-D transient models, Semi-infinite wall, Error in Temperature measurement, Diffusion mass transfer in 1-D steady state • **Module-3:** Convection: Forced and free convection - mass, momentum and energy conservation equations, scaling analysis and significance of non-dimensional numbers, velocity & thermal boundary layers, heat transfer in external and internal laminar and turbulent flows, and use of correlations, • **Module-**4: Convective mass transfer; Boiling and Condensation: physical phenomena and correlations; Heat Exchanger types and analysis: LMTD and Effectiveness-NTU method • **Module-**5: Radiation heat transfer: Properties, laws, configuration factors, radiation shields, three-surface network of diffuse gray surfaces

15. **Lecture outline***(with topics and number of lectures)*

Module No.	Topics	No. of hours
1	General Introduction: One dimensional	10
	Heat conduction; Introduction to mass transfer	
2	Introduction to extended surfaces	7
	1-D transient heat conduction analysis	
3	Velocity and thermal boundary layer concepts	12
	Forced and Free convection, correlations	

4	Boiling and condensation, convective mass transfer	7
	Heat exchangers	
5	Radiation heat transfer	9
COURSE TOTAL		45

16. Brief description of tutorial activities

The tutorial problems are associated with individual units.

17. Brief description of laboratory activities

Module No.	**Experiment description**	**No. of hours**
	Heat conduction apparatus: plane slab	03
	Conduction in cylindrical pipe	03
	Critical radius of insulation	03
	Pin fin apparatus	03
	Forced convection	03
	Free convection	03
	Unsteady state heat transfer	03
	Stefan Boltzmann apparatus	03
	Emissivity of test plate	03

18. Suggested texts and reference materials

Text Books:

1. Heat Transfer, Cengel, McGraw Hill
2. Heat & Mass Transfer, DS Kumar, Katsons

Reference Books:

1. Heat Transfer, JP Holman, McGraw Hill
2. Heat Transfer, SP Sukhatme, Tata McGraw Hill
3. Heat & Mass Transfer, SC Sachadeva, EEE

19. Resources required for the course (*itemized and student access requirements, if any*)

19.1.	Software	**MATLAB, SCILAB**
19.2.	Hardware	**Nil**
19.3.	Teaching aides (videos,etc)	**Videos**
19.4.	Laboratory	
19.5.	Equipment	
19.6.	Classroom infrastructure	**LCD**
19.7.	Site visits	

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1.	Design-type problems	**10%**
20.2.	Open-ended problems	
20.3.	Project-type activity	**10%**
20.4.	Open-ended laboratory work	
20.5.	Others (please specify)	

COURSETEMPLATE

1.	**Department/Centreproposingthecourse**	Mechanical Engineering
2.	**CourseTitle**(<45characters)	**MANUFACTURING SCIENCE-II**
3.	**L-T-Pstructure**	3-0-0
4.	**Credits**	3
5.	**Coursenumber**	**ME6TPC12**
6.	**Status** (categoryforprogram)	CORE

7.	**Prerequisites**(course no./title)	Knowledge of Workshop and Machine Operations
8.	**Statusvis-à-visothercourses**(givecoursenumber/title)	
8.1	Overlap with anyUG/PGcourseof theDept./Centre	No
8.2	Overlap with anyUG/PGcourseof other Dept./Centre	No
8.3	Supercedesany existingcourse	No

10.	**Frequencyofoffering**	☐ Every sem ☐ 1st sem ☐ 2nd sem ☐ 6th sem
11.	**FacultywhowillteachthecourseMr. Manish Bhaskar**	
12.	**Willthecourserequireanyvisitingfaculty ?**	No
13.	**Courseobjective**(about50words)**:**	

1. To understand grinding and other surface finishing operations.
2. To understand the design considerations of Jigs and Fixtures.
3. To understand various non-conventional machining processes and their applications.
4. To understand the process of Gear Shaping and Gear Hobbing.

14. **Coursecontents**(about100words)(Includelaboratory/designactivities)**:**

Unit-I

General purpose machine tools: Constructional details of lathe, drilling, milling, shaping, planning machines. Tooling, attachment and operation performed, selection of cutting parameters, calculation of forces and time for machining. Broaching operation. Capston and turret lathes, single and multiple spindle automates, operation planning and tool layout.

Jigs and Fixtures; Degree of freedom, principles of location and clamping, locating,clamping and indexing devices, principles of design, design of simple jigs and fixtures.

Unit-II

Mechanics of metal cutting: Classification of metal removal process and machines, geometry of single point cutting tool and tool angles. Tool nomenclature in ASA, ORS& NRS and interrelationship. Mechanism of chip formation and types of chips, chip brakers. Orthogonal and oblique cutting. Cutting forces and power required, theories of metal cutting, thermal aspects of machining and measurement of chip tool interface temperature. Friction in metal cutting.

Unit-III

Machinability: Concept & evaluation of Machinability, tool life and mechanisms of toolfailure, cutting parameter, Machinability index, factors effecting Machinability. Cutting Fluids-Types, selection and application methods. Cutting tool material-Requirement of tool material, classification of tool material and their properties.

Unit-IV

Grinding Processes & Gear Cutting: Abrasives: natural and synthetic, Manufacturingnomenclature, Selection of grinding wheels, wheel mounting and dressing ,surface and cylindrical grinding, their constructional detail and processes. Principle of gear generation, gear cutting by milling machines, gear shaping and gear hobbing machines processes.

Unit-V

Non-Conventional Machining: Mechanism of material removal, tooling and equipment, process parameter, surface finishing obtained by EDM, LBM, EBM, ECM, USM, AJM processes, benefits, generation application and survey of non-conventional machining process.

15.LectureOutline (withtopicsandnumberoflectures)

Moduleno.	Topic	No.ofhours
1	**General purpose machine tools -** Constructional details of lathe	1
	Drilling, milling, shaping, planning machines.	1
	Comparison of Otto, Diesel and Dual cycles	1
	Tooling, attachment and operation performed, selection of cutting parameters	2
	calculation of forces and time for machining	1
	Broaching operation. Capston and turret lathes, single and multiple spindle automates	1
	Operation planning and tool layout.	1
	Jigs and Fixtures: Degree of freedom, principles of location and clamping	1
	locating, clamping and indexing devices, principles of design	2
	design of simple jigs and fixtures	1
2	**Mechanics of metal cutting:** Classification of metal removal process and machines	1
	geometry of single point cutting tool and tool angles	1
	Tool nomenclature in ASA, ORS & NRS and interrelationship	1
	Mechanism of chip formation and types of chips, chip brakers	1
	Orthogonal and oblique cutting. Cutting forces and power required	1
	theories of metal cutting and measurement of chip tool interface temperature	1
3	**Machinability:** Concept & evaluation of Machinability	1
	tool life and mechanisms of tool failure, cutting parameter	2
	Machinability index, factors effecting Machinability	1
	Cutting Fluids-Types, selection and application methods	2
	Cutting tool material-Requirement of tool material	1
	classification of tool material and their properties	2
4	**Grinding Processes & Gear Cutting:** Abrasives: natural and synthetic	1

	Manufacturing nomenclature, Selection of grinding wheels	1
	wheel mounting and dressing	1
	surface and cylindrical grinding, their constructional detail and processes	1
	Principle of gear generation	2
	gear cutting by milling machines, gear shaping	1
	gear hobbing machines processes	2
5	**Non-Conventional Machining:** Mechanism of material removal, tooling and equipment	2
	Basic measurements, Blow by measurement	1
	process parameter, surface finishing obtained by EDM processes	1
	LBM, EBM processes	1
	ECM, USM, AJM processes	2
	Benefits, generation application and survey of non-conventional machining process.	1
	COUSE TOTAL	45

16. Briefdescriptionoftutorialactivities

- Visiting of Workshop to Explain Cutting and Tooling of Machines

17. Briefdescriptionoflaboratoryactivities

- Not Applicable

18. Suggestedtextsandreferencematerials

1. Manufacturing technology (Vol.-I & II) by P.N. Rao Tata McGraw Hill Publishers.
2. Manufacturing Engg. And technology by S. Kalpakjian& S.R. Schmid, Addision Wesley Longman, New Delhi
3. Manufacturing science By A. Ghosh& A.K. Mallik East West Press Pvt. Ltd New Delhi
4. Manufacturing Process by O P Khanna Dhanpat Rai Publication
5. A Textbook of Production Engineering by Dr P C Sharma S Chand Publications
6. Metal Working Technology Narayanaswamy. R, , PHI

19. Resourcesrequiredforthecourse(itemized&studentaccessrequirements,ifany)

19.1	Software	NA
19.2	Hardware	Machines and tools for Demonstration
19.3	Teaching aides (videos, etc.)	Video Projector Required for Explanation
19.4	Laboratory	Workshop

19.5	Equipment	• Lathe Machine • Drilling Machines • Milling, Shaping Planning Machines • Tools, Cooling oils • Grinding Wheels • Work piece
19.6	Classroominfrastructure	Regular Classroom
19.7	Site visits	Any Manufacturing workshops

20. Designcontentofthecourse (Percentofstudenttimewithexamples,ifpossible)

20.1	Design-type problems	15% Numerical
20.2	Open-ended problems	10% Current Technology used
20.3	Project-type activity	15% Preparing and Hands on Practice on Machines
20.4	Open-ended laboratorywork	
20.5	Others (pleasespecify)	60 % theory and Principle of Operations

COURSE TEMPLATE

1.	**Department/Centreproposingtheco urse**	Mechanical Engineering
2.	**CourseTitle**(<45characters)	**MEASUREMENT, METROLOGY AND CONTROL**
3.	**L-T-Pstructure**	3-0-0
4.	**Credits**	3
5.	**Coursenumber**	**ME6TPE31**
6.	**Status** (categoryforprogram)	Theory (Professional Elective)

7.	**Prerequisites**(courseno./titl e)	Knowledge of Measuring instruments and Scale
8.	**Statusvis-à-visothercourses**(givecoursenumber/title)	
8.	Overlap with anyUG/PGcourseof theDept./Centre	No
8.	Overlap with anyUG/PGcourseof other Dept./Centre	No
8.	Supercedesany existingcourse	No

10.	**Frequencyofoffering**	☐ Every sem ☐ 1st sem ☐ 2nd sem ☐ 6th sem
11.	**FacultywhowillteachthecourseMr. Manish Bhaskar**	
12.	**Willthecourserequireanyvisitingfaculty?**	No
13.	**Courseobjective**(about50words)**:** 5. To understand the concepts in measurement and metrology. 6. To be familiar with different sensors and transducers. 7. To build suitable measurement technique. 8. To have the confidence to apply automation solutions for given industrial applications. 9. To demonstrate the ability to design and conduct experiments, interpret and analyze data, and report results. 10. To familiarize with various standards and calibration methods used in industry.	

14. **Coursecontents**(about100words)(Includelaboratory/designactivities)**:**

UNIT-I

Introduction to Measurement and Measuring Instruments: Generalized Measuring Systems and Functional Element, Static & Dynamic Performance Characteristic of Measurement Devices, Calibration, Concept of Error, Sources of Error, and Analysis of Error. Transducers: Types of Transducers and Their Characteristics, Measurement of Strain, Strain Gauges and Their Working, Gauge Factor, Strain Gauge Circuits, Strain Rosettes.

UNIT-II

Measurement of Pressure: Pressure Measuring Transducers, Elastic Diaphragms, Measurement of Vacuum and Low Pressure, Various Low Pressure Gauges. Measurement of Fluid Flow: Various Methods of Flow Measurement and Devices Temperature Measurement: Bi-Metallic Thermometers, Thermocouples, Thermistors and Pyrometers.

UNIT-III

Metrology : Standards of Linear Measurement ,Line and End Standards System of Limit and Fits, Limit Gauges and Their Design, Measurement of Geometric Forms Like Straightness, Flatness, Roundness and Circularity ,Measurement of Surface Textures, Quantitative Evaluation of Surface Roughness and Its Measurement, Introduction of CMM, Its Working and Application.

UNIT-IV

Interferometry: Principle and Uses of Interferometry, Types of Interferometers Comparators: Classification, Working Principle and Magnification Range of Mechanical, Electrical, Optical, Electronic, Pneumatic Comparators, Measurement of Screw Threads & Gears, Two Wire and Three Wire Method

UNIT-V

Fundamentals of Control System: Control system concepts, classification of control systems, mathematical representation of system equations, hydraulic, pneumatic, thermal and mechanical system and their mathematical modelling, response characteristics of components and systems through classical solution.

15.LectureOutline (withtopicsandnumberoflectures)

Moduleno.	Topic	No.ofhours
1	**Introduction to Measurement and Measuring Instruments:** Generalized Measuring Systems and Functional Element	2
	Static & Dynamic Performance Characteristic of Measurement Devices	1
	Calibration, Concept of Error, Sources of Error, Analysis of Error	2
	Transducers: Types of Transducers and Their Characteristics	1
	Measurement of Strain, Strain Gauges and Their Working	1
	Gauge Factor, Strain Gauge Circuits, Strain Rosettes	2
2	**Measurement of Pressure:** Pressure Measuring Transducers, Elastic Diaphragms	1
	geometry of single point cutting tool and tool angles	1
	Measurement of Vacuum and Low Pressure, Various Low Pressure Gauges	2
	Measurement of Fluid Flow	1
	Various Methods of Flow Measurement and Devices	2
	Temperature Measurement: Bi-Metallic Thermometers, Thermocouples	1
	Thermistors and Pyrometers	
3	**Metrology :**Standards of Linear Measurement ,Line and End Standards	2
	System of Limit and Fits	1
	Limit Gauges and Their Design	1
	Measurement of Geometric Forms Like Straightness, Flatness, Roundness and Circularity	2
	Measurement of Surface Textures	1
	Quantitative Evaluation of Surface Roughness and Its Measurement	1
	Introduction of CMM, Its Working and Application.	1
4	**Interferometry:**Principle and Uses of Interferometry	1
	Types of Interferometers Comparators	1
	Classification, Working Principle and Magnification Range of Mechanical, Electrical Comparators	2
	Optical, Electronic, Pneumatic Comparators	2

	Measurement of Screw Threads & Gears	2
	Two Wire and Three Wire Method	1
5	**Fundamentals of Control System:**Control system concepts, classification of control systems	1
	mathematical representation of system equations	1
	hydraulic, pneumatic, thermal and mechanical system and their mathematical modelling	2
	Response characteristics of components and systems through classical solution.	2
	COUSE TOTAL	**41**

16. Briefdescriptionoftutorialactivities

- By Showing Measuring Instruments and there calibration process

17. Briefdescriptionoflaboratoryactivities

- Not Applicable

18. Suggestedtextsandreferencematerials

7. Mechanical Measurementby Beckwith &BuchPearson Education.
8. Automatic Control Engineeringby H Raven McGraw Hill.
9. Instrumentation Measurement & Analysis by Nakra&ChoudharyTMH Education. Ltd New Delhi
10. A Textbook of Measurement and Metrology by A K Sawhney& M MahajanDhanpatRai Publication
11. Metrology and Measurement, AnandBewoor&Vinay Kulkarni McGraw-Hill
12. Mechanical Measurement & Control by D.S. KumarKhanna Publisher

19. Resourcesrequiredforthecourse(itemized&studentaccessrequirements,ifany)

19.1	Software		NA
19.2	Hardware		Measuring Instruments
19.3	Teaching aides (videos,		Video Projector Required for Explanation
19.4	Laboratory		Workshop
19.5	Equipment		• Transducers • Gauges • Thermocouples • Digital Recorders • Comparators
19.6	Classroominfrastructure		Regular Classroom
19.7	Site visits		Any Quality Check Centre

20. Designcontentofthecourse (Percentofstudenttimewithexamples,ifpossible)

20.1	Design-type problems	15% Numerical
20.2	Open-ended problems	10% Current Technology used
20.3	Project-type activity	15% Hands on Measurement Practice through instruments
20.4	Open-ended laboratorywork	-
20.5	Others (pleasespecify)	60 % theory and Principle of Operations

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	Operations Research
3.	**L-T-P structure**	3-0-0
4.	**Credits**	3
5.	**Course number**	ME06TOE13
6.	**Status** (*category* for *program*)	Open Elective

7.	**Pre-requisites** (course no./title)	
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	NA
8.2	Overlap with any UG/PG course of other Dept./Centre	NA
8.3	Supercedes any existing course	NO

9.	**Not allowed for** (indicate program names)	☐ ☐ ☐
10.	**Frequency of offering**	Every sem 1st sem 2nd sem ☒Either sem
11.	**Will the course require any visiting faculty?**	NO
12.	**Course objective** *(about 50 words)*: Knowledge and understanding - Be able to understand the characteristics of different types of decision-making environments and the appropriate decision making approaches and tools to be used in each type. Cognitive skills (thinking and analysis) - Be able to build and solve Transportation Models and Assignment Models. Communication skills (personal and academic). - Be able to design new simple models, like: CPM, MSPT to improve decision – making and develop critical thinking and objective analysis of decision problems. Practical and subject specific skills (Transferable Skills). - Be able to implement practical cases, by using TORA, WinQSB.	
13.	**Course Outcome** At the end of this course, the students will be able to	

	1. Visualize and apply mathematics to obtain analytical solutions in solid mechanics. 2. Interpret the principle of superposition, energy methods of determining the reaction and their applications for solving statically indeterminate structures. 3. Apply the basic concepts of stress and strain in dealing problems related to unsymmetrical bending, fixed beams, continuous beams, curved beams, thick and thin pressure vessels.. 4. Discover principles of solid mechanics by solving engineering problems. 5. Develop appropriate models for practical situations to formulate solutions.
14.	**Course contents** *(about 100 words) (Include laboratory/design activities)***:** **UNIT I** Introduction to linear programming: Graphically solution to linear programming problem, solving linear problem by simplex method, optimization problem, maximization & minimization function with or without constraints, sack surplus & artificial, variable method, degeneracy problem. **UNITII** Mathematical statement of the transportation problem: The transportation model, method for basic feasible solution, Degeneracy & unbalance problem, Mathematical statement of the assignment problem, solution of assignment problem, travelling sales-man problem. **UNIT III** Game theory: Rule of game, Method of solving game , graphically & Arithmetic , saddle point &without saddle point , dominance method, mixed strategies 2 X 2game , 2 X N game , M X 2 game , 3 X 3game (Method of matrix's, method of linear programming etc). Inventory: Introduction, classification, function, level, control techniques, models, and various costs associated, EOQ, optimum lot sizing. **UNITIV** Introduction of queuing theory: Elements of queuing system ,operating characteristics of a queuing system, Poisson arrivals & exponential service time , waiting time & idle time cost, single channel queuing theory. Replacement problems: Requirement policy, replacement of items, machinery various themes, group replacement policy, MAPI methods. **UNITV** Network analysis: Introduction of PERT & CPM, computation of PERT, Time estimation, measure of deviation &variation, probability of completing project, Arrow diagram &critical path method, Scheduling, cost analysis & crushing of network.

15. Lecture Outline *(with topics and number of lectures)*

S. No.	Topic	No. of hours
1	Linear Programming, Graphical solution	3
2	Simplex method, Optimization Problem	4
3	Transportation problem	5
4	Assignment problem	4
5	Game theory: Rule of game, Method of solving game , graphically &	3

	Arithmetic , saddle point &without saddle point	
6	dominance method, Inventory: Introduction, classification, function, level, control techniques, models, and various costs associated, EOQ, optimum lot sizing	5
7	Queuing Theory	5
8	Replacement Problems	4
9	Network Analysis: PERT	4
10	CPM, Scheduling, cost analysis & crushing of network	4
COURSE TOTAL		42

16. Brief description of tutorial activities

NA

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Book: 1. Operation Research– Hira& Gupta – S. Chand & Co.

2. Sharma & S D Kedarnath - Operation Reasearch, Ramnath& Co Meerut

Reference Book: 1. Operation Research, SasienYaspan

2. Operation Research – N. D. Vohra – TMH Publication

3. Operation Research – H. Gillette – TMH, New Delhi

19. Resources required for the course *(itemized & student access requirements, if any)*

19.1	Software	
19.2	Hardware	
19.3	Teaching aides (videos, etc.)	
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	LCD , OHP projectors
19.7	Site visits	

20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	10
20.2	Open-ended problems	10
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

COURSE TEMPLATE

1.	**Department/Centre proposing the course**	Mechanical Engineering
2.	**Course Title**	**Machine Design- II**
3.	**L-T-P structure**	4-0-0
4.	**Credits**	4
5.	**Course number**	ME06TOE21
6.	**Status**(*category* for *program*)	OPEN ELECTIVE

7.	**Pre-requisites** (course no./title)	Machine Design -I Mechanics Of Solids-I Engineering Mechanics
8.	**Status vis-à-vis other courses** *(give course number/title)*	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	No

9.	**Not allowed for** (indicate program names)	
10.	**Frequency of offering**	Every even semesters
11.	**Will the course require any visiting faculty?**	No
12.	**CourseObjective***(about50words)***:** To apply the concepts of stress analysis, theories of failure and material science toanalyse, design and/or select commonly used machine components. To illustrate to students the variety of mechanical components available and emphasizethe need to continue learning. To teach students how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly usedmechanical systems.	
13.	**Course Outcomes:** At the end of this course, students will be able to Design springs under static and fluctuating loading conditions Design brakes and clutches Perform design and selection of transmission elements Design and suggest selection of bearings.	
14.	**Course content** **UNIT-I:** **Springs**: Spring Materials and Their Mechanical Properties, Equation for Stress AndDeflection, Helical Coil Springs of Circular Section for Tension, Compression and Torsion, Dynamic Loading, Fatigue Loading, Wahl Line, Leaf Spring and Laminated Spring. **UNIT-II:**	

	Gears : Spur Gears ,Gear Drives, Classification of Gears, Selection of Type of Gears,Lawof Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth,Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.Design of gear trains. **UNIT-III:** **Helical Gears**, Terminology of Helical Gears, Virtual Number of Teeth,Tooth Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears. **Bevel Gears**, Terminology of Bevel Gears, Force Analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth. **UNIT-IV:** **Rolling Contact Bearings**, Types of Ball and Roller Bearings, Selection ofBearing for Radial and Axial Load, Bearing Life, Mounting and Lubrication, ShaftScales – Contact Type and Clearance Type. **Journal Bearings:** Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication,Sommerfield Number, Heat Balance, Self-contained Bearings, Bearing Materials. **UNIT V:** **Clutches and Brakes**: Friction Clutches, Friction Materials, Torque TransmittingCapacity,Single& Multiple Plate Clutch, Centrifugal Clutches. Band and Block Brakes. **Belt Drive**:Flat and V-belts, Belt Constructions, Geometrical Relationships for Length oftheBelt,Analysis of Belt Tensions, Condition for Maximum Power, Selection of Flat & V-Belts,Adjustment of Belt Tensions.Pulleys for Flat & V-Belts, Wire rope and stress in wire ropes. **Chain Drives**:Chain drives, roller chains, geometric relationships, dimensions ofchaincomponents polygonal effect, power rating of roller chains, sprocket wheels.

15. Lecture Outline *(with topics and number oflectures)*

S.No	Topic	No. of hours
1	Springs: Spring Materials and Their Mechanical Properties, Equation for Stress and Deflection.	1
2	Helical Coil Springs of Circular Section for Tension, Compression and Torsion, Dynamic Loading, Fatigue Loading, Wahl Line, Leaf Spring and Laminated Spring.	4
3	Spur Gears ,Gear Drives, Classification of Gears, Selection of Type of Gears.	2
4	Lawof Gearing, Force Analysis, Gear Tooth Failures, Selection of Material, Number of Teeth, Face Width, Beam Strength of Gear Tooth, Effective Load on Gear Tooth,Estimation of Module Based on Wear Strength, Lewis equation, Gear Design for Maximum Power Transmitting Capacity, Gear Lubrication.Design of gear trains.	4
5	Helical Gears, Terminology of Helical Gears, Virtual Number of Teeth,Tooth	4

	Proportions, Force Analysis, Beam Strength of Helical Gears, Effective Load on Gear Tooth, Wear Strength of Helical Gears	
6	Bevel Gears, Terminology of Bevel Gears, Force Analysis, Beam strength of Bevel Gears, Wear Strength of Bevel Gears, Effective Load on Gear Tooth	3
7	Rolling Contact Bearings, Types of Ball and Roller Bearings, Selection ofBearing for Radial and Axial Load, Bearing Life, Mounting and Lubrication, ShaftScales – Contact Type and Clearance Type.	5
8	Journal Bearings: Types of Lubrication, Viscosity, Hydrodynamic Theory of Lubrication,Sommerfield Number, Heat Balance, Self-contained Bearings, Bearing	4
9	Clutches and Brakes: Friction Clutches, Friction Materials, Torque TransmittingCapacity,Single& Multiple Plate Clutch, Centrifugal Clutches. Band and Block Brakes.	5
10	Belt Drive:Flat and V-belts, Belt Constructions, Geometrical relationships for length ofthe Belt,Analysis of Belt Tensions, Condition for Maximum Power, Selection of Flat & V-Belts,Adjustment of Belt Tensions.Pulleys for Flat & V-Belts, Wire rope and stress in wire ropes	5
11	Chain Drives:Chain drives, roller chains, geometric relationships, dimensions ofchaincomponents polygonal effect, power rating of roller chains, sprocket wheels.	5
COURSE TOTAL		42

16. Brief description of tutorialactivities

NA

17. Brief description of laboratoryactivities

Module no.	Experiment description	No. of hours
NA	NA	NA

18. Suggested texts and reference materials

STYLE: Book Title, Author name and initials, Edition, Publisher

Text Books:

1. Design of Machine Elements, V.B. Bhandari, TMH Publications.

2. Machine Design, Shigley,McGraw Hill Pub.

Reference Books:

1. Principles of Mechanical Design, R. Phelan, McGraw Hill Pub.

19. Resourcesrequiredforthecourse*(itemized&studentaccessrequirements,ifany)*

19.1	Software	
19.2	Hardware	

19.3	Teaching aides (videos, etc.)	Videos, images and animations
19.4	Laboratory	
19.5	Equipment	
19.6	Classroom infrastructure	
19.7	Site visits	

20. Designcontentofthecourse*(Percentofstudenttimewithexamples,ifpossible)*

20.1	Design-type problems	
20.2	Open-ended problems	
20.3	Project-type activity	
20.4	Open-ended laboratory work	
20.5	Others (please specify)	

Date: (Signature of the Head of the Department)

All India Council for Technical Education

(A Statutory body under Ministry of HRD, Govt. of India)

Nelson Mandela Marg,Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org

APPROVAL PROCESS 2020-21

Extension of Approval (EoA)

F.No. Central/1-7011593850/2020/EOA Date: 09-Jun-2020

To,

The Commissioner cum principal Secretary,
Higher Education,
D. K. S. Bhawan Mantralaya,
Room No. 266, Raipur-492001 Chhattisgarh

Sub: Extension of Approval for the Academic Year 2020-21

Ref: Application of the Institution for Extension of Approval for the Academic Year 2020-21

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations 2020 notified by the Council vide notification number F.No. AB/AICTE/REG/2020 dated 4th February 2020 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-32938411	**Application Id**	1-7011593850
Name of the Institute	SMT. SLT INSTITUTE OF PHRMACEUTICAL SCIENCES	**Name of the Society/Trust**	GURU GHASIDAS VISHWAVIDYALAYA
Institute Address	SMT SLT INSTITUTE OF PHRMACEUTICAL SCIENCES GURU GHASIDAS VISHWAVIDYALAYA BILASPUR CG 495009, BILASPUR, BILASPUR, Chhattisgarh, 495009	**Society/Trust Address**	KONI, BILASPUR (CG),BILASPUR,BILASPUR,Chhattisgarh,495009
Institute Type	Government	**Region**	Central

To conduct following Courses with the Intake indicated below for the Academic Year 2020-21

Program	Level	Course	Affiliating Body (University /Body)	Intake Approved for 2019-20	Intake Approved for 2020-21	NRI Approval Status	PIO / FN / Gulf quota/ OCI/ Approval Status
PHARMACY	DIPLOMA	PHARMACY	Guru Ghasidas Vishwavidyalaya, Bilaspur	60	60	NA	NA
PHARMACY	UNDER GRADUATE	PHARMACY	Guru Ghasidas Vishwavidyalaya, Bilaspur	60	60	NA	NA
PHARMACY	POST GRADUATE	PHARMACEUTICAL CHEMISTRY	Guru Ghasidas Vishwavidyalaya, Bilaspur	10	10	NA	NA

PHARMACY	POST GRADUATE	PHARMACEUTICS	Guru Ghasidas Vishwavidyalaya, Bilaspur	8	8	NA	NA
PHARMACY	POST GRADUATE	PHARMACOLOGY	Guru Ghasidas Vishwavidyalaya, Bilaspur	18	18	NA	NA
PHARMACY	POST GRADUATE	PHARMACOGNOSY	Guru Ghasidas Vishwavidyalaya, Bilaspur	0	15##	NA	NA

Approved New Course(s)

It is mandatory to comply with all the essential requirements as given in APH 2020-21 (Appendix 6)

The Institution/ University is having the following deficiencies as per the online application submitted to AICTE and the same shall be complied within Six Months from the date of issue of this EoA

Deficiencies Noted based on Self Disclosure	
Particulars	**Deficiency**
1. Library Facilities	
Volumes	Yes
Titles	Yes

***Please refer Deficiency Report for details**

Important Instructions

1. The State Government/ UT/ Directorate of Technical Education/ Directorate of Medical Education shall ensure that 10% of reservation for Economically Weaker Section (EWS) as per the reservation policy for admission, operational from the Academic year 2020-21 is implemented without affecting the reservation percentages of SC/ ST/ OBC/ General. However, this would not be applicable in the case of Minority Institutions referred to the Clause (1) of Article 30 of Constitution of India. Such Institution shall be permitted to increase in annual permitted strength over a maximum period of two years beginning with the Academic Year 2020-21

2. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time now amalgamated as total intake shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2020-21 for the Total Approved Intake. Further, the Institutions Deemed to be Universities/ Institutions having Accreditation/ Autonomy status shall have to maintain the Faculty: Student ratio as specified in the Approval Process Handbook. All such Institutions/ Universities shall have to create the necessary Faculty, Infrastructure and other facilities WITHIN 2 YEARS to fulfil the norms based on the Affidavit submitted to AICTE.

3. In case of any differences in content in this Computer generated Extension of Approval Letter, the content/information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.

4. Strict compliance of Anti-Ragging Regulation: - Approval is subject to strict compliance of provisions made in AICTE Regulation notified vide F. No. 373/Legal/AICTE/2009 dated July 1, 2009 for Prevention and Prohibition of Ragging in Technical Institutions. In case Institution fails to take adequate steps to Prevent Ragging or fails to act in accordance with AICTE Regulation or fails to punish perpetrators or incidents of Ragging, it will be liable to take any action as defined under clause 9(4) of the said Regulation.

Prof.Rajive Kumar
Member Secretary, AICTE

Copy to:

1. **The Director Of Technical Education**, Chhattisgarh**

2. **The Registrar**,**
   Guru Ghasidas Vishwavidyalaya, Bilaspur

3. **The Principal / Director,**
   SMT. SLT INSTITUTE OF PHRMACEUTICAL SCIENCES
   Smt Slt Institute Of Phrmaceutical Sciences Guru Ghasidas Vishwavidyalaya Bilaspur Cg 495009,
   Bilaspur,Bilaspur,
   Chhattisgarh,495009

4. **The Secretary / Chairman,**
   KONI, BILASPUR (CG)
   BILASPUR,BILASPUR
   Chhattisgarh,495009

5. **The Regional Officer,**
   All India Council for Technical Education
   Airport Bypass Road, Gandhi Nagar,
   Bhopal – 462 036, Madhya Pradesh

6. **Guard File(AICTE)**

Note: Validity of the Course details may be verified at http://www.aicte-india.org/

****** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

BOARD OF STUDIES IN PHYSICS & ELECTRONICS

A meeting of the Board of studies of Physics and Electronics was held in the e-class room of Department of Pure and Applied Physics, GGV in the hybrid mode. The internal members were present physically, whereas external expert Prof. D.C. Gupta was present in the meeting in virtual mode. The following members were present in the BOS meeting:

1. Prof. PK Bajpai, HoD & Chairman BOS
2. Dr. Arun Kumar Singh, Member
3. Mr. P. Rambabu, Member
4. Dr. R. P. Patel, Academic Coordinator (Special Invitee)
5. Prof. D.C.Gupta, Jiwaji University, External Member expert BOS

The following agenda items were discussed in the meeting:

1. The draft of course structure, examination scheme and detailed syllabi of VIth semester for B.Sc. (Physics) and B.Sc.(Electronics) Hons as the recommended by faculty were discussed and the syllabi for the following papers were discussed and approved by the BOS members:-

   For B.Sc. (Physics)

   1- Electro-magnetic Theory
   2- Electro-magnetic Lab
   3- Statistical Mechanics
   4- Statistical Mechanics Lab
   5-DSE-3 Nuclear & Particle Physics
   6- DSE-3 Nuclear & Particle Physics Lab
   7 DSE-4 Dissertation/ project work followed by seminar

   For B.Sc. (Electronics)

   1-CommunicationElectronics
   2- Communication Electronics Lab
   3- Photonic Devices and Power Electronics
   4- Photonic Devices and Power Electronics Lab
   5- DSE-3 Semiconductor Fabrication & Characterization
   6-DSE-3 Semiconductor Fabrication & Characterization Lab
   7- DSE-4 Dissertation/ project work followed by seminar

2. The course structure, examination scheme and detailed syllabi for M.Sc. (Physics) and M.Sc. (Electronics) have also been discussed. The chairman informed that the university has taken a decision to prepare the curriculum framework for these programs as per CBCS scheme. It was discussed and resolved in the BOS meeting that the new syllabi based on CBCS scheme for M.Sc. (Physics) and M.Sc. (Electronics) be assigned to various faculty members of the department as per course structure of CBCS scheme. The same will be presented in the next BOS meeting for further consideration and approval.

   Meeting ended with vote of thanks to Chair.

23/09/21

23-09-2021

Scheme and Syllabus

For

M. Sc. Zoology

Applicable from Session 2020-2021 to onwards

Department of Zoology

School of Life Sciences

Guru Ghasidas Vishwavidyalaya, Bilaspur (CG)

Post Graduate Program: M. Sc. Zoology
Offered by the Department of Zoology, School of Life Sciences

1. Name of the Program : Master of Science in Zoology.

2. Specializations available : Biochemistry and Molecular Biology, Epidemiology and Molecular Genetics, Fish Biology, Mammalian Reproductive Physiology and Endocrinology, Neuroscience, Toxicology.

3. Program Specifications
   School of studies: School of Life Sciences
   Department: Department of Zoology
   Program: M.Sc. in Zoology
   Date of approval in Board of Studies: 18/08/2020

4. Mode of study: Full time (semester system)
   Class room teaching; experiential learning; tutorials; project assignments and dissertation work.

Purpose of the Program:
The Master of Science degree program in Zoology provides students the opportunity to enhance their knowledge and competence in the diverse field of animal science and encourages students to get indulges in the subject. Another focus of this program is to motivate students towards research. Students are encouraged to get involved in dissertation projects under the guidance of faculty mentors that address topics related to animal health, environment, nutrition, physiology, production, and behavior. The attainment of a master's degree also qualifies students to pursue further specialized training and gain entrance to professional schools, or to pursue a doctorate.

Learning outcomes:
- Students will be able to identify the major groups of organisms with an emphasis on animals and be able to classify them within a phylogenetic framework.
- Students will be able to compare and contrast the characteristics of animals that differentiate them from other forms of life.
- Students will be able to use the evidence of comparative biology to explain how the theory of evolution offers the only scientific explanation for the unity and diversity of life on earth.
- Students will able to understand the concepts of physiology, nutrition, health and economics with reference to animals.
- Students will be able to explain the mechanisms and role of reproductive physiology, Immunology, toxicology & neurobiology in health & disease
- Students will be able to apply the scientific method to questions in biology by formulating testable hypotheses, gathering data that address these hypotheses, and analyzing those data and will be able to demonstrate critical thinking and problem solving skills in Biostatistics course.
- Students will be able to explain how organisms function at the level of the gene, genome, cell, tissue, organ and organ-system.
- Students will be able to demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization within biology.

Semester-wise Theory Papers/ Practical: Masters of Science in Zoology

Department of Zoology, School of Life Science

Type of Course	Course Code	Title of the Course	Lecture-Tutorial-Practical / week	No. of credits	Continuous Comprehensive Assessment (CCA)	End-Semester Exam. (ESE)	Total
Semester – I[st]							
Core Course 1	LZT 101	Comparative Anatomy of Vertebrates	4	4	40	60	100
Core Course 2	LZT 102	Cell Biology	4	4	40	60	100
Core Course 3	LZT 103	Reproduction and Developmental Biology	4	4	40	60	100
Core Course 4	LZT 104	Basic Mammalian Physiology	4	4	40	60	100
Core Course Practical 1	LZL 105	Lab. Exercises based on courses LZT 101 and 102	6	3	40	60	100
Core Course Practical 2	LZL 106	Lab. Exercises based on courses LZT 103 and 104	6	3	40	60	100
				22	**240**	**360**	**600**
Semester II[nd]							
Core Course 5	LZT 201	Biochemistry and Molecular Biology	4	4	40	60	100
Core Course 6	LZT 202	Regulatory Mammalian Physiology	4	4	40	60	100
Core Course 7	LZT 203	Endocrinology	4	4	40	60	100
Core Course 8	LZT 204	Biotechniques	4	4	40	60	100
Core Course Practical 3	LZL 205	Lab. Exercises based on course LZT 201 and 202	6	3	40	60	100
Core Course Practical 4	LZL 206	Lab. Exercises based on course LZT 203 and 204	6	3	40	60	100
				22	**240**	**360**	**600**
Semester III[rd]							
Core Course 9	LZT 301	Molecular Genetics	4	4	40	60	100
Core Course 10	LZT 302	Animal Behavior	4	4	40	60	100

DSE: A *Biochemistry and Molecular Biology*	LZT 303A	Biochemistry of Intermediary Metabolism	4	4	40	60	
DSE: A *Biochemistry and Molecular Biology*	LZT 304A	Molecular Biology of Information Pathway: Nucleic Acids	4	4	40	60	
DSE: B *Mammalian Reproductive Physiology and Endocrinology*	LZT 303B	Neuroendocrinology and Non-Classical Hormones	4	4	40	60	100
DSE: B *Mammalian Reproductive Physiology and Endocrinology*	LZT 304B	Male and Female Reproduction	4	4	40	60	100
DSE: C *Fish Biology*	LZT 303C	Fish Culture and Pathology	4	4	40	60	100
DSE: C *Fish Biology*	LZT 304C	Fish Anatomy and Physiology	4	4	40	60	100
DSE: D *Neuroscience*	LZT 303D	Brain and Neuron	4	4	40	60	100
DSE: D *Neuroscience*	LZT 304D	Developmental Neurobiology	4	4	40	60	100
DSE: E *Toxicology*	LZT 303E	Occupational and Environmental Toxicity	4	4	40	60	100
DSE: E *Toxicology*	LZT 304E	Mechanism of Toxicology	4	4	40	60	100
DSE: F *Epidemiology and Molecular Genetics*	LZT 303F	Basic Epidemiology	4	4	40	60	100
DSE: F *Epidemiology and Molecular Genetics*	LZT 304F	Clinical Epidemiology	4	4	40	60	100
Core Course Practical 5	LZL 305	Lab. Exercises based on courses LZT 301 and 302	6	3	40	60	100
DSE Practical (Elective)	LZL 306	Lab. Exercises based on courses LZT 303 and 304 (A-F)	6	3	40	60	100
				22	**240**	**360**	**600**

Semester IVth

Core Course 11	LZT 401	Evolution and Environmental Biology	4	4	40	60	100
Core Course 12	LZT 402	Biostatistics OR Discrete Data Analysis: MOOC	4	4	40	60	100
DSE: A *Biochemistry and Molecular*	LZT 403A	Protein and Enzymology	4	4	40	60	100

ology							
DSE: A *Biochemistry and Molecular Biology*	LZT 404A	Medical Biochemistry	4	4	40	60	100
DSE: B *Mammalian Reproductive Physiology and Endocrinology*	LZT 403B	Hormone Receptors and Signaling Mechanism	4	4	40	60	100
DSE: B *Mammalian Reproductive Physiology and Endocrinology*	LZT 404B	Fertility and Sterility	4	4	40	60	100
DSE: C *Fish Biology*	LZT 403C	Fish Reproduction, Genetics and Biotechnology	4	4	40	60	100
DSE: C *Fish Biology*	LZT 404C	Capture Fishery	4	4	40	60	100
DSE: D *Neuroscience*	LZT 403D	Cellular Neurophysiology and Neurochemistry	4	4	40	60	100
DSE: D *Neuroscience*	LZT 404D	Sensory, Motor and Regulatory Systems	4	4	40	60	100
DSE: E *Toxicology*	LZT 403E	Mechanism of Toxicity	4	4	40	60	100
DSE: E *Toxicology*	LZT 404E	Systemic Toxicity	4	4	40	60	100
DSE: F *Epidemiology and Molecular Genetics*	LZT 403F	Molecular Markers and Genome Analysis	4	4	40	60	100
DSE: F *Epidemiology and Molecular Genetics*	LZT 404F	Prenatal Diagnosis and Pre-Implantation Genetics	4	4	40	60	100
DES Dissertation	LZL 405	Project work / Dissertation	12	6	80	120	200
				22	**240**	**360**	**600**

1. Discipline Specific Electives (DSE) for each session will be offered to students on the basis of availability of faculty and infrastructure.
2. Offering of DSE in any particular session will be decided after a formal meeting of faculty members of Department of Zoology.
3. Each student may elect any one out of the given electives (A, B, C, D, E and F).
4. Elective papers will be distributed among the students on the basis of merit/choice. The project work/dissertation will be carried out only in the field of respective elective papers (A, B, C, D, E and F) opted by the students.

Prof. S K Prasad
(External Expert)

Dr. Rohit Seth
(Member)

Dr. S K Verma
(Member)

Prof. LVKS Bhaskar
(HOD)