Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	Semester: **V**
Branch: **Mechanical Engineering**	Code: **C037511(037)**
Subject: **Internal Combustion Engine**	Total Tutorial Periods: **01**
Total Theory Periods: **03**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives:

The main objective of the course to impart an understanding of construction, working and performance of reciprocating internal combustion engines The focus is on explaining its thermodynamic cycle, combustion process, fuel supply system, various auxiliary systems and engine performance.

UNIT- I	**a) Introduction:** Internal and external combustion engine and their comparison, four stroke cycle S.I. and C.I. engine, two strokeengine, comparison of four stroke and two stroke engines, comparison of S.I. and C.I. engine, classification of I.C. Engine onvariousbasisValvetimingdiagramforS.I.andC.I.engines. Effectofvalve timingandenginespeedonvolumetricefficiency. **b) Fuel-air cyclesandactual cycle:** Reasons fordeviationof actualcyclefromair standardcycles,fuelair cyclesand theiranalysis, actualcyclesandtheir analysis.Reasons ofignition advanceandinjectionadvance.
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) 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) IgnitionSystem:**Batteryandmagnetoignitionsystemandtheircomparativestudy,sparkplugheatrange,electronicignitionsystem,firingorder,Ignitiontiming,centrifugaland vacuumignitionadvance. **b) CoolingSystem:**Coolingrequirement,aircooling,liquidcooling,typeofliquidcoolingsystem,advantageanddisadvantageofaircoolingandwater coolingsystem,Antifreezemixture. **c)LubricationSystem:**Functionoflubricatingsystem,Classificationoflubricatingsystem,mistlubricationsystem,drysumplubrication, wetsumplubrication-splash,andmodifiedandfull pressuresystem. **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, 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.

Text Books:	
1.	A Course in Internal Combustion Engines – M.L. Mathur& R.P. Sharma – DhanpatRai& 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 – DhanpatRai&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

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Describe the construction and working principle of various internal combustion engines. Explain the concepts of fuel air cycle and actual cycle and apply it to analyze related practical problems.
2.	Explain the theory of combustion of S.I. engine and C.I. engine, describe I.C.Engine fuels and solve problem related to flue gas analysis.
3.	Discuss properties of air-petrol mixtures and describe fuel supply system of S.I. and C.I. Engine.
4.	Describe ignition system, cooling system, lubrication system and Engine emissions and its control.
5.	Describe various performance parameter of I.C. Engine, its method of testing and analyze related practical problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	Semester: **V**
Branch: **Mechanical Engineering**	Code: **C037512(037)**
Subject: **Solid Mechanics**	Total Tutorial Periods: **01**
Total Theory Periods: **03**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives: The objective of this course is to impart an understanding of analysis of structural member by energy methods, analysis of fixed and continuous beam, pressure vessel and application plane stress and plain strain to analyze related practical problems.

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	**Plane stress and plane strain problems**: introduction to governing equations in cylindrical and spherical coordinates, axisymmetric problems. Plane stress and plane strain application to rotating discs, torsion of non-circular cross-sections, stress concentration problems, thermo-elasticity, 2-d contact problems.

Text Books:	
1.	Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC,New York, USA.
2.	Mechanics of Materials - Ferdinand P. Beer, E. RusselJhonston Jr., John T. DEwolfm, TMH

Reference Books:	
1.	Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
2.	Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: PearsonPrentice 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 Hallinternational

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Analyze problems related to deformable body under load using energy methods.
2.	Analyze fixed beams and continuous beams under load.
3.	Analyze thin and thick pressure vessels.
4.	Analyze column and find shear center.
5.	Solve plane stress and plain strain problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	Semester: **V**
Branch: **Mechanical Engineering**	Code: **C037513(037)**
Subject:**Fluid Machines**	Total Tutorial Periods: **01**
Total Theory Periods: **03**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives:

The objectives of this course is to impart an understanding boundary layer concepts, principle of operation of turbinesand pumps and its and performance characteristic.

UNIT- I	**Boundary Layer Theory :**Boundary layer definition and characteristics, momentum equation, Laminar andturbulent boundary Layer, Total drag, separation and control. Flow around submerge bodies Force exerted byflowing fluid on a body:Drag and lift; stream lined and bluff body, Drag on sphere and cylinder, circulationand lift oncircular cylinder,lift ofanairfoil, induceddrag.
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.
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.
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.

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

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Explain the concepts of 'boundary layer theory' and ' lift and drag theory' and apply to solve related practical problems
2.	Explain the principle of impulse-momentum and impulse turbines and apply it to analyze related problems.
3.	Explain the construction and principle of operation of reaction turbine and apply it to analyze related problems.
4.	Explain the construction and principle of operation of centrifugal pump and apply it to analyze related problems.
5.	Explain the construction and principles of operation of reciprocating pump and apply it to analyze related problems.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: Bachelor of Technology	**Semester: V**
Branch: Mechanical Engineering	**Code: C037514(037)**
Subject: Dynamics of Machines	**Total Tutorial Periods: 01**
Total Theory Periods: 02	**Maximum Marks: 100**
Class Tests: Two (Minimum)	**Minimum Marks: 35**
Assignments: Two (Minimum)	**ESE Duration: Three Hours**

Course Objectives:

The objective of this course is to introduce the approaches and mathematical models used in dynamic analysis of machinery to develop understanding of characteristics of governors, dynamic balancing, gyroscopic forces and moments, mechanical vibrations, inertia force and flywheel analysis.

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 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 movingoncurvedpath.
UNIT- IV	**Mechanical Vibrations:** One- dimensional ,longitudinal, Transverse, andtorsional 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, Coefficientof fluctuation of speed, Coefficient of fluctuation of energy, 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

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Explain principles of operation of mechanical governors and analyze its performance parameters.
2.	Apply the theory of balancing to rotating and reciprocating masses.
3.	Analyze gyro-effect on moving bodies.
4.	Explain principles of vibrations of different systems and analyze related practical problems.
5.	Perform inertia force analysis of machine elements. Draw turning moment diagram of reciprocating engine and analyze performance parameter of flywheel.

Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	Semester: **V**
Branch: **Mechanical Engineering**	Code: **C037531(037)**
Subject: **Operation Research**	Total Tutorial Periods: **Nil**
Total Theory Periods: **02**	Maximum Marks**: 01**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives:

The objective of this course is to impart an understanding the mathematical tools that are needed to solve optimization problems.

UNIT- I	**Introduction:**Various stages ofO.R., Fields ofapplication, optimization anditsclassification. GeneralLinear Programming Problems- Introduction, maximization and minimization of function with or withoutconstraints, formulation of a linear programming problem, graphical method and simplex method, Big M method degeneracy, application of L.P.P. inMechanicalEngineering**.**
UNIT-II	**The Transportation Problems:** Mathematical formulation computational procedures, Steppings tone method, Modified Distribution Method, Vogels Approximation Method, Solution of balanced and unbalancedtransportationproblemsandcase ofDegeneracy. 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 knownqueuing situationsKendall'sservicetime, solutionto M/M/1:∞ /FCFSmode
UNIT- IV	**NetworkAnalysis:**CPM/PERT,NetworkRepresentation,Techniquesfordrawingnetwork.Resourcesmoothing andleveling,projectcost,Optimumprojectduration,projectcrashing,updating,TimeestimationinPERT.
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 ofsimulation,meritsanddemerits ofsimulation,MonteCarlo simulation, simulationofInventorysystem, simulationofQueuingsystem.

Text Books:	
1.	OperationResearch–Hira&Gupta–S.Chand&Co.
2.	OperationResearch–N.D.Vohra–TMH

Reference Books:	
1.	OperationResearch–S.D.Sharma–S.Chand&Com.NewDelhi
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

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Formulate and solve real-world problems as linear programs for better decision-making.
2.	Solve specialized linear programming models like the transportation and assignment Models.
3.	Model a dynamic system as a queuing model and compute important performance measures.
4.	Use CPM and PERT techniques, to plan, schedule and control project activities.
5.	Propose the best strategy using decision making methods under game theory & apply concepts of Simulation to optimize practical problems.

Chhattisgarh Swami Vivekanand Technical University,Bhilai	
Name of program: **Bachelor of Technology**	Semester:**VI**
Branch: **Mechanical Engineering**	Code: **C037532(037)**
Subject: **Composite Materials**	Total Tutorial Periods: **Nil**
TotalTheoryPeriods:**02**	MaximumMarks**:100**
ClassTests:**Two(Minimum)**	MinimumMarks:**35**
Assignments:**Two(Minimum)**	ESE Duration: **Three Hours**

Course Objectives: The objective of this course is to develop an understanding of the design, processing, and behavior of compositematerials.

UNIT-I	**Introduction to Composites:** Definition, classification/ types and characteristics of composite materials; Basic composite constituents – fiber and matrix; Properties of unidirectional long fiberandshortfibercomposites;Polymericmaterialsandpolymericcomposites;Honeycomband 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

ReferenceBooks:	
1.	Introductiontocompositematerialsdesign -EverJ.Barbero.–CRC Press
2.	DesignandAnalysisofCompositeStructures:WithApplicationstoAerospace-ChristosKassapoglou-Wiley
3.	MechanicsofcompositestructuresLászlóP.Kollár,GeorgeS.-Springer.
4.	DamageandfailureofcompositematerialsRameshTalreja,ChandraVeerSingh-WoodheadPublishing
5.	ASMHandbookVolume21

CourseOutcomes:	
Onsuccessfulcompletionofthecourse,thestudent willbeableto:	
1.	Discussvarioustypesofcomposites.
2.	Discussmanufacturing,testingandenvironmentalissuespertainingtocomposites.
3.	Explainthevariationinpropertiesofcompositesinrelationtovariousaffectingparameters
4.	Explainelasticresponseofcomposites.
5.	DiscussCompositeLaminates.

ChhattisgarhSwamiVivekanandTechnicalUniversity,Bhilai	
Name of program:**Bachelor of Technology**	Semester:**VI**
Branch:**Mechanical Engineering**	Code: **C037533(037)**
Subject:**Gas Dynamic and Jet Propulsion**	TotalTutorialPeriods:**Nil**
Total Theory Periods: **02**	MaximumMarks**:100**
ClassTests:**Two(Minimum)**	MinimumMarks:**35**
Assignments:**Two(Minimum)**	ESEDuration:**ThreeHours**

Course Objectives: The objective of this course is to impart an understanding ofthe basic difference between in compressible and compressible flow, phenomenon of shock waves and its effect on flow and fundamentals of jet propulsion and Rocket Propulsion.

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 – Isentropicflowthroughvariableducts –NozzleandDiffusers
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 thenormal And oblique shocks–Prandtl–Meyerrelations–Applications.
UNIT-IV	**Theoryofjetpropulsion**: Thrustequation –Thrustpower andpropulsiveefficiency– Operatingprinciple,cycleanalysisanduseofstagnationstateperformanceoframjet,turbojet,turbofanand Turbo propengines.
UNIT-V	**Spacepropulsion:**Typesofrocketengines–Propellants-feedingsystems–Ignitionandcombustion –Theoryofrocketpropulsion–Performancestudy–Staging –Terminalandcharacteristicvelocity– Applications–spaceflights.

TextBooks:	
1.	Fundamentals of Compressible Flow-Yahya,S.M.-New Age International
2.	ModernCompressibleflow -Anderson,J.D.-McGrawHill

ReferenceBooks:	
1.	MechanicsandThermodynamicsofPropulsion-Hill.P.andC.Peterson-Addison–Wesley
2.	PrinciplesofJetPropulsionandGasTurbinesZucrow.N.J-ZucrowN.J.-JohnWiley
3.	Aircraft and Missile Propulsion-Zucrow.N.J-ZucrowN.J.-JohnWiley
4.	Rocket Propulsion Elements-Sutton.G.P.-Johnwiley
5.	Dynamics and Thermodynamics of Compressible fluid Flow-Shapiro.A.H.-Johnwiley
6.	Gas Turbines- Ganesan .V-TMH
7.	Gas Dynamics and Jet Propulsions-Somasundaram.PR.S.L.-NewAge
8.	Gas Turbine Theory-Cohen.H.,G.E.C.RogersandSaravanamutto-Longman

CourseOutcomes:	
Onsuccessfulcompletionof thecourse,thestudentwillbeableto:	
1.	Apply the concept of compressible fluid flows invariable areaducts
2.	Apply the concept of compressible flows in constant area ducts
3.	Examinetheeffectofcompressionandexpansionwavesincompressibleflow.
4.	UsetheconceptofgasdynamicsinJetPropulsion
5.	ApplytheconceptofgasdynamicsinSpacePropulsion.

Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	
Branch: **Mechanical Engineering**	Semester:**V**
Subject: **Internal Combustion Engine Lab**	Code: **C037521(037)**
Total Lab Periods: **48**	Batch Size – **30**
Maximum Marks**: 40**	Minimum Marks:**20**

Course Objectives:
The core objective of this lab is to impart an understanding of construction and working of Petrol and Diesel Engines and to understand how the different engine variables affect the engine performance.

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 sectionmodels.
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 simplecarburettor)
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 ignitionsystem).
9.	Study of Lubrication system of an ICEngine (Mist, Splashand 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 forgivencompressionratio, speedand load andplottheperformancecurves.
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.Enginein Cut Section
4.	Single CylinderActual C.I..Engine in Cut Section
5.	Four Stroke,Four-Cylinder Petrol Engine in Cut Section
6.	Carburettorsin 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.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Describe the basic engine nomenclature and working principle of four stroke and two stroke Petrol and Diesel engine.
2.	Describe the fuel supply system of a Petrol and Diesel engine.
3.	Describe Ignition, Lubrication and cooling system of an internal combustion engine.
4.	Analyze the performance parameters of diesel engine.
5.	Analyze the performance parameters of petrol engine.

Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	
Branch: **Mechanical Engineering**	Semester:**V**
Subject: **Fluid Machines Lab**	Code: **C037523(037)**
Total Lab Periods: **48**	Batch Size – **30**
Maximum Marks**: 40**	Minimum Marks:**20**

Course Objectives:
The core objective of this course is to impart an understanding of performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head and to develop an understanding of basic working principles of various fluid machines.

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 Hydrauliclift
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.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Analyze the performance parameters of Pelton Turbine.
2.	Analyze the performance parameters of Francis and Kaplan Turbine
3.	Analyze the performance parameters of Centrifugal Pump and Reciprocating Pump.
4.	Determine Lift and drag force over an air foil.
5.	Explain the construction and working of various fluidicdevices.

Chhattisgarh Swami Vivekanand Technical University, Bhilai	
Name of program: **Bachelor of Technology**	
Branch: **Mechanical Engineering**	Semester:**V**
Subject: **Dynamics of Machine Lab**	Code: **C037522(037)**
Total Lab Periods: **48**	Batch Size – **30**
Maximum Marks**: 40**	Minimum Marks:**20**

Course Objectives:
The overall objective of this course is to impart an understanding of techniques for dynamic analysis of machines and their components

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.	UniversalVibrationApparatus
2.	WhirlingofShaftApparatus.
3.	Balancing Apparatus (Both Static & Dynamic)
4.	Epi cyclic Gear Train and Holding Torque Apparatus
5.	Gyroscope apparatus
6.	Governor apparatus with differential attachment

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Analyze the vibration parameters of various systems.
2.	Analyze gyroscopic parameters.
3.	Analyze various types of governors.
4.	Find the critical speed of different diameters of shafts.
5.	Analyze the effects of unbalance in machine and methods to reduce/eliminate these effects.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of the Program: BTech **Semester: V**
Subject: Environmental Studies **Code: C000506(020)**
Period per week (L-T-P): (2-0-0) / Week **Non-Credit**
Total Contact Hours: 40 **No. of assignments to be submitted: 05**
PREREQUISITE: Knowledge of basic Chemistry, Physics and Mathematics.

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/