BHARTI VISHWAVIDYALAYA, DURG

SCHEME OF TEACHING AND EXAMINATION

Courses of Study and Scheme of Examination of P 1 Group

B. Tech. (First Semester - Common to all Branches of Engineering)

S. No.	Courses (Subject)	Course Code	Period per Week			Scheme of Examination			Total Marks	Credit (L+T+P/2)
						Theory/Lab				
			L	T	P	ESE	CT	TA		
1.	Physics-I	BT00101	3	1	-	70	10	20	100	4
2.	Mathematics-I**	BT00102	3	1	-	70	10	20	100	4
3.	Basic Electrical and Electronics Engg.	BT00103	2	1	-	70	10	20	100	3
4.	Engineering Graphics and Design	BT00104	1	0	-	70	10	20	100	1
5.	Fundamentals of Computer	BT00105	2	0	-	70	10	20	100	2
6.	Physics (Lab)	BT00106	-	-	2	35	-	15	50	1
7.	Basic Electrical and Electronics Engg. (Lab)	BT00107	-	-	2	35	-	15	50	1
8.	Fundamentals of Computer (Lab)	BT00108	-	-	2	35	-	15	50	1
9.	Engineering Graphics and Design (Lab)	BT00109	-	-	4	35	-	15	50	2
10.	Value Education	BT00110	-	-	-	-	-	50	50	-
Total Marks			11	3	10	490	50	210	750	19

L-Lecture, T-Tutorial, P-Practical, ESE-End Semester Exam,

CT–Class Test, TA–Teacher's Assessment

Note: - (a) The teaching in the 1st and 2nd Semester will be divided in two groups consisting of branches as shown below:

P1–GROUP: Mechanical Engineering, Civil Engineering, Electronics and Telecommunication Engineering.

Q1–GROUP: Computer Science and Engineering, Electrical Engineering.

(b) *Mathematics–I will be taught to both the groups in the first semester.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 1st | **Branch: Common to all Branches**

Subject: Physics-I | **Course Code: BT00101**

Total Marks in End Semester Exam: 70 | **L: 3 T: 1 P: 0**

Minimum number of Class Tests: 02 | **Min. Marks - 28**

Unit-1: Physical Quantities, Motion in Two or Three dimensions (10hrs.)

Standards and Units, Unit consistency and conversions, Uncertainty and Significant figures, Position and velocity vectors, The Acceleration vector, Projectile motion, Motion in a circle, Relative velocity, Free body diagrams, Conservative and Non-conservative Forces; Central forces, No inertial frames of reference.

Unit-2: Mechanics of Solids (10hrs.)

Angular velocity and acceleration, Rotation with constant angular acceleration, Energy in rotational motion, Parallel axis theorem, Moment of Inertia calculations, Conditions for equilibrium, Bending Stress, Shear stress, Concept of strain energy, *Determination of Moment of Inertia of Fly Wheel, Young's Modulus*, Elastic Module, Concepts of elasticity and plasticity.

Unit-3: Wave Optics (10hrs.)

Superposition of waves and interference of light by wave front splitting and amplitude splitting, Fresnel bi- prism; wedge shaped film, Newton's rings, *Diffraction*, Farunhofer diffraction from a single slit, Diffraction gratings and their resolving power, *Difference between Interference and Diffraction*.

Unit-4: Electrostatics in vacuum and dielectric medium (10hrs.)

Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplace's and Poisson's equations for electrostatic potential, Laws of electrostatics, Polarization, Permeability and dielectric constant, Polar and non-polar dielectrics.

Unit-5: Magneto static in a linear magnetic medium (10hrs.)

Bio-Savart law, Divergence and curl of static magnetic field, vector potential and calculating it for a given magnetic field using Stokes' theorem, Magnetization, Solving for magnetic

field due to simple magnets likea bar magnet, Permeability and Susceptibility, Classification of magnetic materials, Ferromagnetism, Paramagnetic and diamagnetic materials, Magnetic domains and hysteresis.

Unit-6: Faraday's law and Electromagnetic waves (10hrs.)

Faraday's law of electromagnetic induction, Continuity equation for current densities, Maxwell's equation in vacuum, Energy in an electromagnetic field, Flow of energy and Pointing vector, Plane electromagnetic waves in vacuum, Their transverse nature and polarization, Relation between electric and magnetic fields of an electromagnetic wave.

Unit-7: Introduction to Quantum Mechanics (10hrs.)

Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wave function, Free-particle wave function and wave-packets, Uncertainty principle, Solution of stationary-state Schrodinger equation for one dimensional problem like particle in a box.

Unit -8: Solid electronic materials (10hrs.)

Electron in periodic potential, Kronig-Penny model (only basic to introduce origin of band gap), E-k diagram, Electron conduction, Conductivity, Drift velocity, Energy bands in solids, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Fermi level, Effective mass, Density of states and energy band diagrams.

Unit -9: Semiconductors (10hrs.)

Intrinsic and extrinsic semiconductors, Electron and hole concentration, Concept of Fermi Level, Dependence of Fermi level on carrier-concentration and temperature, Doping, impurity states, n and p type semiconductors, Carrier generation and recombination, Law of mass action, Charge neutrality condition, Carrier transport: diffusion and drift, p-n junction, Depletion region and potential barrier, Energy band structure of PN junction in forward and reverse biasing.

Unit-10: Lasers & Fiber Optics (10hrs.)

Einstein's theory of matter radiation interaction and A & B coefficients, amplification of light by population inversion in optical resonator, different types of lasers: gas lasers (He Ne,),

solid-state lasers (ruby, Neodymium), semiconductor laser, Properties of laser beams. Fiber Optics: Introduction, Optical fiber as a dielectric wave guide, Total internal reflection, Numerical aperture, Losses associated with optical fibers, Step and graded index fibers, Application of optical fibers.

Text Books:

1. Introduction to Mechanics-Mahindra K. Verma, Universities Press, Hyderabad
2. David Griffiths, Introduction to Electrodynamics, Addison-Wesley Professional
3. H. J. Pain, The Physics of Oscillations and Waves, Wiley
4. J. Singh, Semiconductor Optoelectronics: Physics and Technology McGraw-Hill Inc
5. Quantum Mechanics, Ajay Ghatak S. Lokanathan, Trinity
6. Engineering Physics by Gaur & Gupta, Dhanpat Rai Publications

Reference Books:

1. Engineering Physics by PG Kshirsagar & M N Avadhanulu, S. Chand Publications
2. Modern Physics for Engineers, S.P. Taneja, R. Chand
3. Engineering Physics, Malik and Singh, Tata McGraw Hill
4. Sears and Zemansky's University Physics, Volume-1 Mechanics, Pearson
5. Mechanics, Mathur, S.Chand Publishing
6. Electromagnetic Theory, Prabir K. Basu & Hrishikesh Dhasmana, An eBooks
7. David Griffiths, Quantum Mechanics, Pearson Education
8. Quantum Mechanics: A Text Book for undergraduates, Mahesh C Jain, TMH
9. A. Ghatak , Optics, McGraw Hill Education
10. O. Svelto, Principles of Lasers, Springer Science & Business Media
11. The Physics of waves and Oscillations, N.K. Bajaj, TMH
12. H. C. Verma, Concepts of Physics Vol – 1&2, Bharti Bhawan Publication
13. Halliday and Resnick, Physics.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.- Ist | **Branch: Common to all Branches**

Subject: Mathematics - I | **Course Code: BT00102**

Total Marks in End Semester Exam: 70 | **Min. Marks - 28**

Minimum number of Class Tests: 02 | **L: 3 T: 1 P: 0**

UNIT I: Calculus **(8 hours)**

Evaluation of improper integrals, reduction formulae, Beta and Gamma functions and their properties; *Applications areas and volumes.*

UNIT II: Calculus **(8 hours)**

Rolle's Theorem, Mean value theorems, *Taylor's and Maclaurin's theorems*; indeterminate forms and Maxima and minima.

UNIT III: Sequences and series **(8 hours)**

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series.

UNIT IV: Multivariable Calculus (Differentiation) **(8 hours)**

Limit continuity and partial derivatives, total derivative; Tangent plane and normal line; Maxima,minima and saddle points; Gradient, curl and divergence directional derivatives.

UNIT V: Matrices **(8 hours)**

Elementary row and column transformations, Consistency of linear system of equations; Symmetric, skew symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem and Orthogonal transformation, *Complex and unitary matrixes.*

Text/Reference Books

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. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, AffiliatedEast–West press, Reprint 2005.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.- 1st | **Branch: Common to all Branches**

Subject: Basic Electrical and Electronics | **Course Code: BT00103**

Total Marks in End Semester Exam: 70 | **Min. Marks - 28**

Minimum number of Class Tests: 02 | **L: 2 T: 1 P: 0**

Unit – I: D.C. Networks:

Introduction, Ohm's law, Kirchhoff's laws, Mesh and Nodal analysis, *Definition of Electrical Component*. Definitions of MMF, Magnetic field strength, Reluctance, Leakage flux and fringing, Core losses, Comparison of the Electric and Magnetic Circuits, Problems on Series and Parallel Magnetic Circuits.

Unit – II: A. C. Circuits:

Production of AC voltage, Basic Definitions of root mean square and average values, form factor and peak factor and *Phasor Algebra*, Analysis of ac series and Parallel Circuits, Series-Parallel Circuits.

Unit – III: Single phase Transformers:

Introduction, Principles of operation, Constructional details, Ideal Transformer and Practical Transformer, EMF equation, Rating, Phasor diagram at no load *and on load*, Losses in Transformers.

Unit-IV: Diode:

Brief Review of Semiconductors, N-Type & P-Type Semiconductors, Formation of Depletion Layer in a PN Junction, Forward & Reverse Biased, V-I Characteristic, Diode Current Equation. LED, Seven-segment displays.

Unit-V: Transistor:

BJT Construction, Junction Biasing of BJT, Operation of NPN & PNP BJT, Input and Output Characteristics of Transistor in CE configuration; *Characteristics of Transistor in CB configuration*; Transistor as an Amplifier & as a Switch.

Text Books:

1. Fundamentals of Electrical Engineering & Electronics, B.L. Theraja, S. Chand Publication.

2. Principles of Electronics by V. K. Mehta, 3rd Edition, S. Chand and Co. Ltd. (Unit-IV & V).
3. D.P. Kothari and I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI.

Reference Books:

1. Fitzrald and Higgonbothom, "Basic Electrical Engineering", Fifth Edition, McGraw Hill.
2. V.N. Mittal and Arvind Mittal, "Basic Electrical Engineering", Second Edition, Tata McGraw Hill.
3. Electrical and Electronic Technology By Hughes 10th Edition, Pearson Education.
4. A textbook of Electronic Circuits. By R. S. Sedha, S. Chand Publication.
5. H. Cotton,"Advance Electrical Technology," ISSAC Pitman, London.
6. Parker Smith S. (Ed. Parker Smith N.N.), "Problems in Electrical Engineering", Tenth edition, Asia publication.
7. Del Torro, Vincent "Electrical Engineering Fundamentals", Second Edition Prentice Hall of India Pvt. Ltd.
8. Basic Electrical & Electronics Engineering 1stEdition by D. P. Kothari and I. J. Nagrath,
9. Electronics Devices and Circuits by Jacob Millman and Christos C. Halkias, 3rd Edition Mc. Grah Hill Pub.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.- 1st | **Branch: Common to all Branches**

Subject: Engineering Graphics and Design | **Course Code: BT00104**

Total Marks in End Semester Exam: 70 | **Min. Marks - 28**

Minimum number of Class Tests: 02 | **L: 1 T: 0 P: 0**

Unit I: Introduction to Engineering Drawing

Principles of Engineering drawing and their significance, Lines, Lettering, Dimensioning, Scales, *Types of Scale – Plain, Diagonal*.

Unit II: Projection

Principles of projection, Method of projection, First and third angle projections, *Traces*, Orthographic projections, Isometric projection, Projection of Plain, Solid.

Unit – III: Development of Surface

Development of Surface of Right, Regular Solids, Development of Prisms, Cylinders, Pyramids, Cone and their Parts.

Isometric Projection: Principles of Isometric Projection – Isometric View, Isometric Scale, Conventional Plane figure, Simple and Compound Solids.

Unit IV: Basic concept of drafting software

Introduction to CAD software, merits and demerits of CAD, Application of CAD, GUI, limits and units, Basic co-ordinate system, setting of status bar option-snap, grid, O-snap, Dynamic input, ortho, polar, and etc. concept of block, viewports and layer.

Unit V: Drafting using CAD software

Drawing Tools: Circle, Arcs, Rectangle, Polygon, Ellipse, Spline, Poly-Line, and Multi-Line. Editing Tools: Trim, Move, and Copy, Rotate. Geometry Modifying Tools: Fillet, Chamfer, Scale, Stretch. Copying Tools: Array, Mirror, and Offset. Dimensioning and Annotations.

Text Books:

1. Bhatt, N. D.., "Elementary Engineering Drawing", Charotar Book Stall, Anand
2. George Omura, " Mastering AutoCAD" B.P.B. Publication, New Delhi

Reference Books:

1. Engineering Graphics – Laxminarayanan & V. and Vaish Wanar, R.S. Jain Brothers, New Delhi
2. Engineering Graphics – Chandra, AM & Chandra Satish 1998.
3. Engineering Graphics – K.L. Narayan and P. Kannaih, Tata McGraw Hill
4. AutoCAD: A problem solving approach- Tickoo, S. Delmar Cengage Learning 2015.
5. Mastering AutoCAD and AutoCAD LT-George Omura, Brian C. Benton, Wiley publisher, 2018.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.- 1st | **Branch: Common to all Branches**

Subject: Fundamentals of Computer | **Course Code: BT00105**

Total Marks in End Semester Exam: 70 | **Min. Marks - 28**

Minimum number of Class Tests: 02 | **L: 2 T: 0 P: 0**

Unit I: Fundamentals of Computers

History of computer, concept of data and information, computer hardware and software components: Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Computer Memory, Memory Hierarchy: Primary and Secondary Storage (Auxiliary Storage), Secondary storage; magnetic disks vs. optical disks (CD, CD-RW and DVD Memory), data – numeric data, alpha numeric data, concept of data and information: storage, seeking, processing and transmission, *and file organization*.

Unit II: Hardware and Software

Introduction of Computer Peripherals: Cables, Buses, Device drivers, installation of devices: keyboard, mouse, scanner, printer, web-camera, speakers and many more; plug-and-play devices; expansion slots……..System software, *difference between software and hardware*, Program Language Translators, application software, Programming Language Paradigms: Imperative, Object-Oriented and Logic languages, Basics of Popular Operating Systems (Windows and Linux); The User Interface, Using Mouse and Organizing Desktop components, Running an Application, File, Folders and Directory management features, Using Help; Creating Short cuts, Configuring Operating System: Windows and Ubuntu, BIOS, System Utilities and Antivirus software.

Unit III: Basic Computer Literacy

Word Processing Basics (MS Word / LibreOffice Writer): *Creating, deleting,* Opening and Closing of documents; Text creation and Manipulation; Formatting of text; Table handling; Spell check, language setting and thesaurus; Printing of word document; Using Spread Sheets (MS Excel / LibreOffice Calc) Basic operations of Spreadsheets; Manipulation of cells; Formulas and Functions; Editing of Spread Sheet, printing of Spread Sheet; Basics of presentation software (MS PowerPoint / LibreOffice Impress) Preparation and Presentation of Slides; Slide Show; *with shortcuts* How to make an effective presentation: Working with

Presentation Tools (Create, Edit, Move, Delete, Resize, Format text object), Working with Graphics tools (Creating Tables, Organization Charts, Hyperlinks), Saving, editing and closing presentation; Taking printouts of presentation / handouts.

Unit IV: Computers and Communication

WWW and Web Browsers: Basic of Computer networks; LAN, WAN, *MAN*, *PAN*, *SAN*; Networking Devices, Topologies, Cables and connectors, Connecting to internet; ISP; Basics of internet connectivity related troubleshooting, Web Browsing software, *IP Addressing, Wi-Fi and Bluetooth technology* overview Search Engines; URL; Domain Names;, Internet and Intranet: architecture, various file formats, Applications of INTERNET: Electronic mailing systems (Google Mail features): Creating and Managing mailing accounts, folders, Document collaboration, Instant Messaging, Netiquettes; Skype calling and Messenger services; functioning and features of smart gadgets: Smartphones, 4K smart television gadgets, kindle, gaming-gadgets, fitness gadgets and alike.

Unit V: Application Domains

Computer applications in office automation, *graphics and multimedia,* book publishing, data analysis, accounting, investment, inventory control, robotics, cyber security, air and railway ticket reservation sites, Audio and Video-conferencing, social networking, surveillance, Case Studies: Computer Literacy for banking, KYC, Insurance and financial transactions, operating mobile banking, Nine Pillars of Mission Digital India (DI-Initiatives) and their scheme highlights.

Text Books:

1. Computer Basics by IGNOU.
2. Suresh K Basendrea: Computers Today
3. Pradeep K. Sinha, Priti Sinha, “Computer Fundamentals”. BPB Publications.
4. Rajaraman, V., “Fundamental of Computers”. Prentice Hall India, New Delhi
5. Sanders Donald H Computers Today

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 1st | **Branch: Common to all Branches**

Subject: Physics (Lab) | **Course Code: BT00106**

Total Marks in End Semester Exam: 35 | **L: 0 T: 0 P: 2**

Min. Marks - 14

Total 36 labs. Hrs. About 10 – 12 experiments to illustrate the concepts learnt in Physics (Hrs. 3/ week).Suitable number of experiments from the following categories:

- Mechanics
- Optics and its applications
- Electromagnetic
- Semiconductor Physics
- Laser & Optical fiber

Text book:

1. A textbook of Engineering Physics Practical 2nd edition, University Science Press

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 1st **Branch: Common to all Branches**

Subject: Basic Electrical and Electronics Engineering (Lab) **Course Code: BT00107**

Total Marks in End Semester Exam: 35 **L: 0 T: 0 P: 2**

Min. Marks - 14

List of Experiments (To perform minimum 10 experiments):

1. To verify Superposition theorem.
2. To verify Kirchhoff's Current Law and Kirchhoff's Voltage Law.
3. To determine V– I characteristics of Incandescent lamp.
4. To study B-H curve.
5. To measure current, power, voltage and power factor of series RLC circuit.
6. To measure current, power, voltage of parallel RLC circuit.
7. To measure current, power, voltage of series parallel RLC circuit.
8. To measure R and L of choke coil.
9. To study construction of a single phase transformer.
10. To perform ratio test and polarity test of a single phase transformer.
11. To calculate efficiency of a single phase transformer by direct loading.
12. To verify the venin's theorem and Norton's theorem.
13. To study construction of Single Phase A.C. machines.
14. To study construction of Three Phases Induction motors.
15. To study charging and discharging of a capacitor.
16. To study types of meters in the lab.
17. To study construction of D.C. machine.
18. To plot V-I characteristics of PN Junction Diode.
19. To plot V-I characteristics of Light Emitting Diode.
20. To plot Static Characteristics of Transistor in CE configuration
21. To study the operation of transistor as a switch.
22. To study the operation of transistor as an amplifier.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.- 1st **Branch: Common to all Branches**

Subject: Fundamental of Computer (Lab) **Course Code: BT00108**

Total Marks in End Semester Exam: 35 **L: 0 T: 0 P: 2**

Min. Marks - 14

The laboratory should be preceded or followed by a Practical Lecture to explain the approach oralgorithm to be implemented for the problem given. Open Source software can be used.

Practical Lecture (L T P) – 0 0 1	**Lab. Work (L T P) – 0 0 3**
Practical Lecture 1:Introduction and workingof Hardware Components	**Lab1**: Identifying the computer hardware likeinput output devices, CPU, mother board, Buses etc.
Practical Lecture 2: Introduction and workingof Software.	**Lab 2**: Making Algorithm, DFD, ER diagram. Working of software's like system, Utility, Application software.
Practical Lecture 3: Introduction and working of Operating System	**Lab 3**: Basic operations of Operating System: creating file, Directory, Removing file, directory, date time setting, renaming etc. use internal and external connabds.
Practical Lecture 4: Introduction and working of MS Office	**Lab 4**: use the basic features of MS Office
Practical Lecture 5: Introduction of MS Word	**Lab5: Create** the document with a Alignment. Use the different properties of MSWord
Practical Lecture 6: Introduction of MS Excel	**Lab 6**: Make the use of Spreadsheet for data representations, Calculation and graphical presentations. Use properties of Excel
Practical Lecture 7: Introduction of Power presentation	Lab 7: MS-PowerPoint Make the presentation with features. Use the animation tools Multimedia
Practical Lecture 8 &9: Introduction of computer communication	**Lab 8 and 9**: *Computer communication related practical*

	1. Connect the Internet; open any website of your choice and save the WebPages. 2. Search any topic related to your syllabi using any search engine and download the relevant material. 3. Send any greeting card to your friend. 4. Create your E-Mail ID on any free E-Mail Server. 5. Login through your E-Mail ID and do the following: a. Read your mail b. Compose a new Mail c. Send the Mail to one person d. Send the same Mail to various persons e. Forward the Mail f. Delete the Mail g. Send file as attachment 6. Surf Internet using Google to find information about your state 7. Surf Internet using Google to find Tourism information about your state 8. Surf Internet using Yahoo to find Hotels around your state 9. Surf Internet using Google to find information about educational institutes for teaching M.S in comp science in India a. Surf Internet using Google to find information about Indian Compare the cost, overheads and

Practical Lecture 10: installing Computer System	**Lab 10:** Installing the working computer system
Practical Lecture 11: Different ICT use of Government Schemes	**Lab 11: Filling online AAADHAR, Voter id, PAN etc. form**
Practical Lecture 12: Applications of Computer in Digital India	**Lab 12**: online filling of different digital India applications

Laboratory Outcomes:

- To give idea about fundamentals of Computer
- To make familiar with MS Office
- To be able to write, document, present their work when developing project
- To be able to better foundations in Computer Field.
- To be able to know online applications of Digital India.

Text & Reference books:

1. Pradeep K. Sinha, Priti Sinha, "Computer Fundamentals". BPB Publications.
2. Rajaraman, V., "Fundamental of Computers". Prentice Hall India, New Delhi
3. Suresh K Basendrea: Computers Today
4. Sanders Donald H Computers Today

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.- 1st **Branch: Common to all Branches**

Subject: Engineering Graphics and Design (Lab) **Course Code: BT00109**

Total Marks in End Semester Exam: 35 **L: 0 T: 0 P: 4**

Min. Marks - 14

List of Practical:

1. Study of any drafting software- GUI, limits and units, drawing tools, editing tools, annotations, etc.
2. Study of co-ordinates systems- Cartesian and polar (absolute and relative system of measurement) and Practice drawing by using following tools: Grid, snap, O-snap, Lines, Erase, Zoom.
3. Study and create drawing by using Drawing tools: Circle, arcs, rectangle, polygon, ellipse, Editing tools: trim, move, copy, rotate and practice of drawing using these commands.
4. Study and create drawing by using Geometry modifying tools: fillet, chamfer, scale, stretch
5. Study and create drawing by using copying tools like array, mirror, block and offset.
6. Study and detailing of drawing by using dimensioning and annotations tools.
7. Study and create drawing with different types of line by using Layer command
8. Create geometry by modify it by using Scales- plane and diagonal scale and create conicssections- ellipse, parabola, hyperbola, rectangular hyperbola, involutes.
9. Draw regular solids: Cube, Prism, Pyramid, Cylinder, Cones
10. Draw sectional views of solids- Cube, Prism, Pyramid, Cylinder, Cones.

BHARTI VISHWAVIDYALAYA, DURG

SCHEME OF TEACHING AND EXAMINATION

Courses of Study and Scheme of Examination of Q1 Group

B. Tech. (Second Semester - Common to all Branches of Engineering)

S. No.	Courses (Subject)	Course Code	Period per Week			Scheme of Examination			Total Marks	Credit (L+T+P/2)
						Theory/Lab				
			L	T	P	ESE	CT	TA		
1.	Chemistry-I	BT00201	3	1	-	70	10	20	100	4
2.	Mathematics-II**	BT00202	3	1	-	70	10	20	100	4
3.	Programmingfor Problem Solving	BT00203	3	-	-	70	10	20	100	3
4.	English	BT00204	2	-	-	70	10	20	100	2
5.	Basic Civil Engineering and Mechanics	BT00205	3	-	-	70	10	20	100	3
6.	Chemistry (Lab)	BT00206	-	-	2	35	-	15	50	1
7.	Programming forProblem Solving(Lab)	BT00207	-	-	4	35	-	15	50	2
8.	Basic CivilEngg. & Mechanics(Lab)	BT00208	-	-	2	35	-	15	50	1
9.	Workshop Practice/ ManufacturingProcess(Lab)	BT00209	-	1	4	35	-	15	50	3
10.	Language (Lab)	BT00210	-	-	2	-	-	50	50	1
Total Marks			14	3	14	490	50	210	750	24

L-Lecture, T-Tutorial, P-Practical, ESE-End Semester Exam,

CT–Class Test, TA–Teacher's Assessment

Note: - (a) The teaching in the 1st and 2nd Semester will be divided in two groups consisting of branches as shown below:

P1–GROUP: Mechanical Engineering, Civil Engineering, Electronics & Telecommunication Engineering

Q1–GROUP: Computer Science and Engineering, Electrical Engineering

(b) **Mathematics–II will be taught to both the groups in the first semester.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd | **Branch: Common to all Branches**

Subject: Chemistry–I | **Course Code: BT00201**

Total Marks in End Semester Exam: 70 | **L: 3 T: 1 P: 0**

Minimum number of Class Tests: 02 | **Min. Marks – 28**

Unit – I Atomic & Molecular Structure **10 hours**

Molecular orbital Theory: Equations for atomic and molecular orbitals (LCAO), Energy level diagram of homo(H2, N2, O2, Li2, F2) & hetero molecules (CO, NO, HF), Concept of bond order. Pi-molecular orbitals of butadiene, Aromaticity.

Crystal Field Theory: Splitting of d-orbital of octahedral and tetrahedral complexes, Energy level diagram of transition metal ion & magnetic property, Application of crystal field Theory.

Unit – II Spectroscopic Techniques and Applications **10 hours**

Principle of spectroscopy. Electromagnetic radiation, Spectrophotometer (line diagram) Electronic Spectroscopy (Ultraviolet–visible spectroscopy): Theory, Types of electronic transition, Chromosphere, auxo chromes , Electronic excitation in conjugated Dienes , Uses or application of Electronic Spectroscopy, Vibrational spectroscopy (Infrared spectroscopy): Molecular vibration, Selection rule, functional group region, fingerprint region and uses or application of Vibrational spectroscopy. Nuclear magnetic resonance spectroscopy: Introduction, number of signal, chemical shift, Spin-spin coupling and uses or application of Nuclear magnetic resonance spectroscopy.

Unit – III Use of free energy in Chemical Equilibriums **8 hours**

Thermodynamic Functions: Energy, Entropy, Free energy, Cell potential, Estimations of entropy and free energies, Nernst Equation & its application to voltaic cell.

Corrosion: Electrochemical theory of corrosion, galvanic series, Galvanic corrosion, Differential aeration corrosion, Pitting, and Water line corrosion, factors affecting corrosion , Cathodic Protection, *Boiler Corrosion Scale of Sludge*.

Unit –IV Periodic properties **8 hours**

Periodic table, atomic and ionic radii, ionization energies, electron affinity, electronegativity. Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of

atoms. Polari ability, Oxidation states, coordination numbers and geometries, Hard, soft acids and bases (Classification, Pearson's HSAB principle, its applications & limitations) Molecular Geometry(Valence shell electron pair repulsion theory to NH3,H3O+, SF4, CIF3, ICl2 and H2O), *Application of Molecular Geometry*.

Unit –V Organic reactions and synthesis of drug molecule 8 hours

Introduction to reactions involving substitution (free radical-Chlorination of molecule, Gomberg reaction, Wurtz reaction, Electrophilic, Nucliophilic-SN1, SN2), Addition (Electrophilic–Morkownihoff rule, Nucleophile)Elimination (α elimination , β elimination , unimolecular E1, bimolecular E2), oxidation (Baeyer villager oxidation), reduction (Clemmensen reduction, Wolff Kishner reduction), Reimer- Thiemann reaction, Canannizaro, *Condensation Reaction, Aldal Condensation*.

Synthesis of a commonly used drug molecule: General guidelines of drug making, synthesis of Aspirin, Paracetamol.

Unit – VI Introduction to quantum theory 8 hours

Schrodinger equation & its importance, Applications to hydrogen atom, Wave mechanical model for many electron atoms, radial distribution curves.

Unit –VII Chemical Bonding in Molecules 10 hours

MO theory, Structure, bonding and energy levels of bonding and shapes of many atom molecules, Coordination Chemistry, Electronics plectra and magnetic properties of complexes with relevance to bio- inorganic chemistry, organometallic chemistry.

Unit –VIII Stereochemistry: 8 hours

Introduction to Stereochemistry: Representations of 3 dimensional structures, Chirality, Optical activity. Isomerism structural isomerism, stereoisomers, enantiomers, diastereomers, Configurations (D, L & R, S), Geometrical isomerism (cis and Trans & E and Z). Racemic modification & their resolution, Isomerism in transitional metal compounds. Conformational analysis: Conformations of cyclic (cyclohexane) and acyclic compounds (ethane & butane).

Unit –IX Reactivity of organic molecules: 8 hours

Organic acids and bases: factors influencing acidity, basicity, and nucleophilicity of molecules, kinetic vs. thermodynamic control of reactions.

Unit –X Strategies for synthesis of organic compounds: 10 hours

Reactive intermediates substitution, elimination, rearrangement, kinetic and thermodynamic aspects, role of solvents.

Text Books:

1. A Text Book of Engg. Chemistry, Shashi Chawala, Dhanpat Rai &Co.(P)Ltd.
2. Engineering Chemistry by P. C. Jain (Dhanpat Rai Publishing Company.
3. Engineering Chemistry, Concept in engineering Chemistry by Satyaprakash and Manisha Agrawal by Khanna Publication.

Books for Chemical Engineering:

1. Advanced Inorganic Chemistry Vol 1 & II by Gurdeep Raj, Goel Publishing House.
2. Organic Reaction and Their Mechanism, P. S Kalsi, New Age International Publishers.

Reference Books:

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamal uddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins
6. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5thEdition
7. Essentials of Physical Chemistry, Bahi & Tuli, S. Chand Publishing
8. Introduction to Nano science by S. M. Lindsay

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd	**Branch: Common to all Branches**
Subject: Mathematics - II	**Course Code: BT00202**
Total Marks in End Semester Exam: 70	**L: 3 T: 1 P: 0**
Minimum number of Class Tests: 02	**Min. Marks – 28**

UNIT I Multivariable Calculus (Integration) (8 hours)

Double and triple integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian),

Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes (without proof) & its applications.

UNIT II First Order Ordinary Differential Equations (8 hours)

Exact, linear and Bernoulli's equations, Euler's equations, *Formation of Differential Equation, Linear Equation, Equation Reducible to exact equation*, Equations of first order and higher degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut'stype.

UNIT III Ordinary differential equations of higher orders (8 hours)

Higher order linear differential equations with constant coefficients & variable coefficients, methodof variation of parameters, Cauchy-Euler equation. Power series solutions; Legendre polynomials and their properties, Bessel functions of the first kindand their properties.

UNIT IV Complex Variable – Differentiation (8 hours)

Limit of complex function, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

UNIT V Complex Variable – Integration (8 hours)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Lowville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series. Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

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. Di Prima, Elementary Differential Equations and Boundary ValueProblems,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 HallIndia, 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., Mc-Graw 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.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd	**Branch: Common to all Branches**
Subject: Programming for Problem Solving	**Course Code: BT00203**
Total Marks in End Semester Exam: 70	**L: 3 T: 0 P: 0**
Minimum number of Class Tests: 02	**Min. Marks – 28**

Unit I: Introduction **(4 lectures)**

Introduction to Programming, *Evaluation of programming language*, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), and Idea of Algorithm: steps to solve logical and numerical problems.

Unit II: Programming Concepts **(9 lectures)**

Algorithm: Flowchart, Pseudo code and Source code with examples. Variables, data types, memory locations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence, Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching, Iteration and loops, *Sub program implementing sub program.*

Unit III: Arrays **(9 lectures)**

Introduction to Arrays (1-D, 2-D), Character arrays and Strings, 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), *Expression statements*.

Unit IV: Function **(9 lectures)**

Function programming, prototyping, built in libraries, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion: Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit V: Structure **(9 lectures)**

Defining structures and Array of Structures, Union, and enumeration, Pointers: Idea of pointers, Defining pointers, Use ofPointers in self-referential structures, notion of linked list (no implementation), bit-fields. File handling: concept of a file, text files and binary files, Formatted I/O, file I/O operations,example programs

Text Books:

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

Reference Books:

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

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd | **Branch: Common to all Branches**

Subject: English | **Course Code: BT00204**

Total Marks in End Semester Exam: 70 | **L: 2 T: 0 P: 0**

Minimum number of Class Tests: 02 | **Min. Marks – 28**

UNIT – I

Vocabulary Building

1.1 Root words from foreign languages and their use in English

1.2 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.3 Synonyms, antonyms, Homonyms and Homophones.

1.4 One Word Substitution

1.5 Basics of Phonetics: Definitions, Phonetic Symbols, Transcription of one and two syllablewords

1.6 Communication: Definition, Cycle, Elements, 7Cs & Barriers

UNIT – II

Basic Writing Skills

2.1 Types of Sentences and Tenses, Voices and narration

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Techniques for writing precisely

UNIT – III

Identifying Common Errors in Writing

3.1 Parts of speech, Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions

3.6 Redundancies

3.7 Clichés

3.8 Errors in Spelling/ Misspelled words

UNIT – IV

Writing Practices

4.1 Comprehension

4.2 Précis Writing

4.3 Essay Writing

4.4 Business Letters & Job Application

4.5 Formal Reports: Components & Characteristics

4.6 Writing e-mails

UNIT – V

Listening

5.1 Listening: Definition, purposes, types, and strategies to improve listening.

5.2 Characteristics of effective listening.

5.3 Barriers to Listening and measures to overcome barriers

5.4 Note making: types and conversion of notes into texts.

UNIT – VI

Oral Communication (This unit involves interactive practice sessions in Language Lab)

6.1 Listening Comprehension

6.2 Pronunciation, Intonation, Stress and Rhythm

6.3 Common Everyday Situations: Conversations and Dialogues

6.4 Communication at Workplace

6.5 Interviews

6.6 Formal Presentations

Suggested Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007

3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
7. English and Communication Skills for Students of Science and Engineering. S.P. Dhanavel.Orient Blackswan Ltd.2009.
8. Scientific English: A Guide for Scientists and Other Professionals. R A Day. UniversitiesPress. 2000.
9. Word Power Made Easy. Norman Lewis. W R Goyal Publishers and Distributors. Publishers. 2009
10. Textbook of English Phonetics for Indian Students. T Balasubramaniam. MacmillanPublishers.2012
11. Technical Communication: Principles and Practice. Meenakshi Raman and SangeetaSharma. Oxford University Press. 2015.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd	**Branch: Common to all Branches**
Subject: Basic Civil Engineering & Mechanics	**Course Code: BT00205**
Total Marks in End Semester Exam: 70	**L: 3 T: 0 P: 0**
Minimum number of Class Tests: 02	**Min. Marks – 28**

UNIT – I Building Material

Nominal and actual dimensions of modular and traditional bricks, Qualities of good brick, Water absorption and Compressive Strength test for bricks. Types of Cement, Ingredients of Portland cement and their functions, Fineness, Setting Times and Compressive Strength of Cement, Functions of Sand in mortar, Mortar Mix proportions for various uses.

UNIT – II Building Construction

Ingredients of Cement Concrete, *Coarse and Fine Aggregates*, Grades of Concrete, proportions for Nominal mix concrete, Workability & Compressive Strength of Concrete, Curing of Concrete.

Define Footing Foundation, Necessity of foundations, Definitions of Safe bearing capacity, Ultimate bearing capacity and factor of safety, *Relationship between SBC, UBC and FOS*, Difference between Load Bearing & framed Construction.

UNIT – III Surveying & Leveling

Principles of Surveying, Technical terms, Calculation of reduced level by Height of instrument and Rise & Fall method, Simple problems in leveling.

UNIT – IV General System of Forces

Equations of equilibrium for a system of concurrent forces in a plane. Constraint, Action and Reaction. Types of support and support reactions. Free Body Diagram – Body subjected to two forces & Body subjected to three forces. Theorem of Varigonon's, Equations of Equilibrium.

UNIT –V Analysis of Plane Trusses

Rigid or perfect Truss, Determination of Axial forces in the members of truss, Method of Joints, Method of Sections.

Text books:

1. Comprehensive Basic Civil Engineering B.C. Punmia
2. Building construction by Ahuja and Birdi
3. Engineering Mechanics by A. K. Tayal

Reference books:

1. Basic Civil Engineering by Ramamurutham
2. Engineering Mechanics by R. K. Bansal

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd | **Branch: Common to all Branches**

Subject: Chemistry-I (Lab) | **Course Code: BT00206**

L: 0 T: 0 P: 2 | **Minimum number of Class Tests: 02**

Total Marks in End Semester Exam: 35 | **Min. Marks – 14**

List of Experiments:

Choice of 8 – 10 experiments from the following:

1. Determination of surface tension and viscosity.
2. Thin layer chromatography.
3. Ion exchange column for removal of hardness of water.
4. Determination of chloride content of water.
5. Colligative properties using freezing point depression.
6. Determination of the rate constant of a reaction.
7. Determination of cell constant and conductance of solutions.
8. Potentiometric - determination of redox potentials and emfs.
9. Synthesis of a polymer/drug/ organic compounds.
10. Saponification/acid value of oil.
11. Chemical analysis of salt / organic compounds.
12. Lattice structures and packing of spheres.
13. Models of potential energy surfaces.
14. Chemical oscillations- Iodine clock reaction.
15. Determination of the partition coefficient of a substance between two immiscible liquids.
16. Adsorption of acetic acid by charcoal.
17. Use of the capillary viscometers to the demonstrate of the isoelectric point as the Ph ofminimum viscosity for gelatin sols and/or coagulation of the white part of egg .
18. Spectrophotometric determination.

Text Books:

1. Laboratory Manual Engg. Chemistry, Anupama Rajput, Dhanpat Rai & Co. (P) Ltd.
2. Laboratory Manual on Engg. Chemistry, S. K. Bhasin& Sudha Rani, Dhanpat Rai & Co. (P) Ltd.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd **Branch: Common to all Branches**

Subject: Programming for Problem Solving (Lab) **Course Code: BT00207**

Total Marks in End Semester Exam: 35 **L: 0 T: 0 P: 4**

Min. Marks - 14

The laboratory should be preceded or followed by a Practical Lecture to explain the approach oralgorithm to be implemented for the problem given.

Practical Lecture (L T P) – 0 0 1	**Lab. work (L T P) – 0 0 3**
Practical Lecture 1: Problem solving using computers	**Lab1**: Familiarization with programming environment
Practical Lecture 2: Variable types and type conversions	**Lab 2**: Simple computational problems using arithmetic expressions
Practical Lecture 3: Branching and logical expressions	**Lab 3**: Problems involving if-then-else structures:
Practical Lecture 4: Loops, while and for loops	**Lab 4**: Iterative problems e.g., sum of series
Practical Lecture 5: 1D Arrays: searching, sorting	**Lab 5**: 1D Array manipulation
Practical Lecture 6: 2D arrays and Strings	**Lab 6**: Matrix problems, String operation
Practical Lecture 7: Functions, call by value	**Lab 7**: Simple functions
Practical Lecture 8 & 9: Numerical methods (Root finding, numerical differentiation, numerical integration):	**Lab 8 & 9**: Programming for solving Numerical methods problems
Practical Lecture 10: Recursion, structure of recursive calls	**Lab 10**: Recursive functions
Practical Lecture 11: Pointers, structures and dynamic memory allocation	**Lab 11**: Pointers and structures
Practical Lecture 12: File handling	**Lab 12**: File operations

Text Books:

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

Reference Books:

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

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd | **Branch: Common to all Branches**

Subject: Basic Civil Engineering & Mechanics (Lab) | **Course Code: BT00208**

Total Marks in End Semester Exam: 35 | **L: 0 T: 0 P: 2**

Min. Marks - 14

List of Experiments:

1. Water Absorption test on bricks.
2. Compressive strength test on bricks.
3. Fineness of cement by sieve analysis.
4. Initial setting time of cement.
5. Compressive Strength test of Cement.
6. Sieve analysis and F.M. of fine aggregate.
7. Sieve analysis and F.M. of coarse aggregate.
8. Compressive strength test of Concrete.
9. Difference in level between two given stations by Height of Instrumentmethod.
10. Difference in level between two given stations by Rise & Fall method.

BHARTI VISHWAVIDYALAYA, DURG

Semester: B. Tech.– 2nd **Branch: Common to all Branches**

Subject: Workshop Practice/Manufacturing Process (Lab) **Course Code: BT00209**

Total Marks in End Semester Exam: 35 **L: 0 T: 1 P: 4**

Min. Marks - 14

Unit I:

Forging: Introduction to manufacturing process, and its classification, use of various forging tools,forging operations, forging defects.

Suggested Jobs: Forging of chisel, forging of screw driver.

Unit II:

Carpentry: Different types of wood, carpentry tools, different joints, polishing, wood workingLathe.

Suggested Jobs: Making of name plate, stools and a small job on wood working lathe.

Unit III:

Fitting Shop: Introduction to bench working. Work holding devices, measuring instruments, fittingtools and their specification, types of joints fitting operations.

Suggested Jobs: Preparation of job by use of filling, sawing, chipping, drilling and tapping operations.

Unit IV:

Moulding: Pattern materials, allowances, moulding terminology.

Suggested Jobs: Prepare moulds of patterns, casting small household objects like paper-weight etc.

Unit V:

Welding: Study and use of gas, Arc, soldering, brazing methods. Safety precaution.

Suggested Jobs: Preparing Lap and Butt joints by gas and arc welding method.

Unit VI:

Metal Cutting: Common machining operations, different machine tools, cutting tools

materials, different type of Lathes, Lathe operations, shaper and its specification. Quick return mechanism of shaper.

Suggested Jobs: Making small shaft, cutting screw thread on Lathe.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.
3. B.S. Raghuvanshi, Workshop Technology, Vol I&II, Dhanpat Rai & Sons.

Reference Books:

1. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
2. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.
3. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
4. M.L.Begeman and B.H.Amstead, Manufacturing Process, Wiley
5. W.A.J.Chapman and E. Arnold, Workshop Technology, Vol I, II, & III, CRC Press, Prentice Hall
6. V. Narula, Workshop Technology, S.K. Kataria and sons.

BHARTI VISHWAVIDYALAYA, DURG

SCHEME OF TEACHING AND EXAMINATION
B. Tech. (Third Semester – MECHANICAL Engineering)

S. No.	Sub. Code	SUBJECT	PERIODS PER WEEK			SCHEME OF EXAM Theory/Practical			Total Marks	Credit (L+T+P/2)
			L	T	P	ESE	CT	TA		
1.	**BT02301**	Mathematics-III	3	1	-	70	10	20	100	4
2.	**BT02302**	Mechanical Measurement and Metrology	2	1	-	70	10	20	100	3
3.	**BT02303**	Engineering Mechanics	2	1	-	70	10	20	100	3
4	**BT02304**	Engineering Thermodynamics	2	1	-	70	10	20	100	3
5	**BT02305**	Material Science	2	1	-	70	10	20	100	3
6	**BT02306**	Computer Aided Machine Drawing Lab	-	-	4	35	-	15	50	2
7	**BT02307**	Mechanical Measurement and Metrology Lab	-	-	2	35	-	15	50	**1**
8	**BT02308**	Engineering Thermodynamics Lab	-	-	2	35	-	15	50	1
9	**BT02309**	Software Lab	-	-	2	35	-	15	50	1
10	**BT02310**	Personality Development	-	-	2	-	-	50	50	-
Total			**19**	**5**	**9**	**490**	**50**	**310**	**750**	**21**

L-Lecture, T-Tutorial, P-Practical, ESE-End Semester Exam,
CT–Class Test, TA–Teacher's Assessment

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Mathematics - III**	**Code:**	**BT02301**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT-I Laplace transform:

Definition, Transform of elementary functions, Properties of Laplace transform, Transform of derivatives & integrals, Multiplication by t", Division by t, Evaluation of integrals, Inverse Laplace Transform, Convolution theorem, Unit step function, Unit impulse function, Periodic function, *Simultaneous Linear Equationwith Constant Coefficients*.

UNIT- II Partial differential equation:

Formation of Partial Differential Equation, Solution of Partial Differential Equation, Equation Solvable by Direct Method, homogeneous linear equations, Method of separation of variables.

UNIT- III Random variable:

Discrete and continuous probability distributions, Mathematical expectation, Mean and Variance, Moments, Moment generating function, probability distribution, Binomial, Poisson and Normal distributions.

UNIT- IV Interpolation with equal and unequal intervals:

Finite differences, Newton's Forward & Backward Difference Formulae, Central Difference Formula, Stirling's Formula, Bessel's Formula, Lagrange's Formula and Newton's Divided Difference Formula.

UNIT-V Numerical Solution of Ordinary Differential Equations:

Picard's Method, Taylor's Series Method, Euler's Method, Euler's Modified Method, Runge-Kutta Methods, Predictor-corrector Methods- Milne’s Method, Adams-Bash forth Method,

Second Order Differential Equation..

Text Books:

1. "Higher Engg. Mathematics", Dr. B.S. Grewal, Khanna Publishers.
2. “Advanced Engg. Mathematics", Erwin Kreyszig - John Wiley & Sons "Numerical
3. “Methods in Engineering and Science", Dr. B.S. Grewal, Khanna Publishers.
4. "Numerical Methods for Scientific and Engineering Computation", M.K. Jain, S. R. K

Reference Books:

1. “Applied Mathematics”, P. N. Wartikar& J. N. Wartikar. Vol-II Pune Vidyarthi GrihaPrakashan, Pune.
2. “Applied Mathematics for Engineers & Physicists”, Louis A. Pipes- TMH.
3. "Numerical Methods for Scientists and Engineers” K. Shankar Rao, Prentice Hall of India.
4. "Numerical Methods” P. Kandasamy, K. Thilagavathy and K. Gunavathi, S. Chand publication.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Mechanical Measurement and Metrology**	**Code:**	**BT02302**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Four Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT I: Generalized Measurement System: Introduction - Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, static and dynamic performance characteristics of measurement devices, Calibration, Error-concept and sources, statistical analysis of errors, Sensors and Transducers– Types of sensors, type of transducers and their characteristics.
Intermediate modifying and terminating devices, Mechanical systems, Inherent problems, Electrical Intermediate modifying devices, Input circuitry, Ballast circuit, Electronic Amplifiers, Terminating Devices, Cathod ray oscilloscope, oscillograph.

UNIT II: Measurement of pressure: Pressure standard, Bourdon tubes, Diaphragm and bellows, Measurement of very low pressure- Mcleod gauge and Pirani gauge.
Measurement of Strain: Type of strain gauges and their working, temperature compensation. Strain rosettes. Measurement of temperature by thermometers, bimetallic, thermocouples, thermistors and pyrometers-total radiation and optical pyrometry.

UNIT III: Measurement of flow: Variable head meters, hot wire and magnetic meters, ultrasonic flow meters. **Vibration measurement:** Seismic instruments, vibration pickups. **Data acquisition system:** Introduction to data acquisition systems, single and multi-channel systems, Input – output devices signal transmission and Processing.

UNIT IV: Metrology: Standards of measurement; Limits, Fits and Tolerances; Linear and angular measurement devices and systems limit gauges, gauge blocks. Measurement of geometric forms like straightness, flatness, roundness and circularity, surface texture

measurement, principles and application of optical projectors, tool makers microscope, autocollimators etc.

UNIT V: Metrology: Principle and use of interferometry, Comparators, Screw Threads Measurement, Measurement of Gears tooth. Coordinate measuring machine (CMM): need, construction, types and application.

Tutorial from above units covering practical applications.

Text Books:

1. Mechanical Measurements – G. Beckwith Thomas G. – Pearson Education.
2. Mechanical Measurements and Control – D.S. Kumar – S.K. Kataria & Sons.

Reference Books:

1. Metrology and quality control- A.M. Badadhe -Technical Publication.
2. Measurement Systems, Application Design – E.O. Deoblein - McGraw Hill.
3. Engineering Metrology – K.J. Hume - MacDonald and Company.
4. Engineering Metrology – I.C. Gupta - Dhanpat Rai & Sons.
5. Mechanical & Industrial Measurements – R.K. Jain – Khanna Publishers.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Engineering Mechanics**	**Code:**	**BT02303**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT–I:

Introduction to Engineering Mechanics- Rigid body, Force and force systems, Principles of mechanics, composition and resolution of forces, Resultant, types of supports and support reactions, free body diagrams, equilibrium of concurrent forces in a plane, Moment of Force and its Application- Varignon's Theorem, Parallel forces in a plane, General cases of forces in a plane. Forces in space-Resultant of system of force in space, equilibrium of spatial system of forces.

UNIT–II:

Friction-Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Angle of friction, Angle of Repose, Motion of Bodies, wedge friction, ladder friction, rolling friction.

Belt and rope friction- length of belt in open and closed belt drives, ratio of tensions, initial tension in belt, power transmitted, condition for maximum power, stress in belt material, V belt. Screw jack & differential screw jack

UNIT–III:

Centroid- Centroid of simple figures from first principle, centroid of composite sections.

Area moment of inertia- Definition, Area moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections;

Product of inertia: Definition, Product of inertia of plane sections from first principles Displacement of axes, Rotation of axes, Principle axes, Principal moment of inertia.

UNIT–IV: Kinematics

Rectilinear motion of Particle: Displacement, velocity and acceleration

Curvilinear motion of Particle: Rectangular components of velocity, Rectangular components of acceleration, component of motion: Radial and transverse components

UNIT-V: Kinetics

D'Alembert's principle and its applications in plane motion of connected bodies; **Work-energy principle** and its application in plane motion of connected bodies;

Principle of impulse and momentum and its application in plane motion of connected bodies;

Tutorial from above units covering practical applications.

Text Books:

1. Engineering Mechanics – A. K. Tayal - Umesh Publications.
2. Engineering Mechanics- S. Timoshenko and D.H. Young- TMH.
3. Vector Mechanics for Engineers - F. P. Beer and E. R. Johnston - Tata McGraw Hill.

Reference books:

Engineering Mechanics: Principles of Statics and Dynamics - R.C. Hibbeler - Pearson Press.

1. Engineering Mechanics -Irving H. Shames- Prentice Hall.
2. Introduction to Statics and Dynamics - Andy Ruina and Rudra Pratap - Oxford Univ Press.
3. Engineering Mechanics - Shanes and Rao - Pearson Education.
4. Engineering Mechanics (Statics, Dynamics) - Hibler and Gupta - Pearson Education.
5. Singer's Engineering Mechanics - Reddy Vijaykumar K. and K. Suresh Kumar.
6. A Text Book of Engineering Mechanics – R. K. Bansal - Laxmi Publications.
7. Engineering Mechanics – R. S. Khurmi - S. Chand.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Engineering Thermodynamics**	**Code:**	**BT02304**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:70**	**Minimum Marks: 28**

UNIT I:

(a) Introduction to Engineering Thermodynamics-Macroscopic vs microscopic view point, Thermodynamic System, properties, process, cycle, thermodynamic equilibrium, Quasistatic Process, Zeroth Law of thermodynamics, concept of continuum. Exact & Inexact differentials. Work- electrical, magnetic, gravitational, spring and shaft work, Displacement work, flow work , free expansion, work done in various quasistatic process, work as a path function. Heat transfer-sensible heat, latent heat, heat as a path function.

(b) **First Law of thermodynamics**-Joule's experiment, internal energy as property of system, first law applied to various quasistatic process, PMMI , Limitations of the First Law, control volume, Steady flow energy equation, Applications of SFEE. *Throttling process. Filling and emptying process.*

UNIT II:

(a) Second law of thermodynamics: Thermal Reservoir, Heat Engine, cyclic Heat engine, Kelvin-Planck statement and Clausius Statements and their Equivalence, Refrigerator and Heat pump, COP, PMMII, ,reversibility and irreversibility, causes of irreversibility, Carnot cycle, reversed heat engine, Carnot theorem, corollaries of Carnot theorem, Absolute thermodynamic temperature scale.

(b) Entropy: Clausius theorem, the property of entropy, the inequality of Clausius, Entropy principle and its applications, Entropy change during different thermodynamic processes, entropygeneration in closed system and open system, first and second law combined.

UNIT III:

Exergy: Available energy, availability and availability function of a closed system, availability and availability function of an open system , dead state, Helmholtz function , Gibbs functions, Irreversibility and Gouy-Stodola Theorem, Second law efficiency.

UNIT IV:

(a) Properties of gases: Equation of state of a gas, Ideal gas, gas compression, deviation of Real gas from ideal gas, *Virial equation of state,* Vander Waal's equation of state, correction for the intermolecular attractions, correction for finite size of molecules, evaluation of constants a and b, virial expansions, limitations of the van der Wall's equation, Reduced coordinates, compressibility factor, the law of corresponding States.

(b) Ideal and Real Gases: *Introduction, the equation of state for perfect gas, PVT surface for an ideal gas, internal energy and enthalpy of perfect gas, specific heat capacities of an ideal gas, real gas. Beattie- Bridgeman equation, Reduced properties, Law of corresponding states.*

UNIT V:

Properties of Pure substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases, Phase Transformations, *Formation of steam* dryness fraction, Triple point, critical state, p-v, p-T, T-s, h-s diagrams, p-v-T surfaces, Properties and Processes in ideal vapor, use of steam tables and Mollier diagram in determination of steam properties, energy interaction and Entropy calculations, ***Steam power cycle:-*** *Reheat and Regenerative cycles, economizer, pre heater, Binary and combined cycles.*

Tutorial from above units covering practical applications.

Text Books:

1. Thermodynamics- An Engineering Approach – Cengal & Boles – McGraw Hill.
2. Engineering Thermodynamics – P.K. Nag – TMH.

Reference Books:

1. Fundamental of engineering thermodynamics- R. Yadav-CPH.
2. Thermal Science & Engineering – D.S. Kumar – S.K. Kataria .
3. Fundamental of Thermodynamic- Claus Borgnakke, Richard E. Sonntag- Wiley.
4. An Introduction to Thermodynamics-Y.V.C. Rao- University Press.
5. Engineering Thermodynamics-M. Achuthan- PHI.
6. Thermodynamics & Thermal Engineering – J. Selwin Rajadurai – New Age.
7. Thermodynamics – C.P. Arora – TMH.
8. Thermodynamics – S.C. Gupta – Pearson.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Material Science**	**Code:**	**BT02305**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks:70**	**Minimum Marks: 28**

UNIT I:

Structure of Materials: Crystalline and non crystalline solid, Concept of unit cell and space lattice, Crystal structure of metal, Miller indices.

Crystal Imperfection: Point defects – Interstitial defect, Frankel defect and Schottky defect; Line defects- Edge dislocations, Screw dislocation; Surface defects- Grain boundary, Tilt boundary, Twin boundary and Volume defects- Stacking fault.

Solidification of Metals and Alloys: *Mechanism of solidification, nucleus formation and crystal growth, Homogeneous and Heterogeneous nucleation, Metal ingot structure- dendritic and columnar grains, grain boundaries, grain growth, solidification process, effect of grain size on properties of metals.*

UNIT II:

Mechanical Properties of Materials: Stress-strain diagrams for engineering materials, Young's modulus, Yield strength, Tensile strength, Elasticity, Plasticity, Ductility, Malleability, Brittleness, Toughness, Stiffness, Hardness, Hardenability, Fatigue and Creep.

Deformation of Metals: Elastic deformation: Elastic after effect, Plastic deformation: deformation by slip (shear deformation)-Critical resolved shear stress, Deformation by twinning, Differences between slip and twinning. Dislocation theory - edge dislocation, screw dislocation. Strain hardening, Cold and hot working processes, Effect of cold work, recovery, recrystallization, grain growth on properties of crystalline materials.

UNIT III:

Phase and Phase Equilibrium Diagram: Phase & types of phase, Hume-Rothery's rule, Cooling curve of pure metals and alloys, Gibb's phase rule, Types of phase equilibrium diagrams: Isomorphous- Lever rule, Monotectic, Eutectic-Hyper, Hypoeutectic, Eutectoid -Hyper, Hypoeutectoid, Peritectic and Peritectoid system. Allotropy of Iron, Iron-Iron carbide phase diagram.

UNIT IV:

Heat Treatment: Introduction, Purpose and advantages of heat treatment, T-T-T curve and Micro constituents in steel, Heat treatment processes: Annealing-Stress relief, Spheroidising, Process and full annealing, Normalising, Hardening, Tempering, Austempering, Martempering. **Surface Hardening**-Flame, Induction and Case hardening: Carbuising- Pack and Gas carburizing, Nitriding, Cyaniding, Carbo-nitriding, Vacuum and Plasma hardening.

UNIT V:

Composition, Properties and application of the following engineering materials:-**Ferrous: Cast Iron**- Grey cast iron, White cast iron, Malleable cast iron, and Spheroidal cast irons. **Steel**- Unalloyed or plain carbon steels- Low, Medium, High carbon steels **Alloy steel**- Stainless steel, Tool steel, Maraging steels, Spring steel. **Non-ferrous:** Copper alloys: Brasses – Muntz metal, Cartridge brass, Naval brass, Admiralty brass, Bronzes – Gun metal, Phospher bronze, Aluminium bronze, Copper-nickels alloys. Aluminium alloys : Duralumin, Cast aluminium alloys, Aluminium silicon alloys. Sintered carbide. Al-Cu-Mg alloy, Nickel base superalloy, Titanium alloy.

Text Books:

Material Science & Engineering A First Course- V. Raghavan- PHI.

1. Material Science- O.P. Khanna- Dhanpat Rai.

Reference Books:

1. Elements of Material Science & Engg. – Van Vlack- Pearson.
2. Physical Metallurgy – Clark & Varney- CBS Publishers & Distributors

3. Engineering Physical Metallurgy – Lakhtin- CBS Publishers & Distributors
4. Physical Metallurgy Principles – Robert E Reed Hill- Cengage Learning
5. Materials Science – Narang- CBS Publishers & Distributors
6. Engineering Materials – Woulf Series.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Computer Aided Machine Drawing Lab**	**Code:**	**BT02306**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Exercises: (At least ten exercises including first five compulsorily)

1. Code of practice for general engineering drawings (BIS) – Conventional representation of lines, Letter, standard machine components, surface roughness, direction of lay of machining and welded joints.
2. Limits, Fits, Tolerances and representation of dimensional and geometrical tolerance in engineering drawing.
3. Conversion of pictorial view of solids to its orthographic views.
4. Sectional view: type of sectional views-full section, half section, partial or broken section and sectioning conventions-spokes, web, rib, shaft, pipes, different types of holes, hatching or section lines, conventions of sections of different metals and materials.
5. Conversion of pictorial view of solids to orthographic sectional view.
6. Assembly drawing of Screwed Fasteners.
7. Assembly drawing of Riveted Joint.
8. Assembly drawing of Cotter joint- Sleeve & Cotter Joint, Spigot and Cotter joint.
9. Assembly drawing of Pin Joint or Knuckle joint.
10. Assembly drawing of Bearing-Bushed bearing, Plummer block.
11. Assembly drawing of Coupling-Flange coupling, Flexible coupling.
12. Assembly drawing of Pulley-Fast and loose pulley.
13. Assembly drawing of Valves-Steam stop valve, Blow-off cock, Lever safety valve.

Note: Students are required to submit a mini project on assembly drawing of one important mechanical engineering assembly with its part drawing and bill of materials at the time of final assessment.

Software/ System/ Books Required:

1. Intel® Core 2 Duo or greater, 3.0 GHz or greater. Microsoft® 64-bit Windows® 7 or greater. RAM: 2 GB or greater recommended, Free Disk Space: 250 GB or greater recommended.
2. Software Required – Drafting Software.
3. N. D. Bhatt and V.M. Panchal, "Machine Drawing", Charotar Publishers
4. Gopalakrishna K.R., "Machine Drawing", Subhas Stores Books Corner, Bangalore
5. Junnarkar, N.D., "Machine Drawing", Pearson Education

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Mechanical Measurement and Metrology Lab**	**Code:**	**BT02307**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Experiments: (At least Ten experiments are to be performed by each student)

(Minimum Seven experiments to be performed from the following group)

1. Measurement of Pressure Using Bourdon Pressure Gauge.
2. Calibration of Pressure Gauge Using Dead Weight Pressure Gauge Tester.
3. Measurement of Displacement Using LVDT.
4. Measurement of Temperature Using Thermister.
5. Measurement of Flow Rate Using Rotameter.
6. Measurement of Angle Using Angular Sensor.
7. Measurement of Torque Using Torque Transducer.
8. Measurement of Pressure Using Pressure Transducer.
9. Measurement of Strain Using Strain Cantilever Beam.
10. Measurement of Temperature Using RTD.
11. Measurement of Temperature Using Thermo Couple.
12. Measurement of Temperature by Themocouple.
13. Experimentation using Data Acquisition System.

(Minimum Three experiments to be performed from the following group)

1. Measurement of length, height, diameter by Vernier Calipers, Vernier Height Gauge, Micrometers.
2. Measurement of various angles using Bevel Protractor, Sine Bar & Combination Set.
3. Determination of the accuracy of Electrical and Optical Comparator.
4. Determination of the Surface Flatness and Contour using Interferometer.

5. Determination of the Effective Diameter of screw threads by using Two wire & Three wire methods.
6. Measurement of Gear Elements using Profile Projector and image analyzer.
7. Measurement of Tool Angles of a Single Point Cutting Tool by using Tool Makers Microscope.
8. Calibration of Vernier Calipers, Micrometer, Height Gauge, Depth Micrometer using Slip Gauges.

Note: Students are required to submit a mini project at the time of final assessment.

List of Equipment and Machine Required

Measurement	Metrology
1. Data Acquisition System **2.** Software compatible with DAS **3.** Displacement Measurement Tutor Using (LVDT) **4.** Pressure Measurement Tutor Using Pressure Transducer **5.** Strain Measurement Tutor Using Strain Cantilever Beam **6.** Torque Measurement Tutor Using Torque Transducer **7.** Temperature Measurement Tutor Using RTD Sensor **8.** Temperature Measurement Tutor Using Thermistor **9.** Temperature Measurement Tutor Using Thermistor **10.** Angular Measurement Tutor Using Angular Sensor **11.** Rotameter Trainer Module **12.** Dead Weight Pressure Gauge Tester **13.** Bourdon Gauge Trainer **14.** Image Analyzer	**1.** Vernier Calipers **2.** Vernier Height Gauge **3.** Depth Micrometers **4.** Set of Slip Gauges **5.** Interferometer **6.** Tool Makers Microscope **7.** Profile Projector **8.** Bevel Protector **9.** Sine Bar **10.** Combination Set **11.** Optical & Electrical Comparator **12.** Optical Flats **13.** Surface Plates **14.** Dial Indicators **15.** Snap and Ring Gauges (Go and No-Go Type)

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Engineering Thermodynamics Lab**	**Code:**	**BT02308**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To study the rise in temperature of liquid due to external work.
2. Effect of reduction in temperature in a steam pressure vessel.
3. To study the expansion process using throttling devices.
4. To study the effect of mixing of two/three fluid streams having different flow rates and temperatures.
5. To study the different thermodynamic working fluid e.g. air, steam.
6. To study boiler, boiler classification and performance parameters of boiler.
7. To study draught, classification of draught and related parameters.
8. To study the Cochran boiler and its accessories and mountings.
9. To study the Lancashire boiler and its accessories and mountings.
10. To study the Babcock Wilcox boiler and its accessories and mountings.
11. To study a simple steam engine.
12. To study a compound steam engine.
13. Performance and testing of surface steam condenser.
14. Performance and testing of steam jet condenser.
15. Study of steam turbines.
16. Study of reciprocating air compressor.

Note: Students are required to submit a mini project at the time of final assessment.

Equipment/Machines/Instruments/Tools/Software Required:

- Insulated agitated vessel.
- Steam pressure vessel with arrangement for external cooling.
- Compressed air tank with expansion device.
- Arrangement of mixing of two/three fluid streams.
- Boiler mountings

- Boiler accessories
- Cochran boiler
- Lancashire boiler
- Babcock and Wilcox boiler
- Simple Steam engine
- Compound steam engine • Steam Turbines
- Surface steam condenser
- Jet steam condenser
- Reciprocating air compressor

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Software Lab**	**Code:**	**BT02309**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Exercises: (At least ten exercises)

Part A: Surface and solid modeling

1. Introduction to surface modeling, surface representation method and classification of surface entity.
2. Introduction to solid modeling, solid representation and classification of solid entity.
3. Introduction to sketcher module of modeling software and practice drawing.
4. Surface/solid modeling using extrude, sweep features.
5. Surface/solid modeling using revolve features.
6. Editing of surface/solid model using editing tools such as pattern, holes, fillet and chamfer features.
7. Practice engineering drawing use of various surface commands.
8. Create assembly using Bottom-up Assembly Modeling Catalogs & CAD Data Formats.

Part B: Working with sheet metal module

1. Introduction to sheet metal process in CAD software and its applications in engineering.
2. Sheet metal modeling using different flange, wall and wall on edge features.

3. Design of sheet metal using bend features.
4. Design of sheet metal using extrusion features.
5. Design of sheet metal using cut-out, tear drop features.

Note: Students are required to submit a mini project on assembly modeling of equipment of practical application at the time of final assessment.

Software and System Requirement:

- Software: 3D Modeling Software

The following operating systems are recommended:

- Microsoft Windows 7 or Windows 10 (64-bit)
- Multi-core, 64-bit processor (ex. Intel Dual Core, Intel i3, i5 etc.)
- Dedicated graphics card recommended (not integrated on motherboard such as Intel Integrated graphics)
- 4GB of RAM - 8GB or more is highly recommended
- Minimum 10GB Free Hard Disk space
- Microsoft Office 2013 or newer for report generation

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**III**
Subject:	**Personality Development**	**Code:**	**BT02310**
No. Of Periods:	**2 Periods/Week**	**Total Tutorial Periods:**	**NIL**
Maximum Marks:	**50 (TA)**	**Minimum Marks:**	**18**

UNIT- I

Aim of Education and Necessity for Value Education: Education in values / wisdom / etc and education in traits / technologies / etc as the two fundamental strands of education; Answer to the frequently asked questions such as "Why to do studies", "What studies to do in overall", "How to do studies in a proper way", "How to think systematically and talk systematically"

UNIT-II

Humanitarian Viewpoint and Basic Human Objective: Meaning and concept of happiness, Need for a fundamental viewpoint to judge things in all cases of human concerns, Proposal of the natural path of humanitarian coexistentialism; Consciousness development and its expression; Fundamental want of sustainable happiness in human being; Understanding the distinct activities and needs of self (I) and body in human being; Fundamental goal of human being; Sustainable-solution in individual (At the place of delusion); Sustainable-prosperity in family (At the place of poverty); Sustainable-cooperation in society (At the place of competition); Sustainable-coexistence in planet (At the place of struggle)

UNIT- III

Elements of Holistic and Systematic Perspective: Need for study of fundamental information categories to develop holistic perspective; Particular-time actions and general-time laws; Need for fundamental information sequence to develop systematic perspective, Some examples for systematic study sequence

UNIT-IV

Elements of Society-friendly and Environment-friendly Goals: Elements of Knowledge of whole existence; Elements of Knowledge of human being; Elements of fundamental Values and Wisdom; Value spectrum with reference to general relationships and particular relationships of the objects in nature; Elements of History and Contemporarity used to set current goals; Elements of Sciences and Techniques to formulate methods to achieve goals; Elements of Motoricity and Mattericity to make actions to execute the methods

UNIT-V

Lifelong Exercise for All-round Sustainability: Collecting information for sustainability issues; Motivating people towards sustainable life-style; Ability to identify and develop appropriate technologies and management patterns for society-friendly and environment-friendly systems for production /protection/ utilization/ experimentation ; Ability to establish and execute the fundamental five-fold system in order to ensure sustainable peace-and-prosperity worldwide.

Text Books:

1. Value Education for Consciousness Development by Dr P B Deshmukh, Radha K Iyer, and Deepak KKaushik (2nd Edition, 2012, ISBN: 978-81-924034-0-3)

Reference Books:

1 International Research Handbook on Values Education and Student Wellbeing by Terence Lovat, Ron Toomey, Neville Clement (Eds.), Springer 2010, ISBN: 978-90481-86747

2 Values Education and Lifelong Learning: Principles, Policies, Programmes by David N Aspin and Judith DChapman (Eds.); Springer 2007, ISBN: 978-1-4020-6183-7

3 Fundamentals of Ethics for Scientists and Engineers by E G Seebaur and Robert L Berry, 2000, OxfordUniversity Press

BHARTI VISHWAVIDYALAYA, DURG

SCHEME OF TEACHING AND EXAMINATION

B. Tech. (Fourth Semester – Mechanical Engineering)

S. No.	Sub. Code	SUBJECT	Periods Per Week			Scheme Of Exam Theory/Practical			Total Marks	Credit (L+T+P/2)
			L	T	P	ESE	CT	TA		
1.	**BT02401**	Applied Thermodynamics	2	1	-	70	10	20	100	3
2.	**BT02402**	Fluid Mechanics	3	1	-	70	10	20	100	4
3.	**BT02403**	Strength of Materials	2	1	-	70	10	20	100	3
4	**BT02404**	Manufacturing Process	2	1	-	70	10	20	100	3
5	**BT02405**	Kinematic of Machine	3	1	-	70	10	20	100	4
6	**BT02406**	Fluid Mechanics Lab	-	-	2	35	-	15	50	1
7	**BT02407**	Material Testing Lab	-	-	2	35	-	15	50	1
8	**BT02408**	Manufacturing Process Lab	-	-	2	35	-	15	50	1
9	**BT02409**	Virtual Lab	-	-	2	35	-	15	50	1
10	**BT02410**	Indian Culture and Constitution of India	-	-	2	-	-	50	50	-
Total			**23**	**5**	**10**	**490**	**50**	**210**	**750**	**21**

L-Lecture, T-Tutorial, P-Practical, ESE-End Semester Exam,

CT–Class Test, TA–Teacher's Assessment

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**IV**
Subject:	**Applied Thermodynamics**	**Code:**	**BT02401**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT- I *Gas power cycles: Definition of a cycle, Air standard efficiency, The carnot cycle, Otto cycle, Diesel cycle, Dual combustion cycle, comparison of Otto, Diesel and Dual combustion cycle, Atkinson cycle. Ericcsion cycle, Brayton cycle.*

UNIT-II Reciprocating Air Compressors: Classification of air compressors, working of single acting single cylinder reciprocating compressor, single acting reciprocating compressor without clearance, single acting reciprocating compressor with clearance-equation of work, volumetric efficiency. Multistage reciprocating air compressors, advantage of multistage compression, two stage air compressor- minimum work, Indicator diagram, mean effective pressure and indicated power, compressor power , efficiencies, shaft power of the compressor, advantages and limitations of reciprocating compressors.

UNIT- III Vapor Power Cycle: Simple steam power cycle, Rankine cycle; p-v, T-s and h-s diagrams, efficiency, steam rate, heat rate, comparison of Rankine and Carnot cycles, mean temperature of heat addition, reheat cycle, ideal regenerative cycle, practical regenerative cycle, Feed Water Heaters (FWH)- open and closed FWH, characteristics of ideal working fluids, binary vapor cycle.

UNIT- IV *Steam Generators:- classification of boilers, comparison between fire tube and water tube boiler, selection of boiler, essentials of a good steam boilers, Boiler terms, fire tube boilers and water tube boilers, high pressure boiler, combustion equipment for steam boilers.*

UNIT-V Thermodynamics of Compressible Fluids: Velocity of pressure waves in a fluid, Mach number, isentropic stagnation state, stagnation enthalpy, temperature, pressure, density, one dimensional steady isentropic flow, area velocity relationship, critical properties-choking in isentropic flow, dimensionless velocity, Effect of back pressure on the performance of nozzle flow. Flow of steam through nozzle, throat area for maximum discharge, supersaturated Flow in nozzle.

Text Books:

1. Thermodynamics- An Engineering Approach – Cen gal & Boles – McGraw Hill, Delhi
2. Engineering Thermodynamics – P.K. Nag – TMH Publishers

Reference Books:

1. Fundamental of engineering thermodynamics- R. Yadav, CPH, Allahabad
2. Thermal Science & Engineering – D.S. Kumar – S.K. Kataria & Sons
3. Fundamental of Thermodynamic- Claus Borgnakke, Richard E. Sonntag, Wiley, Delhi
4. An Introduction to Thermodynamics-Y.V.C. Rao, University Press, Hyderabad
5. Thermodynamics & Thermal Engineering – J. Selwin Rajadurai – New Age International Publishers
6. Thermodynamics – C.P. Arora – TMH, Delhi
7. Thermodynamics – S.C. Gupta – Pearson Education, Delhi

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Analyze and evaluate gas power cycles.
2. Analyze reciprocating air compressors.
3. Analyze vapour power cycle.
4. Analyze steam condenser and discuss working principle of cooling pond and cooling towers.
5. Analyze thermodynamic system with compressible fluid.

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**IV**
Subject:	**Fluid Mechanics**	**Code:**	**BT02402**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT- I

Properties of fluid: Fluid, ideal and real fluid, properties of fluid : mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapour pressure, compressibility and bulk modulus. Newtonian and non-Newtonian fluids
Fluid Statics: Pressure, *Absolute and Gauge pressure, pressure measurement by manometers*. Pascal's law, Hydrostatic law, Manometry, Hydrostatic force on submerged plane and curved surface, Buoyancy and Flotation.

UNIT-II

Fluid Kinematics: Description of fluid motion, Langragian and Eulerian approach, Type of fluid flow, Type of flow lines-path line, streak line, stream line, stream tube. Continuity equation, acceleration of a fluid particle, motion of fluid particle along curved path,
Normal and tangential acceleration, Rotational flow, Rotation and Vorticity, circulation, stream and potential function, flow net , its characteristics and utilities. Liquid in relative equilibrium.

Fluid Dynamics: Euler's Equation, Bernoulli's equation and its practical application, Venturimeter,
Orifice meter, Nozzle, Pitot tube. Impulse momentum equation, Momentum of Momentum equation, Kinetic energy and Momentum correction factor, Vortex motion, Radial flow.

UNIT- III Laminar Flow: Reynold's experiment, flow of viscous fluids in circular pipe, shear stress and pressure gradient relationship, Velocity distribution, Hagen-Poiseuille Equation, flow of viscous fluids between two parallel plates (Coutte flow) shear stress and pressure Gradient relationship, Velocity distribution, Drop of pressure head.

Turbulent flow: Effect of turbulence, Expression for loss of head due to friction in pipes (Darcy- Weisbach equation), Expression for co-efficient of friction in terms of shear stress.

Flow through pipe: Loss of energy in pipes, Hydraulic gradient and total energy line, pipe in series and parallel, equivalent pipe power transmission through pipe, water hammer in pipes.

UNIT- IV *Boundary Layer Theory :- Definition, Boundary Layer on a flat plate, Laminar and Turbulent Boundary Layer, Displacement, Energy, and Momentum Thickness. Momentum integral equation, Boundary Layer separation and control, Drag on flat plate.*

UNIT-V Dimensional Analysis: Methods of dimensional analysis, Rayleigh's method, Buckingham's theorem, Limitations.

Model analysis: Dimensionless number and their significance, model laws, Reynolod's model law, Fraude's model law, Euler's model law, Weber's model law, Mach's model law, Type of models, scale effect in model, limitation of hydraulic similitude.

Text Books:

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons – New Delhi
2. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi

Reference Books:

1. Fluid Mechanics & Hydraulics Machines-R.K. Bansal-Laxmi Publications., Delhi
2. Engineering Fluid Mechanics –K.L. Kumar, Eurasia Publication House, Delhi
3. Mechanics of Fluid – B.S. Massey – English Language Book Society (U.K.)
4. Fluid Mechanics- Yunus A. Cengel, John M. Cimbala- TMH, Delhi
5. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- TMH ,Delhi
6. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi,& SM Seth-Standard, Delhi
7. Theory and Application of Fluid Mechanics- K. Subramanya-TMH Delhi

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**IV**
Subject:	**Strength of Materials**	**Code:**	**BT02403**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT- I *Introduction: Basic of Stress & Strain, elastic constants, stress – strain diagram, Hooke's law, Poisson's ratio, shear stresses, stresses in the components subjected to multi-axial forces, thermal stresses, statically indeterminate systems*

UNIT-II (a) S.F. and B.M. diagrams of beams: Types of load, types of beams, SF and BM diagram for cantilever, simply supported and overhanging beams, Point of contra-flexure, relation between load, SF and BM. (b) Bending stresses in beams: Pure bending, neutral axis, moment of resistance, bending stresses in symmetric sections, section modulus, bending equation, bending stress distribution, problems.
(c) Shear stress in beams: shear stress at a section, shear stress distribution for rectangular, circular, I and T sections.

UNIT- III Deflection of transversally loaded beams: Relation between slope, deflection and radius of curvature, determination of slope and deflection by Double integration method, Macaulay's method, Moment Area Method in simply supported, cantilever and overhanging beams.

UNIT- IV Torsion of shafts: Shear stress in circular shaft due to torsion, torque and power transmitted by solid, hollow & stepped circular shaft, polar modulus, strength of shafts and torsional rigidity, composite shaft, shafts in series, shafts in parallel, deflection of shafts fixed at both ends, combined bending and torsion.

Springs: Types of spring, Closed Coil Helical Springs subjected to Axial Load, springs in series & parallel.

UNIT-V Principal stresses and strain: Transformation of plane stresses, Principal stresses, Maximum shear stresses, Mohr's circle for plane stresses, Plain strain and its Mohr's circle representation, Principal strains, Maximum shear strain.
Combined Loading: Components subjected to bending, torsion & axial loads.

Text Books:

1. Elements of Strength of Material – Timoshenko & Young- EWP press
2. Strength of Materials – Dr. Sadhu Singh – Khanna publication
3. Mechanics of Solids – Beer & Johnson, Tata McGraw Hill Publications

Reference Books:

1. Strength of Materials – R.K. Rajput – Dhanpat Rai & Sons
2. Mechanics of Material-Gere and Timoshenko CBS Publications
3. Strength of Materials- R. Subramanian, Oxford University Press
4. Strength of material – Ryder–ELBS
5. Introduction to Solid Mechanics – I.H. Shames–PHI
6. Engineering Mechanics of Solids – E.P. Popov – PHI

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**IV**
Subject:	**Manufacturing Process**	**Code:**	**BT02404**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT- I Introduction to Manufacturing Processes: Importance of Manufacturing Processes, classification, technological definitions.
Metal Casting (Foundry): Introduction: Basic Principle, Advantages and Limitations, Applications. Pattern Making: Pattern materials, allowances, types of pattern, color code scheme Mould Making: Green and dry sand casting process, types of sand, molding sand and its properties, molding sand composition and applications. Elements of mould: Cores; Use, core material, types of cores, advantages and limitations, core prints, chaplets, Gating and Risering System, Sand casting defects: appearance, causes & remedies. Special Molding Processes: Carbon dioxide molding process, investment casting process, Die casting process, shell molding process, continuous casting process, centrifugal casting processes.

UNIT-II Welding – I: Introduction: Principle, classification based on application of filler material & without filler material, source of energy, fusing and pressure welding processes, application of welding processes. Arc welding: Principle, power source and equipments, welding electrodes- types' composition & specification, Metal Arc welding (MAW), flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes. (AHW).
Gas Welding: Principle, Oxy-Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working, forward and backward welding.

UNIT- III Welding – II: Resistance Welding: General, principle of heat generation in resistance welding, application of resistance welding processes. *Resistance spot*, seam and projection welding, electrode materials, shapes of electrodes, electrode cooling, selection of welding currents, voltages. Special type of welding: Friction welding, Explosive

welding, Thermit welding, Laser welding, Electron beam welding, Electroslag welding, Ultrasonic welding; principle, equipments, operations.
Soldering, Brazing & Braze welding, Welding Defects

UNIT- IV Machine Tools: Lathe: Principle of operation, basic parts of a lathe, types – speed lathe, engine, bench, tool room, capstan, turret, automatic, specification, construction, operations-facing, turning, knurling, taper turning, thread cutting, drilling, boring, reaming, work holding devices & tools, mechanism and attachments for various operations. Shaper: Principle of operation, parts, types horizontal, vertical, universal, Operations – horizontal cutting, vertical cutting, angular cutting, irregular cutting, specification, Quick return Mechanisms. Table feed mechanism, work holding devices. Planner: Principle of operation, parts, types – double housing, open side, pit type, plate type, divided table. Specification, types of drives.

UNIT-V Milling: Principle of operation, parts, specification, types- horizontal, vertical, universal, milling operations – plain, face, slotting, gear cutting mechanisms and attachments for milling, indexing-simple, compound and differential.
Broaching: Principle of operation, parts, types of broaches- horizontal, vertical, pull, surface-internal and external broaching machines, nomenclature, of broach.
Drilling: Principle of operation, parts, drill nomenclature, types of drilling machines, other operations like counter boring, counter sinking, spot facing etc.
Reaming: Principle of operation, parts, description of reamers, and type of reaming operations.
Boring: Principle of operation, parts, types of boring machines, boring operations, boring tools

Text Books:

1. Manufacturing Technology (Vol. – I & II) – P.N. Rao – Tata McGraw Hill Pub. Company, New Delhi.
2. A Text Book of Production Technology (Manufacturing Processes) – P.C. Sharma – S. Chand and Company Ltd., New Delhi.

Reference Books:

1. Manufacturing Science – A. Ghosh & A.K. Mallik – East West Press Pvt. Ltd., New Delhi
2. Manufacturing Engineering and Technology – S. Kalpakjian & S.R. Schmid – Addision Wesley Longman, New Delhi
3. Production Technology – R. K. Jain – Khanna Publishers, New Delhi
4. A Text Book of Production Technology (Vol. I & II) – O.P. Khanna – Dhanpat Rai & Sons, New Delhi.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**IV**
Subject:	**Kinematics of Machine**	**Code:**	**BT02405**
Total Theory Periods:	**40**	**Total Tutorial Periods:**	**10**
Class Tests:	**Two (Minimum)**	**Assignments:**	**Two (Minimum)**
ESE Duration:	**Three Hours**	**Maximum Marks: 70**	**Minimum Marks: 28**

UNIT- I Relative velocity: Elements, pairs, Mechanism, Four bar chain and its inversion, Velocity diagrams, Relative velocity method, Instantaneous centre method.

UNIT-II Relative Acceleration: Synthesis of mechanism, Pantograph, Lower pair mechanism, Relative acceleration diagram, Kliens construction, Coroillis component of acceleration. *Analytical method of calculating velocity and acceleration of a piston in a reciprocating engine mechanism.*

UNIT- III Cams: Classification of cams and followers, Nomenclature of a radial cam, Description of follower movement, Displacement diagrams, Uniform and modified uniform motion, Simple harmonic motion, Uniform acceleration motion and its modifications, Cycloidal motion, Synthesis of cam profile by graphical approach, Considerations of pressure angle. Cams with specified contours: Circular arc cam & tangent cam.

UNIT- IV Gear: Types of gears, Gear terminology, Law of gearing, Gear tooth forms, Involute and Cycloid tooth profile, Interference and Undercutting of Involutes teeth, Minimum number of teeth on pinion to avoid interference.
Gear trains: Simple, Compound, Reverted, and Epicyclical gear trains, computation of velocity ratio in gear trains by different methods.

UNIT-V
- Friction: Applications of friction, Pivot and collar friction, Thrust bearing.
- Belt-Drives: Ratio of tensions for flat belt & V-belt, Centrifugal tension, condition for maximum power transmission.
- Brakes and dynamometer: Simple block and shoe brake, Band brake, Band and block

brake, and internal expanding shoe brake, Absorption dynamometer, Transmission dynamometer.

Text Books:

1. Theory of Machine – S. S. Ratan-Tata McGraw Hill.
2. The Theory of Machine – Thomas Beven – CBS Publishers.

Reference Books:

1. Theory of mechanism and machine – A. Ghosh, A.K. Mallik –EWP Press.
2. Theory of Machine – Shigley, JE- Oxford University Press
3. Theory of Machine- Jagdish Lal- Metropolitan Book Co. Pvt. Ltd.
4. Theory of machine – J.E. Singh – McGraw Hill.

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering **Semester: IV**

Subject: Fluid Mechanics Lab **Code: BT02406**

Maximum / Minimum Marks: 35 / 14

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To determine the meta-centric height of a ship model.
2. To verify Bernoulli's Theorem.
3. To verify Impulse Momentum Principle.
4. To calibrate a Venturimeter and study the variation of coefficient of discharge.
5. To calibrate an orifice-meter.
6. Experimental determination of critical velocity in pipe.
7. To determine of head loss in various pipe fittings.
8. Flow measurement using Pitot tube.
9. To study the transition from laminar to turbulent flow and to determine the lower critical Reynold's number.
10. To determine the hydraulic coefficients (Cc, Cd and Cv) of an orifice.
11. To determine the coefficient of discharge of a mouth piece.
12. To obtain the surface profile and the total head distribution of a forced vortex.
13. To study the velocity distribution in pipe and to compute the discharge by integrating velocity profile.
14. To study the variation of friction factor for pipe flow.
15. To determine the roughness coefficient of an open channel.

List of Equipment/Instruments/Machines/Software Required:

1. Apparatus for determination of metacentric height
2. Bernoulli's apparatus
3. Impact of jet apparatus
4. Venturimeter
5. Orifice meter

6. Pipe friction apparatus
7. Orifice apparatus
8. Mouth Piece apparatus with the provision for determination of hydraulic coefficient Cc, Cd & Cv
9. Vortex flow apparatus
10 Apparatus of head loss in various pipe fittings.
11 Reynold's apparatus
12 Complete setup for flow measurement using Pitot tube

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering **Semester: IV**

Subject: Material Testing Lab **Code: BT02407**

Maximum / Minimum Marks: 35 / 14

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To study the Universal Testing Machine.
2. To perform the Tensile Test of Mild Steel on U.T.M and To Draw Stress–Strain Curve.
3. To determine strength of wood on U.T.M (i) Along the Grain (ii) Across the Grain.
4. To determine shear strength of Mild Steel on U.T.M.
5. To observe Flexural Behavior of Timber specimen and to determine it's strength under transverse loading on U.T.M.
6. To study the Impact Testing Machine and test specimen of Izod and Charpy.
7. To determine Izod and Charpy Value of the given mild steel specimen.
8. To study the Fatigue Testing Machine and to discuss the procedure to find out endurance limit of given material.
9. To study the Spring Testing Machine.
10. To determine modulus of rigidity for the material of open and closed Coiled Helical Spring Subjected to Axial Load by spring testing machine.
11. To study the Torsion Testing Machine.
12. To determine ultimate shear stress and modulus of rigidity under Torsion.
13. To study the Cupping Test Machine and to determine Erichsen value of Mild Steel sheet.
14. To study the Rockwell Hardness Testing Machine and to determine the Rockwell Hardness of the given material.
15. To study the Brinell Hardness Machine and to determine the Brinell hardness of the given material.
16. To study the Vickers Hardness Machine and to conduct a hardness test on the machine.
17. To study Column testing machine and to conduct Buckling Test of column.

Equipment/Machines/Instruments/Tools/Software Required:

- Universal Testing Machine
- Impact Testing Machine
- Fatigue Testing Machine
- Spring Testing Machine
- Torsion Testing Machine
- Cupping Testing Machine
- Rockwell Hardness Testing Machine
- Brinell Hardness Machine
- Vickers Hardness Machine
- Column Testing Machine

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Analyze mechanical properties of various engineering materials under a specific types of load in universal testing machine.
2. Analyze mechanical properties of engineering materials under impact loading.
3. Analyze mechanical properties of specimen under torsion (Torsion Testing Machine, Spring Testing Machine)
4. Determine hardness of given material.
5. Analyze mechanical properties of specimen under fatigue, deep drawing and buckling load.

BHARTI VISHWAVIDYALAYA, DURG

Branch: **Mechanical Engineering** **Semester:** **IV**

Subject: **Manufacturing Science Lab** **Code: BT02408**

Maximum/Minimum Marks: 35/14

List of Experiments: (At least Ten experiments are to be performed by each student)

Foundry

1. Moulding of a multi-piece pattern by green sand moulding.
2. Making a mould (with core) and casting.

Machine Tool

3. Taper turning in a Lathe
4. Thread cutting in Lathe
5. Slot cutting in Shaper
6. Gear cutting in milling machine using indexing head.
7. Alignment testing of Lathe
8. Drilling, boring and reaming of a hole.

Cutting Tool

9. Study of turning tool of Lathe (Tool signature)
10. Study of twist drill

Welding

11. Joining MS plates by arc welding (SMAW,MIG)
12. Joining metal sheet by resistance welding
13. Joining metal by soldering/brazing

Inspection and Testing

14. Inspection of casting defect and welding defects
15. Non destructive testing of casting and welding defects

Equipment/Machines/Instruments/Tools/Software Required:

1. Moulding equipment
2. Melting facility
3. Lathe
4. Shaper
5. Drilling Machine
6. Milling Machine
7. Reamers
8. Arc welding equipments
9. Soldering / Brazing equipments
10. Non destructive testing equipments

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering **Semester: IV**

Subject: Virtual Lab **Code: BT02409**

Maximum / Minimum Marks: 35 / 14

List of Experiments			
Sl.	Name of Virtual Lab	Website link	
A.	Strength of materials Lab	http://sm-nitk.vlabs.ac.in/	(Any 03)
	1. To study the mechanical properties of Mild Steel and Cast iron specimen under tension load and compression load. 2. To study the mechanical properties of mild steel under torsion and bending. 3. To determine experimentally, the ultimate shear strength of timber. 4. To find the Rockwell and Brinell hardness number of mild steel, cast iron, brass, aluminum and spring steel. 5. To find the impact resistance of mild steel and cast iron using Izod and Charpy test.		
B.	Mechanics of Machine lab/ Mechanisms Lab	http://mm-nitk.vlabs.ac.in/ http://vlabs.iitkgp.ernet.in/mr/	(Any 03)
	1. To study Kinematic analysis of Slider cranks mechanism. 2. To study Kinematic analysis of Elliptical Trammel. 3. To study Kinematic analysis of Crank and Slotted Mechanism 4. To study Oldham Coupling Mechanism. 5. To study quick return mechanism.		
C.	Virtual laboratory Experience in Fluid and Thermal Sciences	https://mfts-iitg.vlabs.ac.in/	(Any 03)
	1. To perform conduction analysis of Single Material Slab and cylinder. 2. To perform conduction analysis of Double Material Slab. 3. To perform conduction analysis of cylinder. 4. To determine the overall heat transfer coefficient (U) in the parallel flow heat exchanger. 5. To determine the overall heat transfer coefficient (U) in the counter flow heat exchanger.		
D.	Micromachining laboratory	http://mm-coep.vlabs.ac.in/	(Any

			02)
	1. To study the Wire Electrical Discharge Machining process. 2. To study the Laser Hardening process. 3. To study the electrochemical machining Process.		
E.	Fabrication Laboratory (FAB LAB)	http://fab-coep.vlabs.ac.in/Introduction.html	(Any 01)
	1. Study of Moulding and Casting of complex shapes using Polyurethane rubber mold compounds. 2. To understand the process parameters of 3D scanning to generate digitized data from physical model.		

Equipment/Machines/Instruments/Tools/Software Required:

1. Computer system with good connectivity to Internet, any specific software is not required.

Note:

1. Refer Virtual Labs website which is an initiative of ministry of education under the national mission on education through ICT to conduct virtual lab. Link: https://www.vlab.co.in/
2. It is advised to visit https://www.vlab.co.in/broad-area-mechanical-engineering frequently for any update and new experiments on the listed subjects.

BHARTI VISHWAVIDYALAYA, DURG

Name of program:	**Bachelor of Technology**		
Branch:	**Mechanical Engineering**	**Semester:**	**IV**
Subject:	**Indian Culture and Constitution of India**	**Code:**	**BT02410**
No. Of Periods:	**2 Periods/Week**	**Total Tutorial Periods:**	**NIL**
Maximum Marks:	**50 (TA)**	**Minimum Marks:**	**18**

Objective: The Constitution is the supreme law and it helps to maintain integrity in the society and to promote unity among the citizens to build a great nation. The main objective of the Indian Constitution is to promote harmony throughout the nation.

Course Objectives

Upon completion of this course, the student shall be able

- To understand Meaning and concepts of Traditional and Modern of Culture
- To understand Sources of the Study of Indian Culture
- To Enable the student to understand the history and importance of constitution
- To understand philosophy of fundamental rights and duties
- To understand the powers and functions of executive, legislature and judiciary
- To understand the powers and functions of state government
- To understand the recent trends in Indian constitutional and election commission of India.
- To understand the central and state relation, financial and administrative.

UNIT-I

Meaning and concepts of Culture: Traditional and Modern concepts of Culture-Notions of Culture in textual tradition, anthropological, archaeological and sociological understanding of the term culture. Elements of Culture, concept of Endianness and value system. Relation between culture and civilization. Historiography and approaches to the study of Indian Culture– Stereotypes, Objectivity and Bias, Imperialist, Nationalist, Marxist and Subaltern. Heritage of India and world's debt to Indian Culture.

UNIT–II

Sources of the Study of Indian Culture: Archaeological: cultural remains, Monuments, Numismatics, Epigraphy; Literary sources and Oral traditions; Foreign Accounts; Archival sources.

UNIT–III

History of Indian Constitution Constitutional History, Preamble salient features, citizenship, Method of Amendment and Recent Amendments. Rights and Duties Fundamental Rights and Directive Principles of State Policy. Fundamental Duties. Difference between Fundamental Rights and Directive Principles of State Policy

Union Government. a) President-powers and functions. Vice president powers and functions, Prime Minister and council of ministers powers and functions. b) Parliament- Loksabha, Rajyasabha- composition powers and functions.

c) Judiciary (Supreme Court) composition powers and functions Judicial Activism

UNIT–IV

State Government. a) Governor: powers and functions. b) Chief minister: powers and functions. c) State Legislative

Assembly and Legislative Council- composition powers and functions. d) High Court : composition powers and functions

UNIT–V

Recent Trends in Indian Constitutional a) Basic structure of Indian Constitution. b) Electoral Reforms c) Panchayati Raj system in India.

Books of Reference

1. Dr. P. K. Agrawal Indian Culture, Art and Heritage,
2. P. Raghunadha Rao Indian Heritage and Culture
3. M.V. Pylee, An Introduction to the Constitution of India, New Delhi, Vikas, 2005.
4. Subhash C. Kashyap, Our Constitution: An Introduction to India's Constitution and constitutional Law, New Delhi, National Book Trust, 2000.
5. Durga Das Basu, Introduction to the Constitution of India, New Delhi, Prentice Hall of India, 2001.
6. D.C. Gupta, Indian Government and Politics, VIII Edition, New Delhi, Vikas, 1994.
7. V.D.Mahajan, Constitutional Development and National Movement inIndia, New Delhi, S. Chand and Co., latest edition.

BHARTI VISHWAVIDYALAYA, DURG

SCHEME OF TEACHING AND EXAMINATION
B. Tech. (Fifth Semester – Mechanical Engineering)

S. No.	Sub. Code	SUBJECT	Periods Per Week			Scheme Of Exam Theory/Practical			Total Marks	Credit (L+T+P/2)
			L	T	P	ESE	CT	TA		
1	BT02501	Internal Combustion Engine	2	1	-	70	10	20	100	3
2.	BT02502	Solid Mechanics	3	1	-	70	10	20	100	4
3.	BT02503	Fluid Machines	2	1	-	70	10	20	100	4
4.	BT02504	Dynamics of Machine	3	1	-	70	10	20	100	3
5.	Professional Elective-1 (Refer Table I)		2	1	-	70	10	20	100	3
6.	BT02506	Internal Combustion Engine Lab	-	-	2	35	-	15	50	1
7.	BT02507	Dynamics of Machine Lab	-	-	2	35	-	15	50	1
8.	BT02508	Fluid Machines Lab	-	-	2	35	-	15	50	1
9.	BT02509	Project-I based on Summer Internship/ Industrial Training	-	-	2	35	-	15	50	1
10.	BT02510	Environmental Studies	-	-	2	-	-	50	50	-
Total			**13**	**6**	**11**	**490**	**50**	**210**	**750**	**21**

L – Lecturer, T – Tutorial, P – Practical , CT –Class Test
ESE – End Semester Exam TA – Teacher's Assessment

Note: - The students have to attend the four weeks industrial training /summer internship in B. Tech.program after fourth semester, which will be evaluated in fifth semester.

Table I

Professional Elective-1

S.N.	Course Code	Subject
1.	**BT02505(01)**	**Operation Research**
2.	**BT02505 (02)**	**Composite Materials**
3.	**BT02505 (03)**	**Gas Dynamics and Jet Propulsion**

Note:

1. $1/4^{th}$ of total strength of students subject to minimum of 20 students is required to offer and elective in the college in a particular academic
2. Choice of elective course once made for an examination cannot be changed in future examinations.

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Internal Combustion Engine | **Code: BT02501**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted: 2 (Minimum) | **ESE Duration : Four Hours**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

Note: Design data book by PSG and ISI data sheets are allowed in the examination

UNIT- I

a) **Introduction:** Internal and external combustion engine and their comparison, four stroke cycle S.I. and C.I. engine, two stroke engine, comparison of four stroke and two stroke engines, comparison of S.I. and C.I. engine, classification of I.C. Engine on various basis Valve timing diagram for S.I. and C.I. engines. Effect of valve timing and engine speed on volumetric efficiency.

b) **Fuel-air cycles and actual cycle:** Reasons for deviation of actual cycle from air standard cycles, fuel air cycle sand their analysis, actual cycle sand their analysis. Reasons of ignition advance and injection advance.

UNIT-II

a) **Combustion in S.I. engine:** stages of combustion, factor influencing the flame speed, the phenomenon of knock in S.I. engine, effect of engine variable on knock, effects of detonation, Pre-ignition, effect of preignition.

b) **Combustion in C.I. engine:** stages of combustion, factor influencing the delay period,, the phenomenon of knock in C.I. engine, effect of engine variable on knock, comparison between knock in S.I. and C.I. engine.

UNIT- III

a) **Fuel Supply System in S.I. Engine:** Properties of air-petrol mixtures, air fuel mixture requirement low power, normal power and maximum power range, air fuel mixture requirement for idling & acceleration, simple carburetor, limitation of simple carburetor, Gasoline injection system: Type of injection system, components of injection system, Electronic gasoline fuel injection system, multi-point fuel injection system, working, advantages and disadvantages.

b) *effect of fuel structure on combustion, volatility of liquid fuels, ASTM distillation curve, effect of volatility on engine performance - cold starting, hot starting, vapour*

lock, acceleration, carburetor icing, and crank case dilution. Antiknock rating of fuels, CCR, HUCR, Octane number, performance number, Cetane number. Dopes

c) **Fuel Supply System in C.I. Engine:** Requirement, type of injection systems, Bosch fuel injection pump, type of fuel injector, type of nozzle, atomization, spray penetration and spray direction. Electronic diesel injection System.

UNIT- IV

a) **Ignition System:** Battery and magneto ignition system and their comparative study, spark plug heat range, electronic ignition system, firing order, Ignition timing, centrifugal and vacuum ignition advance.

b) **Cooling System:** Cooling requirement, air cooling, liquid cooling, type of liquid cooling system, advantage and disadvantage of air cooling and water cooling system, Antifreeze mixture.

c) **Lubrication System:** Function of lubricating system, Classification of lubricating system, mist lubrication system, dry sump lubrication, wet sump lubrication-splash, and modified and full pressure system.

d) **Emission and Pollution:** S. I. Engine and C. I. Engine emissions and its control and comparison. Effect of pollution on Human health and biosphere.

UNIT-V

Testing and Performance: Performance parameters, Measurements of brake power, indicated power, Friction power, *Willan's line method, Morse test, motoring test,* Fuel and air consumption, Exhaust gas calorimeter, Calculation of various performance parameter, Heat balance sheet. Performance curves for S.I. and C.I. engine with load and speed, *exhaust gas calorimeter.*

Governing: *Necessity of governing, methods of governing-hit and miss governing, quantity governing*

Text Books:

1. A Course in Internal Combustion Engines – M.L. Mathur & R.P. Sharma – Dhanpat Rai& Sons, Delhi
2. Internal Combustion Engine – V. Ganeshan – TMH, New Delhi

Reference Books:

1. Internal Combustion Engine – R. Yadav – Central Publishing House, Allahabad
2. A Course in Internal Combustion Engine – V.M. Domkundwar – Dhanpat Rai & Sons, Delhi
3. Internal Combustion Engines – R.K. Rajput – Laxmi Publications
4. Internal Combustion Engine Fundamentals-John B. Heywood- McGraw Hill International, Delhi
5. Fundamental of Internal Combustion Engine – Paul W. Gill, James H. Smith, Eugene – Oxford and IBH

   Publishing company
6. Fundamental of Internal Combustion Engine- H.N. Gupta-PHI- New Delhi

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Solid Mechanics | **Code: BT02502**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted: 2 (Minimum) | **ESE Duration: Four Hours**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

Note: Steam Tables are allowed in the examination

UNIT- I **Energy Methods:** Introduction, Strain energy, Elastic strain energy in tension, compression, bending and torsion. Impact loading in tension and bending, Theorem of Castiglione's and its applications, Reciprocal relations, Maxwell -Betti theorem, Introduction to plasticity.

UNIT-II **Fixed Beams**: Fixed beam subjected to different types of loads and couples, Calculations of fixing moments and reactions at supports, deflection. Effect of sinking of support.

Continuous beams: Continuous beams subjected to different type of loads and couples, beams with overhang, beams with one end fixed, Chaperon's theorem. Effect of sinking of supports.

UNIT- III **Thin Pressure Vessel**: Thin Pressure Vessels, Circumferential and longitudinal stresses in thin cylindrical shells and thin spherical shell under internal pressure,

Thick Pressure Vessel: Introduction, Lames Theorem, Thick Pressure vessels subjected to internal pressure, External Pressure & both, compound cylinders.

UNIT- IV **Columns:** Struts and Columns, Stability of columns, Euler's formula for different end conditions,

Equivalent load, Eccentric loading, Rankine's formula.

Shear center: Definition, Position of shear center for angle, Channel and I-sections.

UNIT-V ***Bending of curved beams****: Bending of curved bars in a plane of loading, Wrinkler batch theory, Crane hooks, Chain links, Bending of ciecular rings, Stresses in Circular rings.*

Reference Books:

1. Kazmi, S. M. A., “Solid Mechanics” TMH, Delhi, India.
2. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall
3. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill
4. Y. C. Fung, Foundations of Solid Mechanics, Prentice Hall International,
5. Lawrence. E. Malvern, Introduction to Mechanics of a Continuous Medium, Prentice Hall international

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Fluid Machines | **Code: BT02503**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted:2 (Minimum) | **ESE Duration: Three Hours**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

UNIT- I **Boundary Layer Theory :** Boundary layer definition and characteristics, momentum equation, Laminar and turbulent boundary Layer, Total drag, separation and control. Flow around submerge bodies Force exerted by flowing fluid on a body: Drag and lift; stream lined and bluff body.

UNIT-II **Impact of Free Jets:** Impulse momentum principle, force exerted by the jet on stationary flat and curved plate, hinged plate, moving plate and moving curve vanes, jet propulsion of ship.

Impulse Turbine: Classification of turbine, impulse turbine, Pelton wheel, Construction working, work done, head efficiency and Design aspects, Governing of impulse turbine. *Orifice and Mouth pieces :- introductions and its classifications*.

UNIT- III **Reaction Turbine:** Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over Pelton wheel. Axial flow reaction turbine Propeller and Kaplan turbine, bulb or tubular turbine, draft tube, specific speed, unit quantities, cavitation, degree of reaction, performance characteristics, surge tanks, governing of reaction turbine.

UNIT- IV **Centrifugal Pumps :** Classification of Pumps, Centrifugal pump, Construction, working, work done, heads, efficiencies, multistage centrifugal pump, pump in series and parallel, specific speed, characteristic, net positive suction head, cavitation. *Efficiency of centrifugal pump, Mechanical efficiency, manometric efficiency, overall efficiency.*

UNIT-V **Reciprocating Pumps:** Classification, component and working, single acting and double acting pump, discharge, work-done and power required, slip & coefficient of discharge, indicator diagram, air vessels. *Discharge of a single acting reciprocating pump, working*

and power required by single acting reciprocating pump, Cavitation, common defects in pump.

Text Books:

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar– Kataria & Sons-Delhi
2. Fluid Mechanics- Yunush A Cengel, John M. Cimbala- TMH, Delhi

Reference Books:

1. A text of Fluid Mechanics – R. K. Rajput – S. Chand & Company Ltd., Delhi
2. Fluid Mechanics & Hydraulics Machines-R.K. Bansal- Laxmi Publications, Delhi
3. Mechanics of Fluid – B.S. Massey – English Language Book Society(U.K.)
4. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas- TMH, Delhi
5. Hydraulics and Fluid Mechanics Including Hydraulic Machine- PN Modi, & SM Seth-Standard, Delhi
6. Hydraulic Machines: Fundamentals of Hydraulic Power Systems – P. Kumar – BSP Books Pvt, Ltd., Hyderabad

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Dynamics of Machines | **Code: BT02504**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted: 2 (Minimum) | **ESE Duration: Three Hour**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

UNIT- I **Governors:** Characteristics of centrifugal governors, Gravity controlled governors, Porter and proell. Spring controlled centrifugal governor: Hartung, & Hartnell governor. Performance parameter: Sensitivity, stability, Isochronisms, Governor Effort and power.

UNIT-II **Balancing:** Balancing of rotating masses, Static and dynamic balancing, Determination of balancing masses in two plane balancing, *Balancing of Reciprocating masses.* Balancing of internal combustion engines, Balancing of in-line engines, Firing order, Balancing of V-twin and radial engines, Forward and reverse crank method, Balancing of rotors.

UNIT- III **Gyroscope:** Gyroscopic forces and couple, gyroscopic effect in Airplanes, Ship motion and Vehicles moving on curved path.

UNIT- IV **Mechanical Vibrations:** One- dimensional ,longitudinal, Transverse, and torsional vibrations, Natural frequency, Effect of damping on vibrations, Different types of damping .Forced vibration, Forces and displacement, Transmissibility ,Vibration Isolation, Vibration sensors: seismometer and Accelerometers, Whirling of shafts with single rotor.

UNIT-V **(a)Inertia force analysis :** Effective force and inertia force on link, Inertia force on reciprocating engine. Inertia force in four bar chain mechanism.

(b)Turning moment diagram and flywheel: Turning moment diagram for single and multi cylinder internal combustion engine, Coefficient of fluctuation of speed, Coefficient of fluctuation of energy, Flywheel. *Comparison between Governer and Flywheel.*

Text Books:

1. Theory of Machine- S.S. Rattan - Tata McGraw Hill, New Delhi
2. Theory of Machines - Thomas Bevan, - CBS/ Cengage Publishers

Reference Books:

1. Theory of Machines and Mechanism– Uicker, Pennock, & Shigley – Oxford Univ. Press
2. Theory of Mechanisms and Machines- A. Ghosh, A. K. Mallik – EWP Press.
3. Mechanism and Machine theory- Ambekar- PHI, Delhi
4. Theory of Machine – P.L. Ballaney – Khanna Publishers, New Delhi
5. Theory of Machine -JagdishLal- Metro Politan Books, New Delhi

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Operation Research | **Code: BT02505(01)**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted: 2 (Minimum) | **ESE Duration: Three Hours**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

UNIT- I **Introduction:** Various stages of O.R., Fields of application, optimization and its classification. General Linear Programming Problems- Introduction, maximization and minimization of function with or without constraints, formulation of a linear programming problem, graphical method and simplex method, Big M method degeneracy, application of L.P.P. in Mechanical Engineering**.**

UNIT-II **The Transportation Problems:** Mathematical formulation computational procedures, Stepping stone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems and case of Degeneracy. The Assignment Problems: Mathematical formulation of assignment problems , solution of assignment problems, traveling sales man problems, Aircrew Assignment problems.

UNIT- III **Waiting Line Theory:** Basic queuing process, basic structure of queuing models, some commonly known queuing situations Kendall' service time, solution to M/M/1:∞ /FCFS mode

UNIT- IV **Network Analysis:** CPM/PERT, Network Representation, Techniques for drawing network. Resource smoothing and leveling, project cost, Optimum project duration, project crashing, updating, Time estimation in PERT.

UNIT-V ***Game Theory:*** Introduction, two person zero sum game, methods for solving two person zero sum game: when saddle point exists, when no saddle point exists, solution of 2xnandmx2game.

Simulation: Basic concept of simulation, applications of simulation, merits and

demerits of simulation, Monte Carlo simulation, simulation of Inventory system, simulation of Queuing system.

Text Books:

1. Operation Research–Hira & Gupta–S. Chand& Co.
2. Operation Research–N.D. Vohra–TMH

Reference Books:

1. Operation Research–S.D. Sharma–S. Chand & Com. New Delhi
2. Operations Research – Hamdy. M. Taha – TMH, New Delhi
3. Operations Research Theory and applications J K Sharma, Macmillan
4. Operations Research, Col. D. S. Cheema, University Science Press, New Delhi
5. Operations Research- A. P. Verma – S. K. Kataria & Sons

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Composite Materials | **Code: BT02505(02)**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted: 2 (Minimum) | **ESE Duration: Three Hours**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

Note: Four questions of 20 marks to be set taking one from each unit

UNIT-I **Introduction to Composites:** Definition, classification/ types and characteristics of composite materials; Basic composite constituents – fiber and matrix; Properties of unidirectional long fiber and short fiber composites; Polymeric materials and polymeric composites; Honeycomb and Sandwich Composite Structure; Application areas of composites.

UNIT-II **Manufacturing, Testing and Environmental Issues:** Moulding, pultrusion, filament winding, other advanced manufacturing techniques; Quality inspection and testing– uniaxial tension test, uniaxial Compression test, sheartest , fracture toughness testing of composites .Environmental Issues related with composite manufacturing and their applications.

UNIT-III **Material Properties:** Orthotropic and Anisotropic materials ;properties relating stress stostrain, properties relating temperature to strain ,properties relating moisture tostrain, properties relating
stress(or strain) to failure, Failure Criterion–Maximum Stress and Maximum Strain ;Review of force tensors, stress tensors, strain tensors.

UNIT-IV **Elastic Response Analysis:** Hooke's law for orthotropic and anisotropic materials; Linear Elasticity for Anisotropic Materials; Unidirectional composite laminates; Rotations of Stresses, Strains; Residual Stresses; Stress and environmental effects on composites behaviour.

UNIT-V **CompositeLaminates:**Thin-platetheory,classicallaminationtheory;Angle-ply and cross ply laminates; Static, dynamic and stability analysis for simple cases of composite plates; Inter laminar Stress behaviour; Composite Joints; Design with Composites.

TextBooks:

1. Composite Materials Science and Engineering- Krishan K. Chawla-Springer
2. Compositematerials:production,properties,testingandapplications-K.Srinivasan-AlphaScience

Reference Books:

1. Introduction to composite materials design –Ever J. Barbero. – CRC Press
2. Design and Analysis of Composite Structures: With Applications to Aerospace- Christos Kassapoglou -Wiley
3. Mechanics of composite structures- LászlóP. Kollár, GeorgeS.- Springer.
4. Damage and failure of composite materials- Ramesh Talreja, Chandra Veer Singh-Woodhead Publishing
5. ASM Handbook Volume21

BHARTI VISHWAVIDYALAYA, DURG

Branch: Mechanical Engineering | **Semester: V**

Subject: Gas Dynamic and Jet Propulsion | **Code: BT02505(03)**

Total Theory Periods: 40 | **Total Tutorial Periods: 10**

No. of class Tests to be conducted: 2 (Minimum) | **ESE Duration: Three Hours**

No. of assignments to be submitted: 2 (Minimum) | **Maximum Marks in ESE: 70**

Minimum Marks: 28

UNIT-I **Basic concepts and isentropic flows:** Energy and momentum equations of compressible fluid flows– Stagnation states,

Mach waves and Mach cone – Effect of Mach number on compressibility

Isentropic flow through variable ducts –Nozzle and Diffusers

UNIT-II **Flow through ducts:** Flows through constant area ducts with heat transfer (Rayleigh flow)and Friction (Fann of low)–variation of flow properties.

UNIT-III **Normal and obliques hocks:** Governing equations–Variation of flow parameters a cross the normal And oblique shocks–Prandtl–Meyer relations–Applications.

UNIT-IV **Theory of jet propulsion**: Thrust equation –Thrust power and propulsive efficiency– Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and Turbo prop engines.

UNIT-V **Space propulsion :** Types of rocket engines–Propellants-feeding systems–Ignition and combustion –Theory of rocket propulsion–Performance study–Staging –Terminal and characteristic velocity– Applications–spaceflights.

Text Books:

1. Fundamentals of Compressible Flow-Yahya, S.M.-New Age International
2. Modern Compressible flow -Anderson, J.D.-McGraw Hill

Reference Books:

1. Mechanics and Thermodynamics of Propulsion- Hill. P. and C. Peterson-Addison–Wesley
2. Principles of Jet Propulsion and Gas Turbines Zucrow. N.J- Zucrow N.J.- John Wiley
3. Aircraft and Missile Propulsion- Zucrow. N.J- Zucrow N.J.- John Wiley
4. Rocket Propulsion Elements- Sutton. G.P.-John wiley
5. Dynamics and Thermodynamics of Compressible fluid Flow- Shapiro. A.H.- John wiley
6. Gas Turbines- Ganesan .V-TMH
7. Gas Dynamics and Jet Propulsions-Soma sundaram. PR.S.L.-New Age
8. Gas Turbine Theory-Cohen. H.,G.E.C. Rogers and Saravana mutto-Longman

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**V**
Subject:	**Internal Combustion Engine Lab**	**Code:**	**BT02506**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. Study of IC Engine.(Engine components, material used and engine nomenclature)
2. Study of working of four stroke petrol engine and four stroke diesel engine with the help of cut section models.
3. Study of working of two stroke petrol and two stroke diesel engine with the help of cut section models.
4. Study of fuel supply system of petrol engine(fuel pump and simple carburettor)
5. Study of complete caurburettor
6. Study of Petrol Injection System.
7. Study of fuel supply system of a Diesel engine(fuel pump and fuel injector)
8. Study of Ignition systems of an IC Engine (Battery and Magneto ignition system and Electronic ignition system).
9. Study of Lubrication system of an IC Engine (Mist, Splash and Pressure lubrication)
10. Study of cooling systems of an IC Engine(Air cooling and water cooling)
11. To conduct a performance test on diesel engine to draw heat balance sheet for given load and speed.
12. To determine friction power of diesel engine by Willan's line or fuel rate extra polation method.
13. To conduct a performance test on the variable compression ratio engine and to draw the heat balance sheet forgiven compression ratio, speed and load and plot the performance curves.
14. To conduct a performance test on a four cylinder four stroke petrol engine and to draw the heat balance sheet and performance curves.
15. To calculate the indicated power, friction power and mechanical efficiency of four stroke four cylinder petrol engine at full load and rated speed by Morsetest.
16. To draw the valve timing diagram of a four-stroke S.I. or C.I. Engine using experimental setup.

17. Analysis of engine exhaust gases using Orsat apparatus/gas analyzer.

List of Equipment/Instruments/Machines/Software Required:

1. Model of Two & Four Stroke Petrol Engine
2. Model of Two & Four Stroke Diesel Engine
3. Single Cylinder Actual S.I. Engine in Cut Section
4. Single Cylinder Actual C.I.. Engine in Cut Section
5. Four Stroke, Four-Cylinder Petrol Engine in Cut Section
6. Carburettor sin Cut Section/Without Cut Section.
7. Model of Petrol Injection System
8. Bosch Fuel Pump in Cut Section
9. Nozzles in Cut Section.
10. Diesel Injectors in Cut Section
11. Four Stroke Single-Cylinder Diesel Engine Test Rig
12. Variable Compression Ratio Engine Test Rig.
13. Four Stroke Multi- Cylinder Petrol Engine Test Rig
14. Experimental Setup for Drawing Valve Timing Diagram Of Four Stroke S.I .or C.I.Engines.
15. Orsat Apparatus/Gas Analyzer for Engine Exhaust Gas Analysis.

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**V**
Subject:	**Dynamics of Machine Lab**	**Code:**	**BT02507**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To find out the oscillations of simple pendulum with universal vibration apparatus.
2. To find out the oscillations of Compound pendulum with universal vibration apparatus.
3. To find out the radius of gyration of bi-filler suspension with universal vibration apparatus.
4. To find out undamped torsional vibrations of single rotor system with universal vibration apparatus.
5. To find out the frequency of damped torsional vibration of single rotor system with universal vibration apparatus
6. To measure the frequency of torsional vibrations of single rotor system with universal vibration apparatus.
7. To measure the frequency of torsional vibrations of double rotor system with universal vibration apparatus.
8. To find out free vibration of helical coiled spring with universal vibration apparatus.
9. To study forced damped vibration of a spring mass system and simple supported beam with universal vibration apparatus
10. To find out the Gyroscopic couple and prove the Gyroscopic law with Gyroscope apparatus.
11. To find out the Power and effort of Proel, Porter & Hartnell Governor with Governor Apparatus
12. To find out the critical speed for different diameters of shaft by whirling of shaft apparatus.
13. To verify the static and dynamic balancing for different planes and masses by balancing apparatus

List of Equipment/Instruments/Machines/Software Required:

1. Universal Vibration Apparatus
2. Whirling of Shaft Apparatus.
3. Balancing Apparatus (Both Static & Dynamic)
4. Epi cyclic Gear Train and Holding Torque Apparatus
5. Gyroscope apparatus
6. Governor apparatus with differential attachment

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**V**
Subject:	**Fluid Machines Lab**	**Code:**	**BT02508**
Maximum Marks:	**35**	**Minimum Marks:**	**14**

List of Experiments / Studies to be Performed

(Minimum seven experiments and three studies are to be performed by each student)

1. Performance characteristics of Pelton wheel turbine.
2. Performance characteristics of Francis turbine.
3. Performance characteristics of Kaplan turbine.
4. Performance characteristics of variable speed centrifugal pump.
5. Performance characteristics of rated speed centrifugal pump.
6. Performance characteristics of multi stage centrifugal pump.
7. Study of Wind Tunnel (Open Circuit blower type).
8. Determination of Lift and drag force over an airfoil.
9. To study the working of fluid IC devices (Analog and Digital).
10. To study the Hydraulic Accumulator.
11. To study the Hydraulic Intensifier.
12. To study the Hydraulic Crane.
13. To study the Hydraulic lift.
14. To study the Hydraulic Ram.
15. To study the Jet Pump.
16. To study the Air Lift Pump.

List of Equipment / Instruments / Machines / Software Required:

1. Pelton Wheel Turbine
2. Francis Turbine Test Rig
3. Kaplan Turbine Test Rig
4. Variable Speed Centrifugal Pump Test Rig
5. Rated Speed Centrifugal Pump Test Rig
6. Multi Stage Centrifugal Pump Test Rig

7. Reciprocating Pump Test Rig
8. Complete setup of Wind Tunnel (Open circuit blow type) with minimum wind speed not less than 30m/sec
9. Fluidic devices (Analog and Digital)
10. Air of oil with the provision of measurement of pressure distribution over the surface.
11. Cut section model of Hydraulic Accumulator
12. Cut section model of Hydraulic Intensifier
13. Cut section model of Hydraulic Crane
14. Cut section model of Hydraulic Lift
15. Cut section model of Hydraulic Ram
16. Cut section model of Hydraulic Jet and Air lift pump.

BHARTI VISHWAVIDYALAYA, DURG

Branch:	**Mechanical Engineering**	**Semester:**	**V**
Subject:	**Environmental Studies**	**Code:**	**BT02510**
Maximum Marks:	**50 (TA)**	**Minimum Marks:**	**14**

COURSE OBJECTIVES:

1. Basic knowledge of environment, ecology, ecosystems, biodiversity and conservation.
2. Fundamentals of natural resources, control, uses and its impact on environment.
3. Human population, growth, growing needs and its impact on society and environment.
4. Types of environmental pollution, legislations, enactment and management.

COURSE DETAILS:

UNIT I: Introduction to environmental studies, ecology and ecosystems

(06 hours)

Introduction to environment; Concept and structure of ecology and ecosystem, energy flow; Community ecology; Food chains and webs; Ecological succession; Characteristic features of forest, grassland, desert and aquatic ecosystem; Multidisciplinary nature of environmental studies, scope and importance; Concept of sustainability and sustainable development.

UNIT II: Biodiversity and conservation

(06 hours)

Introduction to biological diversity and levels of genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots; Threats to biodiversity, habitat loss, conflicts and biological invasions; In-situ and Ex-situ conservation of biodiversity: Ecosystem and biodiversity services.

UNIT III: Natural resources and environment

(08 hours)

Concept of Renewable and non-renewable resources; Land resources, land use change, land degradation, soil erosion; Desertification; Deforestation: causes, consequences and remedial measures; Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state); Energy resources: environmental impacts of energy generation, use of alternative and nonconventional energy sources, growing energy needs.

UNIT IV: Human communities, social issues and environment

(08 hours)

Basic concept of human population, growth and communities; Impacts on environment, human health, welfare and human rights; Resettlement and rehabilitation; Environmental natural disaster: floods, earthquake, cyclones, tsunami and landslides; Manmade disaster; Environmental movements; Environmental ethics: role of gender and cultures in environmental conservation; Environmental education and public awareness; Human health risks and preventive measurements.

UNIT V: Environmental pollution, policies, legislations, assessment and practices

(12 hours)

Environmental pollution: Causes, effects and controls of air, water, soil, noise and marine pollution; Concept of hazardous and non-hazardous wastes, biomedical and e-wastes; Solid waste management and control measures; Climate change, global warming, ozone layer depletion, acid rain and their societal impacts; Environment laws: Wildlife Protection Act, Forest Conservation Act, Water (Prevention and control of Pollution) Act, Air (Prevention & Control of Pollution) Act, Environment Protection Act, Biodiversity Act, International agreements negotiations, protocols and practices; EIA, EMP.

On completion of each unit, students have to submit one assignment from each unit.

COURSE OUTCOMES (CO):

On completion of the course, students will able to:

1. Interpret and demonstrate the concept of ecology and ecosystem for environmental sustainability.
2. Define and establish the diversified knowledge of biodiversity and its conservation.
3. Explain the uses of natural resources efficiently and its impact on environment.
4. Illustrate and solve the simple and complex social issues relating to human communities.
5. Exemplify and make useful solution to combat the environmental degradation with the aid of national and international legislations and protocols there under.
6. Demonstrate and elucidate the complicated issues and anthropological problems for societal development.

TEXT BOOKS:

1. De, A.K., (2006).Environmental Chemistry, 6th Edition, New Age International, New Delhi.
2. Bharucha, E. (2013). Textbook of Environmental Studies for Undergraduate Courses. Universities Press.
3. Asthana, D. K. (2006).Text Book of Environmental Studies. S. Chand Publishing.

REFERENCE BOOKS:

1. Odum, E. P., Odum, H. T., & Andrews, J. (1971).*Fundamentals of ecology*. Philadelphia: Saunders.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India.
3. Sharma, P. D., & Sharma, P. D. (2005).*Ecology and Environment*. Rastogi Publications.

OPEN SOURSE LEARNING:

http://nptel.ac.in/

BHARTI VISHWAVIDYALAYA, DURG

SCHEME OF TEACHING AND EXAMINATION
B. Tech. (Sixth Semester – Mechanical Engineering)

Sl. No.	Courses (Subject)	Course Code	Period per Week			Theory/Lab			Total Marks	Credit (L+T+P/2)
			L	T	P	ESE	CT	TA		
1.	Design of Machine Elements	BT02601	3	1	-	70	10	20	100	4
2.	Manufacturing Technology	BT02602	3	1	-	70	10	20	100	4
3.	Heat & Mass Transfer	BT02603	3	1	-	70	10	20	100	4
4.	Professional Elective-II (Refer Table I)		2	1	-	70	10	20	100	3
5.	Open Elective – I (Refer Table II)		2	0	-	70	10	20	100	2
6.	Design of Machine Elements Lab	BT02606	-	-	2	35	-	15	50	1
7.	Computer Aided Modeling &Analysis Lab	BT02607	-	-	2	35	-	15	50	1
8.	Heat & Mass Transfer Lab	BT02608	-	-	2	35	-	15	50	1
9.	Virtual Lab-2	BT02609	-	-	2	35	-	15	50	1
10.	Technical Communication and Soft Skill	BT02610	-	-	2	-	-	50	50	-
Total			**13**	**4**	**10**	**490**	**50**	**210**	**750**	**21**

L: Lecture, **T: Tutorial,** **P: Practical,**

ESE: End Semester Exam, **CT: Class Test,** **TA: Teachers Assessment**

Note: Duration of End Semester Examination all theory papers will be of Three Hours except for Machine Drawing Paper(at Sl. No. 2) which is of four hours duration.

Table I (Professional Elective II)

S.N.	Subject	Course Code
1.	Finite Element Analysis	BT02604(01)
2.	Power Plant Engineering	BT02604(02)
3.	Maintenance and Reliability	BT02604(03)

Note: (1) 1/4th of total strength of students subject to minimum of 20 students is required to offer and elective in the college in a particular academic session.

(2) Choice of elective course once made for an examination cannot be changed in future examinations.

List of Open Elective – I (Table III) (For 6th Semester)

S.N.	Board of Studies	Subject	Course Code
1.	Agriculture Engg	Energy Conservation & Management	BT02605(01)
2.	Agriculture Engg	Non Conventional Energy Sources	BT02605(02)
3.	Mechanical Engineering	Safety Engineering	BT02605(03)
4.	Mechanical Engineering	Value Engineering	BT02605(04)
5.	Mechanical Engineering	Environment Pollution & Control	BT02605(05)

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering**
Subject :**Design of Machine Elements**
Total Theory Periods:**03**
Class Tests: **Two (Minimum)**
Assignments: **Two (Minimum)**

Semester: **VI**
Code: **BT02601**
Total Tutorial Periods: **01**
Maximum Marks**:70**
Minimum Marks:**28**
ESE Duration: **Four Hours**

Course Objectives: The objective of this course is to teach students how to apply the concepts of stress analysis, theories of failure and material science analyze/ design commonly used machine components.

UNIT-I **General Considerations:** Selection of Materials, Design Stress, Factor of Safety, *Impact and shock loading, Design based on strength and stiffnesss,* bending and torsion, theories of failures. Notch sensitivity, design stress for variable and repeated loads, fatigue stress concentration factor, endurance diagrams.

UNIT-II **Mechanical Joints:** Design of socket pigot cotter joint, design of sleeve and cotter joint , design ofKnuck le joint.

Keys and Splines: Types of keys, design of keys, design of splines.

Couplings: Types of couplings, design of flange and flexible couplings, compression coupling, muffcoupling.

UNIT-III **Shafts and Axles :** Transmission shaft, Design against static load, Design for strength, rigidity andstiffness, design under continuous loading for fatigue.

Clutches: *Principal and Working of clutches,* Friction clutches, Friction materials, Single & Multiple plateclutch, centrifugal clutches.

UNIT-IV ***Temporary Joints:-*** Threaded Fasteners, Geometry of thread forms, terminology of screw threads and thread standards, specifications of steel bolts, initial tension, and relation between bolt tension and torque, design of statically loaded tension joints, design of bolted joints due to eccentric loading.

Riveted Joints: *Types of rive threads, types of riveted joints, failure of riveted joint , strength of rivet joint,efficiency of riveted joint, design of riveted joint for boiler.*

Power Screws: Power screws, Force analysis- square and trapezoidal threads, Collar friction, Stresses in screw, coefficient of friction, efficiency of thread.

UNIT-V ***Permanent Joints and Bearing:-*** Welded Joints, Types of welded joints, stresses in butt and fillet welds, strength of welded joints, location and dimension of weld design, eccentrically loaded joint, welded joint subjected to bending moment ,designprocedure, fillet weld sunder varying loads, stress relieving techniques.

Bearings:- *Sliding contact and Rolling contact Bearing, Journal Bearing, selection of bearing, Bearing materials.*

Text Books:

1. Design of Machine Elements-V.B .Bhandari- TMH, New Delhi
2. Mechanical Engineering Design- Shigley– Mc Graw Hill, Delhi

Reference Books:

1. Machine Design-Moving– MIR Publishers, Moscow
2. Machine Design-Fundamental & Application– Gope– PHI, New Delhi
3. Machine Design-Sharma & Agrawal– Katson, New Delhi
4. Principles of Mechanical Design-R. Phelan–Mc Graw Hill, New Delhi.
5. Machine Design– Sundaraja moorthy & Shanmugum–Anuradha Agencies, Chennai

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Select proper material for specific application with proper assumptions with respect to design stress, factor ofSafety, stress concentration factor and theory of failure.
2. Design and analyze Mechanical Joints, keys and couplings.
3. Design and analyze shafts, axle and clutches.
4. Design and analyze threaded fastener and power screws.
5. Design and analyze riveted and welded joint.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**
Branch: **Mechanical Engineering**
Subject :**Manufacturing Technology**
Total Theory Periods:**03**
Class Tests: **Two (Minimum)**
Assignments: **Two (Minimum)**

Semester: **VI**
Code: **BT02602**
Total Tutorial Periods:**01**
Maximum Marks**:70**
Minimum Marks:**28**
ESE Duration: **Three Hours**

Course Objectives:

To impart basic knowledge and understanding about grinding, surface finishing, unconventional machining,bulk metal forming and sheet metal forming.

UNIT-I **Grinding:** Processes. Grinding wheels, compositions- abrasives, bonding materials. Grinding wheel characteristics-abrasive type, grain size, bonding material, structure, and grade. Wheel specification and selection. Wheel life. Types of grinding operations, design consideration for grinding, specification of grinding wheel, process , parameters, economics of grinding.

Surface finishing operations: Honing, lapping, super finishing, polishing, buffing, process parameters and attainable grades of surface finish

UNIT-II **Unconventional Machining:** Advantages, application and limitation, Processes-Electro DischargeMachining(EDM), Electro Chemical Machining(ECM),Ultrasonic Machining(USM), Abrasive JetMachining (AJM),Electron Beam Machining (EBM), Laser Beam Machining (LBM), Electro Chemicalgrinding(ECG). Mechanics of metal removal, tooling, equipment ,process parameters and surface Finish obtained & specific applications

UNIT-III **Introduction to metal forming:** Classification, Hot and Cold working.

Forging: Principle. Forging operations, drawing out and upsetting. Types of forging method- smith, drop, press and machine forging. Forging equipment. Forging dies. Tools

and fixture of forging, forging dies. Forging design, Forging designs factors. Drop forging die design, Upset forging die design. Forgingpractice–sequenceofsteps.Forgingdefects.Inspectionandtestingofforgedparts.

Extrusion: Principle, extrusion processes- hot extrusion, cold extrusions. Process parameters. Extrusion equipment. Extrusion of seamless tubes. Extrusion defects.

UNIT-IV **Rolling:** Principle, classification of rolled products, Types of rolling mills, rolling mill train components, Roll pass sequences-break down passes, roughing passes, finishing passes. Roll passes design for continuous mill. Roll separating force. Rolling load calculation. Power required in rolling. Effect of front and back tensions. Effect of friction. Shape rolling operations-ring rolling, thread rolling. Defects in rolled products.

Surface finishing operation*- Honing, Lapping, Super finishing, polishing, Buffing, process parameters*

UNIT-V **Sheet metal forming:** Types of presses, Selection of press, component sofa simple press, press working operations shear, bending. Shearing operations: Blanking, piercing, trimming, shaving, nibbling and notching. Calculation of punching force and shear force. Punch and die size calculation. **Drawing operation:** Principle of operation. Draw dies design.

Extrusion:- Principal, Extrusion process, Process parameters, Extrusion equipment.

Text Books:

1. Manufacturing Technology (Vol.-I&II)–P.N. Rao–Tata McGraw Hill Pub. Company, New Delhi
2. A Text Book of Production Technology(Manufacturing Processes)–P.C. Sharma–S. Chand

Reference Books:

1. Manufacturing Engineering and Technology –S. Kalpakjian & S.R. Schmid– AWL, New Delhi
2. Tool Engineering & Design–G.R. Nagpal–Khanna Publishers–New Delhi

3. A Text Book of Production Technology–O.P. Khanna – Dhanpat Rai &Sons, New Delhi
4. Manufacturing Science – A. Ghosh & A.K. Mallik –East West Press Pvt. Ltd., New Delhi
5. Production Technology–R.K. Jain–Khanna Publishers, New Delhi

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain the principles and techniques of grinding and other surface finishing operations.
2. Explain the principles and appropriateness of unconventional machining processes and analyze relatedProcess parameters.
3. Describe the principles and techniques of forging and extrusion operations, determine their suitability andAnalyze related process parameters.
4. Describe the principles and techniques of rolling and drawing operations and be able to analyze relatedProcess parameters.
5. Describe the principles and techniques of sheet metal forming operation and be able to analyze relatedProcess parameters.

BHARTI VISHWAVIDYALAYA, DURG

Name of program :**Bachelor of Technology**
Semester: **VI**
Branch: **Mechanical Engineering**
Code: **BT02603**
Subject: **Heat & Mass Transfer**
Total Tutorial Periods:**01**
TotalTheoryPeriods:**03**
MaximumMarks**: 70**
Class Tests: **Two(Minimum)**
Minimum Marks**: 28**
Assignments: **Two(Minimum)**
ESE Duration: **Three Hours**

Course Objectives:

The main objective of the course is to impart an understanding of the governing laws for heat and mass transfer; The focus is on explaining steady state and transient conduction, convection, heat transfer with phase change (boiling / condensation), heat exchangers , radiation and mass transfer.

UNIT-I **Conduction:** Heat conduction without heat generation: Derivation of general differential equation of heat conduction in Cartesian co-ordinate. One dimensional steady state conduction, linear heat flow through a plane and composite wall, heat conduction without heat generation in cylinder and sphere,
Critical thickness of insulation. Conduction with heat generation in flat wall and solid cylinder.

UNIT-II **Heat transfer from extended surface (Fins):** Types of fins, Fin equation for uniform cross sectional area(rectangular profile), Solution for infinite length, negligible heat loss from fin tip, finite long and heat transfer from fin tip .Fine effectiveness and efficiency . Error in temperature measurement from thermometer.
Transient / Unsteady State Heat Conduction: Lumped system analysis ,criteria for lumped system analysis ,solution of transient heat conduction in large plane wall ,long cylinder sand sphere through
Heisler`s chart.

UNIT-III ***Convection*:** Physical Mechanism of Forced Convection, Dimensional analysis for forced convection, velocity and Thermal Boundary layer, Flow over plates, Flow across cylinders and spheres, Flow in tubes, Reynold's analogy.

Physical Mechanism of Natural Convection ,Dimensional analysis of natural

Convection ; empirical relationship for natural convection.

UNIT-IV ***Radiation:*** *Blackbody radiation, graybody radiation, shape factor,electrical analogy, radiation shield ,radiation through gases.*

IntroductiontoMassTransfer: Massandmoleconcentrations,moleculardiffusion,eddydiffusion,

Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar andturbulent convection Combined heat and mass transfer, the wet and dry bulb thermometer.

UNIT-V ***Mass transfer &Heat Exchanger:*** *Basic concept, diffusion mass transfer, ficks law of diffusion , heat and mass transfer anology ,convective mass transfer correlation.*

Text Books:

1. Heat Transfer–S.P. Sukhatme–TMH, Delhi
2. Heat & Mass Transfer–D.S. Kumar–S.K. Kataria & Sons, Delhi

Reference Books:

1. Heat transfer-C P Arora, TMH ,Delhi
2. Heat & Mass Transfer–R, Yadav, Central Publishing House, Allahabad
3. Heat & Mass Transfer–R.K. Rajput, S. Chand, Delhi
4. Heat & Mass Transfer–P.K. Nag, TMH, Delhi
5. Heat Transfer–J.P. Holman–TMH, Delhi
6. Heat Transfer–A Practical Approach–Yunus A. Cengel –Mc Graw Hill, Delhi
7. Heat Transfer–P.S. Ghosh dastidhar–Oxford University Press

8. Heat And Mass Transfer Fundamentals And Applications- Yunus A. Cengel, and A J Ghajar, TMH, Delhi
9. A Course In Heat And Mass Transfer-S.C. Arora & S Donkundwar, S- Dhanpat Rai, Delhi
10. Heat and Mass Transfer Data Book-C.P. Kothandaraman C.P. &S. Subramanyan, New Age, Delhi

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain the principles of heat transfer due to conduction, convection and radiation and analyze problems

   Related to conduction.
2. Analyze problems related to heat transfer from extended surfaces and unsteady state heat conduction.
3. Analyze problems related to forced convection and natural convection.
4. Apply basic concepts of phase change processes and principles of mass transfer to solve related practical

   problems.
5. Analyze heat exchangers and problems related to radiation.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**
Semester: **VI**
Branch: **Mechanical Engineering**
Code: **BT02604(01)**
Subject: **Finite Element Analysis**
Total Tutorial Periods:**01**
Total Theory Periods: **02**
Maximum Marks**:70**
Class Tests: **Two(Minimum)**
Minimum Marks:**28**
U8Assignments: **Two (Minimum)**
ESE Duration: **Three Hours**

Course Objectives:

To introduce importance and applications of Finite Element Method /analysis and learn to apply to formulatefundamental engineering problems related to solid mechanics and heat transfer.

UNIT-I **Finite Element Analysis:** Basic concepts of finite element analysis, steps infinite elementanalysis, finite element formulationtechniques:weightedresidualmethod,Ritztechnique,stiffness Matrix and boundary conditions. Numerical integration-one and two dimensional.

UNIT-II **One-dimensional :** One dimensional second order equations discretization, element types- linear and higher order elements, derivation of shape functions and stiffness matrices and force vectors, assembly of matrices, solution of problems from solid mechanics and heat transfer .Direct formulation Of spring mass system.

UNIT-III **Beam and truss elements:** Finite element formulation for linear static analysis of solids and structures:
Beam and frame element, solutions of problems from beam and frame.

UNIT-IV **Two dimensional scalar :** Second order 2D equations involving scalar variable functions, variational formulation, finite element formulation, triangular and quadrilateral elements – shape functions and element matrices, application of field problems-thermal problems, torsion of non

Circular shafts.

UNIT-V **Two dimensional vector :** Equations of elasticity, plane stress ,plane strain and Axis symmetric problems, body forces and temperature effects, stress calculations–plate and shellelements.

Text Books:

1. Reddy JN; An introduction to finite element method; TMH
2. Seshu P; Text book of Finite Element Analysis; PHI.

Reference Books:

1. A First Course in Finite element Method; Logan DL; Cegage
2. Finite Element Analysis, theory and programming; Krishna moorthy; TMH
3. Fundamentals of Finite Element Analysis; Hutton D; TMH
4. The Finite Element Method in Engineering ; Rao ,S.S., Peragamon Press, Oxford.
5. Introduction to Finite Elements in Engineering , Chandrupatla, T.R. and Belegundu, A.D.,PHI

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Describe the concepts of finite element formulations.
2. Solve one dimensional solid mechanics and heat transfer problems.
3. Solve one dimensional beam and frame element.
4. Describe two dimensional elements and solve for thermal and tensional problems
5. Solve problems related to plate and shell elements.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**
Semester: **VI**

Branch: **Mechanical Engineering**
Code: **BT02604(02)**

Subject: **Power Plant Engineering**
Total Tutorial Periods: **01**

Total Theory Periods: **02**
Maximum Marks**: 70**

Class Tests: **Two (Minimum)**
Minimum Marks: **28**

Assignments: **Two (Minimum)**
ESE Duration: **Three Hours**

Course Objectives:

The objective of this course is to provide an overview of power plants and the associated energy conversion issues.

UNIT- I **Elements of Power Plant:** General Sources of power, Importance of Central Power Stations, types of power stations – steam, nuclear, diesel and hydro – Elements of modern power stations (Steams only)brief layout and arrangement of elements and complements, sitting of different power stations, foundation. Elements of Electric power systems primary and secondary distribution substations.

UNIT-II ***Steam Power Plant:*** *Classification of steam power plants, selection of working medium , air pre –heater , feed water, pre- heaters , steam re- heaters, feed water treatment , pumping and regulation water walls, factors to be controlled from maximum efficiency and variable output.*

UNIT- III **Hydro Electric power station:** Potential power with reference to rainfall and catchments area, Waterstorage, equipment used in hydroelectric power stations. Characteristics of hydraulic turbines.

Comparison of the factors governing the cost of hydro steam and diesel power stations.

Diesel power station: Suitability of diesel engines for bulk power, advantages and limitations of diesel,power stations, efficiency and heat balance.

UNIT- IV ***Nuclear Power Plant :*** *comparison of fission and fusion process, classification of nuclear reactors, compoents of a nuclear reactor , metals for nuclear energy, application of nuclear power plant , arrangements of various elements in a nuclear power station.*

UNIT-V **Variable load problems**: Idealized and realized load curves, effect of variable load on plant design andoperation variable load operation and load dispatch.

Power station Economics: Source of income, cost of plant and production, elements of cost, depreciation and replacement theory of rates

Text Books:

1. Power Plant Engineering – P.K. Nag – Tata McGraw-Hill Pub. Com., New Delhi
2. Power Plant Technology - M. M. El-wakil– Tata McGraw-Hill

Reference Books:

1. Power Plant Engineering - Elliot T.C., Chen K and Swanekamp R. C.- McGraw Hill.
2. Text Book of Power Plant Engineering – R.K. Rajput – Laxmi Publications
3. Power Plant Engineering – G.R. Nagpal – Khanna Publishers
4. Steam and gas turbine and power plant engineering- R. Yadav-CPH Allahabad
5. A Course in Power Plant Engineering – S.C. Arora Domkundwar- Dhanpat Rai & Co.

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Describe the elements of power plant.
2. Describe the working principle and basic components of steam power plants and analyze and its working .
3. Describe the working principle and basic components of hydro-electric and diesel power station and analyze its working.
4. Describe the working principle and basic components of nuclear power station and analyze and its working.
5. Discuss variable load problems and power station economic

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**
Semester: **VI**
Branch: **Mechanical Engineering**
Code: **BT02604(03)**
Subject: **Maintenance and Reliability**
Total Tutorial Periods:**01**
Total Theory Periods:**02**
Maximum Marks**:70**
Class Tests: **Two (Minimum)**
Minimum Marks:**25**
Assignments: **Two(Minimum)**
ESE Duration: **Three Hours**

Course Objectives: The objective of this course is to impart an understanding of fundamentals of maintenance and reliability engineering; the application of concepts of the course leads to the optimization of equipment, procedures, and departmental budgets to achieve better maintain ability, reliability , and availability of equipment.

UNIT-I **Maintenance Engineering:** Objective and functions, organization and administration, economicsand maintenance policies . Types of maintenance systems-planned, unplanned, preventive, predictive, conditional monitoring, total predictive maintenance.

UNIT-II **Failure Analysis:** Analysis of source, identification, classification and selectivity of failures, catastrophic, wear out and cumulative failures, failure rate Mortality distribution, statistical and reliability concept of failure analysis, equipment replacement policy.

UNIT-III **Reliability Engineering:** Concept, bath tub curve, elements, Hazard Models-constant, linearly increasing, Weibull. System Reliability-Series configuration, parallel configuration, mixed configuration, reliability improvement – Improvement of components, Redundancy – element, unit, stand by, repairable and non-repairable systems, reliability, availability, maintain ability, MTBF, MTTR, reliability allocation for simple series system.

UNIT-IV **Maintenance Management:** Maintenance planning, maintenance scheduling, work orders, Work measurement, maintenance cost budgeting, store and spare control, maintenance planningand control techniques, Incentives for maintenance

work.

UNIT-V **Maintenance of Mechanical System:** Introduction, Bearings, Friction Clutches, Couplings, FasteningDevices, Chains, Gear Drives, Support Equipment, Cooling Towers.

Text Books:

1. Reliability, Maintain ability and Risk: Practical Methods for Engineer-David J. Smith-Elsevier Science
2. Maintenance Engineering & Management–R.C Mishra, K. Pathak–Prentice Hall of India, New Delhi

Reference Books:

1. Maintenance Engineering Handbook- by Keith Mobley, Lindley Higgins, Darrin Wikoff ,Mc Graw-Hill
2. Maintenance Engineering–S. Shrivastava–S. Chand &Sons–New Delhi
3. Industrial Maintenance–H.P. Garg–S. Chand Publication, New Delhi
4. Maintenance Planning &Control–A. Kelly–TMH, New Delhi
5. Concept in Reliability–LS. Srinath–Affiliated East- West Press, New Delhi

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain the basic concepts and types of maintenance systems
2. Describe failure analysis and equipment replacement.
3. Apply their liability tools and techniques.
4. Describe the various concepts of maintenance management.
5. Discuss various tools for maintenance of mechanical system.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**

Branch: **Mechanical Engineering** Semester: **VI**

Subject: **Design of Machine Element Lab** Code: **BT02606**

Maximum Marks**:35** Minimum Marks:**14**

Course Objectives: The primary objective of this course is to learn how the principles learned in theory courses are appliedto provide design solution.

List of Experiments / Activities

1. Select a product used in day to day life and design the conceptual design by applying the design processtaking the controlling parameters
2. Make a list of mechanical components studied in and list out their materials and suggest some alternativematerials for the each one of them.
3. Design cotter joint and knuckle joint for given loading condition
4. Find a flange coupling in the college laboratory and justify its design by actual measurements
5. Design a shaft used in some practical application ,by actual working and loading conditions
6. Justify the design of single plate clutch of an engine assembly
7. Design a wall bracket, which is being used in real life by actual measurement of load using :
   a) Welded joints
   b) Riveted and bolted joints
   c) In addition, justify your findings.
8. Design a screw jack.
9. Design a machine element by using any software in some high level language or excel sheets for design of acomponent
10. **Mini Project: Student team od maximum four students** will be given a real life problem for the complete design of a subsystem/system using either manual calculation with the help of design handbook or throughcomputer program, if needed. The report in

given format will be submitted at the end of semester.

Course Outcomes:

On successful completion of the course, the student will be able to:

- Design a daily use product by applying the conceptual design process and able to suggest some alternative material for it.
- Design Flange coupling/ shaft/ single plate clutch/screw jack used in practical application and justify its design
- Design welded joint/riveted joint/ bolted joint used in real life and justify its design.
- Design machine element using software.
- Design complete system/subsystem using design hand book and/or design software.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**

Branch: **Mechanical Engineering** Semester: **VI**

Subject: **Computer Aided Modeling & Analysis Lab** Code: **BT02607**

Maximum Marks**:35** Minimum Marks:**14**

Course Objectives: The objective of this course is to develop skills among students to use modeling software to create2D and 3D models of simple mechanical parts and analysis using modern tools.

List of Experiments

***(At least five exercises are to be* completed from each part)**

Part-I: Computer Aided Modeling

1. Introduction to modeling software, and its working procedure.
2. Discuss various CAD tools required to model the engineering problems such as extrusion, rotation, sweep,
   Boolean algebra etc.
3. Modeling of part for structural problem such as bar, beam ,frame etc.
4. Modeling of part for heat transfer problem such as plate ,shell etc.
5. Modeling of part for fluid flow problems such as pipes, mixing elbow, flow over cylinder etc.
6. Practice with 3D model like butterfly assembly, sprocket etc.

Part-II: Analysis

1. Introduction to analysis software and its working procedure.
2. Discuss structural module of the software and mesh generation.
3. Discuss CFD module of the software and mesh generation.
4. Analysis of structural problem.
5. Analysis of heat transfer problem.
6. Analysis of fluid flow problem.

Note:

1. Computer aided modeling software Such as Creo, solidworks, Catia etc.
2. Lab operating requirements: Computer system with good configuration depending upon the requirement ofsoftware.

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Demonstrate working knowledge in Computer Aided Design methods and procedures.
2. Construct solid modeling using 3D modeling standard software.
3. Describe boundary conditions for structural, heat and fluid flow problems.
4. Solve simple structural and heat problems using standard FEA software.
5. Solve fluid flow problems using standard FEA software.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: **Bachelor of Technology**

Branch: **Mechanical Engineering** Semester: **VI**

Subject: **Heat & Mass Transfer Lab** Code: **BT02608**

Maximum Marks**:35** Minimum Marks:**14**

Course Objectives: The objective of this laboratory course is to further rein force the students' under standing of theanalysis of applications pertaining to Heat and Mass Transfer through suitably designed experiments.

List of Experiments: (At least Ten experiments are to be performed by each student)

1. To Determine Thermal Conductivity of Insulating Powders.
2. To Determine Thermal Conductivity of a Good Conductor of Heat (Metal Rod).
3. To Measure the thermal Conductivity of Liquid.
4. To determine the transfer Rate & Temperature Distribution For a Pin Fin.
5. To Measure the Emissivity of the Test plate Surface.
6. To Determine Stefan Boltzman Constant of Radiation Heat Transfer.
7. To Determine the Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection.
8. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
9. To Determine Critical Heat Flux in Saturated Pool Boiling.
10. To Study Performance of Simple Heat Pipes.
11. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
12. To Find the Heat transfer Coefficient in Forced Convection in a tube.
13. To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.
14. To find out the thermal conductivity of given slab material.
15. To determine the individual thermal conductivity of different lagging in a lagged pipe
16. To study the rates of heat transfer for different materials and geometries
17. To understand the importance and validity of engineering assumptions through the lumped heat capacity

    method.

18. Testing and performance of different heat insulators

List of Equipment/Instruments/Machines/Software Required:

1. Thermal Conductivity of Insulating Powder Apparatus
2. Thermal Conductivity of Metal Bar Apparatus
3. Thermal Conductivity of Liquid Apparatus
4. Transfer Rate and Temperature Distribution For A Pin Fin Apparatus
5. Emmissivity of The Test Plate Surface And Plotting A Graph of Emmissivity Versus Temperature Apparatus
6. Stefen- Boltzman Constant Of Radiation Of Heat Transfer Apparatus
7. Surface Heat Transfer Coefficient For Heated Vertical Cylinder in Natural Convection Apparatus
8. Heat Transfer Coefficient In Drop Wise And Film Wise Condensation Apparatus
9. Critical Hat Flux In Saturated Pool Boiling Apparatus
10. Performance Of Different Heat Pipe Apparatus
11. Heat Transfer Rate Through Heat Exchanger Apparatus
12. Heat Transfer Coefficient In Forced Convection of Air in a Tube Apparatus
13. Heat transfer through composite wall Apparatus
14. Thermal conductivity of insulating slab Apparatus
15. Heat transfer through lagged pipe Apparatus
16. Unsteady state heat transfer Apparatus
17. Testing and performance Test Rig for heat insulators

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Demonstrate conduction, convection and radiation heat transfer through experiments.
2. Determine thermal conductivity and temperature distribution in different system.
3. Determine heat transfer coefficient of different system.
4. Determine emissivity and Stefen- Boltzman constant of radiation.
5. Analyze the performance characteristics of heat transfer equipments.

BHARTI VISHWAVIDYALAYA, DURG

Name of program: Bachelor of Technology

Branch: Mechanical Engineering **Semester: VI**

Subject: Virtual Lab2 **Code: BT02609**

Maximum Marks: 35 **Minimum Marks:14**

Course objective:

The objective of this course is to inculcate a habit of self-learning in our students through virtual lab. Virtual Labs is a project initiated by the Ministry of Human Resource Development, Government of India, under the National Mission on Education through Information and Communication Technology. Virtual lab provides remote experimentation which furnishes basic leaning skill, and built advanced concepts as well. It provide complete Learning Management System around the Virtual Labs where the students can avail the various tools for learning, including additional web-resources, video-lectures, animated demonstrations and self evaluation.

List of Experiments

.	Name of Virtual Lab	Website link
A.	**Remote Triggered Virtual Lab on Automotive Systems**	**http://vlabs.iitkgp.ac.in/rtvlas/ (Any03)**

1. PV Diagram of a SI Engine
2. Torque Crank Angle Curve of a SI Engine
3. Load Test on a SI Engine
4. Mechanical Efficiency of a SI Engine
5. Determination of Cylinder Mean Effective Pressure
6. Engine Health Monitoring by Vibration Analysis
7. Variation of Exhaust Noise with Engine Speed
8. Tensional Vibrations of an Engine

B. Machine Dynamics and Mechanical Vibrations Lab **http://mdmv-nitk.vlabs.ac.in/#** **(Any02)**

1. Free vibration of cantilever beam
2. Free vibration of simply supported beam
3. Free vibration of fixed beam
4. Forced vibration of SDOF system
5. Base Excitation
6. Rotating Unbalance
7. 2D OF Forced vibration
8. Dynamic Vibration Absorber

C. Rotating Machinery Fault Simulation Lab **http://vlabs.iitkgp.ac.in/rmfs/** **(Any02)**

1. Diagnosis of Shaft Misalignment and its Effects
2. Static Balancing Studies of Rotary Systems
3. Mechanical Looseness
4. Bearing Defects of Various Types
5. Effects of Bent Shafts on Rotor Performance
6. Cavitation of Centrifugal Pump

D Fabrication Laboratory (FABLAB) http://fab-coep.vlabs.ac.in/ **(Any02)**

2. Computer Controlled Cutting of wooden object
2. 3D Machining
3. PCB design & fabrication
4. Interface & Application Programming
5. Digital Fabrication of Flexible Circuit board
6. Digital Fabrication and Project Development

E. Metal forming virtual simulation Lab **http://msvs-dei.vlabs.ac.in/msvs-dei/** -

Study of metal forming processes, equipments and applications.

Equipment/Machines/Instruments/Tools/Software Required:

1. Computer system with good connectivity to Internet, any specific software is not required.

Note:

1. Refer Virtual Labs website which is an initiative of ministry of education under the national mission on
   Education through ICT to conduct virtual lab .Link: https://www.vlab.co.in/
2. It is advised to visit https://www.vlab.co.in/broad-area-mechanical-engineering frequently for any update
   And new experiments on the listed subjects.

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Analyze auto motive systems.

2. Analyze vibration through virtual simulator.
3. Analyze rotating machinery fault
4. Describe digital fabrication after learning the process through fabrication laboratory
5. Describe metal forming processes, equipments and applications.

BHARTI VISHWAVIDYALAYA, DURG

Program / Semester: B. Tech (VI)	**Branch: Humanities**
Subject: Technical Communication & Soft Skills	**Course Code: BT02610**
Total Marks (Internal Assessment): 50 (TA)	**L: 0 T:0 P: 2**
Minimum Marks:18	
Internal Assessments to be conducted: 02	**Duration (End Semester Exam): NA**

UNIT-1 Communication Skills- Basics: Understanding the communicative environment, Verbal Communication; Non Verbal Communication & Cross Cultural Communication, Body Language & Listening Skills; Employment Communication & writing CVs, Cover Letters for correspondence. Common errors during communication, Humour in Communication.

UNIT-2 Interpersonal communication: Presentation, Interaction and Feedbacks, Stage Manners, Group Discussions (GDs) and facing Personal Interviews, Building Relationships, Understanding Group Dynamics- I, Emotional and Social Skills, Groups, Conflicts and their Resolution, Social Network, Media and Extending Our Identities.

UNIT- 3 Vocational skills: Managing time: Planning and Goal setting, managing stress: Types of Stress; Making best out of Stress, Resilience, Work-life balance, Applying soft-skills to workplace.

UNIT-4 Mindsets and Handling People: Definitions and types of Mindset, Learning Mindset, Developing Growth Mindset, Types of People, How to Lead a Meeting, How to Speak Effectively in Meetings, Behavior & Roles in Meetings, Role Play: Meeting. On Saying “Please”, How to say “NO”.

UNIT-5 Positive psychology: Motivating oneself, Persuasion, Survival Strategies, Negotiation, Leadership and motivating others**,** controlling anger**,** Gaining Power from Positive Thinking.

Text Books:

1. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
2. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley& Sons, 2006.
3. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.

Reference Books:

1. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders.Washington, DC: Pfeiffer & Company, 2013.
2. Peale Norman Vincent. The Power of Positive Thinking: 10 Traits for Maximum Result. Paperback Publication.2011.
3. Klaus, Peggy, Jane Rohman & amp; Molly Hamaker. The Hard Truth about Soft Skills. London: Harper Collins E-books, 2007.

Course Outcomes:

1. Learn to listen actively to analyse audience and tailor the delivery accordingly.
2. Increase their awareness of communication behaviour by using propriety-profiling tool.
3. Master three “As” of stressful situation: Avoid, Alter, Accept; to cope with stressors and create a plan to reduce or eliminate them.
4. Develop growth mind-set and able to handle difficult person and situations successfully.
5. Develop technique of turning negativity into positivity and generate self-motivation skills.

BHARTI VISHWAVIDYALAYA, DURG

Branch: Common to all Branches **Semester: VI**

Subject: Energy Conservation and Management **Code: BT02605(01)**

Total Theory Periods: 40 **Total Tutorial : Ten (Minimum)**

Class Tests: Two (Minimum) **Assignments: 2 (Minimum)**

ESE Duration: Three Hours **Maximum Marks: 70**

Minimum Marks: 28

Course Objectives:

- To carryout energy accounting and balancing
- To understand and analyze the energy data of industries
- To conduct energy audit and suggest methodologies for energy savings and
- To utilize the available resources in optimal ways

UNIT I: Introduction Energy – Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing. Energy intensity, Energy production and imports.

UNIT II Energy Conservation in Major utilities Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets, Energy management programmes, Energy conservation measures.

UNIT III Thermal Systems Utilization Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and economic measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV Energy Storage Technologies Overview of storage technologies, Principal forms of stored energies, Application of energy storage, Specifying energy storage devices, Specifying fuels, Direct electric storage, Electrochemical energy storage,

Mechanical energy storage, Direct thermal storage, Thermochemical energy storage

UNIT V Industrial Energy Efficiency and Energy Management Introduction, Industrial energy management and efficiency improvement, Improving industrial energy audits, Industrial electricity end uses and electrical energy management, Thermal energy management in industry, The role of new equipment and technology in industrial energy efficiency

Textbooks:

1. Energy Management and Conservation Handbook - D. Yogi Goswami, and Frank Kreith
2. Energy Management – W.R. Murphy, G. Mckay

Reference Books:

1. Energy Management – Paul O'Callaghan
2. Engineering Economics & Engineering Management – R. Raju – Anuradha Agencies
3. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilization" Hemisphere Publ, Washington, 1988.
4. Dryden. I.G.C., "The Efficient Use of Energy" Butterworth's, London, 1982

Course Outcomes:

1. Can carry out energy accounting and balancing
2. Upon completion of this course, the students can able to analyse the energy data of industries.
3. Can suggest methodologies for energy saving

BHARTI VISHWAVIDYALAYA, DURG

Name of Program: Bachelor of Technology **Semester: VI**

Branch: Common to all Branches **Code: BT02605(02)**

Subject: Non Conventional Energy Sources **Total Tutorial : Ten (Minimum)**

Total Theory Periods: 40 **Class Tests: Two (Minimum)**

Assignments: 2 (Minimum) **Maximum Marks : 70**

ESE Duration: Three Hours **Minimum Marks : 28**

Course Objectives:

1. To study the non-conventional energy sources.
2. To analyze the sources of non-conventional energy
3. To use non-conventional energy sources more efficiently.

UNIT I: Introduction: Various non-conventional energy sources, Need, availability, classification, Relative merits & demerits. Energy storage, distribution and conservation.

UNIT II Solar Energy: Solar Cells; Theory of Solar Cells, Materials, Solar Cell Power Plants, merits / demerits. Solar Thermal Energy: Solar energy collectors, Applications, storage, Solar Thermal Power Plants, merits / demerits.

UNIT III Wind Energy: Basic Principles of Wind Energy conversion Site Selection criterion, wind Data & Energy Estimation, Types of Rotors, Characteristics, performance & limitations of energy conversion systems.

UNIT IV Tidal Energy: Basic Principles, Components of Tidal Plants, Operation methods & utilization, Bio-Mass Energy – Conversion Technology, Classification of Plants, Advantages & Disadvantages Geo-Thermal Energy – Sources of Geo- Thermal

energy, Thermal energy conversion- electrical / Non electrical conversion. Advantage & Disadvantages.

UNIT V MHD Power Generation – Principle of working open cycle / close cycle system. Advantages & Disadvantages Thermo Electric Power – Basic Principles, Thermo Electric Materials, Performance & Limitations. Thermionic Conversion – Principles of working. Hydrogen Energy – Principles of conversion ,production of H2

Text Books:

1. G.D. Rai – Non Conventional Energy Sources –(4th ed. Khanna Pub.)
2. S.P. Sukhatme – Solar Energy – TMH

Reference Books:

1. Bansal, Kleemann & Meliss – Renewable Energy Sources & Conversion Technology – TMH

Course Outcomes:

1. To be able to understand the non-conventional energy sources
2. To be able to use non-conventional energy sources more efficiently.

BHARTI VISHWAVIDYALAYA, DURG

Name of Program: Bachelor of Technology | **Semester: VI**

Branch: Common to all Branches | **Code: BT02605(03)**

Subject: Safety Engineering | **Total Tutorial : Ten(Minimum)**

Total Theory Periods: 40 | **Assignments: 2(Minimum)**

Class Tests: Two (Minimum) | **Maximum Marks: 70**

ESE Duration: Three Hours | **Minimum Marks: 25**

Course Objectives:

- To Know safety philosophy and principles of accident prevention
- To know the safety rules, regulations, standards and codes
- To achieve an understanding of principles of safety management.
- To learn about various functions and activities of safety department.
- To study various mechanical machines and their safety importance

UNIT – I Safety philosophy and principles of accident prevention

Introduction, accident, injury, unsafe act, unsafe condition, reportable accidents, need for safety, break down of accidents, hazardous industries. Theories & principle of accidents casualty, cost of accident, computation of cost, utility of cost data.

Accident reporting & Investigation, Identification of the key facts, corrective actions, classification of facts. Regulation- American (OSHA) and Indian Regulation.

UNIT – II Safety Management

Division of responsibility, location of Safety function, size of safety department, qualification, for safety specialist, safety committee – structure and functions.

UNIT – III Safe working condition and their development

Standard Operating Procedure (SOP) for various mechanical equipments, incidental safety devices and methods, statutory of provisions related to safeguarding of Machinery and working condition.

UNIT – IV Safety in Operation and Maintenance

Operational activities and hazards, starting and shut down procedures, safe operation of pumps, compressor, heaters, reactors, work permit system, entry into continued spaces.

UNIT – V Safety in Storage and Emergency Planning

Safety in storage, handling of chemicals and gases, storage layout, ventilation, safety in chemical laboratories, emergency preparedness on site plan, off site plan, toxic hazard control.

TEXT BOOKS

1. Safety Management : Strategy And Practice - Pybus R - Butterworth Heinmann, Oxford
2. Safety and Accident Prevention in Chemical Operation – H.H. Faweett and Wood

REFERENCE BOOKS

1. Industrial Safety Management- Trafdar N K, Tarafdar K J – Dhapat Rai, New Delhi
2. Safety Management In Industry- Krishna, N V- Jaico Publication House; New Delhi
3. Industrial Safety And Pollution Control Hand Book - Nagraj, J N & Rameshchandar, R V - Associate Publisher, Securndabad
4. Fire and Safety Manual Refineries and Petrochemical Panel - National Safety Council, Bombay
5. Safety in Use of Compressed Gas Cylinders - National Safety Council, Bombay
6. Encyclopaedia of Occupational Health and Safety -Stallman I M, Mccann M, Warshaw L, Brabant C -International Labour Office, Geneva
7. Industrial Safety Environmental Pollution Health Hazard And Nuclear Accidents - A Chand – Mittal Publication, New Delhi
8. Personal Protective Equipment – National Safety Council, Bombay
9. Accident Prevention Manual for Business and Industrial Administration and Programs - Krieger, G R Montgomerji - National Safety Council, Ittenois.
10. Major Hazard Control A Practical Manual – ILO - National Safety Council, Bombay.

Course Outcomes:

a. Ability to understand the functions and activities of safety engineering department.
b. Apply knowledge of safety engineering specialization for hazard identification, risk assessment and control of occupational hazards.
c. Communicate effectively on health and safety matters among the employees and with society at large.

BHARTI VISHWAVIDYALAYA, DURG

Name of Program: **Bachelor of Technology**
Semester: **VI**

Branch: **Common to all Branches**
Code: **BT02605(04)**

Subject: Value Engineering
Total Tutorial : **Ten (Minimum)**

Total Theory Periods: **40**
Assignments: **2 (Minimum)**

Class Tests: **Two (Minimum)**
Maximum Marks: 70

ESE Duration: **Three Hours**
Minimum Marks: 28

Course Objectives:

- The objective of this course is to introduce students with the methodology of Value Engineering and its decision-making process.
- To familiarize students with procedures that provides standards for Value Engineering applications.
- To teach value engineering in a practical, project-based manner.
- During the course student will be engaged in decision-making using Value Engineering tools to ensure quality and value while reducing the cost of projects.
- Student will know about a number of case study applications of the Value Engineering to gain practical experience.

UNIT – I : Basic Concepts

Meaning of the term value, basic kind, and reasons for poor value, value addition, origin and history. Benefits, relevance in Indian scenario.

UNIT – II : Techniques

Different techniques, organizing value engineering study, value engineering and quality.

UNIT – III : Job Plan

Different phases, General phase, Information phase, Functional Phase, Creation Phase, Evaluation Phase, Investigation Phase, Implementation Phase, Audit.

UNIT – IV : Selection of evaluation of VE Projects

Project selection, method selection, value standard, application of methodology.

UNIT – V : Value Engineering Program

VE operations in maintenance and repair activities, VE Cost, life cycle, cost model, training for VE,

general value engineering, case studies.

Course Outcomes:

- Understand the basics of Value Engineering (VE) to ensure that a standardized method is used for VE applications to projects
- Learn to perform function analysis for projects
- Understand the appropriate time to apply VE for projects

TEXT BOOKS

1. Value Engineering a How to Manul– S.S. Iyer – New Age International Publishers, New Delhi
2. Industrial Engineering & Management – O.P. Khanna – Dhanpat Rai& Sons

REFERENCES

1. Techniques of Value Analysis and Engineering – L.D. Miles – McGraw Hill, New York
2. Value Engineering: A Systematic Approach – A.E. Mudge – McGraw Hill, New York
3. Getting More at Less Cost: The Value Engineering Way - Jagannathan G - TMH, New Delhi
4. Value Engineering a Practical Approach for Owners Designers & Constructions – Zimmerman LW & Gilen HD – CBS, New Delhi.
5. Compendium on Value Engineering – H.G. Tufty – Indo-American Society.

BHARTI VISHWAVIDYALAYA, DURG

Name of Program: **Bachelor of Technology** Semester: **VI**

Branch: **Common to all Branches** Code: **BT02605(05)**

Subject: : **Environmental Pollution & Control** Total Tutorial : **Ten(Minimum)**

Total Theory Periods: **40** Assignments: **2 (Minimum)**

Class Tests: **Two (Minimum)** **Maximum Marks: 70**

ESE Duration: **Three Hours** **Minimum Marks: 28**

Course Objectives:

- To provide an introduction to Environmental Pollution.
- To develop an understanding of the causes, chemistry and effects of pollution.
- To build awareness of the strategies used to control and manage pollution.
- To make aware of Environmental Laws & Acts

UNIT-I Environmental Pollution – Introduction & Classification

Sources and classification of air pollutants, aerosols, primary and secondary air pollutants, effect of air pollution on human health, effect of SO2, CO2, NO2 H2S and lead, economic effect of air pollution, mechanism of deterioration in polluted atmosphere. Factors influencing atmospheric deterioration,

UNIT – II Environmental Pollution - Sources

Air pollution due to automobiles, exhaust, Crankcase and evaporative emissions and their control, effect of various parameters of I.C. engines on air pollution, photochemical air pollution, air pollution from ferrous metallurgical operations and thermal power plants.

UNIT – III Chemistry of Pollution

Definition of pollutant concentrations, mass concentration, volume concentration, mass-volume concentration and relationship between these concentrations, smoke and its control. Ningalmam smoke chart, smoke prevention and control of air pollution by process change, elementary ideas of control of gaseous contaminants for combustion and absorption.

UNIT – IV Pollution Control

Control of air pollution by equipment, objectives of using control equipment, settling chambers,

inertial separators, cyclones, principle of electroscopic precipitators, descriptive study of the above equipment only, merits and demerits of the equipment, choice of equipment.

UNIT – V Environmental Laws & Acts

Air pollution indices, definition of air pollution index, type and use of air pollution indices, criteria for a standardized index, acid rain, causes of acid rain and its remedy, green house and its effect, air pollution legislation and regulations, constitution of the Board, functions of the central board and state boards, classification of pollution sources under Air Act 1981 and 1986.

TEXT BOOKS

1. Environmental Chemistry and Pollution Control - S S Dara – S Chand , New Delhi
2. Air Pollution - M.N. Rao and H.V.N. Rao – TMH, New Delhi.

REFERENCE BOOKS

1. Air Pollution Control Theory - Martin Crawford.- TMH, New Delhi
2. Encyclopaedia of Environment Control Technology & Air Pollution Control – Cheremisinott P N – Gulf Publication, London
3. Pollution Control Hand Book - Utility Publication, Securndarabad
4. Environmental Pollution Conservation And Planning – Pashupatinath & Siddh Nath - Chugh Publications, Allahabad
5. Environmental Air Pollution and Its Control - Chhatwal, Mehra & Katyal - Anmol Publications, New Delhi
6. Environmental Pollution Control Engineering – Rao C S –Wiley, New Delhi
7. Environmental Pollution Analysis – Khopkar S M- Wiley, New Delhi
8. Air Pollution Control Technology - R.W. Bethewaven - Van Nostrans.
9. Air Pollution & Control – KVSG Murali Krishnan – Kaushal & Company
10. Air Pollution & Control Technologies – Y. Anjaneyulu – Allied Publishers
11. Water & Air Pollution & Environmental Protection Laws, Vol. - II – M C Mehta – Delhi Law House

Course Outcomes

- Understand contemporary pollution issues.
- Have insight into specific examples of environmental pollution.

- Understand the causes and effects of key types of environmental pollution.
- Appreciate different pollution control strategies.
- Awareness of Environmental Laws & Acts