2022

SYLLABUS SCHEME

B. TECH IN MECHANICAL ENGINEERING

VEER MADHO SINGH BHANDARI
UTTARAKHAND TECHNICAL UNIVERSITY

SHIVALIK
COLLEGE OF ENGINEERING

EVALUATION SCHEME & SYLLABUS

W.E.F. ACADEMIC SESSION 2020-21

Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Scheme & Syllabus

I Year (Common to All Branches)

W.E.F. Academic Session 2020-21

Uttarakhand Technical University, Dehradun
New Scheme of Examination as per AICTE Flexible Curricula
Bachelor of Technology (B. Tech.) I Year
W.E.F. Academic Session - 2020-21

I Semester - GROUP A: (Branches for Group "A" to be decided by the Institutes)

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
Mandatory Induction Program (First three weeks)				Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations									
Fourth week onwards classes will start													
1.	BAST 101 BASP 101	BSC-1	Engineering Chemistry	100	30	20	30	20	200	3	1	2	5
2.	BAST 102	BSC-2	Mathematics-I	100	30	20	-	-	150	3	1	-	4
3.	BAST 103 BASP 103	HSMC-1	English for Communications	100	30	20	30	20	200	3	-	2	4
4.	BEET 101 BEEP 101	ESC-1	Basic Electrical Engineering	100	30	20	30	20	200	3	1	2	
5.	BCST 101 BCSP 101	ESC-6	Fundamentals of Computers & Programming in C	100	30	20	30	20	200	3	1	2	5
6.	BMEP 101	ESC-3	Manufacturing Practices / Workshop	-	-	-	30	20	50	1	-	2	2
7.	BASP 102	DLC-1	Internship-I (60 Hrs Duration) at the Institute level	To be completed during or at the end of the second semester. Its evaluation/credit to be added in third semester.									
8.	BASP 105	DLC-2	Swachh Bharat Summer Internship Unnat Bharat Abhiyan (100Hrs)/ Rural Outreach				15	10	25*	-	-	4	-
			Total	**500**	**150**	**100**	**150**	**100**	**1000**	**16**	**4**	**10**	**25**

*It is non credit course. Student must clear it to be promoted in II Year; Marks will not be added to the total

Note: The Meaning of last Character of Subject Code (T – Theory and P – Practical)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

Uttarakhand Technical University, Dehradun
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I Semester - GROUP B: (Branches for Group "B" to be decided by the Institutes)

S.No .	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem Exam.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
1.	BAST 104 BASP 104	BSC-3	Engineering Physics	100	30	20	30	20	200	3	1	2	5
2.	BAST 102	BSC-2	Mathematics-I	100	30	20	-	-	150	3	1	-	4
3.	BMET 102 BMEP 102	ESC-4	Basic Mechanical Engineering	100	30	20	30	20	200	3	1	2	5
4.	BECT 101 BECP 101	ESC-5	Basic Electronics Engineering	100	30	20	30	20	200	3	1	2	5
5.	BMEP 103	ESC-2	Engineering Graphics	-	-	-	50	25	75	1	-	2	2
6.	BASP 106	HSMC-2	Language Lab & Seminars	-	-	-	50	25	75	1	-	2	2
7.	BEST 101	BSC	Environmental Studies	70	Not Credit Course. Student must clear it to complete the degree.			30 (Field & Project Work)	100	3	-	-	-
8.	BASP 102	DLC-1	Internship-I - (60 Hrs Duration) at the Institute level	To be completed during first/second semester. Its evaluation/credit to be added in third semester.									
			Total	**470**	**120**	**80**	**190**	**140**	**1000**	**17**	**4**	**10**	**23**

Note: The Meaning of last Character of Subject Code (T – Theory and P – Practical)

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

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II Semester - GROUP A: (Branches for Group "A" to be decided by the Institutes)

S.No .	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory Slot			Practical Slot						
				End Sem.	Mid Sem Exam.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
1.	**BAST 104 BASP 104**	BSC-3	**Engineering Physics**	100	30	20	30	20	200	3	1	2	5
2.	**BAST 105**	BSC-4	**Mathematics-II**	100	30	20	-	-	150	3	1	-	4
3.	**BMET 102 BMEP 102**	ESC-4	**Basic Mechanical Engineering**	100	30	20	30	20	200	3	1	2	5
4.	**BECT 101 BECP 101**	ESC-5	Basic Electronics Engineering	100	30	20	30	20	200	3	1	2	5
5.	**BMEP 103**	ESC-2	**Engineering Graphics**	-	-	-	50	25	75	1	-	2	2
6.	**BASP 106**	HSMC-2	**Language Lab & Seminars**	-	-	-	50	25	75	1	-	2	2
7.	**BEST 101**	**BSC**	**Environmental Studies**	70	Not Credit Course. Student must clear it to complete the degree.			30 (Field & Project Work)	100	3	-	-	-
8.	**BASP 102**	DLC-1	**Internship-I - (60 Hrs Duration) at the Institute level**	**To be completed during first/second semester. Its evaluation/credit to be added in third semester.**									
			Total	**470**	**120**	**80**	**190**	**140**	**1000**	**17**	**4**	**10**	**23**

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II Semester - GROUP B: (Branches for Group "B" to be decided by the Institutes)

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem.	Quiz/ Assignment	End Sem.	Lab work & Sessional		L	T	P	
Mandatory Induction Program (First three weeks)				Physical Activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations									
Fourth week onwards classes will start													
1.	**BAST 101 BASP 101**	BSC-1	**Engineering Chemistry**	100	30	20	30	20	200	3	1	2	5
2.	**BAST 105**	BSC-4	**Mathematics-II**	100	30	20	-	-	150	3	1	-	4
3.	**BAST 103 BASP 103**	HSMC-1	**English for Communication**	100	30	20	30	20	200	3	-	2	4
4.	**BEET 101 BEEP 101**	ESC-1	**Basic Electrical Engineering**	100	30	20	30	20	200	3	1	2	5
5.	**BCST 101 BCSP 101**	ESC-6	**Fundamentals of Computers & Programming in C**	100	30	20	30	20	200	3	1	2	5
6.	**BMEP 101**	ESC-3	**Manufacturing Practices / Workshop**	-	-	-	30	20	100	1	-	2	2
7.	**BASP 102**	DLC-1	**Internship-I (60 Hrs Duration) at the Institute level**	**To be completed during or at the end of the second semester. Its evaluation/credit to be added in third semester.**									
8.	**BASP 105**	DLC-2	Swachh Bharat Summer Internship Unnat Bharat Abhiyan (100Hrs)/ Rural Outreach				15	10	25*	-	-	4	-
			Total	**500**	**150**	**100**	**150**	**100**	**1000**	**16**	**4**	**10**	**25**

*It is non credit course. Student must clear it to be promoted in II Year; Marks will not be added to the total

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1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

BAST-101 **BASP-101**	**Engineering Chemistry**	**3 1 2**	**05 Credits**

Course Contents:

Periodic Properties (5 Lectures)

Effective Nuclear Charge, Atomic & Ionic sizes, Electron affinity, Electro negativity, Ionization Potential, Ploarizability, Oxidation States & Hydrogen Bonding.

Phase equilibrium (5 Lectures)

Gibbs Phase Rule, Phase diagram of single component system (Water & Sulphur) Phase diagram of Binary Eutectic System (Cu-Ag.)

Water Analysis - (8 Lectures)

Soft and Hard Water, Degree of Hardness, Determination of hardness by EDTA method (related numerical problems), Softening methods (Lime-Soda, Zeolite and Ion Exchange Methods), Alkalinity & It's determination.

Boiler Feed Water, Sludge & Scale, Priming & Foaming, Boiler Corrosion, Caustic Embrittlement.

Polymers (8 Lectures)

Introduction, Types of polymerization, Classification, Thermoplastic & Thermosetting polymers Elementary idea of Biodegradable polymers, Conducting Polymers & Nano Particles, Preparation, properties & uses of the following polymers - PVC, PMMA, Teflon, Nylon 6, Nylon 6:6, Polyester & Bakelite, Rubbers, Vulcanization of Rubber.

Corrosion (4 Lectures):

Introduction, Dry Corrosion, Wet Corrosion, Mechanism of Corrosion, Factors affecting corrosion and Prevention of corrosion.

Lubricants (6 Lectures)

Introduction, Mechanism of lubrication, Classification of lubricants, significance & determination of Viscosity and Viscosity Index, Flash & Fire Points, Cloud & Pour Points, Aniline & Mixed Aniline Points, Acid Number, Saponification Number.

Spectroscopic techniques and application (4 Lectures)

Principle and Applications of UV – visible, IR, Raman & NMR, Spectroscopy.

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Practical List

NOTE: Choice of 10-12 experiments of the following core experiments must be performed during the session.

1. Determination of hardness of water using EDTA method (Complexometric Titration).

2. Determination of alkalinity of water.
3. Determination of chloride content of water (Mohr's Method)
4. Determination of viscosity of unknown sample using Ostwald's viscometer
5. Determination of surface tension of unknown sample using stalagmometer.
6. Determination of saponification value of oil sample
7. Determination of acid value of oil sample
8. Synthesis of a polymer.
9. Determination of percentage moisture content in a coal sample.
10. Determination of percentage volatile matter in a coal sample.
11. Determination of ash content in a coal sample.
12. Separation of binary mixture by thin layer chromatography.
13. Separation of binary mixture by ascending paper chromatography.
14. Determination of adsorption isotherm of acetic acid on charcoal.
15. Determination of percentage purity of ferrous ammonium sulphate and copper sulphate.
16. Chemical analysis of salt (mixture of one acidic and one basic radical)

Reference Books :

1 Chemistry in Engineering and Technology - Vol.1 &2 Kuriacose and Rajaram , McGraw Hill Education
2 Fundamental of Molecular Spectroscopy C.N. Banwell , McGraw Hill Education
3 Engineering Chemistry – B.K. Sharma, Krishna Prakashan Media (P) Ltd., Meerut.
4 Basics of Engineering Chemistry – S.S. Dara & A.K. Singh, S. Chand &Company Ltd., Delhi.
5 Applied Chemistry – Theory and Practice, O.P. Viramani, A.K. Narula, New Age International Pvt. Ltd. Publishers, New Delhi.
6 Elementary Spectroscopy ,Y .R. Sharma , S. Chand Publishing
7 Polymer Science, Vasant R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, New Age International Pvt. Ltd
8 Advanced Inorganic Chemistry, G.R. Chatwal, Goal Publishing house
9 Engineering Chemistry (NPTEL Web-book) B.L. Tembe, Kamaluddin and M.S. Krishna
10 Advanced Physical Practical Chemistry by JB Yadav.

BAST-102	MATHEMATICS-I	3 1 0	04 Credits

OBJECTIVES: The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines. More precisely, the objectives are:

To introduce the idea of applying differential and integral calculus to notions of curvature and to improper integrals. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

To introduce the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

To familiarize the student with functions of several variables that is essential in most branches of engineering.

To develop the essential tool of vector spaces, matrices and linear algebra in a comprehensive manner.

Course Contents:

Module 1: Calculus: (10 hours): Rolle's theorem, Mean Value theorems, Expansion of functions by Maclaurin's and Taylor's for one variable; Taylor's theorem for function of two variables, Partial Differentiation, Maxima & Minima (two and three variables), Method of Lagranges Multipliers.

Module 2: Calculus: (8 hours): Definite Integral as a limit of a sum and Its application in summation of series; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions. Multiple Integral, Change the order of the integration.

Module 3: Vector Calculus : (10 hours) : Differentiation of Vectors, Scalar and vector point function, Gradient, Geometrical meaning of gradient, Directional Derivative, Divergence and Curl, Line Integral, Surface Integral and Volume Integral, Gauss Divergence, Stokes and Green theorems (without proof).

Module 4: Vector Spaces (6 hours): Vector Space, Vector Sub Space, Linear Combination of Vectors,Linearly Dependent, Linearly Independent, Basis of a Vector Space,Linear Transformations.

Module 5: Matrices (6 hours): Rank of a Matrix, Solution of Simultaneous Linear Equations by Elementary Transformation, Consistency of Equation, Eigen Values and Eigen Vectors, Diagonalization of Matrices, Cayley-Hamilton theorem and its applications to find inverse.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11thReprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

BAST 103 & BASP 103	English for Communication	3L-0T-2P	4 Credits

COURSE CONTENTS:

Unit-I

Identifying Common errors in writing: Articles, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Reported Speech: Direct and Indirect, Sentence Structure.

Unit-II

Vocabulary building and Comprehension:

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, synonyms, antonyms, Reading comprehension.

Unit-III

Communication:

Introduction, Meaning and Significance, Process of Communication, Oral and Written Communication, 7 c's of Communication, Barriers to Communication and Ways to overcome them, Importance of Communication for Technical students, nonverbal communication.

Unit-IV

Developing Writing Skills:

Planning, Drafting and Editing, Precise Writing, Précis, Technical definition and Technical description. Report Writing: Features of writing a good Report, Structure of a Formal Report, Report of Trouble, Laboratory Report, Progress Report.

Unit-V

Business Correspondence:

Importance of Business Letters, Parts and Layout; Application, Contents of good Resume, guidelines for writing Resume, Calling/ Sending Quotation, Order, Complaint, E-mail and Tender.

Books Recommended:

1. 'Technical Communication : Principles and practice', Meenakshi Raman and Sangeeta Sharma (Oxford)
2. 'Effective Business Communication', Krizan and merrier (Cengage learning)
3. 'Communication Skill, Sanjay Kumar and pushlata, OUP2011
4. "Practical English Usage Michael Swan OUP, 1995.
5. "Exercises in spoken English Parts I-III CIEFL, Hyderabad, Oxford University Press
6. On writing well, William Zinsser, Harper Resource Book 2001.
7. Remedial English Grammar, F.T. Wood,Macmillan2007.

Course Outcomes:

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Communicative Language Laboratory:

Course objective: The language laboratory focuses on the practice of English through audio-visual aids and Computer software. It intends to enable the students to speak English correctly with confidence and intends to help them to overcome their inhibitions and self –consciousness while speaking in English.

Topics to be covered in the Language laboratory sessions:

1. Listening Comprehension.
2. Pronunciation, Intonation, Rhythm
3. Practising everyday dialogues in English
4. Interviews.
5. Formal Presentation

Final Assessment should be based on assignment, assessment, presentation and interview of each candidate.

BEET 101 & BEEP 101	Basic Electrical Engineering	3L-1T-2P	5 Credits

Course outcomes:

The final outcome of the subject will result into an enhancement in understanding the basic concepts of Core Electrical Engineering subjects.

The topics covered under this subject will help to enhance the basic understanding of Electrical machines and power systems and basic electronics.

Course Contents:

UNIT 1 :

DC Circuits (8 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin , Norton Theorems and maximum power transfer theorem . Star to Delta conversion. Time-domain analysis of first-order RL and RC circuits.

UNIT 2:

AC Circuits (8 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections and power measurement

UNIT 3:

Transformers (6 hours)

Magnetic circuits and materials, BH characteristics, Basic laws of electromagnetism, single phase transformer. ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

UNIT 4:

Electrical Machines (8 hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor construction and workings . Construction, working, torque-speed characteristic and speed control of separately and self excited dc machines . Construction and working of synchronous generators

Unit 5:

Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing methods. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

References

1. D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, latest edition.
2. S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
3. Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014
4. M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and electronics engineering, Oxford University press, 2012
5. C.L. Wadhwa, Basic Electrical Engineering. New Age International.
6. B.L. Theraja & A.K Theraja Textbook of Electrical Technology - Vol. 1, S. Chand Publication
7. E. Hughes & I.M. Smith Hughes Electrical Technology Pearson
8. Vincent Del Toro Electrical Engineering Fundamentals

List of experiments/demonstrations:

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

2. Measurement of steady-state and transient response of R-L, R-C, and R-L.
3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L- C circuits.
4. Verification of Network theorems.
5. To perform Load test on single phase Transformer.
6. To study the Starting and reversal of 3 phase induction motor.
7. Study of Speed control of a DC shunt Motor by Field Control Method.
8. Study the characteristic of DC Motor.
9. Study the characteristic DC generator.

Institute can add upto two experiment of their own choice.

BMET 105	Engineering Graphics	1L-0T-2P	2 Credits

Course Objective:

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

Goals & Outcomes:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modeling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Course Contents:

UNIT 1: Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Orthographic Projections covering, Principles of Orthographic Projections- Conventions - Projections of Points

UNIT 2: Projection of lines inclined to both planes; vertical and horizontal traces. Projections of planes - Auxiliary Planes; Projections of Regular Solids in simple position, projection of solids with base on ground and axis perpendicular to HP, Projection of solids with axis parallel to both the principal planes. Projection of solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning.

UNIT 3: Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Frustums and truncated solids. Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only) . Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Isometric axes, Conventions; Isometric Views of solids, Box method, coordinate method, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

UNIT 4: Introduction of CAD in engineering drawing. Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area

(Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable),

UNIT 5: Customization & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits Applying various ways of drawing circles; ; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing of lines, circles, polygons using CAD technique. Introduction of solids. Multi views.

Text/Reference Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
   B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
3. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
4. (Corresponding set of) CAD Software Theory and User Manuals

BMEP 101	Manufacturing Practices/Workshop	1L-0T-2P	2 Credits

Course Objective:

Manufacturing is fundamental to the development of any engineering product. The course on Engineering Workshop Practice is intended to expose engineering students to different types of manufacturing / fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weightage, some lectures and video clips available on different methods of manufacturing are also included.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understanding different manufacturing techniques and their relative advantages/ disadvantages with respect to different applications.
- Selection of a suitable technique for meeting a specific fabrication need.
- Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.
- Introduction to different manufacturing methods in different fields of engineering.
- Practical exposure to different fabrication techniques.
- Creation of simple components using different materials.
- Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Course Contents:

Lectures & videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, Introduction to Lathe, Drilling etc. **(3 lectures)**
2. CNC machining, Additive manufacturing **(1 lecture)**
3. Fitting operations & power tools **(1 lecture)**
4. Electrical &Electronics **(1 lecture)**
5. Carpentry **(1 lecture)**
6. Plastic moulding, glass cutting **(1 lecture)**
7. Metal casting **(1 lecture)**
8. Welding (arc welding & gas welding), brazing **(1 lecture)**

(ii) Workshop Practice:(60 hours)

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics- Soldering, Brazing, Winding etc.**(8 hours)**
5. Welding shop **(8 hours (Arc welding 4 hrs + gas welding 4 hrs)**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic moulding/ Glass Cutting/ Sheet Metal Shop (6 hours)

Note: Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

BAST 104 & BASP 104	Engineering Physics	3L-1T-2P	5 Credits

Course Contents:

Module 1: Wave nature of particles and the Schrodinger equation (8 lectures)

Introduction to Quantum mechanics, Wave nature of Particles, Free-particle wave function and wave-packets, Group Velocity and Phase Velocity and relation, Uncertainty principle, wave function, Born interpretation of wave function, operators, Time-dependent and time-independent Schrodinger equation for wave function, Application: Particle in a One-dimensional Box.

Module 2: Wave optics (8 lectures)

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach- Zehnder interferometer.

Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Module 3: Introduction to solids (8 lectures)

Free electron theory of metals, Fermi level of Intrinsic and extrinsic, density of states, Bloch's theorem for particles in a periodic potential. V-I characteristics of PN junction, Zener diode, Solar Cell, Hall Effect, concept of zero resistivity and superconductivity, Meissner effect, Type - I and Type - II superconductors, applications of superconductivity.

Module 4: Lasers (8 lectures)

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine. Introduction to Optical fiber, acceptance angle and cone, Numerical aperture, V number, attenuation.

Module 5: Electrostatics in vacuum (8 lectures)

Gradient, Divergence and curl, Stokes' theorem, Gauss Theorem, Calculation of electric field and electrostatic potential for a charge distribution; Electric displacement, Basic Introduction to Dielectrics, Continuity equation for current densities; Maxwell's equation in vacuum and non-conducting medium; Poynting vector.

List of Experiment*

1. To determine the dispersive power of prism.
2. To determine the wave length of sodium light with the help of newton's Ring.
3. Resolving Power of Telescope.
4. YDSE (Young's double slit Experiment).
5. To determine the frequency of AC mains supply.
6. V-I Characteristics of P-N junction diode.
7. To determine the wave length of diode loses by single slit diffraction.
8. To determine the plank's constant with the help of photocell.
9. Hall's effect experiment.
10. Calibration of ammeter by using reference zener diode.

11. To study the effect of temperature on reverse saturation current in P-N junction diode and to determine the energy band gap.
12. To determine the wave length of sodium by using plane diffraction grating.
13. To determine the prominent lines of mercury source by plane diffraction grating.
14. To determine the numerical aperture of an optical fiber.
15. To determine wave length of given laser by plane diffraction grating.
16. To determine the variation of magnetic field along the axis of current carrying circular coil and the estimation the radius of coil. 1. To determine the resistivity and band gap by four probe method.
17. Use of Michelson-Morley interferometer for determining the wavelength of He-Ne laser
18. To determine the specific rotation of sugar solution using Loren's half shade polarimeter.
19. To calculate the dielectric constant of the given dielectric material.
20. To find the capacitance and permittivity of the given material.
21. Measurement of length (or diameter) using vernier calliper, screw gauge and travelling microscope
22. To determine g by bar pendulum and Kater's pendulum.
23. To determine g and velocity for a freely falling using digital timing technique.
24. To study the motion of a spring and calculate (a) spring constant (b) value of g
25. To determine the height of an object using a sextant.
26. Determination of the value of e/m of an electron by helical method/ Thomson method.

**** Minimum 15 experiment are mandatory to perform out of above list of experiments as well other than these experiments 3-4 more experiments can be considered as per their availability***

Suggested Reference Books

1. A. Ghatak, Optics.
2. O. Svelto, Principles of Lasers.
3. David Griffiths, Introduction to Electrodynamics.
4. D.J. Griffiths, Quantum Mechanics.
5. Halliday & Resnick, Physics.
6. HC Verma, Quantum Physics
7. MN Avdhanulu, PG Kshirsagar et all, Engineering Physics

BAST 105	MATHEMATICS-II	3L-1T-0P	4 Credits

OBJECTIVES: The objective of this course is to familiarize the prospective engineers with techniques in Ordinary and partial differential equations, complex variables and vector calculus. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines. More precisely, the objectives are:

- To introduce effective mathematical tools for the solutions of ordinary and partial differential equations that model physical processes.
- To introduce the tools of differentiation and integration of functions of complex variable that are used in various techniques dealing engineering problems.
- To acquaint the student with mathematical tools available in vector calculus needed various field of science and engineering.
- To develop the tool of Series and Fourier series for learning advanced Engineering Mathematics.

Course Contents:

Module 1:Ordinary Differential Equations I :(8 hours) : Differential Equations of First Order and First Degree (Leibnitz linear, Bernoulli's, Exact), Differential Equations of First Order and Higher Degree, Higher order differential equations with constants coefficients, Homogeneous Linear Differential equations, Simultaneous Differential Equations.

Module 2:Ordinary differential Equations II:(8 hours) : Second order linear differential equations with variable coefficients, Method of variation of parameters, Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Module 3: Partial Differential Equations : (8 hours) : Formulation of Partial Differential equations, Linear and Non-Linear Partial Differential Equations, Homogeneous Linear Partial Differential Equations with Constants Coefficients.

Module 4: Sequences and series: (8 hours): Convergence of sequence and series, tests for convergence; Comparison Test; Ratio Test; D'Alembert's Ratio Test, Raabe's Test, Logarithmic Test, Cauchy Root Test, Weierstrass M Test; Alternating Series, Uniform Conversions, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 5: Functions of Complex Variable :(8 hours) : Functions of Complex Variables: Analytic Functions, Harmonic Conjugate, Cauchy-Riemann Equations (without proof), Line Integral, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Singular Points, Poles & Residues, Residue Theorem, Application of Residues theorem for Evaluation of Real Integral (Unit Circle).

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

BMET 102 **BMEP 102**	**Basic Mechanical Engineering**	**3L-1T-2P**	**5 Credits**

Course Contents:

UNIT-1:Fundamental Concepts and Definitions

Definition of thermodynamics, System, Surrounding and universe, Phase, Concept of continuum,Macroscopic & microscopic point of view. Density, Specific volume, Pressure, temperature.Thermodynamic equilibrium, Property, State, Path, Process, Cyclic and non cyclic processes,Reversible and irreversible processes, Quasi static process, Energy and its forms, Enthalpy.

UNIT-2:

Zeroth law: Zeroth law, Different temperature scales and temperature measurement

First law: First law of thermodynamics. Processes - flow and non-flow, Control volume, Flow work and non-flow work, Steady flow energy equation, Unsteady flow systems and their analysis.

Second law: Limitations of first law of thermodynamics, Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law and their equivalence,Carnot cycle, Carnot theorem, Thermodynamic temperature scale, Clausius inequality. Concept of entropy.

UNIT-3:

Properties of steam: Properties of steam, Phase transformation process and its graphical representation on P-V, T-V& T-s diagram, Mollier diagram and Steam Tables, Processes involving steam in closed and open systems.

Introduction to I.C. Engines: Two & four stoke S.I. and C.I. engines. Otto cycle, Diesel cycle, Dual cycle.

UNIT-4:Force system and Analysis

Basic concept: Review of laws of motion, transfer of force to parallel position, resultant of planer force system,Free Body Diagrams, Equilibrium. **Friction:** Introduction, Laws of Coulomb friction,Equilibriumof bodies involving dry fiction.

Structure Analysis

Beams: Introduction, Shear force and bending moment, Shear force and bending moment diagram for statically determinate and indeterminate beams.

Trusses: Introductio n, Simple Trusses, Determination of forces in simple truss members, Method of Joints and Method of section.

UNIT-5

Stress and Strain Analysis

Simple stress and strain: Introduction, Normal shear stresses, Stress-strain diagrams for ductile and brittle materials,Elastic constants, One dimensional loading of members of varying cross section, Strain energy,Thermal stresses.

Compound stress and strains: Introduction, State of plane stress, Principal stress and strain, Mohr's circle for stress and strain.

Pure Bending of Beams: Introduction, Simple bending theory, Stress in beams of different cross sections.

Torsion: Introduction, Torsion of Shafts of circular section, Torque and Twist, Shear stress due to Torque.

References:

1. Van Wylen G.J. & Sonntag R.E. : Fundamentals of classical thermodynamics, John Wiley &Sons, Inc.NY.
2. Holman, J.P. : Thermodynamics, Mc Graw Hill book Co. NY.
3. Singh Onkar, Bhavikatti S.S., Chandra Suresh : Introduction to Mechanical Engineering: Thermodynamics, Mechanics and Strength of Materials, New Age International Publishers
4. Yadav R. : Thermodynamics and Heat Engines, Vol I & II (SI Editio n) Central Publishing House Allahabad.
5. G. H. Ryder : Strength of Materials, Mc Millan Publishers India Ltd.
6. Timoshenko : Strength of Materials, D. Van Nostrand Company Inc.

MECHANICAL ENGINEERING LAB

List of Practical **L T P 0 0 2**

A minimum of 8 experiments from the following :

1. Study of Steam engine and steam turbine models.
2. Study of 2-stroke and 4 -stroke I.C.E. models.
3. Study of Fiat engine and/ or Diesel engine prototype.
4. Study of a vapour compression Refrigeration unit tutor/refrigerator.
5. Study of a window type air conditioner.
6. To conduct the tensile test on a UTM and determine ultimate Tensile strength, percentage elongation for a steel specimen.
7. To conduct the compression test and determine the ultimate compressive strength for a specimen.
8. To conduct the Impact test (Izod / charpy) on the Impact testing machine and to find the impact strength.
9. To determine the value of acceleration due to gravity by Atwood's Machine appratus.
10. To verify the principle of moment by Bell Crank Lever Appratus
11. To determine the moment of inertia of a flywheel apparatus about its axis of rotation.
12. To find out coefficient of friction by combined inclined plane & friction slide apparatus.

BecT 101 **BECP 101**	**Basic Electronics Engineering**	**3L-1T-2P**	**5 Credits**

Course Contents:

Module	Basic Electronics(BECT101,BECP101)	Hr
1.	**Semiconductor Diodes** Semiconductor materials- intrinsic and extrinsic types , Ideal Diode , Terminal characteristics of diodes: p-n junction under open circuit condition p-n junction under forward bias and reverse bias conditions p-n junction in breakdown region , Diode small signal model Zener diode and applications , Rectifier Circuits, Clipping and Clamping circuits	**8**
2	**DIODE APPLICATIONS:** Rectifiers and filter circuit: Half wave rectifier, Full wave rectifier, bridge rectifier and their analysis, L,C and Pi filters, Series and shunt diode clippers, Clipping at two independent levels, Clamping operation , Clamping circuit, Practical clamping circuits, Basic regulator supply using zener diode	**7**
3	**Bipolar Junction Transistors (BJTs)** Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers, Transistor as a switch: cut-off and saturation modes , High frequency model of BJT amplifier	**10**
4	**Field Effect Transistor (FET**) ***Enhancement-type MOSFET***: structure and physical operation, current-voltage characteristics Depletion-type MOSFET , D.C. operation of MOSFET circuits, MOSFET as an amplifier, Biasing in MOSFET amplifiers , Basic MOSFET amplifier configuration: common source, common gate and common drain types , High frequency model of MOSFET amplifier , Junction Field-Effect Transistor (JFET)	**10**
5	**Operation Amplifier (Op-amps)** ***Ideal Op-amp Differential amplifier*:** differential and common mode operation common mode rejection ratio (CMRR) , ***Practical op-amp circuits***: inverting amplifier, non -inverting amplifier, weighted summer, integrator, differentiator , Large signal operation of op-amps , Other ***applications of op-amps*:** instrumentation circuits, active filters, controlled sources, logarithmic amplifiers, waveform generators, Schmitt triggers, comparators	**10**

TEXT BOOKS:

1. Integrated devices & Circuits by Millman & Halkias.
2. Electronics Devices and Circuit Theory by R. Boylestad.

REFERENCE BOOKS:

1. Electronics Devices and Circuits-II by A.P.Godre & U.A. Bakshi.
2. Electronics Devices and Circuit by G.K. Mithal.

Basic Electronics Lab

Sr.	Experiment
1	CRO-Applications
2	V-I Characteristics of Silicon & Germanium PN Junction diodes
3	V-I Characteristics of Zener Diode
4	Characteristics of BJT in Common Emitter Configuration
5	Characteristics of JFET in Common Source Configuration
6	Half Wave and Full Wave Rectifier With Filter
7	Common Emitter BJT Amplifier for audio signal amplification
8	Applications of Operational Amplifier as adder and Subtractor
9	Applications of Operational Amplifier as differentiator and integrator
10	All logic Gate's truth table validation

BCST 101 & BCSP 101	Fundamentals of Computer & Programming in C	3L-1T-2P	5 Credits

Course Objective

1. To learn basics of computers
2. To learn basics of Operating System
3. To learn basics of C Language
4. To learn basics of Programming

Course Outcomes:

1. The student will learn to formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To use arrays, pointers and structures to formulate algorithms and programs.
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

Detailed Contents

Module I

Introduction to Programming - Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm Flowchart/Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Module II

Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops,

Arrays - Arrays (1-D, 2-D), Character arrays and Strings

Module III

Basic Algorithms - Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Function - Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Module IV –

Recursion - Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Structure - Structures, Defining structures and Array of Structures

Module V

Pointers - Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

File handling - (only if time is available, otherwise should be done as part of the lab)

Experiments

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations Laboratory

Suggested Text Books

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill Suggested

Reference Books

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

13. WAP to illustrate constructor & Destructor
14. WAP to illustrate Object and classes.
15. WAP to illustrate Operator overloading
16. WAP to illustrate Function overloading
17. WAP to illustrate Derived classes & Inheritance
18. WAP to insert and delete and element from the Stack
19. WAP to insert and delete and element from the Queue
20. WAP to insert and delete and element from the Linked List

Recommended Text Books:

1. Fundamentals of Computers : E Balagurusamy, TMH
2. Basic Computer Engineering: Silakari and Shukla, Wiley India
3. Fundamentals of Computers : V Rajaraman, PHI
4. Information Technology Principles and Application: Ajoy Kumar Ray & Tinku Acharya PHI.

Recommended Reference Books:

1. Introduction of Computers : Peter Norton, TMH
2. Object Oriented Programming with C++ :E.Balagurusamy, TMH
3. Object Oriented Programming in C++: Rajesh K.Shukla, Wiley India
4. Concepts in Computing: Kenneth Hoganson, Jones & Bartlett.
5. Operating Systems – Silberschatz and Galvin - Wiley India
6. Computer Networks:Andrew Tananbaum, PHI
7. Data Base Management Systems, Korth, TMH

BASP 206	**Language Lab and Seminars**	**0L-0T-2P**	**1 Credits**

Course objective: This course intends to impart practical training in the use of English Language for Communicative purposes and aims to develop students' personality through language Laboratory.

Topics to be covered in the Language laboratory sessions:

1. Introducing oneself, family, social roles.
2. Public Speaking and oral skills with emphasis on conversational practice, extempore speech, JAM(Just a minute sessions), describing objects and situations, giving directions, debate, telephonic etiquette.
3. Reading Comprehension: Intensive reading skills, rapid reading, and reading aloud (Reading material to be selected by the teacher).
4. To write a book review. Standard text must be selected by the teacher.
5. Role plays: preparation and delivery topic to be selected by teacher/faculty.
6. Practice of Communication Skills using Language Lab

BEST 101	Environmental Studies	L - T - P 3 0 0	0 Credits

AS Per UGC Syllabus

Total Marks - 100

The structure of the question paper and Marks Distribution:

University Examination
Part A - Short answer pattern - 20 marks
Part B - Essay type with inbuilt choice - 50 marks

Internal Evaluation at Institute Level
Part C - Field & Project Work - 30 marks

AIM of Environmental Studies Subject

The aim of E.V.S. (environmental studies) is to develop a world population that is aware of and concerned about the environment and its associated problems and which has the knowledge ,Skills, attitudes ,motivations and commitment to work individually and collectively towards solutions of current problems and prevention of new ones. In view of this aim, environmental studies should form an integral part of the educational process, be centered in practical problems and be of an interdisciplinary/multidisciplinary character.

OBJECTIVES of Environmental Studies Subject

- Awareness: To help social groups and individuals acquire awareness of and sensitively to the total environment and it's allied problems.
- Knowledge: To help social groups and individuals gain a variety of experiences and acquire a basic understanding of environment and it's associated problems.
- Attitudes: To help social groups and individuals acquire a set of values and feelings of concern for environment.
- Skills: To help the individuals in acquiring skills for identifying and solving environmental problems.
- Participation: To provide social groups and individuals with an opportunity to be actively involved at all levels in working towards the resolution of environmental problems.

Detailed Content

Unit I –

Introduction: Introduction to environmental studies, Multidisciplinary nature of environmental studies; Scope and importance; the need for environmental education. Concept of sustainability and sustainable development.

Natural Resources:
Renewable and non-renewable resources: Natural resources and associated problems.

- Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

- Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit II : **Ecosystems**:

- Concept of an ecosystem.
- Structure and function of an ecosystem.
- Producers, consumers and decomposers.
- Energy flow in the ecosystem.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following ecosystem :-
  - Forest ecosystem
  - Grassland ecosystem
  - Desert ecosystem
  - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: **Biodiversity and Conservation**

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biogeographical classification of India
- Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
- Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

Unit IV : **Environmental Pollution**

Definition

- Cause, effects and control measures of :-
  - Air pollution
  - Water pollution
  - Soil pollution
  - Marine pollution
  - Noise pollution
  - Thermal pollution
  - Nuclear hazards
- Solid waste Management : Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution.
- Pollution case studies.
- Disaster management : floods, earthquake, cyclone and landslides.

UNIT V - Social Issues and the Environment

- From Unsustainable to Sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.

- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation.
- Public awareness.

UNIT VI - Human Population and the Environment

- Population growth, variation among nations.
- Population explosion – Family Welfare Programme.
- Environment and human health.
- Human Rights.
- Value Education.
- HIV/AIDS.
- Women and Child Welfare.
- Role of Information Technology in Environment and human health.
- Case Studies. (6 lectures)

Note: Introduction and familiarize students with the following

Global Environmental Issues and Environmental Laws

Pollution Tragedies: Love canal, Bhopal Gas, Endosulfan, Minamata and Flint water. UN Initiatives and International agreements: Montreal and Kyoto protocols, Paris Climate Summit (2015) and Convention on Biological Diversity (CBD). Environment Laws: Environment Protection Act (1986); Air (Prevention & Control of Pollution) Act (1981); Forest Conservation Act (1980); Water (Prevention and control of Pollution) Act (1974); Wildlife Protection Act (1972).

Field work

1. Visit to a local area to document environmental assets river / forest / grassland / hill / mountain
2. Visit to a local polluted site-Urban / Rural / Industrial / Agricultural
3. Study of common plants, insects, birds.
4. Study of simple ecosystems-pond, river, hill slopes, etc.
5. Plantation at least 2 fruits tree in Surroundings. Pic is to taken.
6. Any useful daily good from waste materials.
7. Taken at least 5 pics of surrounding by mobile in relation to environmental/social issues.
8. Development of detailed list of flora and fauna of college campus.
9. Manufacturing of any technical prototype/model in relation to Climatic Change mitigation.

Note: Minimum Five activities shall be done by each class and reports shall submit to University after host institute verification.

Text Books:

1. Basu, M. and Xavier, S.,Fundamentals of Environmental Studies, Cambridge University Press, 2016.
2. Mitra, A. K and Chakraborty, R., Introduction to Environmental Studies, Book Syndicate, 2016.
3. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.
4. Basu, R.N, Environment, University of Calcutta, 2000.

Suggested Readings:

1. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
2. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London,Routledge.
4. Gleick, P. H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
6. McCully, P. 1996. Rivers no more: the environmental effects of dams (pp. 29-64). Zed Books.
7. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
8. Ghosh Roy, MK, Sustainalble Development (Environment, Energy and Water Resources), Ane Books Pvt. Ltd., 2011.
9. Karpagam, M and GeethaJaikumar, Green Management, Theory and Applications, Ane Books Pvt. Ltd., 2010.
10. Bala Krishnamoorthy, Environmental Management, PHI learning PVT Ltd, 2012.

Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Schemes for B. Tech 2nd to 4thYear

W.E.F. Academic Session 2020-21

III to VIII SEMESTER

Bachelor of Technology (B. Tech.)

in

[MechanicalEngineering]

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)II Year

[Mechanical Engineering]

W.E.F. Academic Session 2020-21

III Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BAST 301	BSC-5	Mathematics-III	100	30	20	-	-	150	3	1	-	4
2.	BMET 302	DC-1	Basic Thermodynamics	100	30	20	-	-	150	3	1	-	4
3.	BMET 303 BMEP 303	DC-2	Materials Science & Technology	100	30	20	30	20	200	3	-	2	4
4.	BMET 304 BMEP 304	DC-3	Strength of Material	100	30	20	30	20	200	3	1	2	5
5.	BMET 305 BMEP 305	DC-4	Manufacturing Science & Technology-I	100	30	20	30	20	200	3	0	2	4
6.	BCSP 307	DC	Programming Practices (Introduction to MATLAB)	-	-	-	-	50	50	-	-	4	2
7.	BAST 107	DLC -1	Evaluation of Internship-I Completed at I Year Level //Seminar for Lateral Entry students	-	-	-	-	50	50	-	-	2	1
Total				500	150	100	90	160	1000	15	3	14	24
8	BCST 308	MC *	Cyber Security	Non Credit Course									
NSS/NCC													

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)II Year

[Mechanical Engineering]

W.E.F. Academic Session 2020-21

IV Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BMET 401 BMEP 401	DC	Applied Thermodynamics Engineering	100	30	20	30	20	200	3	1	2	5
2.	BECT 402	ESC	Energy & Environmental Engineering	100	30	20	-	-	150	3	1	-	4
3.	BMET 403 BMEP 403	DC	Theory Of Machine	100	30	20	30	20	200	3	1	2	5
4.	BMET 404 BMEP 404	DC	Fluid Mechanics	100	30	20	30	20	200	3	1	2	5
5.	BMET 405 BMEP 405	DC	Manufacturing Science & Technology-II	100	30	20			150	3	0	0	3
6.	BECT 406	HV	Universal Human Values-2	50	30	20	-	-	100	2	1	0	3
7.	BECP 407	DLC	90 hrs Internship based on using various software's – Internship -II	To be completed anytime during Third/ fourth semester. Its evaluation/credit to be added in fifth semester.									
Total				550	180	120	90	60	1000	17	5	6	25
NSS/NCC													

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)III Year

[Mechanical Engineering]

V Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total marks	Contact Hours per Week			Total Credi
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BMET 501 BMEP 501	DC	Industrial Engineering &Ergonomics	100	30	20	30	20	200	3	0	2	4
2.	BMET -502 BMEP 502	DC	Machine Component Design –I	100	30	20	30	20	200	2	1	2	4
3.	BMET -503 BMEP -503	DC	Heat & Mass Transfer	100	30	20	30	20	200	2	1	2	4
4.	BMET -504	DE	Departmental Elective	100	30	20	-	-	150	3	0	0	3
5.	BOME -505	OE	Open Elective	100	30	20	-	-	150	3	0	0	3
6.	BMEP -506	D Lab	Machine Drawing Lab With Autocad	-	-	-	30	20	50	0	0	2	1
7	BMET -507	DLC	Evaluation of Internship-II completed at II year level	-	-	-	-	50	50	-	-	4	2
8		IN	Internship –III	To be completed any time during Fifth/ Sixth semester. Its evaluation/credit to be added in Seventh semester									
Total				500	150	100	90	110	1000	13	2	12	21
NSS/NCC													

Departmental Electives		Open Electives	
BMET 504(A)	IC Engine	BOME 505(A)	Principle of Management
BMET 504(B)	Machine Tool Design	BOME 505(B)	TQM and SQC
BMET 504(C)	Alternate Automotive Fuels & Emissions	BOET 504(D)	Innovation and Entrepreneurship

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)III Year

[Mechanical Engineering]

W.E.F. Academic Session 2020-21

VI Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BMET 601 BMEP 601	DC	Turbo machinery	100	30	20	30	20	200	3	1	2	5
2.	BMET 602 BMEP 602	DC	Machine Component Design –II	100	30	20	30	20	200	3	0	4	5
3.	BMET -603 BMEP 603	DC	Refrigeration and Air-condition	100	30	20	30	20	200	3	1	2	5
4.	BMET - 604(A/B/C)	DE	Departmental Elective	100	30	20			150	3	0	0	3
5.	BOME -605	OE	Open Elective	100	30	20			150	3	0	0	3
6	BMEP -607	P	Minor Project -I					50	50	0	0	4	2
7	BMEP -608	P	Open Source Lab	-	-	-	30	20	50	0	0	2	1
		IN	Internship –III	To be completed any time during Fifth/ Sixth semester. Its evaluation/credit to be added in Seventh semester									
Total				500	150	100	120	130	1000	15	2	12	24

Departmental Electives		Open Electives	
BMET 604(A)	Mechatronics	BOME 605(A)	Robotics
BMET 604 (B)	Finite Element Method	BOME 605 (B)	Optimization Techniques
BMET 604 (C)	Product Design	BOME 605 (C)	Renewable Energy Technology

***Students may also earn credits of open elective through NPTEL/Swayam.**

New Scheme /-of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)IV Year

[Mechanical Engineering]

W.E.F. Academic Session 2020-21

VII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BMET 701	DC	Maintenance and Safety	100	30	20			150	3	0	0	3
2.	BMET-702 BMEP-702	DC	Computer Integrated Manufacturing	100	30	20	30	20	200	3	0	2	4
3.	BMET-703	DE	Departmental Elective	100	30	20	-	-	150	3	0	0	3
4.	BMET-704	OE	Open Elective	100	30	20	-	-	150	3	0	0	3
5.	BMEP-705	D Lab	Simulation lab/Virtual Lab (Ansys/MATLAB)	-	-	-	30	20	50	0	1	2	2
6.	BMEP-507	IN	Internship III	-	-	-	-	50	50	-	-	2	1
7.	BMEP-706	P	Minor Project-2	-	-	-	50	50	100	0	0	4	2
Total				400	120	80	110	190	900	12	1	10	18
NSS/NCC													

Departmental Electives		Open Electives	
BMET 703(A)	Nano Materials	BMET 704(A)	Energy Conservation
BMET 703(B)	Computational Fluid Dynamics	BMET 704(B)	Introduction to AI
BMET 703(C)	Mechanical Vibration	BMET 704(C)	MEMS & Microsystems Technology

***Students may also earn credits of open elective through NPTEL/Swayam.**

New Scheme of Examination as per AICTE Flexible Curricula

Bachelor of Technology (B.Tech.)IV Year

[Mechanical Engineering]

W.E.F. Academic Session 2020-21

VIII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total marks	Contact Hours per Week			Total Credi
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BMET 801	DC	Operation research	100	30	20			150	3	1	0	4
2	BMET 802 BMEP-802	DC	Automobile	100	30	20	30	20	200	3	1	2	5
3	BMET-803	DE	Departmental Elective	100	30	20			150	3	0	0	3
4.	BMET-804	OE	Open Elective	100	30	20			150	3	0	0	3
5	BMEP-805	S	Open source Lab					50	50	0	0	2	1
6	BMEP-806	P	Major Project				100	100	200	0	0	8	4
Total				400	120	80	50	200	900	12	2	12	20

Departmental Electives		Open Electives	
BMET-802 (A)	Power Plant Engineering	BMET-803 (A)	Concepts of programming and OOPS
BMET-802 (B)	Solar Energy	BMET-803 (B)	Environment and Ecology
BMET-802 (C)	Experimental Stress Analysis	BMET-803 (C)	Programming in python

Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Schemes for B. Tech 3rdYear

W.E.F. Academic Session 2020-21

Vto VIII SEMESTER

Bachelor of Technology (B. Tech.)

in

[MechanicalEngineering]

Uttarakhand Technical University, Dehradun

5th SEM

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET- 501	**Industrial Engineering & Ergonomics**	**L**	**T**	**P**
BMEP- 501		**3**	**0**	**2**

Objectives:

1. Understand the concept of productivity and work study.
2. Understand the importance of plant layout and production planning and control.
3. Understand the role of maintenance management.
4. Understand the concept of inventory and quality control.
5. Differentiate among different job evaluation methods.

Course Outcome:

1. Ability to understand productivity and work study.
2. Ability to apply plant layouts and understanding the application of material handling equipments
3. An understanding of managerial economics
4. Ability to apply the concept of Inventory and supply chain management.
5. An understanding of job evaluation and merit rating.

Detailed Content:

Unit 1 Method study: purpose of work study, its objectives, procedure and applications; method study definition and basic procedure, selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, simo, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study.

Unit 2 Work measurement: Introduction & definition, objectives and basic procedure of work measurement; application of work measurement in industries; time study: basic procedure, equipments needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances, calculation of standard time.
Work sampling: Basic procedure, design of work sampling study conducting work sampling study and establishment of standard-time.

Unit 3 Job evaluation and incentive schemes: Starlight line, Tailor, Merrick and Gantt incentive plans
Standard data system; elemental and non-elemental predetermined motion systems, work factors system; Methods Time Measurement (MTM), MOST

Unit 4 Human factor engineering: Definition and history of development of human factors engineering, types & characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing: Introduction to information theory; factors effecting information reception and processing; coding and selecting of sensory inputs.

Unit 5 Display systems and anthropometric data: Display- types of visual display, visual indicators and warning signals; factorial and graphic display; general principles of auditory and tactral display, characteristics and selection.

Suggested Books:

1. ILO; work-study; International Labour Organization
2. Khan MI; Industrial Ergonomics; PHI Learning
3. Barrnes RM; Motion and Time Study; Wiley pub
4. Megaw ED; Contenmprory ergonomics; Taylor &fracis
5. Sandera M and McCormick E; Human Factors in Engg and design; MGHill
6. Currie RM; Work study; BIM publications
7. Mynard; Hand book of Industrial Engg

Suggested Experiments:

1. design of an office chair based on multiple section data;
2. Evaluation of an automobile driver's work station based on class data and population data using a quarter inch scale grid and jointed anthropometric templates.
3. measurement of impulsive and 3-second sustained strength as a function of handle grip length;
4. Measurement of reaction time (total time and initiation time) as a function of stimulus mode (light or tone), distance, and accuracy of movement.
5. Measurement of production rate and estimation of fatigue sensation (on a five level descriptive scale) using regular, ball handled, and Yankee screwdrivers;
6. Measurements of hand torque using pliers in the frontal and sagittal planes.
7. Measurement of visual acuity, lumens versus wattage for incandescent and fluorescent lighting
8. Determination of required and preferred illumination levels for reading various sizes of print.
9. Measurement of wall and floor reflectances (ceiling reflectances are given for reasons of safety).
10. Study of material handling equipments.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

BMET- 502	**Machine Component Design-I**	**L**	**T**	**P**
BMEP- 502		**2**	**1**	**2**

Objectives:

1. Develop an ability to apply knowledge of mathematics, science, and engineering Outcomes.
2. To develop an ability to design a system, component, or process to meet desired needs.
3. To analyze identify, formulate, and solve engineering problems

Course Outcome:

1. Illustrate the fundamentals of stress analysis, theories of failure and material science in the design of machine components.
2. Analyze the principle of solid mechanics to design machine member, under variable loading.
3. Analyze the shaft design based on strength, rigidity and design various types of coupling based on application
4. Compare and analyze design parameters of Springs& joints on various loading application.
5. Illustrate the different types of Product design & development.

Detailed Content:

Unit 1: **Introduction to stress in machine component:** Stress concentration and fatigue: causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage factor.

Unit 2: Shafts: Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; Design of shaft subjected to dynamic load; Design of keys and shaft couplings.

Unit 3: **Springs:** Design of helical compression and tension springs, consideration of dimensional and functional constraints, leaf springs and torsion springs; fatigue loading of springs, surge in spring; special springs, Power Screws: design of power screw and power nut, differential and compound screw, design of simple screw jack.

Unit 4 : Brakes & Clutches: Materials for friction surface, uniform pressure and uniform wear theories, Design of friction clutches: Disk, plate clutches, cone & centrifugal clutches. Design of brakes: Rope, band & block brake, Internal expending brakes, Disk brakes.

Unit 5: Journal Bearing: Types of lubrication, viscosity, hydrodynamic theory, design factors, temperature and viscosity considerations,
Reynold's equation, stable and unstable operation, heat dissipation and thermal equilibrium, boundary lubrication, dimensionless numbers, Design of journal bearings, Rolling-element Bearings: Types of rolling contact bearing, bearing friction and power loss, bearing life; Radial, thrust & axial loads; Static & dynamic load capacities; Selection of ball and roller bearings; lubrication and sealing.

Suggested Bookss:

1. Shingley J.E; Machine Design; TMH

2. Sharma and Purohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma &Agrawal; Machine Design; Kataria& sons
7. Maleev; Machnine Design;

Suggested Experiments:

1. Study of various engineering materials.
2. Study and nomenclature of cerntrifugal clutch.
3. Design of shaft- (specific design conditions provided by instructor)
4. Design of Spring-(specific design conditions provided by instructor)
5. Design of Rope break-(specific design conditions provided by instructor)
6. Design of band break-(specific design conditions provided by instructor)
7. Design of disc break-(specific design conditions provided by instructor)
8. Design of clutch-(specific design conditions provided by instructor)
9. Design of Journal bearing-(specific design conditions provided by instructor)
10. Design of rolling element bearing-(specific design conditions provided by instructor)

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

ME- 503 Heat and Mass Transfer	**L**	**T**	**P**
	2	**1**	**2**

Objectives:

(1) 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.
(2) Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations.
(3) The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.

Course Outcome:

1. Students will be able to mathematically formulate and analyze heat transfer system by conduction mode
2. Students will be able to apply the conduction heat transfer knowledge on fins which are used in various applications
3. Students will be able to apply the knowledge of fluid flow and convection heat transfer to analyze the thermal system
4. Students will be able to analyzeradiative heat transfer system
5. Students will be able to perform thermal design of various heat exchangers

Detailed Content:

UNIT-1 Introduction to Heat Transfer: Concepts of heat flows: conduction, convection and radiation; effect of temperature on thermal conductivity of materials; introduction to combined heat transfer mechanism.
Conduction : One-dimensional general differential heat conduction equation in the rectangular,initial and boundary conditions.
Steady State one-dimensional Heat conduction : Composite Systems in rectangular, cylindrical and spherical coordinates with and without Energy generation; thermal resistance concept; Analogy between heat and electricity flow; thermal contact resistance; Overall Heat Transfer Coefficient, critical thickness of insulation.

UNIT-2 Types of fins, Fins of uniform cross-sectional area; errors of measurement of temperature in thermometer wells.
Transient Conduction: Transient heat conduction Lumped capacitance method, unsteady state heat conduction in one dimension only, Heisler charts.

UNIT-3
Forced Convection: Basic concepts; hydrodynamic boundary layer; thermal boundary layer, flow over a flat plate; flow across a single cylinder and a sphere; flow inside ducts; empirical heat transfer relations; relation between fluid friction and heat transfer; liquid metal heat transfer.
Natural Convection : Physical mechanism of natural convection; buoyant force; empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and Cylinders, and sphere.

UNIT-4
Thermal Radiation : Basic radiation concepts; radiation properties of surfaces; black body radiation laws; shape factor; black-body radiation exchange; Radiation exchange between non-blackbodies in an enclosure; Infinite parallel Planes, radiation shields;

UNIT-5

Heat Exchanger : Types of heat exchangers; fouling factors; overall heat transfer coefficient; logarithmic Mean temperature difference (LMTD) method; effectiveness-NTU method; compact heat Exchangers, Steam distribution systems.

Condensation And Boiling : Introduction to condensation phenomena; heat transfer relations for laminar film condensation on vertical surfaces and on a horizontal tube; Boiling modes pool boiling, curve, forced convective boiling.

Introduction To Mass Transfer : Introduction; Flick's law of diffusion; steady state equimolar counter diffusion; steady state diffusion though a stagnant gas film.

Suggested Books:

1. Elements of Heat transfer by Cengel, TMH
2. Heat and mass transfer, M.Thirumaleswar, Pearson
3. Fundamentals of Heat & Mass Transfer by Incropera Wiley India
4.Heat& Mass Transfer by Khurmi, Schand,New Delhi 18

Suggested Experiments:

1. Conduction - Composite wall experiment
2. Conduction - Composite cylinder experiment
3. Convection - Pool Boiling experiment
4. Convection - Experiment on heat transfer from tube-natural convection.
5. Convection - Heat Pipe experiment.
6. Convection - Heat transfer through fin-natural convection .
7. Convection - Heat transfer through tube/fin-forced convection.
8. Any experiment - Such as on Stefen's Law, on radiation detrmination of emissivity, etc.
9. Any experiment - Such as on solar collector, etc. on radiation
10. Heat exchanger - Parallel flow experiment
11. Heat exchanger - Counter flow experiment
12. Any other suitable exp such as on critical insultation thickness.
13. Conduction - Determination of thermal conductivity of fluids.
14. Conduction - Thermal Contact Resistance Effect.

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New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET 504-(A) Internal Combustion Engines	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To familiarize with the terminology associated with IC engines.
2. To understand the basics of IC engines.
3. To understand combustion, and various parameters and variables affecting it in various types of IC engines.
4. To learn about various systems used in IC engines and the type of IC engine required for various applications

Course Outcome:

1. Analyse engine classification Cycle analysis
2. Estimate Combustion in SI engine, abnormal combustion and it's control, combustion.
3. Categorize different Fuel injection in CI engines and Fuel injectors.
4. Analyse cooling systems, Cooling Towers & Radiators.
5. To Analyse Performance parameters and Testing of SI and CI engines.

Detailed Content:

Unit 1: Introduction of IC Engine:

Internal Combustion Engine: S.I. and C.I. engines of two and four stroke cycles, real cycle analysis of SI and CI engines, determination of engine dimensions, speed, fuel consumption, output, mean effective pressure, efficiency, factors effecting volumetric efficiency, heat balance, performance characteristics of SI and CI engines, cylinder arrangement, firing order, power balance for multi-cylinder engines .

Unit 2: Combustion in SI engines:

Flame development and propagation, Pressure-Crank Angle diagram, Stages of Combustion ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical aspects, abnormal Combustion, effect of engine and fuel variables on abnormal combustion, pre-ignition, its causes and remedy, salient features of various type combustion chambers.

Unit 3: Combustion in CI Engines:

Various stages of combustion in CI Engines, delay period, diesel knock, knock inhibitors, salient features of various types of combustion chambers. Fuel injection in CI engine, Working Principle of fuel pump & fuel injectors, types of nozzles. Fuel injection in SI engine (MPFI, TBI,CRDI), Theory of carburetion, SolexCarburetor, simple problems on carburetion. Fuel metering in CI engines

Unit 4: Fuel:

Classification of IC Engine fuels, Desirable characteristics of SI & CI engine fuels, Rating of SI & CI engine fuels, Alternative fuels for SI and CI engine (liquid, gaseous, hydrogen, LPG, CNG, Biogas etc.), Air requirement, Analysis of combustion products, HHV and LHV of fuels.

Unit 5: Supercharging & Turbo charging:

Methods of supercharging, & turbo charging Effects of super charging and turbo charging.
Engine Modifications for supercharging, supercharging of two stroke engines. Microprocessor controlled supercharging. Cooling & lubrication of SI & CI Engines.

Suggested books:

1. J.B. Heywood. Internal combustion Engines, Wiley
2. Ganeshan V; Internal Combustion engines; TMH
3. Mathur M L & Sharma RP; A. Course in IC engines; DhanpatRai
4. R Yadav, Internal Combustion Engines
5 Halderman JD and Mitchell CD; Automotive Engines theory and servicing; Pearson
6. DomKundwar; Internal Combustion Engines;DhanpatRai Publications
7. Taylor GF; Internal Combustion Engines Theory & Practice; MIT Press
8. Richard Stone; Introduction to IC Engines; Society of Automotive Engr (Palgrave McMillan)

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET 504-(B)Machine Tool Design	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. Study of various machine internal parts
2. Dynamics of machining by varying parameters
3. Automation of machine parts

Course Outcome:

1. Students are able to apply the transmission concept.
2. Identify various parts of machine tools
3. Apply various design aspects of spindles and bearings
4. Reduce vibration and chatter developing on machine tools

Detailed Content:

Unit 1: Machine Tool Drive: working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission, General requirements of machine tool design, Layout of machine tools

Unit 2: Regulation of Speed and Feed Rates: Aim of speed feed regulation, stepped regulation of speed, design of speed box, Design of feed box, Special cases of gear box design, Set stopped regulation of speed and feed rates.

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Unit 3: Design of Machine Tool Structure: Fundamentals of machine tool structures and their requirements, Design criteria of machine tool structure, Static and dynamic stiffness, Design of beds and columns, Design of housing models, Techniques in design of machine tool structure.

Unit 4: Design of Guide-ways and power Screws: Function and type of guide-ways, design of slide-ways, protecting devices for slide-ways, Design of power screws. Design of Spindles and Spindle Supports: Materials for spindles, Design of spindles, Antifriction bearings, Sliding bearings.

Unit 5: Dynamics of Machines Tools: General procedure of assessing dynamic stability of EES, Cutting processing, closed loop system, Dynamic characteristics of cutting process, Stability analysis.

Suggested books:

1. Machine Tool Design by N.K. Mehta, Tata McGraw Hill
2. Machine Tool design Handbook - CMTI Banglore

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET-504 (C) Alternate Automotive Fuels & Emissions	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To present a problem oriented in depth knowledge of Alternate fuel and energy system.
2. To address the underlying concepts and methods behind alternate fuel and energy system.

Course Outcome:

1. Categorize, interpret and understand the essential properties of fuels for IC engines
2. Identify the need for alternate fuels and characterize prospective alternate fuels
3. Evaluate the vehicle fuel storage and dispensing facility requirements.
4. Analyze the implement limitations with regard to performance, emission and materials compatibility.
5. Develop strategies for control of emissions as per the legislation standards.

Detailed Content:

Unit 1: Introduction Automobile Fuels:

Classification of Automobile alternative fuels (liquid, gaseous, hydrogen, LPG, CNG, Biogas etc.), Desirable characteristics of SI & CI engine alternative fuels, Rating of SI & CI engine fuels, Introduction to alternate energy sources. Like EV, hybrid, fuel cell and solar cars. Merits and demerits of various alternate fuels.

Unit 2: Liquid alternative fuels:

Vegetable Oils: Various vegetable oils for automobile engines, esterification, performance in engines, performance and emission characteristics, bio diesel and its characteristics. Alcohols: Properties as engine fuel, alcohols and gasoline blends, performance in automobile engine, methanol and gasoline blends.

Unit 3: Gaseous Fuels:

Biogas: Introduction to Biogas system, Process during gas formation, Factors affecting biogas formation. Usage of Biogas in SI engine & CI engine., Properties of Natural gas, Hydrogen gas, LPG & CNG as engine fuels, storage and handling, performance and safety aspects to all gaseous fuel, fuel metering systems.

Unit 4: Automobile emissions:

Types of automobile emissions, emission characteristics, formation of automobile emissions, mechanism of HC , CO and NO in SI engine, exhaust emission and factors affecting the emission, evaporative emission, crankcase emission, lead emission CI engine emissions: formation of smoke, factors affecting the smoke formation, unburned hydrocarbons, carbon monoxide, oxides of nitrogen, smog and comparison of diesel and petrol emissions.

Unit 5:Emissions Norms & Measurement:

Emission norms as per Bharat Standard up to BS – IV and procedures for confirmation on production.Demerits of automobile emission to environment. Types Of Catalytic Conversion, Measurement Techniques Emission Standards and Test Procedure NDIR,FID, Chemiluminescentanalyzers, Gas Chromatograph, smoke meters, emission standards.

Suggested Books:

1. J.B. Heywood. Internal combustion Engines, Wiley
2. Ganeshan V; Internal Combustion engines; TMH
3. Mathur M L & Sharma RP; A. Course in IC engines; DhanpatRai
4. R Yadav, Internal Combustion Engines
5 Halderman JD and Mitchell CD; Automotive Engines theory and servicing; Pearson
6. DomKundwar; Internal Combustion Engines; DhanpatRai Publications
7. Taylor GF; Internal Combustion Engines Theory & Practice; MIT Press
8. Richard Stone; Introduction to IC Engines; Society of Automotive Engr (Palgrave McMillan)

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET- 505 (A) Principle of Management	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To enable the students to study the evolution of Management.
2. To study the functions and principles of management.
3. To learn the application of the principles in an organization.
4. To enable the effective and barriers communication in the organization
5. To study the system and process of effective controlling in the organization

Course Outcome:

1. Students will be able to have clear understanding of managerial functions like planning, and have same basic knowledge on international aspect of management.
2. To understand the planning process in the organization
3. To understand the concept of organization
4. Demonstrate the ability to directing, leadership and communicate effectively
5. To analysis isolate issues and formulate best control methods

Detailed Content:

UNIT 1

INTRODUCTION TO MANAGEMENT: Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system.

UNIT 2

MANAGEMENT INFORMATION: Interaction with external environment. Managerial decision making and MIS.

UNIT 3

PLANNING APPROACH TO ORGANIZATIONAL ANALYSIS: design of organization structure; job design and enrichment; job evaluation and merit rating. 3

UNIT 4

MOTIVATION AND PRODUCTIVITY: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques. Case studies.

Suggested Books:

1.Schermerhorn,; Management and Organisational Behaviour essentials, Wiley India
2. Koontz: Essentials of Management, PHI Learning.
3. Hirschey: Managerial Economics, Cengage Learning.
4.A V Rau: Management Science, BSP, Hyderabad
5.Mote, l Paul and Gupta: Managerial Economics Concepts & Cases, TMH, New Delhi.
6.Stephan R Robbins Fundamental of Management, Pearson

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET- 505 (B) TQM and SQC	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To facilitate the understanding of total quality management principles and processes
2. Evaluate the principles of quality management and to explain how these principles can be applied within quality management systems.
3. Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality.
4. Critically appraise the organisational, communication and teamwork requirements for effective quality management.
5. Critically analyse the strategic issues in quality management, including current issues and developments, and to devise and evaluate quality implementation plans.

Course Outcome:

1. Analyze& Correlate the importance of quality control
2. Compare and analyze the concept of Quality Management
3. To analyze the concept of quality circle.
4. Categorize and apply Quality function, decentralization and Theory of control charts
5. Distinguish different types IS0-9000 series and its concept of Quality.

Detailed Content:

Unit 1 Evolution of total quality management, historical perspective, teamwork, TQM and ISO 9000; information technology and Business Process Re-engineering (BPR); TPM and quality awards; aids and barriers to quality mgt, creating vision and initiating transformation, establishing programs for education and self-coordination, policy setting and review, flowchart of policy mgt and relation with daily mgt. improvements, measurement of key indicators; quality mgt leader; cross functional teams and coordination, policy setting and review, flowchart of policy mgt and relation with daily mgt.

Unit 2 Process- definition, variation and feedback, funnel-marble experiment- rules of adjustment and its effects, quality- definition, goalpost and kaizen view, quality of design, conformance and performance; Taguchi loss function, cost of quality, chain action of improving quality to productivity to motivation and low cost; Deming's theory of mgt, fourteen points and variance reduction; attributes enumerative and variables analytic studies.

Unit 3 SQC-Control charts: basic discrete and continuous distributions, measures of central tendency, variability and shapes, sampling, size and central value theorem, control chart structure, process plotting and stability, study of out-of-control evidences, defect detection and prevention, use of control charts in evaluating past, present and future trends; attribute control charts, count and classification charts, construction and interpretation of p , np , c and u charts, PDSA cycle(plan, do, study, act), and R charts, and s charts, individual and moving range chart, trial control limits and out of control points.

Unit 4 Process diagnostics: Between and Within Group variations, periodic and persistent disturbances, control chart patterns-natural, level-shift, cycle, wild, multi-universe, relationship and other out of control patterns; diagnosing a process, brainstorming; cause-effect, Ishikava, interrelationship, systematic and matrix diagrams; change concepts and waste elimination

Unit 5 Process improvement: Performance and technical specifications, attribute-process and variable-process capability studies; unstable and stable process capability studies and examples; attribute and variable improvement studies; Inspection: acceptance sampling(AS)- lot formation, single, double and multiple/sequential sampling plans, operating characteristic (OC) curve, producer and consumer risk, theoretical invalidation of AS, kp rule for stable and chaotic processes.

Suggested Books:

1. Gitlow HS, Oppenheim et al; Quality Management; TMH
2. Gryna FM; Juran's Quality Planning and Analysis; TMH
3. Crosby Philips; Quality is still free; New Amer Library
4. Kulkarni VA and Bewoor AK; Quality Control; Wiley
5. Jankiraman B and Gopal RK; Total Quality Management- Text and Cases; PHI Learning
6. Sugandhi L and Samual A; Total Quality Management; PHI Learning
7. Subburaj R; Total Qality Management; TMH
8. Naidu Babu and Rajendran; TQM; New age International pub;
9. Chase Richard B et al; Operations management; SIE-TMH
10. Chary SN; Production and Operations Management; TMH 12

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET- 505 (C) Innovation and Entrepreneurship	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities
2. To develop the ability of analyzing and understanding business situations in which entrepreneurs act and to master the knowledge necessary to plan entrepreneurial activities.
3. Develop the ability of analyzing various aspects of entrepreneurship – especially of taking over the risk, and the specificities as well as the pattern of entrepreneurship development and, finally, to contribute to their entrepreneurial and managerial potentials.

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Course Outcome:

1. Key concepts underpinning entrepreneurship and its application in the recognition and exploitation of product/ service/ process opportunities
2. Key concepts underpinning innovation and the issues associated with developing and sustaining innovation within organizations
3. How to design creative strategies for pursuing, exploiting and further developing new opportunities
4. Issues associated with securing and managing financial resources in new and established organizations

Detailed Content:

UNIT 1: Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.

UNIT 2: Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.

UNIT 3: Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity,

UNIT 4: Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

Suggested Books:

1. Khanka. S.S., "Entrepreneurial Development" S.Chand& Co. Ltd.,Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, " Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.
4. Mathew J Manimala, "Enterprenuership theory at cross roads: paradigms and praxis" 2nd Edition Dream tech, 2005.

5. Rajeev Roy, ‘Entrepreneurship’ 2nd Edition, Oxford University Press, 2011.
6. EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development”, Institute of India, Ahmadabad, 1986.

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Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

BMET- 601	Turbomachinery	L	T	P
BMEP- 601		3	1	2

Objectives:

1. Giving an overview of different types of turbomachinery used for energy transformation
2. It will focus on applications in power generation, transport, refrigeration and the built environment.

Course Outcome:

1. Determine the velocity triangles in turbomachinery stages operating at design and offdesign conditions
2. Apply the affinity laws to pumps such as to determine their off-design behavior.
3. Perform the preliminary design of turbomachines (pumps, compressors, turbines) on a 1- D basis
4. Recognize relations between choices made early in the turbomachinery design process and the final components and operability
5. Recognize and discuss today's and tomorrow's use of turbomachines for enabling a sustainable society

Detailed Content:

Unit 1: **Energy transfer in turbo machines**: Application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only.

Unit 2: **Steam turbines**: Impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height. Reactions staging: Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.

Unit 3: Water turbines: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines. Centrifugal Pumps: classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done. Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitations.

Unit 4 : Rotary Fans, Blowers and Compressors:Classification based on pressure rise, centrifugal and axial flow machines. Centrifugal Blowers Vane shape, velocity triangle, degree of reactions, slip coefficient, size and speed of machine, vane shape and stresses, efficiency, characteristics, fan laws and characteristics. Centrifugal Compressor – Vector diagrams, work done, temp and pressure ratio, slip factor, work input factor, pressure coefficient, Dimensions of inlet eye, impeller and diffuser. Axial flow Compressors- Vector diagrams, work done factor, temp and pressure ratio, degree of reaction, Dimensional Analysis, Characteristics, surging, Polytrophic and isentropic efficiencies.

Unit 5: Power transmitting turbo machines: Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics, Positive displacement machines and turbo machines, their distinction. Positive displacement pumps with fixed and variable displacements, Hydrostatic systems hydraulic intensifier, accumulator, press and crane.

Suggested Books:

1. Venkanna BK; turbomachinery; PHI
2. Shepherd DG; Turbo machinery
3. Csanady; Turbo machines
4. Bansal R. K; Fluid Mechanics & Fluid Machines;
5. Rogers Cohen &SarvanMulto Gas Turbine Theory
6. Kearton W. J; Steam Turbine: Theory & Practice

Suggested Experiments:

1. Turbine exp. on Pelton wheel. (turbine efficiency)
2. Turbine exp. on Francis turbine. (turbine efficiency)
4. Tubrine exp. on Kaplan turbine. (turbine efficiency)
5. Exp. on Reciprocating pump.
6. Exp. on centrifugal pump.
7. Exp. on Hydraulic Jack/Press
8. Exp. on Hydraulic Brake
9. Exp. on Hydraulic Ram
10.Any other suitable experiment/test rig such as comparision & performance of different types of pumps and turbines.

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

BMET- 602	**Machine Component Design-II**	**L**	**T**	**P**
BMEP- 602		**3**	**0**	**4**

Objectives:

1. Enable students to attain the basic knowledge required understanding, analyzing, designing and select machine elements required in transmission systems.
2. To develop the ability of the selection of gear types, sizing, analysis and material selection of gear systems.
3. To develop the ability of the selection of bearings, analysis and material selection of bearings.
4. To develop an ability to design I.C. Engine parts, component, or process to meet desired needs.
5. To analyze identify, formulate, and solve engineering problems.

Course Outcome:

1. Select appropriate gears for power transmission on the basis of given load and speed.
2. Understand the standard geometry, application, failures of Gear and Design and Developed effectively Gears for different loading conditions
3. Select bearings for a given applications from the manufacturers catalogue.
4. Design and Develop bearings under different loading conditions

Detailed Content:

Unit 1:. Spur Gears Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems,Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods,Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth,Failure of gear tooth, Design of spur gears, AGMA and Indian standards.

Unit 2: Helical Gears Terminology, Proportions for helical gears, Beam strength and wear strength of helicalgears, herringbone gears, crossed helical gears, Design of helical gears.

Unit 3: Worm Gears Types of worms, Terminology, Gear tooth proportions, Efficiency of worm gears, Heatdissipation in worm gearing, Strength and wear tooth load for worm gears, Design of worm gearing

Unit 4 : Sliding Contact Bearing Types, Selection of bearing, Plain journal bearing, Hydrodynamic lubrication,Properties and materials, Lubricants and lubrication, Hydrodynamic journal bearing, Heat generation,Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing,

Unit 5: Rolling Contact Bearing Advantages and disadvantages, Types of ball bearing, Thrust ball bearing,Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings,Dynamic equivalent load for roller contact bearing under constant and variable loading, Reliability ofBearing, Selection of rolling contact bearing, Lubrication of ball and roller bearing, Mounting of bearing.

Suggested Books:

1. Mechanical Design Theory and methodology by Waldron, Springer India
2. Machine Design by Juvinall, Wiley India , New Delhi
3. Handbook of Gear Design by Maitra ,TMH
4. Shigleys Mechanical Engineering Design ,TMH

Suggested Experiments:

1. Study of Design consideration and Gear manufacturing methods.
2. Design of spur Gear- (specific design conditions provided by instructor)
3. Calculation of Beam strength of gear tooth & Dynamic tooth load- (specific design conditions provided by instructor)
4. Design of helical Gear-(specific design conditions provided by instructor)
5. Design of Worm Gear-(specific design conditions provided by instructor)
6. Design of Sliding contact Bearing-(specific design conditions provided by instructor)
7. Design of Rolling contact bearing-(specific design conditions provided by instructor)
8. Design of Journal bearing-(specific design conditions provided by instructor)

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New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

		L	T	P
BMET-603 **BMEP-603**	**Refrigeration and Air Conditioning**	**3**	**1**	**2**

Objectives:

1. To understand the principles of refrigeration and air conditioning.
2. To calculate the cooling load for different applications.
3. To select the right equipment for a particular application.
4. To design and implement refrigeration and air conditioning systems using standards.
5. Energy Conservation and Management.

Course Outcome:

1. Interpret the working principles and applications of refrigeration systems.
2. Interpret the vapour compression refrigeration system and identify methods for Performance improvement.
3. Demonstrate the working principles of air, vapour absorption, thermoelectric and estimate the condition of steam and performance of vapour power cycle and vapour compression cycle.
4. Analyze air-conditioning processes using the principles of psychrometry and estimate various essential properties related to Psychrometry and processes.
5. Evaluate cooling and heating loads in an air-conditioning system.

Detailed Content:

Unit-1

Refrigeration:

Introduction to refrigeration system, Methods of refrigeration, Carnot refrigeration cycle, Unit of refrigeration, Refrigeration effect & C.O.P. Air Refrigeration cycle: Open and closed air refrigeration cycles, Reversed Carnot cycle, Bell Coleman or Reversed Joule air refrigeration cycle, Aircraft refrigeration system, Classification of aircraft refrigeration system. Boot strap refrigeration, Regenerative, Reduced ambient, Dry air rated temperature (DART).

Unit-2

Vapour Compression System:

Single stage system, Analysis of vapour compression cycle, use of T-S and P-H charts,

Effect of change in suction and discharge pressures on C.O.P, Effect of sub cooling of condensate & superheating of refrigerant vapour on C.O.P of the cycle, Actual vapour compression refrigeration cycle, Different configuration of multistage system, Cascade system.

Unit-3

Vapour Absorption system;

Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems, Ammonia – Water vapour absorption system, Lithium- Bromide water vapour absorption system, Comparison.

Refrigerants:

Classification, Nomenclature, Desirable properties of refrigerants, Common refrigerants,

Secondary refrigerants and CFC free refrigerants

Unit-4

Air Conditioning:

Introduction to air conditioning, Psychometric properties and their definitions, Psychometric chart, Different Psychometric processes, Thermal analysis of human body Effective temperature and comfort chart, Cooling

and heating load calculations, Infiltration & ventilation, Internal hear gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP).

Unit-5

Refrigeration Equipment & Application:

Elementary knowledge of refrigeration & air conditioning equipmentse.g compressors, condensers, evaporators & expansion devices, Air washers, Cooling, towers & humidifying efficiency, Food preservation, cold storage, Refrigerates Freezers, Icc plant, Water coolers,

Elementary knowledge of transmission and distribution of air through ducts and fans, Basic difference between comfort and industrial air conditioning.

Suggested Books:

1. Refrigeration and Air conditioning by C.P Arora.TMH
2. Refrigeration and Air conditioning by Arora&Domkundwar.DhanpatRai
3. Refrigeration and Air conditioning by stoecker& Jones.
4. Refrigeration and Air conditioning by Roy J. Dossat.Pearson
5. Heating Ventilating and Air conditioning by Mcquiston
6. Thermal Environment Engg. byKuhen, Ramsey &Thelked. Central Book Agency.
7. ASHRAE Handbooks

Suggested References:

1. Visit a chilling plant and determine the COP and tonnage capacity of the chilling plant.
2. Experiment on refrigeration test ring and calculation of various proformance parameters.
3. To determine COP and tonnage capacity of a Air conditioning system.
4. To determine the COP and tonnage capacity of a Mechanical Heat Pump.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. To study air washers
7. Study & determination of volumetric efficiency of compressor.
8. To study different types of expansion devices used in refrigreation system.
9. To study different types of evaporators used in refrigeration systems.
10. To study basic components of air-conditioning system

Uttarakhand Technical University, Dehradun

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Mechanical Engineering, V-Semester

BMET- 604 (A) Mechatronics	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

(i) Tounderstand the structure of microprocessors and their applications in mechanical devices

(ii) To understand the principle of automatic control and real time motion control systems, with thehelp of electrical drives and actuators

(iii) To understand the use of micro-sensors and their applications in various fields.

Course Outcome:

1. Install, troubleshoot, maintain and repair mechatronic systems using industry-standard tools, practices, and procedures.
2. Assist in design and rebuilding projects.
3. Follow, develop, and troubleshoot manufacturing processes and procedures.
4. Organize, interpret, and use technical information and documentation.
5. mechatronics applications and the use of micro-sensors and microprocessors.

Detailed Content:

UNIT – 1 INTRODUCTION: Definition of Mechatronics, Multi-disciplinary scenario, origins. Evaluation of Mechatronics, An over view of mechatronics, Design of mechatronics system.Measurements system and function of main elements of measurement systems. Need for mechatronics in industries. Objectives, advantages and disadvantages of mechatronics.
Microprocessor based controllers. Principle of working of engine management system, automatic washing machine.

UNIT – 2 REVIEW OF TRANSDUCERS AND SENSORS: Defination and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensors and Hall effect sensors. **MICROPROCESSOR**: Introduction, Microprocessor based digital control. Digital member system, binary and hexadecimal number system, Logic functions, Data word representation basic Elements of control systems.

UNIT 3 : MICROPROCESSOR ARCHITECTURE: 8085A processor architecture
Terminology-such as, CPU, memory and address, ALU, assembler, data, registers, Fetch cycle, write cycle, state, bus interrupts. Micro controllers – difference between microprocessor and micro controllers. Requirements for control and their implementation in micro controllers.Classification of micro controllers.

Unit 4 :ELECTRICAL ACTUATORS: Actuator and actuator system. Classifications of actuator system with examples.Mechanical switches.Concept of bouncing Methods of Preventing bouncing of mechanical switches.Solenoids, Relays. Solid state switches – Diodes, Thyristors, Triacs, Trasistors, Darlington pair. Electrical actuator. Principle, construction and working of AC, DC motors, stepper motors, permanent motors, servomotors, Servo systems and control
HYDRAULIC ACTUATORS: Valves – Classifications, Pressure Control Valves – Pressure
relief valves, Pressure regulating/reducing valves, Pressure sequence valve. Flow control valves – Principle, needle valve, globe valve. Direction control valve –sliding spool valve, solenoid operated.

Unit 5 :**SINGLE CONDITIONING:** Concept, necessity, op-amps, protection, filtering, wheat stone bridge – Digital Signals – Multiplexer. Data acquisition – Introduction to digital signal processing – Concepts and different methods.

Suggested Books:

1. **Mechatronics** – Principles, Concepts and applications – Nitaigour and Premchand, Mahilik – Tata McGraw Hill -2003
2. **Mechatronics** – W. Bolton, Pearson Education Asia -2nd Edition, 2001.
3. **Introduction to mechatronics and measurement systems** –David G. Alciatore& Michel BiHistand – Tata McGraw Hill –2000
4. **Mechatronics** – H.D. Ramachandra – Sudha Publication -2003 **Mechatronics** by HMT Ltd. – Tata McGrawHill -2000.
5. **Mechatronics System design** by DevadasShetty and Richard A. Kark – Thomas Learining -1997.
6. **Mechatronics an Introduction** by Robert H Bishop – CRC
7 Mechatronics systems Fundamentals by Rolf Isermann - Springer

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New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, V-Semester

BMET- 604 (B) Finite Element Method	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To illustrate the principle of mathematical modeling of engineering problems
2. To introduce the basics and application of Finite Element Method.
3. To provide the fundamental concepts of the theory of the finite element method
4. To develop proficiency in the application of the finite element method to realistic engineering problems through the use of a major commercial general-purpose finite element code.

Course Outcome:

1. to obtain an understanding of the fundamental theory of the FEA method;
2. to develop the ability to generate the governing FE equations for systems governed by partial differential equations;
3. to understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements; and
4. to understand the application and use of the FE method for heat transfer problems.
5. to demonstrate the ability to create models for trusses, frames, plate structures, machine parts, and components using ANSYS general-purpose software

Detailed Content:

Unit-I :Introduction -Structural analysis, objectives, static, Dynamic and kinematics analyses, Skeletal and continuum structures, Modeling of infinite d.o.f. system into finite d.o.f. system, Basic steps in finite element problem formulation, General applicability of the method.

Unit-II :Element Types and Characteristics -Discretization of the domain, Basic element shapes, Aspect ratio, Shape functions, Generalized co-ordinates and nodal shape functions. ID spar and beam elements, 2D rectangular and triangular elements, Axisymmetirc elements.

Unit-III :Assembly of Elements and Matrices -Concept of element assembly, Global and local co-ordinate systems, Band width and its effects, Banded and skyline assembly, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Choleksy decomposition methods, Numerical integration, One and 2D applications.

Unit-IV :Higher Order and Isoparametric Elements -One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Area co-ordinate system continuity and convergence requirements, 2D rectangular and triangular requirement.

Unit-V :Static & Dynamic Analysis -Analysis of trusses and frames, Analysis of machine subassemblies, Use commercial software packages, Advantages and limitations Hamilton's principle, Derivation of equilibrium, Consistent and lumped mass matrices, Derivation of mass matrices for ID elements, Determination of natural frequencies and mode shapes, Use of commercial software packages.

Suggested Books:

1. Rao, S.S., The Finite Element Method in Engineering, 2nd ed.., Peragamon Press, Oxford.
2. Robert, D. Cook., David, S. Malkins, and Michael E. Plesha, Concepts and Application of Finite Element Analysis 3rd ed., John Wiley
3. .Chandrupatla, T.R. anBelegundu, A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Pvt. Ltd.
4. Zienkiewicz O C, The Finite Element Method, 3rd ed, Tata McGraw Hill.

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Mechanical Engineering, VI-Semester

BMET- 604 (C) Product Design	L	T	P
	3	0	0

Objectives:

1. The program trains multidisciplinary designers to use their creativity, design thinking, and design process to bring new ideas, products, and value to companies, communities, and people.
2. Applying diverse 2-D and 3-D design skills to create well-conceived and executed objects, products, and systems that service a human need.
3. The program emphasis is on creativity, exploration, design thinking, solution finding, personal expression, aesthetics, craftsmanship, and entrepreneurship in the creation of lifestyle products and packaging for the global consumer market. 4.The program assists each student in developing personal career pathways to success.

Course Outcome:

1. Use the Product Design and Development Process, as a means to manage the development of an idea from concept through to production.
2. Apply creative process techniques in synthesizing information, problem-solving and critical thinking.
3. Demonstrate and employ hand drawing and drafting principles to convey concepts.
4. Use basic fabrication methods to build prototype models for hard-goods and soft-goods and packaging.
5. Demonstrate, apply, explain, and recognize basic engineering, mechanical, and technical principles.

Detailed Content:

Unit 1: Introduction to product design

Product life-cycle, product policy of an organization. Selection of a profitable product, Product design process, Product analysis.

Unit 2: Value engineering in product design

Advantages, applications in product design, problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, functional analysis: Functional Analysis System Technique (FAST), Case studies.

Unit 3: Introduction to Product design tools

QFD, Computer Aided Design, Robust design, DFX, DFM. DFA, Ergonomics in product design.

Unit 4: DFMA guidelines

Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc.,

Unit-5: Rapid Prototyping

Needs of rapid prototyping, needs, advantages, working principles of SLA, LOM and SLS.

Suggested Books:

1. Value Engineering: Concepts, Techniques and Applications by A.K. Mukhopadhaya
2. Rapid Prototyping: Principles and Applications by C.K. Chua
3. Engineering Design by Linda D. Schmidt

Uttarakhand Technical University, Dehradun

New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

BMET- 605 (A) Robotics	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To acquire the knowledge on advanced algebraic tools for the description of motion.
2. To develop the ability to analyze and design the motion for articulated systems.
3. To develop an ability to use software tools for analysis and design of robotic systems

Course Outcome:

1. Be able to use matrix algebra and Lie algebra for computing the kinematics of robots.
2. Be able to calculate the forward kinematics and inverse kinematics of serial and parallel robots.
3. Be able to calculate the Jacobian for serial and parallel robot.
4. Be able to do the path planning for a robotic system.
5. Be proficient in the use of Maple or Matlab for the simulation of robots.

Detailed Content:

Unit 1 Introduction:
Need and importance, basic concepts, structure and classification of industrial robots, terminology of robot motion, motion characteristics, resolution, accuracy, repeatability, robot applications.

Unit 2 End Effectors and Drive systems:
Drive systems for robots, salient features and comparison, different types of end effectors, design, applications.

Unit 3 Sensors:
Sensor evaluation and selection, Piezoelectric sensors , linear position and displacement sensing, revolvers, encoders, velocity measurement, proximity, tactile, compliance and range sensing. Image Processing and object recognition.

Unit IV Robot Programming:
Teaching of robots, manual, walk through, teach pendant, off line programming concepts and languages, applications.

Unit V Safety and Economy of Robots:
Work cycle time analysis, economics and effectiveness of robots, safety systems and devices, concepts of testing methods and acceptance rule for industrial robots.

Suggested Books:

1. Mittal RK, Nagrath IJ; Robotics and Control; TMH
2. GrooverM.P,Weiss M, Nagel,OdreyNG; Industrial Robotics-The Appl□; TMH
3. Groover M.P; CAM and Automation; PHI Learning
4. Spong Mark and Vidyasagar; Robot Modelling and control; Wiley India
5. Yoshikava ; Foundations of Robotics- analysis and Control; PHI Learning;
6. Murphy ; Introduction to AI Robotics; PHI Learning
7. FU KS, Gonzalez RC, Lee CSG; Robotics □Control, sensing□; TMH
8. Shimon, K; Handbook of Industrial Robots; John Wiley & Sons,.
9. GhosalAshitava; Robotics Fundamental concepts and analysis; Oxford
10. Saha S; Introduction to Robotics; TMH
11. Yu Kozyhev; Industrial Robots Handbook; MIR Pub.22

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Mechanical Engineering, VI-Semester

BMET- 605 (B) Optimization Techniques	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems
2. To develop and promote research interest in applying optimization techniques in problems of Engineering and Technology
3. To apply the mathematical results and numerical techniques of optimization theory to concrete Engineering problems.

Course Outcome:

1. Understand importance of optimization of industrial process management.
2. Apply basic concepts of mathematics to formulate an optimization problem.
3. analyze and appreciate variety of performance measures for various optimization problems

Detailed Content:

Unit 1 Introduction to Optimization:
Engineering application of Optimization – Statement of an Optimization problem - Optimal Problem formulation - Classification of Optimization problem. Optimum design concepts, Definition of Global and Local optima – Optimality criteria - Review of basic calculus concepts – Global optimality

Unit 2 Linear programming methods for optimum design:
Review of Linear programming methods for optimum design – Post optimality analysis - Application of LPP models in design and manufacturing.

Unit 3 Optimization algorithms for solving unconstrained optimization problems:
Gradient based method: Cauchy's steepest descent method, Newton's method, Conjugate gradient method.

Unit-4 Optimization algorithms for solving constrained optimization problems:
Direct methods – penalty function methods – steepest descent method - Engineering applications of constrained and unconstrained algorithms.

Unit 5 Modern methods of Optimization:
Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search – Neural-Network based Optimization – Fuzzy optimization techniques – Applications.Use of Matlab to solve optimization problems.

Suggested Books:

1. Rao S. S. - 'Engineering Optimization, Theory and Practice' - New Age International Publishers - 2012 - 4th Edition.
2. Deb K. - 'Optimization for Engineering Design Algorithms and Examples' – PHI - 2000
3. Arora J. - 'Introduction to Optimization Design' - Elsevier Academic Press, New Delhi - 2004
4. .Saravanan R. - 'Manufacturing Optimization through Intelligent Techniques' - Taylor & Francis (CRC Press) - 2006
5. Hardley G. -'Linear Programming' - Narosa Book Distributors Private Ltd. - 2002

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New Scheme of Examination as per AICTE Flexible Curricula

Mechanical Engineering, VI-Semester

BMET- 605 (C) Renewable Energy Technology	**L**	**T**	**P**
	3	**0**	**0**

Objectives:

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application
5. Analyse the environmental aspects of renewable energy resources.

Course Outcome:

1. Describe the environmental aspects of non-conventional energy resources.

2. Know the need of renewable energy resources, historical and latest developments.

3. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.

4. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.

5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants-applications

Detailed Content:

UNIT-I Solar Radiation:

Extra-terrestrial and terrestrial, radiation measuring instrument, radiation measurement and predictions. Solar thermal conversion: Basics, Flat plate collectors-liquid and air type. Theory of flat plate collectors, selective coating, advanced collectors, Concentrators: optical design of concentrators, solar water heater, solar dryers, solar stills, solar cooling and refrigeration. Solar photovoltaic: Principle of photovoltaic conversion of solar energy; Technology for fabrication of photovoltaic devices; Applications of solar cells in PV generation systems; Organic PV cells.

UNIT-II Wind Energy:

Characteristics and measurement: Metrology of wind speed distribution, wind speed statistics, Weibull, Rayleigh and Normal distribution, Measurement of wind data, Energy estimation of wind regimes;

Wind Energy Conversion: Wind energy conversion principles; General introduction; Types and classification of WECS; Power, torque and speed characteristics; power curve of wind turbine, capacity factor, matching wind turbine with wind regimes; Application of wind energy.

UNIT-III Production of biomass:

Photosynthesis-C3 & C4 plants on biomass production; Biomass resources assessment; Co2 fixation potential of biomass; Classification of biomass; Physicochemical characteristics of biomass as fuel Biomass conversion routes: biochemical, chemical and thermo chemical Biochemical conversion of biomass to energy: anaerobic digestion, biogas production mechanism, technology, types of digesters, design of biogas plants, installation, operation and maintenance of biogas plants, biogas plant manure-utilization and manure values. Biomass Gasification: Different types, power generation from gasification, cost benefit analysis of power generation by gasification.

UNIT-IV Small Hydropower Systems:

Overview of micro, mini and small hydro system; hydrology; Elements of turbine; Assessment of hydro power; selection and design criteria of turbines; site selection and civil works; speed and voltage regulation; Investment issue load management and tariff collection; Distribution and marketing issues. Ocean Energy: Ocean energy resources, ocean

energy routs; Principle of ocean thermal energy conversion system, ocean thermal power plants. Principles of ocean wave energy and Tidal energy conversion.

UNIT-V Geothermal Energy:
Origin of geothermal resources, type of geothermal energy deposits, site selection geothermal power plants; Hydrogen Energy: Hydrogen as a source of energy, Hydrogen production and storage. Fuel Cells: Types of fuel cell, fuel cell system and sub-system, Principle of working, basic thermodynamics

Suggested Bookss:
1. Kothari, Singal&Rajan; Renewable Energy Sources and Emerging Technologies, PHI Learn
2. Khan, B H, Non Conventional Energy, TMH.
3. Sukhatme and Nayak, Solar Energy, Principles of Thermal Collection and Storage, TMH.
4. Tiwari and Ghosal, Renewable Energy Resources: basic principle & application, NarosaPubl
5. KoteswaraRao, Energy Resources, Conventional & Non-Conventional, BSP Publication.
6. Chetan Singh Solanki, Solar Photovoltaics: Fundamental, technologies and Application,PHI L
7. AbbasiTanseem and Abbasi SA; Renewable Energy Sources; PHI Learning
8. Ravindranath NH and Hall DO, Biomass, Energy and Environment, Oxford University Press.
9. Duffie and Beckman, Solar Engineering of Thermal Process, Wiley
10. Nikolai, Khartchenko; Green Power; Tech Book International
11. Tester, Sustainable Energy-Choosing Among Options, PHI Learning.
12. Godfrey Boyle, Renewable Energy: Power for a sustainable future, Oxford OUP. 24