Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Information Technology, Pune-48

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum for
T. Y. B. Tech
2017 Pattern
(Mechanical Engineering)

Department of
Mechanical Engineering

VISION

Excellenee in Mechanical Engineering for Global Aceeptance

MISSION

- Make spirited mechanical engineers with morals, values and principles for sustainable development of soeiety.
- Strive eontinuously to impart knowledge and skills of the highest standards.
- Our engineers will respond to the eurrent and future needs of the industry, higher studies as well as research.

Program Educational Objectives:

1. Graduates of the program will beeome competent engineers suitable for the mechanical engineering based industry and higher education.
2. Graduates of the program will acquire the necessary foundation in fundamental mechanical engineering subjeets for development of mathematical and analytical abilities.
3. Graduates of the program will acquire the knowledge and skills in mechanical engineering to provide technological solutions.
4. Graduates of the program will learn managerial, financial and ethical practices such as, project and financial management skills, multidiseiplinary approach and soft skills.
5. Graduates of the program will respond to growing demands of society through lifelong learning.

Program Outcomes:

At the end of the program, a student will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system eomponents or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. **Condnct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool nsage:** Create, seleet, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engiueer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environmcut and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Etbics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual aud tcam work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project mauagemeut and finauce:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long lcarning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specifie Outeomes:

At the end of the mechanical engineering program, a student will be able to:

1. Identify, automate and apply manufacturing processes for produetion of mechanical components considering effective use of man, machines, and material resources.
2. Design, formulate, develop and analyze mechanical components and systems using design engineering principles and modern CAD/CAE tools
3. Specify, analyze, evaluate, audit, design and build thermal and fluid systems using modern engineering tools

T.Y. B. TECH (MECHANICAL ENGINEERING), SEMESTER V (PATTERN 2017)

Course Code	Course Title	Course Type	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE T1	ISE T2	CE	ESE	PR/OR		
MEUA31171	Design of Machine Elements -I *	TH	3	-	-	15	15	20	50	-	100	3
MEUA31172	Dynamics of Machinery*	TH	3	-	-	15	15	20	50	-	100	3
MEUA31173	Heat Transfer*	TH	3	-	-	15	15	20	50	-	100	3
MEUA31174	Manufacturing Technology	TH	3	-	-	15	15	20	50	-	100	3
IE31175	Elective-I (Interdisciplinary)	TH	3	-	-	15	15	20	50	-	100	3
MEUA31176	Lab Practice – III	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
MEUA31177	Employability Skills (CAD/CAM)	CE	2	-	2	-	-	50	-	-	50	3
MEUA31178	Mini Project	CE	-	1	2	-	-	50	-	-	50	2
A3	Audit course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	I7	1	10	75	75	250	250	50	700	23

*Courses have lab practice component of 2 hrs./week each under Lab Practice head.

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit, #1 hr. = 1 Credit, Audit Course: No Credits

Elective – I (Interdisciplinary):

1. IE31175CS: Internet of Things
2. IE31175ET: Industrial Automation
3. IE31175ME: Product Design and Engineering
4. IE31175CV: Optimization Techniques
5. IE311751T: Human Computer Interaction

List of Audit Courses:

Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.

Vishwakarma Institute of Information Technology, Kondhwa (Bk.), Pune 48. Dept. of Mechanical Engineering

BoS Cbairman **Dean Academics** **Director**

T.Y. B. TECH (MECHANICAL ENGINEERING), SEMESTER VI (PATTERN 2017)

Course Code	Course Title	Course Tvne	Teaching Scheme			Examination Scheme					Total	Credits
						Formative Assessment			Summative Assessment			
			L	T	P	ISE / TI		CE	ESE	PR/ OR		
MEUA32171	Design of Machine Elements - II*	TH	3	-	-	15	15	20	50	-	100	3
MEUA32172	Metrology and Quality Control*	TH	3	-	-	15	15	20	50	-	100	3
MEUA32173	Elective – II*	TH	3	-	-	15	15	20	50	-	100	3
MEUA32174	Lab Practice – IV	CE-PR/OR	-	-	6	-	-	50	-	50	100	3
MEUA32175A/ MEUA32175B/ IE32175B	Internship / Value Added Course	CE-PR/OR	0/ 4	-	16/ 8	-	-	50	-	50	100	8
A3	Audit Course	AU	-	-	-	-	-	-	-	-	-	-
	Total	-	9/ 13	-	22/ I4	45	45	160	I50	100	500	20

*Courses have lab practice component of 2 hrs./week each under Lab Practice head.

Theory: 1Hr. = 1 Credit, Practical: 2 Hrs. = 1 Credit, #1 hr. = 1 Credit, Audit Course: No Credits

Elective – II:

1. MEUA32173A: Finite Element Analysis
2. MEUA32173B: Computational Fluid Dynamics
3. MEUA32173C: Machine Tool Design

Value added course (Theory 60 Hrs. and Practical 120 Hrs.) will have 4 Hrs. Theory/Week and 8 Hrs. Practical/Week. Students those who will register either for Value added course will earn the required credits in the regular semester. However, Students who will register for internship, commencement of internship will start from 1st June and will be of Eight weeks (June-July). However, students will be encouraged to register for both the value added course and Internship. In that case, two courses; **Elective-IV**(Final Year B.Tech., Semester-I) and **Open elective** (Final Year B.Tech., Semester-II) will wave off to compensate the additional eight credits earned by the student for value added course and Internship at Third Year B.Tech. (Semester- II).

List of Value Added Courses :

MEUA32175B1 : GD & T and Advanced Modeling
MEUA32175B2 : Computer Aided Engineering
MEUA32175B3 : Hydraulics and Pneumatics
MEUA32175B4 : Steam Engineering
IE32175B1 : Social Enterprise and Entrepreneurship
IE32175B2 : General Studies for Indian Services and National Service Scheme
IE32175B3 : National Service Scheme and Social Entrepreneurship.

List of Audit Courses:

Professional Ethics; Cyber Security; Value Engineering and Human Rights; Legislative Procedures; Technical Writing/Documentation; Sports/Yoga; Performing Art such as music, dance, and drama etc.; Languages; Online certification course (minimum two weeks); Participation in intercollegiate co-curricular and extra-curricular activities.

BoS Chairman **Dean Academics** **Director**

Vishwakarma Institute of Information Technology, Kondhwa Bk., Pune 48. Dept. of Mechanical Engineering

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Semester – I

Design of Machine Elements -I (MEUA31I71)

Teaehing Seheme
Credits: 3
Lectures: 3 Hrs./week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Prerequisite: Engineering Graphics, Engineering Mathematics, Strength of Materials, Theory of Machines.

Course ohjectives:

- Student shall gain appreciation and understanding of the design function in Mechanical Engineering, different steps involved in designing and the relation of design activity with manufacturing activity.
- Student shall gain design knowledge of the different types of elements used in the machine design process, for e.g. fasteners, shafts, eouplings etc. and will be able to design these elements for each application.

Course Outcomes: Upon the completion of the course students will able to

1. Identify and understand failure modes for mechanical elements and design of machine elements based on strength.
2. Design, Shafts, Keys and Coupling for industrial applications.
3. Design the Power Screws for various applications
4. Design fasteners and welded joints subjeeted to different loading conditions
5. Design various Springs for strength and stiffness
6. Design of machine elements subjected to fluctuating loads.

Unit 1 : Design of Simple Machiue Elemeuts

Design process, design considerations, use of preferred series, Standards and codes, Design of cotter joint, lever for safety valve, bell crank lever, and components subjected to eeeentric loading.

Unit 2 : Desigu of Shaft, Keys aud Couplings

Shaft design on the basis of strength, A.S.M.E. code for shaft design, torsional rigidity and lateral rigidity. Design of keys, design of flange coupling and flexible bushed pin coupling.

Unit 3 : Design of Power Screws

Forms of threads, multiple start screws, torque analysis and design of power screws with square threads, self-loeking screw, collar friction torque, stresses in power screws, design of a c-clamp. Trapezoidal threads, Design of screw jack, Differential and compound Screw.

Unit 4 :Threaded Joints and Welded Joints

Basic types of screw fasteners, bolts of uniform strength, I.S.O. Metric screw threads, bolts under tension, eecentrically loaded bolted joint in shear, eccentric load perpendicular and parallel to axis of bolt, eccentric load on circular base. Strength of Welds Stress in Welds, Axially loaded unsymmetrical welded joints, eccentric load in plane of welds, welded joints subjected to bending.

Uuit 5 : Mechauical Spriugs

Types, applications and materials for springs, style of ends stress and deflection equations for helical compression springs, design of helical compression and tension springs, concentric helical springs, helical torsion spring, Multi-leaf springs.

Uuit 6 : Design for Fluctuating Load

Stress concentration - causes & remedies, Fluctuating stresses, fatigue failures, S-N curve, endurance strength and modifying faetors, design for finite and infinite life, cumulative damage in fatigue failure,

Soderberg, Gerber, Goodman, Modified Goodman diagrams, Fatigue design of components under combined stresses.

Text Books :

1. Bhandari V.B. – " Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd., ISBN-0070681791
2. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ. Co. Ltd., ISBN- 0071077839

Refereuee Books:

1. Spotts M.F. and Shoup T.E. – "Design of Machine Elements" – Prentice Hall International. ISBN-8177584219.
2. Design Data Book– P.S.G. College of Technology, Coimbatore.
3. Juvinal R.C. – "Fundamentals of Machine Components Design" – John Wiley and Sons. ISBN-1118214110
4. Allen Strickland Hall, A. Holowenko, Herman G. Laughlin – "Schaum's Outline of Machine Design". ISBN-0070255954
5. R. L. Norton-"Machine Design: An Integrated Approach"; Pearson Education India. ISBN-8131705331

Prepared by: Mr. M. N. Jagdale

BOS Member:

BOS Chairman:

Dynamics of Machinery (MEUA31172)

Teaching Scheme
Credits: 3
Lectures:3 Hrs./week

Examlnation Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Prerequisite: Engineering Mathematics –I, II and III, Engineering Physics, Engineering Graphics-I, Engineering Mechanies, Basic Mechanical Engineering, Theory of Machines I.

Course objectives:

- To make conversant with working principle of control mechanisms like clutches, brakes. Also able to understand analysis of gearing systems.

Course Outcomes: Upon the completion of the course, students will able to

1. Analyze static and dynamic effeet of forces acting on mechanisms and machine components.
2. Design and analyze clutehes and brakes.
3. Apply eoncept of static and dynamic balancing
4. Evaluate torque and speed in spur and helical gearing systems
5. Analyze motion transmission by various types of gears and gear trains.
6. Evaluate Torque transmitted by gear trains.

Unit 1: Static aud Dyuamie Force Analysis

Theory and analysis of Compound Pendulum, Concept of equivalent length of simple pendulum, Bifilar suspension, Trifilar suspension. Dynamics of reciprocating engines: Two mass statically and dynamieally equivalent system, correction couple, Static and dynamic force analysis of reciprocating engine mechanism (analytical method only),Crank shaft torque, Introduetion to T-θ diagram

Unit 2: Frictiou Clutches and Brakes

Friction in turning pair, friction circle, friction axis, frietion in four bars and slider crank mechanism. Torque transmitting eapaeity of Pivot and collar friction, Plate elutches, Cone clutches, Centrifugal cluteh, Braking torques of different types of brakes such as shoe brakes, external and internal shoe brakes, block brakes, band brakes and band & block brakes

Unit 3: Balancing

Static and dynamic balaneing, balaneing of rotating masses in single and several planes, primary and secondary balancing of reciproeating masses, balancing in single cylinder engines, balancing in multi-cylinder in-line engines, direct and reverse cranks method, radial and V engines.

Uuit 4: Spur Gear

Classification, Spur gear: definition, terminology, fundamental law of toothed gearing, Involute and cyeloidal profile, Path of contact, arc of contact, Conjugate aetion, Contact ratio, Minimum number of teeth, interference and under cutting, Force analysis.

Uult 5: Helieal, Bevel, Worm aud Worm Wheel

Helical gears: nomenelature, center distance, virtual number of teeth. Bevel Gear: terminology and Efficiency, Worm and worm wheel: terminology, geometrical relationships, tooth forces, torque transmitted.

Unit 6: Gear Trains
Types of Gear Trains, Analysis of epicyclic gear trains, Holding torque – Simple, compound and epicyclic gear trains, torque on sun and planetary gear train, compound epicyclic gear train, Bevel epicyclic Gear train.
Text Books
1. Ballaney P. L., "Theory of Machines and Mechanisms", Khanna Publisher Delhi, 1999. ISBN: 817409122X. 2. Rattan S.S., "Theory of Machines", 2ed.,Tata McGraw-hill publishing, 2005, ISBN 007-059120-2. 3. Thomas Bevan, "Theory of machines", CBS publishers and Distributors, 1984. ISBN: 8131729656
Reference Books:
1. Shigley Joseph Edward and Vicker John Joseph. "Theory of Machines and Mechanisms", 3ed. 1995, Oxford University Press. ISBN 0-19-515598-x. 2. Ghosh Amitabh and Malik Ashok Kumar, "Theory of mechanisms and Machines", 3ed, Affiliated East West press, 2000, ISBN 81-85938-93-8 3. Allen Strickland, Jr. Hall, "Kinematics and Linkage Design", Waveland Pr Inc (1986) ISBN 10: 0881332720 4. Wilson C.E., Sandler J. P. "Kinematics and Dynamics of Machinery", Person Education. ISBN 020135099-8 5. Erdman A.G. and Sandor G.N., "Mechanism Design, Analysis and Synthesis" Volume-I, Prentice –Hall of India.

Prepared by: Mr. A. R. Deshpande

BOS Member:

BOS Chairman:

Heat Transfer (MEUA31173)

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Seheme
Formative Assessment : 50
Summative Assessment : 50

Prerequisite: Thermodynamics, Fluid Mechanics, Engineering Mathematics

Course objectives:

- The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
- Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
- The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

Course Outcomes:

Upon the completion of the course, students will able to

1. Analyze the various modes of heat transfer and implement the basic heat conduction equations for Steady, one dimensional thermal system with and without internal heat generation.
2. Analyze heat conduction in extended surfaees.
3. Formulate and analyze a transient heat transfer problem.
4. Analyze the heat transfer rate in natural and forced convection.
5. Interpret heat transfer by radiation between objects with simple geometries.
6. Analyze the heat transfer equipment and investigate the performance.

Unit I : Steady State Conduction

Introduction: Applications of heat transfer, Modes of heat transfer, Thermal conductivity, Thermal diffusivity

Unidirectional steady state eonduction without internal heat generatiou: Fourier's law, Application of Fourier's law to infinite slab, infinite long hollow cylinder and hollow sphere, Electrical Analogy of conduction, concept of conduction and film resistances, critical insulation thickness, Three dimensional general differential equation of conduction in Cartesian, cylindrical and spherical geometry (no derivation for spherical geometry), Laplace, Fourier's and Poisons equation.

Unidirectioual steady state conduction with internal heat generation: Boundary conditions, Application of Poisons equation

Uuit II : Hcat conductiou through Extended Surfaees – Fins

Types of fins and its applications, Fin effectiveness and fin efficiency, concept of pin fin, Differential equation of pin fin, boundary condition based classification of pin fins, Analysis of pin fin

Unit III : Unsteady state couductiou

Validity and criteria of lumped system analysis, Biot and Fourier number, Time constant and response of thermocouple, Transient heat analysis using Heisler Grober charts.

Unit IV: Convection

Fuudamcutais of Convection: Heat convection, velocity and thermal boundary layers

Forced Convection: Governing equation of forced convection, physical significance of dimensionless numbers, Correlations for flow through Duct/Internal flow and flow over flat plate/ External flow

Natnral Convection: Mechanism of natural convection, Governing equation of natural convection, physical significance of dimensionless numbers, correlations for different cases
Condensation and hoiling: Film wise and drop wise condensation, Typical pool boiling curve

Unit V: Radiation

Fundamental concepts, Laws of radiation, solid angle, intensity of radiation, Radiation between two black surfaces, shape factor, concept of electrical analogy, Radiation between two finite grey surfaces, Radiation shields

Unit Vi: Heat Exchanger

Types of heat exchangers, Overall heat transfer coefficient with scaling effect, Analysis and design of heat exchangers using both LMTD and NTU – ε method, Introduction mass transfer, Similarity between heat and mass transfer.

Text Books:

1. F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley.
2. Mahesh M. Rathod, Engineering Heat and Mass Transfer, Third Edition, University Science Press, 2016
3. Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited.
4. S.P. Sukhatme, A Textbook on Heat Transfer, Universities Press.
5. R.C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age Science.
6. P.K. Nag, Heat & Mass Transfer, McGraw Hill Education Private Limited.
7. V. M. Domkundwar, Heat Transfer
8. Holman, Fundamentals of Heat and Mass Transfer, McGraw – Hill publication.

Prepared by: H. Y. Kolekar

BOS Member:

BOS Chairman:

Manufacturing Technology (MEUA31174)

Teaching Scheme
Credits: 3
Lectures: 3 Hrs./week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Prerequisite: Engineering Physics, Engineering Chemistry, Engineering Mathematies, Manufacturing Processes and Workshop Practice.

Course objeetives:

- To familiarize students with major manufacturing proeesses
- To correlate the material type with the possible fabrication processes
- To describe the operations and tools for major manufacturing processes
- To interpret the knowledge about manufacturing processes, parameters and their effects on performanee.

Coursc Outeomes:

Upon the completion of the course students will able to

1. Evaluate economics of machining processes understanding machining mechanics at different cutting conditions.
2. Differentiate grinding and super-finishing processes in terms of metal removal rate, machining time and their applications.
3. Describe various processes for thread and gear manufacturing and finishing.
4. Develop part programming for plain milling and turning
5. Explain advance machining processes for various applications.
6. Design Jigs and fixtures considering the Principles of locating and clamping.

Uuit I :Mecbauics and Ecouomics of Macbining Processes

Theories on mechanics of metal cutting, Thermal aspects of metal machining, Mechanics, material removal rate and machining time: Shaping, Planing, Drilling, Milling, Boring and Broaching operations. Surfaee finish in machining, Economics of machining operations, Optimizing cutting parameters for minimum cost, Optimizing machining cost for maximum production and optimum cutting speed for maximum efficiency.

Unit II : Grinding aud Finishing Proeesses

Introduction to abrasive machining and finishing operations, Mechanics of grinding: chip formation, components of cutting force, thermal aspects, material removal rate and machining time. Grinding wheel characteristics, Wheel specification and selection, Types of grinding operations, Surface finish in grinding, Finishing operations: Honing, Lapping and superfinishing processes, Polishing, buffing and burnishing processes, Coolants and lubricants.

Unit III : Gear and Thread Manufacturing

Classification, elements and forms of screw threads. Thread making processes: die heads, thread milling, thread rolling, thread grinding and thread tapping, automatic screw machines. Gear teeth forms and tooth terminology, Gear manufacturing: casting, forming, broaching, template and generating methods, Gear shaper, rack planning and hobbing processes, Cutting of bevel gear, worm and worm wheels, Gear finishing: Gear shaving, Gear burnishing, Gear grinding, gear honing and gear lapping processes.

Unit IV: CNC Technology

Introduction to modern machine tools, Classification, Construction and working of NC, CNC, DNC and machining centre. CNC axes and drives. Automatic Tool Changer (ATC) and Automatic pallet changer (APC), CNC Programming: Word address format (WAF) –ISO Standards, G & M codes, Type of CNC Control systems, Manual part programming (plain milling and Turning), Subroutine, Canned cycles. Advantages and limitations of automation and NC, CNC machines, Adaptive control systems, CAD/CAM: introduction, advantages and application areas.

Unit V:Advanced Machining Processes

Introduction, classification of advanced machining processes, selection of process, Mechanics, process parameters, summary of process characteristics, advantages, limitations and applications of abrasive jet machining (AJM), ultrasonic machining (USM), chemical machining, electrochemical machining (ECM), electric discharge machining (EDM), electron beam machining (EBM), laser beam machining (LBM) and plasma arc machining (PAM). Comparison of advanced machining processes.

Unit VI:Jigs and Fixtures

Definition and concept of Jig and Fixture, Advantages, main components and principle of jigs and fixture design, degrees of freedom, principles of location, locating and clamping devices, Principles of clamping, types of clamps, Materials used for locating and clamping devices, Types of Jigs: Channel jig, Template jig, Plate jig, Angle plate jig, Turn over jig, Box jig, and Latch type jig. Types of Fixtures: Turning fixture, Welding fixture, Milling fixture, Indexing fixtures. Concept, elements and advantages of modular fixture, Pokayoke concept in jigs and fixtures.

Text Books:

1. Hajara Choudhari, Bose S.K. – Elements of workshop Technology Vol. I &II , Asian Publishing House, ISBN 0713136227
2. M.P Grover – Fundamentals of modern manufacturing: Materials and systems, John Wiley & Sons, Inc, New Jersey, 2010, ISBN 978-0470-467008.
3. R. K. Jain, Production Technology, Khanna Publishers, 16th Edition, 2003.
4. P. C. Sharma, Production Engineering, S. Chand Publication

Reference Books:

1. B. Ravi – Metal Casting – Computer Aided design and analysis- Prentice Hall of India, a, ISBN: 8120327268, 9788120327269
2. Reikher – Casting: An analytical approach – Springer ISBN 9781846288494
3. Materials and Processes in Manufacturing, DeGarmo, Black, and Kohser, John Wiley & Sons Inc, New York, 2011.
4. Kalpakjian and Schmid - Manufacturing Engineering and Technology, Prentice Hall, New Jersey, 2013
5. Production technology –HMT, Tata McGraw Hill publication
6. Lindberg, Roy A., Processes and materials of manufacture, P H I Learning
7. P. N. Rao, CAD/CAM Principles and Applications, McGraw Hill Education, Third Edition

Prepared by: A.A.Somatkar

BOS Member:

BOS Chairman:

Internet of Things (IE3I175CS)

Teaching Scheme
Credits : 3
Lectures : 3 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Prerequisites :	
	Data Communication
Course Objeetives :	

- To understand fundamentals of IoT
- To implementing small IoT systems using building blocks of IoT
- To gain knowledge of IoT protocols
- To comprehend fundamentals of security in IoT
- To learn how secure infrastructure for IoT is implemented
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies

Course Outcomes :

After completion of the course, student will be able to

1. Demonstrate the fundamentals of IoT
2. Apply concepts of IoT to build small IoT Systems
3. List the IoT protocols
4. Analyze the security issues in IoT
5. Demonstrate the concepts of Cloud & Fog Computing
6. Develop the real world applications of IoT

Unit 1 :	**Introduction to IoT**

IoT: Definition and characteristics of IoT, Internet of Things: Vision, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Things of IoT, IoT Protocols, Logical design of IoT, IoT functional blocks, IoT communication models, IoT Communication APIs, IoT enabling technologies, IoT levels and deployment templates, IoT Issues and Challenges, Applications.

Unit II :	**Protocois for IoT**

IoT Protocols Organization, IoT Protocols: CoAP, MQTT, AMQP, DDS, IPv6, ZigBce, Bluetooth, Wifi, Comparison of Traditional Networking Protoeols and IoT Protocols,Issues with IoT Standardization.

Unit III :	**IoT & M2M**

Machine to Machine, Difference between IoT and M2M, Software define Network, Software define Network for IoT, IoT Physical Devices and Endpoints: Basic building blocks of and IoT device, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with ArduinoIntroduction to Raspberry Pi, Raspberry Pi interfaces, Programming Raspberry Pi with Python.

Unit IV :	**Security in IoT**

IoT Security: Vulnerabilities of IoT, Security Requirements, Challenges for Secure IoT, ThreatModelling, Key elements of IoT Security: Identity establishment, Access control, Data andmessage security, Non-repudiation and availability, Security model for IoT.

Unit V :	**Cloud Computing and Fog Computing**
Introduction to Cloud Computing, Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middle ware, Cloud Standards – Cloud Providers and Systems, Mobile Cloud Computing, The Cloud of Things Architecture. Challenges and issues in cloud Computing. Fog Computing, Need of Fog computing, Fog Computing Architecture.	
Unit VI :	**IoT Case Studies**
Case Studies: Home Intrusion Detection, Weather Monitoring, System, Air Pollution Monitoring, Smart Irrigation, Smart cities, Health Care.	
Text Books :	
1	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, ISBN: 0: 0996025510, 13: 978-0996025515
2	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012. ISBN : 9781439892992
3	Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", Springer, 2011. ISBN: 978-3-642-19156-5
Refereuce Books :	
1	Olivier Hersent, Omar Elloumi and David Boswarthick, "The Internet of Things: Applications to the Smart Grid and Building Automation", Wiley, 2012, 9781119958345
2	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012, ISBN:978-1-119-99435-0
3	Barrie Sosinsky, "Cloud Computing Bible", Wiley-India, 2010.ISBN : 978-0-470-90356-8
4	Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, 2014, ISBN: 978-1-118-43063-7

Prepared by: Mr. Nitin Sakhare

BOS Member:

BOS Chairman:

Indnstriai Antomation (IE31175ET)

Teaehing Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessmcnt: 50 Marks
Summative Assessment: 50 Marks

Prereqnisite: Readers/students are expected to know the following concepts:
1. Basic Electronics devices and their operations
2. Basic understanding of Operational Amplifier.
3. Brief introduction to Controllers, analog and digital controi actions.

Course Objectives:
- To give the students a comprehension of Industrial Instrumentation Design.
- To give the students a comprehension of the relation between Instrumentation and controller design in industrial applications.
- To make the students able to analyze the control loops and to achieve the control actions with different Controllers

Conrse Outcomes:

After completion of this course, students will be able to -

1. Select an appropriate sensor or transducer to meet requirements of an industrial application.
2. Select a signal conditioning circuit for given application based on applied sensing method.
3. Design a data acquisition system using various Bus standards and communication Protocols.
4. Choose different final control elements and Actuators.
5. Design Industrial solutions for complex engineering problems using Programmable Logic controllers.
6. Describe advanced systems in Industrial automations.

Unit I : Seusors and Trausducers
Performance terminology - Displacement, Velocity and Motion sensors - Proximity sensors, Force, Pressure, Flow, Level and Temperature sensors – Humidity, pH and Conductivity sensors – Specifications and selection criteria – Inputting data by switches

Unit II : Trausmitters, Signal couditioning and Couverters
Analog signal conditioning for different sensors – Use of bridge circuits and Instrumentation amplifiers – Design guidelines – Signal converters V/I, I/V, V/F, F/V, I/P & P/I converters – Evolution of two wire transmitters – Isolatcd two wire transmitters – Smart and Intelligent transmitters

Unit III : Data Acquisition, Bns Standards and Protocois
Multichannel data logging and computer based data acquisition system like LABVIEW, – RS 232C standard, IEEE 488 bus, I2C bus, HART protocols – Foundation Field bus and Profibus

Uuit IV: Aetuators aud Final Control elemeuts
Pneumatic and hydraulic actuators- Directional control valves, Pressure control valves, Cylinders, Process control valves - Electrical actuators- Mechanical switches, Solid state switches, Solenoids, DC motors, AC motors and Stepper motors.

Unit V:Programmable Logic Coutrollers, Appiieations aud Interfacing

PLC Architecture – Input / Output processing – Interfacing of input / Output devices with PLC – Analog Input / Output - Ladder logic programming – Selection of PLC – PLC based automated systems.

Unit VI: Advauces in industrial Automations

Direct digital control systems, Distributed control systems (DCS): Introduction, DCS flow sheet symbols, architecture of DCS controller, DCS communication, DCS supervisory computer tasks, Features and advantages of DCS. Supervisory control and Data acquisition (SCADA): SCADA introduction, elements of SCADA, Features of SCADA.

Text Books :

1. K. Krishna Swamy, "Process Control"; New Age International Publishers.
2. C.S. Rangan, G.R. Sarma, V.S.V. Mani; " Instrumentation Devices and Systems "; Tata McGraw Hill; 2nd Edition
3. W. Bolton; " Mechatronics, Electronic Control Systems in Mechanical and Electrical Engineering "; Pearson Education; 3rd Edition

Reference Books :

1. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education.
2. Ernest O. Doebelin; " Measurement System Application and Design "; Mc-Graw Hill; 5th Edition
3. David G. Alciatore, Michael B Histand; " Introduction to Mechatronics and Measurement System "; Tata McGraw Hill

Prepared by

Mr. G. H. Chavhan

Mr. V. B. Ambhore

BOS Member:

BOS Chairman:

Product Design and Engineeriug (IE31175ME)

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Seheme
Formative Assessments: 50
Summative Assessment: 50

Prerequisite:
Engineering Meehanics, Strength of Material, Material Science, CAE and CAMD, MD I and MD II

Course ohjectives:

- To understand basic techniques for particular phases of product development
- Make and manage design teams for product development in a company.

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Describe an engineering design and development process
2. Apply engineering, scientific, and mathematical principles to execute a design from concept to finished product
3. Create 3D solid models of mechanical components from the perspective of aesthetic, ergonomic and functional requirement using CAD software
4. Design for assembly, disassembly, environment, graphics, and packaging.
5. Create new product based on mechanical design engineering.
6. Explain contemporary issues and their impact on provided solution.

Uuit 1: Introduetion to Product Design

Characteristics of Successful Product Development, Innovative Thinking, Challenges to Product Development, Product Development Process, Concept Development, Economics – Cost Vs Performance, Design Considerations

Unit 2 : Product Deveiopment Proeess

Product development process- Identification of customer needs- customer requirements, product development process flows. Product specifications and concept generation, concept seiection, concept screening, concept testing, reverse engineering, product architecture

Unit 3 :Produet Design Toois

Creativity and Problem Solving –Creativity methods-Theory of Inventive Problem Solving (TRIZ), Product function tree, Life cycle analysis, Quality Function Deployment, Competing Product Analysis, SWOT analysis, Failure Mode Effect Analysis.

Uuit 4 : Design for Manufacture and Assemhly

Design for assembly, design for disassembly, design for environment, design for graphics and packaging

Unit 5 : Rapid Prototyping

Understanding Prototypes, Principles of Prototyping, Prototyping Technologies, Planning for Prototypes

Unit-6: Product Testing and Validation

Time value of Money, Analytical technique, Product and Process, Evaluation of component, subassembly, assembly, Reliability Goals, Computer simulations and Bench test results, Comprehensive test plans and reports.

Text Books:

1. Product Design-Techniques in Reverse Engineering and New Product Development, Kevin Otto, Kristion Wood, Pearson Education, ISBN 978-81-7758-821-7.
2. Karl T.U. And Steven D.E., Product Design and Development, McGraw Hill, Ed 2000.

Reference Books :

1. Dieter GE, Engineering Design-Material and Processing Approach, McGraw Hill, Ed 2000

Prepared by: A. R. Deshpande

BOS Member:

BOS Chairman

Optimization Techniqnes (IE31175CV)

Teaching Scheme
Credits: 3
Lectures: 3 hrs./ week

Examination Scheme
Formative Assessment: 50 Marks
Summative Assessment: 50 Marks

Course Ohjectives:

- To introduce students to optimization techniques and applications of same in Civil Engineering.
- To impart the knowledge of different Stochastic Methods of optimization
- To equip the students with advance Linear Programming techniques.
- To impart the knowledge of Non-Linear Programming through unconstrained optimization techniques.
- To make students aware of dynamic programming.

Course Outcomes:

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

1. Discuss optimization techniques and its components
2. Implement sequencing, queuing theory and simulation to stochastic problems
3. Implement LPP with all its variants
4. Construct linear optimization models
5. Use nonlinear programming like constrained and unconstrained optimization
6. Use dynamic Programming for problems related to project investment

Unit I : Introduction of Systems Approach

Introduction to System approach, Operations Research and Optimization Techniques, Applications of systems approach in Civil Engineering. Introduction to Linear and Nonlinear programming methods (with reference to objective function, eonstraints), Graphical solutions to LP problems. Local & Global optima, unimodal function, convex and concave function.

Unit II : Stochastic Programming

Sequencing– n jobs through 2, 3 and M machines. Queuing Theory: elements of Queuing system and its operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single ehannel Queuing theory: Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1): (FCFS/ /).Simulation: Monte Carlo Simulation.

Unit III : Linear Programming (A)

The Transportation Model and its variants.Assignment Model and its variants.

Unit IV: Linear Programming (B)

Formulation of Linear optimization models for Civil engineering applications. The simplex method. Method of Big M, Two phase method, duality.

Unit V: Noniinear programming

Single variable unconstrained optimization: Sequential Search Techniques-Dichotomous, Fibonacci, Golden section.
Multivariable optimization without constraints-The gradient vector and Hessian Matrix, Gradient techniques, steepest ascent/decent technique, Newton's Method. Multivariable optimization with equality constraints - Lagrange Multiplier Technique.

Unit VI : Dynamic programming, Games Theory & Replacement Model

Multi stage decision processes, Principle of optimality, recursive equation, Applications of D. P. Games Theory – 2 person's games theory, various definitions, application of games theory to construction Management.
Replacement of items whose maintenance and repair cost increase with time, ignoring time value of money.

Text books:

1. Operations Research by Premkumar Gupta and D.S.Hira, S. Chand Publications (2014).
2. Engineering Optimization: Methods and Application-- A. Ravindran, K. M. Ragsdell— Wiley India.
3. Engineering Optimization by S. S. Rao.
4. Operations Research by Hamdy A. Taha.
5. Quantitative Techniques in Management by N.D. Vohra (Mc Graw Hill).
6. Operations Research by Pannerselvam, PHI publications.

Reference books:

1. Topics in Management Science by Robert E. Markland (Wiley Publication).
2. An Approach to Teaching Civil Engineering System by Paul J. Ossenbruggen.
3. A System Approach to Civil Engineering Planning & Design by Thomas K. Jewell (Harper Row Publishers).

e – Resources:

1. Mathematical Model for Optimization (MMO Software).
2. nptel.iitm.ac.in/courses/webcourse-contents/IISc-Bang/OPTIMISATION METHODS/Newindex1. html.

Prepared hy-Preeti Kulkarni

BOS Member:

BOS Chairman:

Hnman Computer Interaction (IE31175IT)

Teachiug Scheme:
Credits: 3
Lectures / Week: 3Hrs/week

Examination Scheme
Formative Assessment: 50
Summative Assessment: 50

Prerequisites: Problem Solving and Object Oriented Technologies.

Course ohjectives :

- To introduce the field of human-computer-interaction study.
- To gain an understanding of the human part of human-computer-interactions.
- To learn to do design and evaluate effective human-computer-interactions.
- To study HCI models and theories.
- To understand HCI design processes.
- To apply HCI to real life use cases.

Course Outcomes

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

1. Explain the importance of HCI principles of user-centered design (UCD) approach.
2. Describe various human factors in HCi design.
3. Describe the models, paradigms and context of human interactions with computer system.
4. Design effective user-interfaces following a structured and organized UCD process.
5. Evaluate usability of a user-interface design.
6. Apply cognitive models for predicting human-computer-interactions.

Unit I : Introduction and basic concepts

Need for Design - Examples from Design of everyday things, case studies, Evolution of the web and digital interfaces, Design thinking and wicked problems .Exercise - Identify problems around us requiring design solution Or problems solved using design.

Unit II : Understanding the Human

Human senses: Human input-output channels, human memory, Thinking - reasoning and problem solving, Human emotions, individual differences, Designing interfaces for all, User research and teehniques, Understanding Personae, Good and poor design, Ergonomics. Exercise - Creating personae for different application in everyday use.

Unit IH : Understanding the Interaetion

Understanding device specific interactions and human aspects involved, Interaction styles, Interacting with voice, visual and audio visual interfaces, Understanding Scenarios and context of use for user.

Exercise - Listing down scenarios for an application/system, critical task list for each scenario Understanding user journey and user journey maps.

Exercise - Creating a user journey map for a particular task
Unit IV :HCi Design Process and Staudards
Introduction to UX design process and case study, Understanding Information Architecture, Exercise - Open and closed card sorting technique - Creating information architecture for a system Understanding navigation models based on information architecture, High level concept sketches/wireframes Exercise - Creating low fidelity concept sketches for critical tasks of a system/problems ,Overview of tools
Unit V :UI Evaiuation Teehniques
What, why and when to evaiuate, Design guideiines, Golden rules and heuristics, Goals of Evaluation, Evaluation criteria, Evaluation through: Expert analysis, User participation, Testing techniques - Formative and Summative testing, surveys, peer reviews and so on. Case study - ROI on UX/HCI methodology.
Unit VI : HCi Models and Theories
Cognitive models, Goal and Task hierarchy models, Linguistic models, Physical and Device models, Design principles. Exercise - Conduct evaluation of different sample interfaces using different models Introduction to Prototyping tools, UX - Industry overview.

Text hooks :	1. Alan J, Dix. Janet Finlay, Russell Beale, "Human Computer Interaction", PearsonEducation, 3rd Edition, 2004, ISBN 81-297-0409-9 2. Preece, Rogers, Sharp, "Interaction Design-beyond human-computer Interaction", WILEY-INDIA, ISBN 81-265-0393-9
Reference Books :	1. Ben Shneiderman, "Designing The User Interface", Pearson Education, 2001, ISBN 81-7808-262-4 2. Aian Cooper, Robert Riemann, David Cronin, "The Essentials of interaction Design", WILEY-INDIA, ISBN-10 81-265-1305-5 3. Wilbert O. Galitz, "The Essential Guide to User Interface Design", WILLY, ISBN 81-265-0280-0 4. Donald A. Norman, 2013, The Design of Everyday Things Basic Book, ISBN 978-0-465-07299-6.
Web-links:	1. http://hcibib.org 2. https://developer.android.com/guide/practices/compatibility 3. https://developer.apple.com/design/human-interface-guidelines

Prepared by: S. M. Kulkarni

BOS Memher:

BOS Chairman:

Lah Practice –III (MEUA31176)

Teaehing Seheme
Credits: 3
Lectures: -- Hrs/week
Laboratory Work: 6 Hrs. /week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objectives:

- Enable students to apply engineering tools/techniques to product design.
- Give practice in longer open-ended problems using design methodology.
- To make conversant with working principle of control mechanisms like clutches, brakes. Also able to understand analysis of gearing systems
- To offer hands-on experience through the performance experiments based on various modes of heat transfer

Coursc Outeomcs:

At the end of the course the students will able to,

1. Identify and analyze the mechanical transmission systems.
2. Apply the techniques, skills, and modern engineering tools necessary for engineering practice.
3. Analyze static and dynamic effect of forces acting on mechanisms and machine components.
4. Develop ability for selection of gear trains for specific applications
5. Evaluate the rate at which a system gains/losses thermal energy.
6. Analyze conduction, convection and radiation modes of heat transfer

A] Lab Practice - Design of Maehine Elemeuts -I (MEUA31171)

Term-Work

1. Two design projects on Assemblies covering above syllabus.

The design project shall consist of half imperial sheets (A2 size) involving assembly-drawing with a bill of material and overall dimensions and drawings of individual components. The Project should be assigned to a group of three to five students.

Project 1 shall be based on any one of the following topics-

i) Cotter joint/ knuckle joint for a specified application.
ii) Transmission Shaft/Machine tool spindles/coupling for specified application.
iii) Hand or foot operated levers/lever for safety valve.

Project 2 shall be based on any one of the following topics-

i) Bench vice/Machine vice for specified applications.
ii) Bottle type/toggle jack for vehicles.
iii) Lead screw for machine tool/other applications.

Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified for important surfaces. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file.

Design data book shall be used wherever necessary for selection of standard eomponents.

Drawings of design project should be on any Cad Software.

The ORAL shall be bascd on Term Work.

B] Lab Practice – Dynamics of Machiuery (MEUA31172)

The Term-Work shall consist of

Laboratory Experiments (Any 6+ vb):

1. To determine the mass moment of inertia of a connecting rod using a compound pendulum method.
2. To determine the mass moment of inertia of a flat bar using bifilar suspension method.
3. To determine the mass moment of inertia of a flywheel/gear/circular disc using trifilar suspension method.
4. To measure torque transmitting capacity of friction clutch.
5. To measure the power transmitted by the dynamometer or power absorbed by the brake.
6. Balancing of wheel / rotor on computerized balaucing maehine.
7. To generate involute gear tooth profile nsing raek shift model.
8. To measure holding torque of the epicyclic gear train.

Drawing Assignments (sheets of A2 size) :

9. To draw conjugate profile for any general type of gear tooth.
10. To solve any two problems on balancing of rotating masses using graphical method.

C] Lab Practicc - Heat Transfcr (MEUA31173)

Lab practice consists of the following :

1. Determination of Thermal Conductivity of metal rod.
2. Determination of Thermal Conductivity of insulating powder.
3. Determination of Thermal Conductivity of Composite wall.
4. Determination of heat transfer coefficient in Natural Convection.
5. Determination of heat transfer coefficient in Forced Convection.
6. Determination of temperature distribution, fin efficiency in Natural Convection.
7. Determination of Emissivity of a Test surface.
8. Determination of Stefan Boltzmann Constant.
9. Determination of critical heat flux.
10. Determination of NTU/effectiveness of a heat exchanger (Evaporator/Condenser).

Text Book

1. Bhandari V.B. – " Design of Machine Elements" – Tata McGraw Hill Publ. Co. Ltd., ISBN-0070681791
2. Shigley J.E. and Mischke C.R. – "Mechanical Engineering Design" McGraw Hill Publ. Co. Ltd., ISBN- 0071077839
3. Rattan S.S., "Theory of Machines", 2ed.,Tata McGraw-hill publishing, 2005, ISBN 007059120-2.
4. F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley.
   Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited.

Rcfcrence Books:

1. Spotts M.F. and Shoup T.E. – "Design of Machine Elements" – Prentice Hall International. ISBN-8177584219.
2. Design Data Book– P.S.G. College of Technology, Coimbatore.
3. Shigley Joseph Edward and Vicker John Joseph. "Theory of Machines and Mechanisms", 3ed., 1995, Oxford University Press. ISBN 0-19-515598-x.

Prepared by:

Mr. M. N. Jagdale

Mr. A. R. Deshpande

Mrs. H. Y. Kolekar

BOS Member:

BOS Chairman:

Employability Skills (CAD/CAM) (MEUA31177)

Teaching Seheme
Credits: 3
Lectures: 2 Hrs./week
Practical: 2 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Prerequisitc: Engineering Graphics, Engineering Mathematics, Computer Aided Machine Drawing, Strength of Materials, Manufacturing Processes

Course ohjectives:

- Develop an understanding of the advanced aspects of enabling computer aided technologies used in design, engineering, manufacturing and rapid product development

Conrse Outcomes:

By the end of the course, students will be able to

1. Apply homogeneous transformation matrix for geometrical transformations of 2D CAD entities for basic geometric transformations
2. Analyze the simple component using suitable analysis software
3. Prepare CNC program for Turning / Milling and generate tool path using CAM software
4. Explain the need of antomation and RP in industry

Unit l : Geometric Modeliug and Computer Graphlcs

Transformations (2D & 3D) : Geometrical Transformation, Mapping of geometric models, Projections : Orthographic, Isometric, Perspective projections
Analytical Curves, Surfaces, Synthetic Curves and Surfaces, Solids - Introduction, Geometry and Topology, Solid Representation, Boundary Representation, Euler's equation, Constructive Solid Geometry (CSG), Boolean operation for CSG

Unit II : Finitc Element Analysis

Introduction : Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continunm, Degrees of freedom, loads and constraints), General FEM procedure, Applications of FEM in various fields, Advantages and disadvantages of FEM
One Dimensional Problem: Finite element modeling, coordinate and linear shape function, Assembly of Global Stiffness Matrix and Load Vector, Properties of Stiffness Matrix, Finite Element Equations, Temperature Effects. Trusses : Introduction, 2D Trusses, Assembly of Global Stiffness Matrix

Uuit III : Computer Aided Mannfacturing (CAM)

Numerical Control Machines, Computer Numerical Control , Types of CNC, Coordinate Systems, Direct & Distributed Numerical Control Machines, CNC part program, Computer aided part programming, Tooling, Controllers used, Computer Integrated Manufacturing, Computer Aided Process Planning, Computer Aided Quality Control

Unit IV:Automation and Rapid Prototyping

Automation: Introduction, Automation strategies, Types of Automation - Hard and Soft Automation, Flexible Manufacturing System Types, Advantages, Limitations, AGVs and AS/RS, Group Technology: Robotics: RIA, definition of Robot, Laws of robotics, Classification of robots, robot anatomy, Joints, End Effectors
Rapid Prototyping : Introduction, classification of RP Processes (SLA, LOM, SLS, FDM, 3D printing), Working principle,

Tcrm Work shall consist of following experiments *(any eight)*:

1. Demonstration of Application Programming Interface (API).
2. Stress and deflection analysis of Beam (FEA).
3. Stress and deflection analysis of 2D truss (FEA).
4. Stress and deflection analysis of any Mechanical Component using FEA software.
5. Stress and deflection analysis of any Mechanical Assembly using FEA software.
6. Tool path generation and simulation for Turning, and drilling with help of suitable software.
7. Tool path generation and simulation for Grooving and Threading with help of suitable software
8. Tool path generation and simulation for Milling Facing, Pocketing with help of suitable software.
9. Tool path generation and simulation for Milling , Pocketing, Contouring and drilling, etc. with help of suitable software
10. Manufacturing of product using additive manufacturing.

Tcxt Books:

1. Ibrahim Zeid and R. Sivasubramanian - CAD/CAM - Theory and Practice Tata McGraw Hill
2. S.K. Sinha, CNC Programming using Fanuc Custom Macro B, McGraw-Hill Professional
3. Chandrupatla T. R. and Belegunda A. D. -Introduction to Finite Elements in Engineering - Prentice Hall India.
4. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
5. Radhakrishnan P; Subramanyan S , CAD/CAM/CIM , New Age International

Reference Books:

1. Ibraim Zeid, Mastering CAD/CAM Tata McGraw Hill Publishing
2. Groover M. P, Automation Production Systems and Computer Integrated Manufacturing, PHI
3. Rao P. N., Introduction to CAD/CAM Tata McGraw Hill
4. Groover M.P.- on, production systems and computer integrated manufacturing - Prentice Hall of India
5. Seshu P. Text book of Finite Element Analysis, PHI Learning Private Ltd. New Delhi, 2010

Prcpared by: Dr. A. P. Kulkarni

BOS Member:

BOS Chairman:

Mini Project (MEUA3I178)

Teaching Scheme
Credits: 2
Lectures: -
Practical: 2 Hrs./week
Tutorial: 1 Hr./week

Examination Scheme
Formative Assessment :50 marks

Prereqnisite: All core courses

Course objeetives: •

- To train the students to apply their engineering knowledge to real life problem solving.
- To train the students to plan. implement and execute project work so as to satisfy the stated objectives of the project

Course Outcomes:

1. Formulate a real world problem and develop its requirements
2. Develop a design solution for a set of requirements
3. Test the conformance of the developed prototype against the original requirements of the problem
4. List technical ideas, strategies and methodologies in oral and written form

Guidelines:

1. Mini Project can be an individual or a group activity depending on the depth and scope of the topic.
2. The project work can be any of the form given below :
   a) Making physical working models, prototypes, and scaled models, of a concept machine.
   b) Making virtual / CAD models of a sufficiently complex machines / concepts.
   c) Making study, modeling, analysis, programming and simulation of a system / machine / operation / process.
   d) Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
3. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the Semester.
4. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.
5. A complete Assembly and Details drawings of the project should be submitted along with a detailed project report, where applicable.
6. A Detailed Background / field / literature survey, related to the topic must be made and presented in the report.
7. Review – I: during Mid Semester Examination as per the Academic Calendar.
8. Review – II: The last week of the Semester.

Prepared by: Dr. D.A. Kamble

BOS Member:

BOS Chairman:

SEMESTER- II

Design of Machine Elements-II (MEUA32171)

Teachiug Seheme
Credits: 3
Leetures: 3 Hrs/week

Examination Scheme
Formative Assessments: 50
Summative Assessment: 50

Prerequisite: Basic Mechanical Engg, Engg. Graphics, Strength of Materials, Theory of Machines, CAMD, Design of Machine Elements-I

Course objectives:

- Enable students to attain the basic knowledge required understanding, analyzing, designing and select machine elements required in transmission systems.
- Reinforce the philosophy that real engineering design problems are open-ended and challenging
- Impart design skills to the students to apply these skills for the problems in real life industrial applications
- Inculcate an attitude of team work, critical thinking, communication, planning and scheduling through design projects
- Create awareness amongst students about safety, ethical, legal, and other societal constraints in execution of their design projects
- Develop an holistic design approach to find out pragmatic solutions to realistic domestic and industrial problems

Course Outcomes:

Upon the completion of the course students will able to

1. Design the Spur Gears for required applications
2. Design the Helical Gears for required applications
3. Design the Bevel Gears for required applications
4. Design the Worm Gears for required applieations
5. Generate production drawing using CAD software
6. Design and select different types of bearings from manufacturer's Catalogue.

Unit 1: Design of Spur Gear

Gears basics: Selection of materials for gears, Standard systems of gear tooth, and Basic modes of gear tooth failures. Velocity factor, Service factor, Load concentration factor

Spur Gears: Number of teeth and face width, Beam strength (Lewis) equation, Effective load on gear, Wear strength (Buckingham's) equation, Estimation of module based on beam and wear strength, Estimation of dynamic tooth load by velocity factor and Buckingham's equation, Design of spur gear, Force analysis (Numerical Treatment).

Unit 2 : Desigu of Heiieal Gear

Helical Gears: Beam and wear strengths, Effective load on gear tooth, Estimation of dynamic load by velocity factor and Buckingham's equation, Design of helical gears, Force analysis (Numerical Treatment).

Unit 3 :Desigu of Bevel Gear

Bevel Gear: Beam strength of bevel gears, Wear strength of bevel gears, and effective load on gear tooth, gear design for maximum power transmission Force analysis (Numerical Treatment).

Unit 4 : Desigu of worm gears

Worm and worm gear terminology and geometrical relationship, Standard dimensions, Worm and worm-wheel material, Force anaiysis of worm gear drives, Friction in Worm gears and its efficiency,

Unit 5 : Roiiing coutact beariug

Types, Materials, maintenance of bearings, condition monitoring, major failures in bearing. etc. Static and dynamic load carrying eapacities, Load-life relationship, Selection of rolling contact bearings from manufacturer's catalogue, Design for cyclic loads and speed.

Unit 6 :Sliding Contact Bearing

Hydrostatic step bearing, Petroff's equation, Reynolds's equation, Somerfield number, Raimondi and Boyd method, Temperature Rise, minimum oil film thickness, selection of bearing parameters

Text Books

1) Bhandari V.B, Design of Machine Elements, Tata McGraw Hill Publication Co. Ltd.
2) Shigley J.E. and Mischke C.R., Mechanical Engineering Design, McGraw Hill Publication Co. Ltd.
3) Spotts M.F. and Shoup T.E., Design of Machine Elements, Prentice Hall International.

Reference Books :

1. Black P.H. and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc.
2. Willium C. Orthwein, Machine Components Design, West Publishing Co. and Jaico Publications House.
3. Hall A.S., Holowenko A.R. and Laughlin H.G, Theory and Problems of Machine Design, Schaum's Outline Series
4. C.S. Sharma and Kamlesh Purohit, Design of Machine Elements, PHI Learing Pvt. Ltd.
5. D. K. Aggarwal & P.C. Sharma, Machine Design, S.K Kataria and Sons
6. P. C. Gope, Machine Design: Fundamentals and Applications, PHI Learing Pvt. Ltd.
7. Design Data - P.S.G. College of Technology, Coimbatore.
8. Bhandari, V. B. Machine Design data book, Tata McGraw Hill Publication Co. Ltd.
9. K. Mahadevan, K. Balveera Reddy, Design Data Handbook for Mechanical Engineers, CBS Publishers

Prepared by: A. V. Salve

BOS Member:

BOS Chairman:

Metrology & Quaiity Controi (MEUA32172)

Teaching Scheme
Credits: 3
Lectures: 3 Hrs./week
Tutorial :

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Prerequisite: Basic Mechanical Engineering, Engineering Physics, Machine Shop.

Course objectives:

- Select suitable instrument / gauge / method of inspection for determining geometrical and dimensional Measurements.
- Calibrate measuring instruments and also design inspection gauges.
- Understand the advances in Metrology such as use of CMM, Laser for Metrology etc.
- Select and apply appropriate Quality Control Technique for given application.
- Select and Apply appropriate Quality Management Tool and suggest appropriate Quality Management System (QMS).

Course Outeomes:

Upon the completion of the course students will able to

1. Design limit gauges considering allowance and gauge makers tolerance.
2. Evaluate dimensional and geometric errors using comparators, interferometer, roughness tester and autocollimator
3. Estimate thread form and spur gear parameters using different measuring Instruments.
4. Differentiate cost of quality and value of quaiity to improve product design using various quality tools.
5. Prepare process control charts using suitable sampling plans
6. Apply pillars of total quality management to improve overall quality standards for various engineering applications.

Unit I : Measuremeut standards and Gauges

Introdnction: Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision, Calibration: Concept and procedure, traceability.

Design of Ganges: Tolerances, Limits and Fits [IS 919-1993], Taylor's principle, Types of gauges, Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design (numerical).

Unit II : Measuring deviees and Geometric forms

Comparators: Mechanical, Pneumatic, Electricai (LVDT).
Interferometer: Principle, NPL Interferometer
Surface Ronghness Measnremeut: Introduction to Surface texture, Parameters for measuring surface roughness, Surface roughness measuring instrument: TalySurf.
Geometric Form Measurement: Straightness, Flatness, Roundness - Straight edge, use of level beam comparator, autocollimator testing of flatness of surface plate.

Unit III :Thread and Gear Metrology

Measnrement of Thread form: Thread form errors, Measurement of Minor, Major and Effective diameter (Two Wire Method), Flank angle and Pitch, Floating Carriage Micrometer
Gear Metrology: Errors in Spur Gear form, Gear tooth Vernier, Constant chord, Base tangent (Numerical), Profile Projector, Tool maker's microscope and their applications

Coordinate Measuriug Machine (CMM): Fundamental features of CMM – development of CMMs – role of CMMs – types of CMM and Applications, – types of probes

Unit IV: Iutroduction to Quality and Quality Tools

Coueept of Quality: Various Definitions and Quality Statements, Cost of quality & value of quality, Deming's cycles & 14 Points, Juran Trilogy approach, Old New Seven Tools, Quality Circles.

Importance of Quality deployment at Desigu aud Manufacturing Engineering: Opportunities for improvement product design, Importance of– initial planning for quality, concept of controllability: self-controls – defining quality responsibilities on the factory flow – self inspection.

Uuit V: Statistical quality control

Statistical quality control: Statistical concept, Frequency diagram, Concept of variance analysis, Control Chart for Variable (**X & R** Chart) & Attribute (**P & C** Chart), Process capability, Statistical Process Control (Numerical). Production Part Approval Method (PPAP).

Aeceptanee Sampfing: Sampling Inspection, OC Curve and its characteristics, sampling methods, Sampling Plan: Single, Double (Numerical), Multiple, Comparison of Plan, calculation of sample size, AOQ, Probability of Acceptance (Numerical)

Unit VI: Total Quality Mauagement

TQM: Introduetion, Quality Function Deployment, 5S, Kaizen, Poka yoke, Kanban, JIT, FMECA, Zero defects, TPM. Six Sigma: DMAIC - Concept and Applications.

Quallty Manageuent System

Need for quality management system – design of quality management system - quality management system requirements – ISO 9001, TS-16949, ISO-14000, Quality Audit.

Text Books:

1. Jain R.K., Engineering Metrology, Khanna Publication.
2. I. C. Gupta, Engineering Metrology, Dhanpath Rai.
3. Bewoor A. K. and Kulkarni V. A., Metrology and Measurements, Tata McGraw hill Publication.
4. Grant S.P., Statistical Quality Control, Tata McGraw hill Publication.
5. Mahajan M. Text Book of Metrology Dhanpath Rai. Publications.
6. Ragvendra N V, Engineering Metrology and Measurement, Oxford University Press.

Reference Books:

1. Narayana K.L., Engineering Metrology.
2. Galyer J.F & Shotbolt C.R., Metrology for engineers
3. Gupta I.C., Engineering Metrology, Dhanpatrai Publications
4. Judge A.W., Engineering Precision Measurements, Chapman and Hall
5. Francis T. Farago, Mark A. Curtis, Handbook of dimensional measurement.

Prepared by: A. A. Somatkar

BOS Member:

BOS Chairman:

Finite Element Analysis (MEUA32173A)

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 marks
Summative Assessment: 50marks

Prerequisite: -Strength of Materials, DME I and DME II (Statie and dynamic failure theories),Engineering Mathematics, Heat Transfer, Dynamics of Machinery, Fundamentals of Programming Language

Course objectives:

- To understand the general procedure and philosophy of Finite Element Method as applied to solid mechanics and thermal analysis problems.
- To familiarize students with the displacement-based finite element method for displacement and stress analysis and to introduce related analytical and computer tools.
- It provides a bridge between hand calculations based on mechanics of materials and machine design and numerical solutions for more complex geometries and loading states.
- To study approximate nature of the finite element method and convergence of results are examined

Course Outcomes:

Upon completion of this course, the student will be able to:

1. Describe the different techniques used to solve mechanical engineering problems.
2. Use 1-D and 2-D element stiffness matrices and load vectors from various methods to solve for displacements and stresses.
3. Apply mechanics of materials and machine design topics to provide preliminary results used for testing the reasonableness of finite element results.
4. Explain the inner workings of a finite element eode for linear stress, displacement, temperature and modal analysis.
5. Use commercial finite element analysis software to solve more complex problems in solid mechanics and heat transfer.
6. Summarize the results of finite element analyses in terms of modeling errors, discretization errors, and numerical errors.

Unit I: Fundamentals Concepts of FEA

Introduction– Solution methodologies to solve engineering problems, governing equations, Mathematical modeling of field problems in engineering, discrete and continuous models. Brief History of FEM, Finite Element Terminology (nodes, elements, domain, continuum, Degrees of freedom, loads & constraints), General steps involved in FEM, Applications of FEM in various fields, Advantages and disadvantages of FEM, Consistent units system, Essential and natural boundary conditions, Symmetric boundary conditions.

Unit 2: 1D Elements

Types of 1D elements, Displacement function, Global and local coordinate systems, Polynomial form of interpolation functions- linear, quadratic and cubic, Properties of shape function, primary and secondary variables.
Formulation of elemental stiffness matrix and load vector for bar, truss and beam using any approach, Formulation of load vector due to uniform temperature ehange (only for bar).

Assembly of global stiffness matrix and load vector, Properties of stiffness matrix, half bandwidth, Treatment of Boundary conditions- Elimination Approach, Stress and reaction force calculations.

Unit 3: 2D Elements

Two-Dimensional Stress Analysis: Plane Stress/Strain problems in 2D elasticity, constitutive relations .

Constant Strain Triangle (CST), Liner Strain Rectangle (LSR), Displaeement function, Paseal's triangle, compatibility and eompleteness requirement, geometric isotropy, Convergence requirements, strain filed, stress filed, Formulation of element stiffness matrix and load vector for Plane Stress/Strain problems.

Assembly of global stiffness matrix and load vector, Boundary conditions, solving for primary variables (displacement), stress calculations

Unit 4: Isoparametric Elements & Numerical Integration

Concept of isoparametric elements, Terms Isoparametric, super parametric and subparametric, Isoparametric formulation of bar element.

Coordinate mapping - Natural coordinates, Area coordinates (for triangular elements), higher order triangular and quadrilateral elements (Lagrangean and serendipity elements), geometry associative mesh, quality ehecks, mesh refinement- p Vs h refinements, Uniqueness of mapping - Jacobian matrix.

Numerical integration –Gauss Quadrature in 1 & 2 dimension, Order of Gauss integration, full and reduced integration, Sub-modeling, substructuring.

Unit 5: 1D Steady State Heat Transfer Problems

Introduetion, One dimensional steady-state heat transfer problem- Governing differential equation, Finite Element formulation using Galerkin's approach for eomposite wall and thin Fin , Essential and natural boundary conditions and solving for temperature distribution

Unit 6: Dynamic Analysis

Types of dynamic analysis, General dynamic equation of motion, lumped and consistent mass, Mass matrices formulation of bar, truss and beam element.

Undamped-free vibration- Eigenvalue problem, Evaluation of eigenvalues and eigenvectors (characteristic polynomial technique),

Text Books:

1. A First Course in the Finite Element Method, Daryl L. Logan, 2007.
2. Finite Element Analysis, G Lakshmi Narasaiah, B S Publications, 2008.
3. Finite Element Method with Applications in Engineering, Y. M. Desai, T. 1. Eldho and A. H. Shah, Pearson Education, 2011
4. Chandrupatla T. R. and Belegunda A. D., Introduetion to Finite Elements in Engineering, Prentice Hall India, 2002.
5. Text book of Finite Element Analysis, P., Seshu, PHI Learning Private Ltd., New Delhi, 2010.

Reference Books :

1. Finite Element Procedures, Bathe K. J., Prentice-Hall of India (P) Ltd., New Delhi.
2. Concepts and Applications of Finite Element Analysis, R. D. Cook, et al. Wiley, India
3. Finite Element Method using MATLAB, Kwon Y. W., Bang H., CRC Press, 1997
4. MATLAB Guides to Finite Elements- An Interactive Approach, Peter Kattan, Springer, 2008.
5. Finite element analysis, theory and application with Ansys, S. Moaveni, Prentice Hall
6. The Finite Element Method and Applications in Engineering Using Ansys, Erdogan Madenci and Ibrahim Guven, Springer, 2006.

7. Fundamental of Finite Element Analysis, David V. Hutton, Tata McGraw-Hill
8. Practical Finite Element Analysisl, Gokhale N. S., et al., Finite to Infinite, Pune, 2008.

Prepared by: Dr. A .R. Mache

BOS Member:

BOS Chairman:

Compntational Fluid Dyuamics (MEUA32173B)

Teaching Seheme
Credits: 3
Lectures: 3 Hrs./week

Examination Seheme
Formative Assessment : 50 Marks
Summative Assessment :50 Marks

Prerequisite: Fluid Meehanics, Heat transfer, Numerical methods, Programming Languages

Course objectives:

- Students should be able to model fluid / heat transfer problems and apply fundamental conservation principles.
- Students should be able to do discretize the governing equations by Finite Difference Method and Finite volume Method.
- Students should be able to develop programming skills by in-house code development for conduction, convection and fluid dynamics problems.
- To prepare the students for research leading to higher studies.
- To prepare the students for career in CAE industry using software tools.

Course Outcomes:

- Analyze and model fluid flow and heat transfer problems.
- Generate high quality grids and interpret the correctness of numerical results with physics.
- Estimate solution of two dimensional steady and unsteady heat advection equation using finite volume method.
- Use a CFD tool effectively for praetical problems and research.

Unit 1: Introduction to CFD

Introduction to Computational Fluid Dynamics, Derivation and physical interpretation of governing equations (conservation of mass, momentum and energy) in differential form, Concept of substantial derivative, divergence and curl of velocity, Mathematical behavior of Governing Equations and boundary conditions.

Unit 2: Solution to Conduction Equation

Introduction to FEA, FDM and FVM, Solution of two dimensional steady and unsteady heat conduction equation using finite volume method (Implicit and Explicit) with Dirichlet, Neumann, Robbin boundary conditions, Stability Criteria.

Unit 3: Solution to Adveetion Equation

Solution of two dimensional steady and unsteady heat advection equation using finite volume method (Implieit and Explicit) with Diriehlet BC, Stability Criteria, Introduetion to first order upwind, CD, second order upwind and QUICK eonvection schemes.

Unit 4: Solution to Convection-Diffusion Eqnation

Solution of two dimensional steady and unsteady heat convection-diffusion equation for slug flow using finite volume method (Implicit and Explicit), Stability Criteria, 1-D transient eonvection-diffusion system, Peclet Number.

Uuit 5: Solution to Navier – Stokes Equation

Solution of Navier-Stoke's equation for incompressible flow using SIMPLE algorithms for lid driven eavity flow problem, Introduction to external flow simulation.

Unit 6: Introduction to Tnrbulence Modeling

Introduction to turbulence models, Reynolds Averaged Navier-Stokes equations (RANS), One equation model (Derivation) and two equation model.

Practicals

List of Practicals:

Practical's with programming language and Open source or Commercial Software.

1. One-dimensional steady state conduction using finite volume method
2. Two-dimensional steady state conduction using finite volume method
3. Two-dimensional unsteady state conduction using finite volume method
4. One-dimensional conduction convection problem using finite volume method
5. Solution of Navier Stokes equation using SIMPLE algorithm for Lid Driven Cavity flow problem.
6. Numerical simulation and analysis of boundary layer over a flat plate (Blausius Equation)
7. Numerical simulation and analysis of boundary layer for a Developing flow through Pipe or Fully developed flow through a pipe
8. CFD analysis of heat transfer in pin fin.
9. Numerical simulation and analysis of 2D square lid driven cavity. Effect of Reynolds number on the vorticity patterns.
10. Mini project on any practical application.

Text Books:

1. John D Anderson: Computational Fluid Dynamics- The Basics with Applications, McGraw-Hill
2. Atul Sharma, Introduction to Computational Fluid Dynamics: Development, Application and Analysis, Wiley
3. Suhas V. Patankar, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation
4. A. W. Date, Introduction to Computational Fluid Dynamics, Cambridge Univ. Press, USA.
5. H. Versteeg, and W.Malalasekara, An Introduction to Computational Fluid Dynamics: The Finite Volume Method, Pearson.
6. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press.

Reference Books:

1. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MIT Press.
2. David C. Wilcox, Turbulence Modeling for CFD, DCW Industries.

Prepared by: Dr.D.A.Kamble

BOS Member:

BOS Chairman:

Machine Tool Design (MEUA32I73C)

Teaching Scheme
Credits: 3
Lectures: 3 Hrs/week

Examination Scheme
Formative Assessment: 50 marks
Summative Assessment: 50marks

Prereqnisite: Strength of Machine Elements, Machine Design, Dynamics of machinery, Theory of machines.

Course objectives:

- To introduce the concepts and principles of machine tools
- To acquaint the students with various drives used in machine tools.
- Choosing proper machine tool for a specific operation and quality.
- To understand the concept of design of machine tool structures, industrial automation and control systems in machine tools
- To acquaint the students with different aspects of machine tool design and its better and economical usage.

Conrse Outcomes:
Learner will be able to.....

1. Describe the procedure to design machine tool structures such as guideways, columns, etc.
2. Explain effect of materials and shape factors on the rigidity of structure and overall compliance of machine tool.
3. Select appropriate machine tool for machining operations by making power and time analyses.
4. Develop capability in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products.

Unit 1: Introductiou to Machine Tool Design

General prerequisites for machine tool design, classification of machine tools, General purpose, single and special purpose machine tool, materials of machine tool structures, profiles of machine tool structures, static and dynamic stiffness, Design of guide ways for wear and stiffness, design of columns, deflection of columns.

Unit 2: Streugth & rigidity of machiue tool structure

Basic principles of design for strength. Different types of structures. General design procedures. Effect of materials and shape factors on the rigidity of structure, overall compliance of machine tool. Design of beds, bases columns, tables, cross rails for various machines. Effect of wear of guide ways on the performance.

Unit 3 – Design of drives

Design considerations for drives based on continuous and intermittent requirement of power, Types and selection of motor for the drive, Regulation and range of speed based on preferred number series, geometric progression. Design of speed gear box for spindle drive and feed gear box.

Uuit 4: Design of Spindies, Spindle Supports and Power Screws

Design of spindle and spindle support using deflection and rigidity analysis, analysis of antifriction bearings, preloading of antifriction bearing. Design of power screws: Distribution of load and rigidity analysis.

Unit 5: Dynamics of machine tools

Dynamic characteristic of the cutting process, Stability analysis, vibrations of machine tools. Control Systems, Mechanical and Electrical, electrical brakes, drum control. Different methods for avoiding machine tool chatter and vibrations
Unit 6: Speciai features in Machine Tool Design
Design considerations for SPM, NC/CNC, and micro machining, Retrofitting, Recent trends in machine tools, Design Layout of machine tool using matrices. Step-less drives Design considerations of Step-less drives, electromechanical system of regulation, friction, and ball variators, PIV drive, Epicyclic drive.
Text Books 1. Design of machine tools , S.K.Basu & D.K.Pal, ISBN , 9788120417212 2. Machine Tool Design , N.K.Mehta, ISBN 1259050971, 9781259050978 3. Principles of Machine Tool, Bhattacharya and S. G. Sen. New central book agency Calcutta, ISBN 81- 7381-1555.
Referenee Books : 1. Journal of Machine Design, Chinese Electronic Periodical Services, ISSN: 1001-2354 2. Machine Design, Penton Media, ISSN: 0024-9114 3. Journal of Machine Tool Technology 5.Machine Tool Design Handbook, Tata McGraw-Hill Education, 1982, ISBN 0074515640, 9780074515648

Prepared by: Mr.A.V.Salve

BOS Member:

BOS Chairman:

Lab Practice –IV (MEUA32174)

Teaehing Scheme
Credits: 3
Laboratory Work: 6 Hrs. /week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objectives:

- Enable students to attain the basic knowledge required to understand, analyze, design and select machine elements.
- Enable students to apply engineering tools/techniques to product design.
- Select suitable instrument / gauge / method of inspection for determining geometrical and dimensional Measurements.
- Calibrate measuring instruments and also design inspection gauges.
- To enable student to design cylinders and pressure vessels and to use IS code.
- To enable student to design material handling systems.

Course Ontcomes:

Upon the completion of the course students will able to

1. Identify, formulate, and analyze the mechanical transmission systems.
2. Use the techniques, skills, and modern engineering tools necessary for engineering practice.
3. Evaluate thread form and spur gear parameters using different measuring instruments.
4. Evaluate dimensional and geometric errors using comparators, iterferometer, and roughness tester.
5. Use a CFD tool effectively for practical problems and research.
6. Develop capability in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products.

A] Lah Practice - Design of Machine Eiements -II (MEUA32171)

Term-Work

Term work shall consist of

1. One design project based on either Design of a Two Stage Gear Box (the two stages having different types of gear pair) or single stage worm gear box. The design project shall consist of two full imperial (A1) size sheets involving assembly drawing with a part list and overall dimensions and drawings of individual components. Manufacturing tolerances, surface flnish symbols and geometric tolerances should be specified for important surfaces. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Design data book shall be used wherever necessary to achieve selection of standard components

Drawing Sheets should be plotted using any CAD software.

1. Assignments based on Design / problems on following topics,

i) Design of Sliding Contact Bearing

ii) Problems on design of gear (any one gear)

The ORAL shall be based on Term Work.

B] Lah Practice - · Metrology and Qnality Controi (MEUA32172)
Tutorials –

List of Tutorials:

1. Demonstration of linear and angular measuring instruments, slip gauges and their applications.
2. Error determination of linear / angular measuring instruments and determination of linear and angular dimensions of given part, (MSA: Gauge R & R).
3. Calibration of measuring instrument. Example – Dial gauge, Micrometer, Vernier (any one) (Refer ISO 17025).
4. Verification of dimensions and geometry of given components using Mechanical /Pneumatic comparator. [An assignment with this experiment write-up as, Introduction to use of Standard CODE viz. ASME-Y14.5, ISO-1101].
5. Machine tool alignment testing on machine tool – Lathe / Drilling / Milling.
6. Demonstration of surfaces inspection using optical flat/interferometers. / Demonstration of surface roughness measurement using surface roughness tester.
7. Determination of geometry and dimensions of given composite object / single point tool, using profile projector and tool maker's microscope.
8. Measurement of thread parameters using floating carriage diameter measuring machine.
9. Measurement of spur gear parameters using Gear Tooth Vernier / Span Micrometer / Gear Rolling Tester.
10. Determination of given geometry using coordinate measuring machine (CMM).

Part: **B]** Statistical Quality Control (SQC) (Any Two)

Note - Use of computational tools [such as Minitab / Mat lab / MS Excel] are recommended

1. Analyse the fault in given batch of specimens by using seven quality control tools for engineering application. Submission of these assignments USING STANDAED FORMATS.
2. Determination of process capability from given components and plot variable control chart/ attribute chart.
3. Case study on various tools in Total Quality Management (TQM).

Part: C] Iudustrial visit to:
Calibration lab /Quality control lab / CMM Lab / Gear Inspection Unit

C] Lab Practice - Finite Element Analysis (MEUA32I73A)/ Computational Flnid Dynamics (MEUA32173B) / : Machine Tooi Design (MEUA32173C)/

Fiuite Element Analysis (MEUA32i73A)
List of experiments :

1. The term work shall consist of record of any three from 1 to 4* and any three from 5 to 9** assignments of the problems based on following topic-
2. Computer program for stress analysis of 1D bar using linear and quadratic elements. Show the variation of stress and strain within the element for linear and quadratic bar element.
3. Computer program for stress analysis of 2-D truss subjected to plane forces
4. Computer programs for (i) modal analysis and, (ii) stress analysis for 1-D beam (simply supported or cantilever beams)

5. Computer program for 1-D temperature analysis
6. Static stress concentration factor calculation for a plate with center hole subjected to axial loading in tension using FEA software.
7. Modal analysis of any machinc component using FEA software.
8. Stress and deflection analysis of any machine component consisting of 3-D elements using FEA software.
9. Nonlinear elasto-plastic analysis of plate with hole using FEA software
10. Conpled Thermal-Structural Analysis using FEA software
11.
12. Students can write the program in any of the programming language such as FORTRAN, C,
13. C++, MATLAB, Python, VB.
14. Minimum number of elements considered should be 10 or more.
15. Validate results of the program with analytical method or FEA software such as Abaqus, ANSYS, Msc-Nastran, Optistruct/Radioss, Comsol-Multiphysics
16.
17. **1. Students should do convergence study for all assignment problems.
18. 2. Use different element types from element library, 3. If possible use submodel/symmetry option.
19. Macro mcchanical Analysis of lamina using MATLAB; (iii) macro mechanical Analysis of laminate using MATLAB

Computational Fluid Dynamlcs (MEUA32173B)

Lab Practice

Practical's with programming language and Open source or Commercial Software.

1. One-dimensional steady state conduction using finite volume method
2. Two-dimensional steady state conduction using finite volume method
3. Two-dimensional unsteady state conduction using finite volume method
4. One-dimensional conduction convection problem using finite volume method
5. Solution of Navier Stokes eqnation using SIMPLE algorithm for Lid Driven Cavity flow problem.
6. 6.Numerical simulation and analysis of boundary layer over a flat plate (Blausius Equation)
7. Numerical simulation and analysis of boundary layer for a Developing flow through Pipe or
8. Fully developed flow through a pipe
9. CFD analysis of heat transfer in pin fin.
10. Numerical simulation and analysis of 2D square lid driven cavity. Effect of Reynolds numbcr on the vorticity patterns.
11. Mini project on any practical application.

Macblue Tool Desigu (MEUA32173C)(any 8 cxpcrimeuts)

1. Design and working drawing of Speed Gear Box
2. Design and working drawing of Feed Gear Box
3. Design of clutches or breaks drive.
4. Design of belt or chain drive.
5. Study of Step-less Drives
6. Design of Slide ways
7. Design of Spindle

8. Power Screw Design (Sliding & Rolling friction)
9. Design of Guide ways

Referencc Books:

1. Spotts M.F. and Shoup T.E. – "Design of Machine Elements" – Prentice Hall International. ISBN-8177584219.
2. Design Data Book– P.S.G. College of Technology, Coimbatore.
3. Narayana K.L., Engineering Metrology.
4. Galyer J.F & Shotbolt C.R., Metrology for engineers
5. Finite Element Procedures, Bathe K. J., Prentice-Hall of India (P) Ltd., New Delhi.
6. Concepts and Applications of Finite Element Analysis, R. D. Cook, et al. Wiley, India
7. H. Tennekes and J. L. Lumley, A First Course in Turbulence, MIT Press.
8. David C. Wilcox, Turbulence Modeling for CFD, DCW Industries.
9. Design of machine tools , S.K.Basu & D.K.Pal, ISBN , 9788120417212
10. Machine Tool Design , N.K.Mehta, ISBN 1259050971, 9781259050978

Prcpared by:
Mr. A. V. Salve
Mr. A. V. Somatkar
Dr. A. R. Mache. KambleN.B. Kate

BOS Member:

BOS Cbairmau:

Internship (MEUA32175A)

Teaching Scheme
Credits : 8
Practical : 16 Hrs/week

Examination Scheme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objcctive:
1. Apply existing knowledge in similar or new situations
2. Acquire new engineering knowledge and skill
3. Understand importance of life learning processes through internship experiences.

Coursc Outcomcs:
After completion of the course, student will be able to
1. Apply the existing engineering knowledge in similar or new situations
2. Identify when new engineering knowledge is required, and apply it
3. Examine life-long learning processes through critical reflection of internship experiences.

The preferred duration of an Engineering internship is 3 months, full-time placement with an related industry/organization/consultancy work etc.

Continuous Assessment of Performance During Internship:

During the internship semester, the organization with whom the student is undertaking the internship programme conducts periodic assessments of the intern's progress, performance and achievements.

Students are required to submit progress report of internship as per schedule and being in constant touch with the respective Guide. At least two presentations and report should be submitted to VIIT, Pune.

In order to ensure that the internship remains meaningful, Guide of the respective student from VIIT, Pune will maintains elose contact with organizations/ Industry/Consultancy etc.

Summative Assessment :

After completion of the program, the student submits a detailed report of his internship experience and makes a presentation of the same at VIIT, Pune.

Guidelines for Internship report are mentioned in Annexure I.

Prepared by:

BOS Member:

BOS Cbairman:

Valne Added Courses (MEUA32175B)

Teacbing Scbeme
Credits : 8
Theory: 4 Hrs/week
Practical : 8 Hrs/week

Examination Scbeme
Formative Assessment : 50 Marks
Summative Assessment : 50 Marks

Course Objectives:

- Study of new technology in the field of course
- Understand importance of life learning processes through internship experiences.

Course Outcomes:

After completion of the course, student will be able to

1. Describe the state of art in the respective field of course
2. Demonstrate in-depth knowledge about the subject chosen as value added course.

lustructions:
For this course, Value Added Course are provided as bclow:

MEUA32175B1 : G D & T and Advanced Modeling

MEUA32175B2 : Computer Aided Engineering

MEUA32175B3 : Hydraulics and Pneumatics

MEUA32175B4 : Steam Engineering

IE32175B1 : Social Enterprise and Entrepreneurship

IE32175B2 : General Studies for Indian Services and National Service Scheme

IE32175B3 : National Service Scheme and Social Entrepreneurship.

Department has to select at least one course. Department can select more than one course. Also. set of suggested assignments is provided. Each student must perform 5 to 10 assignments and at. least one mini-project provided in each module. Instructor should frame set of mini projects or guide students to frame the problem statement of mini-project by sticking to technologies in respected module.

Term Work will be based on assignments be carried out by students and Oral Examination will be based on Mini-Project demonstration and related skill learned ONLY.

GD & T and Advanced Modeliug (MEUA32I75B1)
UNIT 1: Introductiou to GD & T
Introduction to GD&T, Features and Rules of GD&T, Limits, fits and Tolerance, ASME Y14.5m-2018 Standards.
Unit II : Featurcs aud Rules of GD&T
GD&T (Envelope Principle), Maximum Material Condition, Least Material Condition, Regardless of Feature's Size, Datum Control, Adding GD&T to a Design,.Different symbols in GD & T, tolerance stackup.
Unit III : Drafting
Introduction To Drafting & Detailing Theory:- (types Generative – Interactive), Initial Drafting setting, Sheet Background, Views, Dimensions (Types Generate Dimension & Create Dimension), Annotations:- GD & T, Symbols, Note, Leaders, Table, Symbols (Machining, Roughness, Welding, Custom), Dress-up Toolbar.
Unit IV : Generative Sheet Metal Desigu
Sheet metal parameters, Wall, Wall on edge 3. Bend extremities, Flange, Hem 4. User flange, Bend from flat, Cut out . Rolled wall, hopper, bending. Conical bend, corner relief. Stamping – all types
UNIT V : Wireframe and Surface Design
Surfacing Modeling based Plastic Component:- Environment, Tool bars, Surface Creation (Extrude, Revolve, Sphere, Cylinder), Surface Modification, Surface Editing (Trim, Split, Shape Fillet, Close Surface, Thickness).
UNIT VI: Iutroduction to Type Script
Type Script : Introduction to Type Script – Features of Type Script – Installation setup – Variables – Data types – Ennm – Array – Tuples – Functions – OOP concepts – Interfaces – Generics – Modules – Namespaces – Decorators – Compiler options – Project Configuration BIW Tcmplates & Advance Surface :BIW Templates:- What is BIW, Junction, Diabolo, Hole, Mating Flange, Bead, Blend Corner, Offset(All 3 types), Fill, Blend, Join, healing, Project-Combine. Advanced Surfacing:- Adaptive Sweep, Sweep(ALL), Multisection Surface.

Compnter Aided Engineering (MEUA32175B2)

UNIT-I: Introduction

Past, Present and Future of FEA, FEA Terminology, Software based FEM, Failure Analysis, Introduction to different types of analysis.

UNIT-II : Discretization

Introduction to meshing/ discretization, Introduction to different element types, selection criterion for Element type, 1D, 2D and 3D elements.

Meshing: Meshing Techniques, Meshing in critical areas, 1D, 2D and 3D Meshing, Mesh Quality Check. Effect of Mesh Density in the critical Region, Effect of biasing in the critical Region, Quality check

UNIT III : Static Analysis

Linear static analysis, condition for static analysis, steps in linear static analysis - Generate the mesh, set the boundary condition, apply loading conditions, solve the model and Interpret the result.

UNIT-IV : Dynamic Analysis

Linear dynamic analysis, static analysis Vs dynamic analysis, significance of natural frequency, steps in dynamic analysis-, Perform the modal analysis: Cantilever beam, tube, connecting rod.

UNIT-V : Buckliug Analysis

Linear buckling analysis, Eigen value buckling curve, buckling load factor, Steps in bucking analysis --Perform Static structural analysis of the component, calculate buckling load factor. Apply buckling load factor, mesh the model, apply constraints and determine the mode shape.

UNIT-VI: Introduction to Computation Fluid Dynamics

Numerical simulation and analysis of 1D and 2D problems using CFD tools

Text Books

1. Nitin Gokhale, "Practical Finite Elcment Analysis",Finite to Infinite
2. J. N. Reddy, "An Introduction to the Finite Element Method", Tata McGraw Hill
3. C.S: Krishnamurthy, "Finite Element Analysis: Theory & Programming", Tata McGraw Hill.

Reference Books

1. Tirupathi R Chandrupatla," Introduction of Finite Element in Engineering", Prentice Hall of India
2. Rao S. S., " The Finite Element Methods of Engineering", Pergamon Press
3. K.J. Bathe, Finite Element Procedures, Klaus-Jurgen Bathe.
4. User manual of Hyperwork software
5.User Manual of ANSYS software

Prepared by: Dr.A.R.Mache

BOS Member:

BOS Chairman:

Hydraulics and Pneumatics (MEUA32I75B3)
Unit I: Introdnction to Hydraulics and Pneumaties Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations. Properties of fluids, Fluids for hydraulic systems, governing laws. Distribution of fluid power, lSO symbols, energy losses in hydraulic systems.
Unit II: Pumps Types, classification, principle of working and constructional details of vane pumps, gear pumps, radial and axial plunger pumps, screw pumps, power and efficiency calculations, characteristics curves, selection of pumps for hydraulic Power transmission.
Unit III: Hydraulic Actuators (i) Linear and Rotary. (ii) Hydraulic motors - Types- Vane, Gear, Piston types, radial piston. (iii) Methods of control of acceleration, deceleration. (iv) Types of cylinders and mountings. (vi) Design considerations for cylinders.
Unit IV: Indnstrial Circnits Simple reciprocating, Regenerative, Speed control (Meter in, Meter out and bleed off), Sequencing, Synchronization, transverse and feed, circuit for riveting machine,automatic reciprocating, fail safe circuit, counter balance circuit.
Unit V: Pneumatics Principle of Pneumatics: (i) Laws of compression, types of compressors, selection of compressors. (ii) Comparison of Pneumatics with Hydraulic power transmissions. (iii) Types of filters, regulators, lubricators, mufflers, dryers. (iv) Pressure regulating valves, (v) Direction control valves, two way, three way, four way valves. Solenoid operated valves, push button, lever control valves. (vi) Speed regulating –
Unit VI: System Design Design of hydraulic/pneumatic circuit for practical application, Selection of different components such as reservoir, various valves, actuators, filters, pumps based on design.
Text Books
1. Esposito, Fluid Power with application, Prentice Hall 2. Majumdar S.R, Oil Hydraulic system- Principle and maintenance ,Tata McGraw Hill 3. Majumdar S.R ,Pneumatics Systems Principles and Maintenance ,Tata McGraw Hill 4. H.L.Stewart, Hydraulics and Pneumatics , Taraporewala Publication
Reference Books
1. J. J. Pipenger, Industrial Hydraulics, McGraw Hill 2. Pinches, Industrial Fluid Power, Prentice Hall 3. D. A. Pease, Basic Fluid Power, Prentice Hall 4. B. Lall, Oil Hydraulics, International Literature Association 5. Yeaple, Fluid Power Design Handbook 6. Andrew A. Parr, Hydraulics and Pneumatics, Elsevier Science and Technology Books. 7. ISO - 1219, Fluid Systems and components, Graphic Symbols

Prepared by: Dr.D.A.Kamble

BOS Memher:

BOS Chairman:

Steam Engineering(MEUA32175B4)
Unit I : Boiler Basics and Flow Measurement Different types of Boilers, Burners F & A Rating, Boiler Mountings Different types of flow meter, working and principle, factors affecting on performance of flow meter
Unit II :Basics of Coutrois & Controi Valves Piping actuators, valve Actuators. Pneumatic actuator
Unit III : Piping Accessories Industrial flanges, pipe fittings, materials of construction
Unit IV: Steam Distribution Standard steam circuit, steam distribution factors, Dead end trap vent, selection of working pressure.
Unit V : Steam Trap Typical trap selection, thermodynamic traps, trap sizing, trap installation
Unit VI : Flash Steam & Coudensate Rccovery Quantity of flash steam, condensate pumping, stall conditions, Boiler Combustion.
Visit to FM Chakan Plant.

Prepared by: H.Y.Kolekar

BOS Member:

BOS Chairman:

Social Enterprise and Entrepreneurship (lE32175BI)

Course ohjectives

This course will lead to the learning of

1. Acquiring Entrepreneurial spirit and resourcefulness
2. Familiarization with various uses of human resource for earning dignified means of living
3. Understanding the concept and process of entrepreneurship -its contribution in and role in the growth and development of individual and the nation
4. Acquiring entrepreneurial quality, competency and motivation
5. Learning the process and skills of creation and management of cntrepreneurial venture

Course Outcomes

On complction of the coursc, student will be able to :

i. Define the concept of Entrepreneurship
2. Describe how entrepreneurship can help shape one's career
3. Differentiate between various typcs of entrepreneurs
4. Identify different and your own personality type to become an entrepreneur
5. Explain the role of global and Indian innovations in entrepreneurial ventures

Unlt I :Entrepreneurship -What, Why and How

Entrepreneurship –Concept, Functions, Nced and Importance, Why Entrepreneurship For You, Myths about Entrepreneurship, Pros and Cons of Entrepreneurship, Process of Entrepreneurship, Startup and its stages, Entrepreneurship –The Indian Why be an Entrepreneur, Types of Entrepreneurs ,Competencies and characteristics: Ethical Entrepreneurship ,Entrepreneurial Values, Attitudes and Motivation ,Mindset of an employee and an entrepreneur difference , Intrapreneur: Importance in any organization Scenario

Unit II : Entrepreneurship Jonrney

Self-Assessment of Qualities, Skills, Resources and Dreams., Generation of Ideas., Business Ideas vs. Business Opportunities, Opportunity Assessment –Factors, Micro and Macro Market Environment, Feasibility Study , Business Plan Preparation, Execution of Business Plan ,Role of networking in entrepreneurship

Unit III: Entrcpreneurship as Innovation and Prohiem Solvlng

Entrepreneurs -as problem solvers., Innovations and Entrepreneurial Ventures –Global and Indian, New Industries of New Age Economy, Role of Technology –E-commerce and Social Media, Social Entrepreneurship as Problem Solving-Concept and Importance,Risk Taking-Concept; types of business risks

Unit IV :Understanding the Market

Business Idea and Concept, Types of Business: Manufacturing, Trading and Services,Stakeholders: sellers, vendors and consumers and Competitors. Market Research -Concept, Importance and Process, Market Sensing and Tcsting, Business Model, Proof of Concept, Pricing and Factors affecting pricing. , Launch Strategies after pricing and proof of concept

Unit V: Introduction to Social Eotrepreneurship

Profile of social entrepreneurs, Create your own profile of a social entrepreneur, Grounding in social entrepreneurship, Typology of ventures, Definitional disputes.Creating social change: The social value

proposition and identifying a social business opportunity, Seizing social business opportunities, Social entrepreneurship profiles, Community asset mapping, Profile of a social entrepreneur: Dr. Venkataswamy, Aravind Eye institute, India. Understanding poverty: The Sustainable Development Goals, The critical need to alleviate poverty, Ecosystem approach, The role of cooperatives in addressing poverty, Profile of a social organization: Grameen Bank. Profile of a social organization: IDEO, The role of mind mapping in creating solutions, Empowerment model: Partnering with targeted community.

Unit VI :The Bnsiness model: Creating a social business model

The role of the business model in starting a social venture, Equitable distribution of value, The role of the business model: The business model canvas, Social business model framework, Profile of a social entrepreneur: Husk Power Systems, Business model canvas exercise, Business model execution failure. Sustainable funding sources: Earned income, Profile of a social entrepreneur: Furniture Resource Centre, Traditional funding sources, Social investment funding sources, Investing in a social venture, Relationship building with donors and investors

Text Books :

1. Udyamita (in Hindi) by Dr. MMP. Akhouri and S.P Mishra, pub. By National Institute for Entrepreneurship and Small Business Development (NIESBUD), NSIC-PATC Campus, Okhla
2. Everyday Entrepreneurs - The harbingers of Prosperity and creators of Jobs - Dr. Aruna Bhargava.
3. Bornstein, D. and Davis, S., *Social Entrepreneurship: What Everyone Needs to Know* (Oxford, Oxford University Press, 2010)
4. Social Entrepreneurship: The Art of Mission-Based Venture Development, by Peter C. Brinckerhoff.

Refereuce books:

1. Udyamita Samachar Patra (Monthly, Hindi), Pub. By centre for Entrepreneurship Development, M.P. (CEDMAP), 60 Jail Road, Jhangerbad, Bhopal-462008.
2. Science Tec. Entrepreneur (A Bi Monthly Publication), centre for Enterprenurship Development, M.P (CEDMAP), 60 Jail Road, Jhangerbad, Bhopal - 462008

Project Work

1) Identify a social problem and its impact
2) Visit and report of Industry or Case Study of the startup associated with the problem identify
3) Identifying possible solutions and analyzing them
4) Business Plan design

Prepared by: Ms Kirti Wanjale

BOS Member:

BOS Chairman:

General Studies for Iudiau Services and Natioual Service Scheme (IE32175B2)

Course Objeetives :

1. To inculcate & improve the understanding about general studies knowledge and analytical qualities which required for various technical & non-technical competitive exams.
2. To foster the student's soeial work identity including professional use of supervision and consultation, self-awareness.
3. To prepare students with critical thinking skills in various areas of practice, research, and aware them about various social work programs.

Course Outeomes:

Upon learning the eourse, the student will be able to

1. State importance of ongoing events and general studies knowledge required for various competitive exams.
2. Describe various concepts of economy, history, our country's constitutional system & its signifieance.
3. Describe environmental issues relevant to engineering industry and its impact on society through engineering prospect as future technocrat.
4. Develop skills in mobilizing eommunity partieipation for the purpose of finding practical solutions to individual and community problems.
5. Explain various health habits and importance of fitness for successful life style through yoga technique.

Unit I : Indian History & Geography

History of India (with special reference to Maharashtra) and Indian National Movement.
Maharashtra, India and World Geography- Physical, Social, Economic Geography of Maharashtra, India and the World.

Unlt II : Indian Political System & Governanee

Constitution, Political System, Panchayati Raj Institutions, Urban Governance, Public Policy, Rights issues, various constitutional and non-constitutional agencies etc

Unlt III : Indian Eeonomy

Economie and Soeial Development - Sustainable Development, Poverty, Inclusion, Demographics, Social Sector initiatives, etc., Banking system and financial transaction techniques.(Including Digital)

Unit IV: Environmental Studies & Current Affairs

Current events of state, national and international importance.
Generai issues on Environmental Ecology, Bio-diversity and Climate Change

Unit V: Introduction To NSS & Viiiage Adoptiou Program

Orientation and structure ofNSS: The history of NSS, Objectives, Symbol and meaning, NSS hierarchy from national to college level, Roles and responsibility of various NSS functionaries.

Definition and importance of Life Competencies: Four aspects of development – Physical, Mental, Social, and Moral, Qualities of constructive leadership, Rapport building with community and role of leadership.

Degeneration of value system, family system, Gender issues ,Regional imbalance, Problems of Rural areas,

Approaches and strategies in adopting a village with special reference to involving people participation in N.S.S. Activities, Govt. and Non-Government agencies (NGO), political and village leadership for effective implementation of N.S.S. program and activities in adopted villages.

Unit VI : Heaith, Hygiene, Sanitation & Yoga

Definition, need and scope of health education, Food and nutrition, Safe Drinking water ,water Borne Diseases and sanitation (**Swachh Bharat Abhiyan**),National health program, Reproductive Health, HIV

Different Yoga Traditions and Their impact, Yoga as a tool for healthy Lifestyle

Text Books :

1. Modern Indian History by Rjiv Ahir, Spectrum Publication
2. Indian Polity by M. Laxmikant
3. Indian Geogrphy Majjid Husain
4. Rural Housing: Policies and Practices by Bhaskar Majumder
5. TISS : Training Programme on National Programme Scheme.

Reference Books

1. Imagining India : Nandan Nilkani
2. I do What I do : Dr. Raghuram Rajan
3. An Uncertain Glory: India and its contradictions: Dr. Amratya Sen.
4. Indian Economy by D.D.Basu
5. Rural Sociology: Dr. Desai A.R. , Ellis Horowitz,
6. Fundamentals of Data Structures: Sartaj Sahni ,Computer Science Press.
7. Introduction to Soeial work: Chowdhry Paul

Practical Sessions Contaiu: (Auy 8 praetical's has to be performed out of 11 suggested but minimum any 2 field visits are mandatory)

1. Practice of Easy writing on current & contemporary issues.
2. Reading Comprehension, Translation practice and precise writing.
3. Visit & report writing on any local government administrative institution / PRI.
4. Report on government scheme of various ministries & Scholarship programs for higher studies.
5. Plantation of trees, their preservation & Watershed management with waste laud development program.
6. Village Visit: Construction & maintenance of village streets, drains, etc. so as to keep the environment clean; Construction of sanitary latrines & Cleaning of village ponds and wells;
7. Popularization and construction of Gobar Gas Plants, use of non-conventional energy sources;
8. Study of Environmental sanitation and disposal of garbage & composting with solid waste management technique;
9. Study of Prevention of soil erosion, and work for soil conservation technique.
10. Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.(Field visit recommended if possible)
11. Visit & case study of any one Non-governmental origination (NGO) work.

Prepared by: Mr A.A. Manikjade

BOS Member:

BOS Chairmau:

National Service Scheme and Social Eutreprenenrship IE32I75B3

Conrse Objectives:

- To equip social workers with generalist knowledge, values, and skills and to prepare competent professionals for entry level social work practice.
- To prepare social workers who understand and values social and economic justice while also respecting and appreciating diversity.
- To foster the student's social work identity ineluding professional use of supervision and consultation, self-awareness.
- To prepare students with critical thinking skills in areas of practice, research, and ethics to help ensure suceess in graduate social work programs.
- Developing creative solutions to address social problems.
- Learning the process and skills of creation and management of social entrepreneurial venture.

Conrse Ontcomes:

On completion of the eourse, students will be able to

1. Develop skills in mobilising community participation.
2. Identify needs and problems of the community and involve them in problem-solving.
3. Develop among themselves a sense of social and civic responsibility
4. Develop practical solutions to individual and community problems
5. Identify innovative solution for identified problems
6. Deseribe the role of global and Indian innovations in social entrepreneurial ventures.

Unit 1:Introduction to NSS and development of Life competencies

Orientation and structure of NSS, The history of NSS, Objectives, Symbol and meaning, NSS hierarchy from national to eollege level, Roles and responsibility of various NSS functionaries. Definition and importance of Life Competencies, Four aspects of development – Physical, Mental, Social, and Moral, Qualities of constructive leadership, Rapport building with community and role of leadership.

Unit 2: Basic social issues in India and Benefits of Village adoption programme

Degeneration of value system, family system, Gender issues ,Regional imbalance, Problems of Rural areas, Approaehes and strategies in adopting a village with special reference to involving people partieipation in N.S.S. Activities, Govt. and Non Government agencies, political and village leadership for effective implementation of N.S.S. programme and activities in adopted villages

Unit 3: Health, Hygiene and Sanitation

Definition, need and seope of health education, Food and nutrition, Safe Drinking water ,water Bornc Diseases and sanitation(Swachh Bharat Abhiyan),national health programme, Reproductive Health

Unit 4: Youth Health and Yoga

Healthy Lifestyles, Aids, HIV, Drugs, Substance abuse, Home Nursing, First aid, Different Yoga Traditions and Their impact, Yoga as a tool for healthy Lifestyle

Unit 5:The Business model: Creating a social business model

Profile of social entrepreneurs, Create your own profile of a social entrepreneur, The role of the business model in starting a soeial venture, Equitable distribution of value, The role of the business model: The business model canvas, Social business model framework, Profile of a social entrepreneur: Husk Power Systems, Business model canvas exereise, Business model execution failure.

Unit 6 :Funding social ventures: Strategies for success

Sustainable funding sources: Earned income, Profile of a social entrepreneur: Furniture Resource Centre, Traditional funding sources, Social investment funding sources, Investing in a social venture, Relationship building with donors and investors.

Text Books :

1. Rural Housing: Policies and Practices by Bhaskar Majumder | 1 December 2007
2. Singh Surendra and Srivastava S. P. (ed) 2005), Social Work Education in India, Challenge and opportunities, New Royal Book Publications, Lucknow
3. Bornstein, D. and Davis, S., *Social Entrepreneurship: What Everyone Needs to Know* (Oxford, Oxford University Press, 2010)

Reference Books :

1. Dr. Desai A.R. : Rural Sociology in India
2. Siddiqui, H.Y.2015, Social Work and Human Relations,Rawat Publications, Jaipur.
3. Raising the Bar : Integrity and Passion in Life and Business: The Story of Clif Bar, Inc., By Gary Erickson

NSS

Students will work on a particular problem at the respective area.

i) Plantation of trees, their preservation and upkeep

(ii) Creation of NSS parks/gardens.
(iii) Construction & maintenance of village streets, drains, etc. so as to keep the environment clean;
(iv) Construction of sanitary latrines etc.
(v) Cleaning of village ponds and wells;
(vi) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
(vii) Environmental sanitation and disposal of garbage & composting;
(viii) Prevention of soil erosion, and work for soil conservation,
(ix) Watershed management and wasteland development
(x) Organic farming

SOCIAL ENTREPRENEURSHIP

(i) Visit and report of Industry or Case Study of the startup associated with the problem identify

(ii) Identifying possible solutions and analyzing them

(iii)Design a business Plan

Prepared by: Ms. Ratnaparkhi

BOS Member:

BOS Chairman:

ANNEXURE I

Department of Meehanical Engineering

(Valne Added Conrses/ / Industrial Training) Report on

(Titie)

By:

(Name)----------

(Roll No)----------

Semester I/II

For the partial fulfillment of B. Tech. degree in (Mechanical Englneering)

of

Under guidance of

(Name of Guide/ Compauy)

20 - 20

CERTIFICATE

This is to certify that the In House Value Added Training/ / Industrial Training Report entitled "_____ _____" is submitted by ---------- bearing Roll No ---------- for the partial fulfillment of B.Tech. degree in (Mechanical Engineering) of Savitribai Phule Pune University, Pune.

Gnide **Gnide**

Head of Department **Director**

Externai Examiner