JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
(An Autonomous Institute of Govt. of M.P.)
Affiliated to Rajiv Gandhi Technological University, Bhopal (MP)
Scheme of Study and Examination   (w.e.f. July 2010)

BE (PTDC)   Sem : Fourth   Branch : Mechanical Engineering

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
					SESSIONAL EXAM			ESE	SUB TOTAL	
		L	T	P	TA	CT	TOTAL			
ME-19	Machine Design & CAD	3	1	-	10	20	30	70	100	4
ME-21	Dynamics of Machines	3	1	-	10	20	30	70	100	4
ME-28	Turbo Machines	3	1	-	10	20	30	70	100	4
MA-03	Mathematics - III	3	1	-	10	20	30	70	100	4
(PRACTICAL/DRAWING/DESIGN)										
ME-20L	Machine Design & CAD Lab	-	-	2	20	-	20	30	50	2
ME-22L	Dynamics of Machines Lab	-	-	2	20	-	20	30	50	2
ME-29L	Turbo Machines Lab	-	-	2	20	-	20	30	50	2
ME-58L	Professional Activity	-	-	2	50	-	50	-	50	2
	Total	12	4	8	150	80	230	370	600	24

T.A. Teachers Assessment, CT- Class Test, ESE - End Semester Examination, Total
Marks 600 Total Periods : 24, Total Credits : 24

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE/PTDC	**MACHINE DESIGN & CAD**	ME-19	Min "D"	Min "D"	5.0

MACHINE DESIGN & CAD

Unit I: **Design Against Fracture and Creep** :
Stress intensity Factor of a crack, Fracture Criteria, Plastic Deformation around crack tip, Crack opening phenomenon, Parameter Methods. Design of coupling, Riveted and Welded Joint. .

Unit – II : Stress Concentration and Fatigue :
Causes of stress concentration, stress concentration in tension, bending and torsion, Mitigation of stress concentration. Cyclic loading, Endurance limit, S-N Curve, Loading effect, size effect, surface effect, Fatique or Effect of stress concentration and Actual stress concentration factor, Notch sensitivity, Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg Equation, Gerber's Parabola, design for finite life, Cumulative fatigue damage factor.

Unit III : **Design of shaft** : Design of shaft under bending, twisting and axial loading; shock factors, rigidity considerations design of shaft under fluctuating loads. Critical speed of shafts, Coupling kays.

Unit IV: Spring stresses and Deflection Equations of helical springs, Design of compression and Tension springs, Torsion springs, Fatigue loading of springs, Surge in spring, Critical load, Special springs, Design of leaf spring.

Unit V : Belt, Rope and chain Drives : Power transmission mode, Selection of Flat belt and pulley design formade method, selection of Vee belts and Sheeve Design, Design of chain drives, Roller chain and its selection, Rope Drives, Rope Drive Design, Hoist rope.

Unit VI : Computer Aided Drafting & Design : Introduction of CAD, coordinate system, translation rotation and scaling transformations, point specification, plotting technique, dimensioning, 2D & 3D drawing concepts, Drawing practice, elementary design calculation e.g. area, moment of inertia, volume etc.

References Books :
1. Machine Design by Pandya Shah
2. Design of Machine elements by Spotts
3. Design of Machine elements by Vallance and Doughtee
4. Machine Design by Mubeen
5. CAD/CAM by Groover & Zimmer

COURSE CONTENT & GRADE   (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE/PTDC	DYANAMICS OF MACHINES	ME-21	Min "D"	Min "D"	5.0

DYANAMICS OF MACHINES

Unit – I : Engine Dynamics : Static force analysis of simple mechanisms with Sand without friction, Dynamic force analysis, D'Alembert's Principle. Engine types, Gas forces, Equivalent mass system for connecting rod, Inertia forces in engine, Crank effort, Turning moment diagram, Inertia torque, Fluctuation of speed energy, Flywheels.

Unit – II : Governors : Function of governors, Dead weight and spring loaded governors, Governor characteristics, sensitiveness, Stability, Isochronism, Hunting, Effort and power, Controlling power, controlling force, Effect of friction and insensitiveness, principle of centrifugal and inertia governors.

Unit – III : Balancing of Machines : Static and dynamic balancing of rotating masses in same planes and in-different planes, Balancing of reciprocating masses,Primary and secondary forces and couples, partial balancing, Hammer blow, Variation of tractive effort, Direct and reverse crank methods, Balancing of multi cylinder in line engines, Balancing machines.

Unit – IV : Vibrations : Degrees of freedom, single degree of freedom free, damped and forced vibrations, whirling of shafts, critical speed, torsional vibration of multirotor system and geared system, Holzer's method, Forced damped vibration, vibration isolation and transmissibility.

Unit – V : Gyroscopic Motion : Principles of gyroscope, Gyroscopic acceleration, couple, Reaction problems of stability of automobiles, ships, Aeroplanes etc. (2) **Cam Dynamics :** Cam and follower forces, pressure angle, Mathematical models, follower response, Jump phenomenon, surge.

Books Recommended :

1. Theory of Machines by Shigley
2. Theory of Machines by Bevan
3. Theory of Machines by Balaney
4. Theory of Vibrations by Thomson
5. Mechanical Vibrations by Grover

COURSE CONTENT & GRADE   (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE/PTDC	**TURBO MACHINES**	ME-28	Min "D"	Min "D"	5.0

TURBO MACHINES

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

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

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

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

Unit V: Fluid Transmission :
1. **Power Transmitting turbo machines**: Application and general theory, their torque ratio, speed ratio, slip and efficiency, velocity diagrams, fluid coupling and Torque converter, characteristics,
2. **Positive displacement machines** and turbo machines, their distinction. Positive displacement pumps with fixed and variable displacements,
3. **Hydrostatic systems** hydraulic intensifier, accumulator, press and crane.

References:
1. Venkanna BK; turbomachinery; PHI
2. Shepherd DG; Turbo machinery
3. Csanady; Turbo machines
4. Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Wiley Eastern Delhi
5. Bansal R. K; Fluid Mechanics & Fluid Machines;
6. Rogers Cohen & Sarvan Multo Gas Turbine Theory
7. Kearton W. J; Steam Turbine: Theory & Practice

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	**P**	
BE/PTDC	**MATHEMATICS- III**	MA-03	Min "D"	Min "D"	5.0

MATHEMATICS- III

Unit – I : Fourier Series : Conditions for a fourier expansion, having finite number of discontinuities, change of interval and half- rang series.
Laplace transform and inverse Laplace transform of simple functions, their elementary properties and application in solution of ordinary differential equations.

Unit – II : Analytic functions, Harmonic conjugates, Cauchy-Reimann equations, line integral, cauchy's theorem, Cauchy's integral formula, poles, residues, Residues theorem, evaluation of real integral, Bilinear transformation.

Unit – III : Difference operators, errors and approximation, interpolation (Newtons interpolation formulae, Central interpolation formulae, Lagranges interpolation, Newtons divided difference interpolation – formula inverse interpolation.
Numerical differentiation, maxima and minima.

Unit – IV : Numerical integration by using simpson's method, weddels rule, Gauss-Legendre open quadrature formula.
Solution of algebraic and transcendental equations by using Regula-Falsi, Newton-Rephson, iterative, Graffes root squaring method, Bairstow's method.

Unit – V : Solution of simultaneous algebraic equatins by using gauss elimination, Gauss-Jorden, Crout's jacobbi iterative, Gauss-siedal, Relaxation methods.
Solution of ordinary differential equations (Taylor series, Picard's Modified Euller method, Runge-kutta, predictor corrector method.)

References :
1. Laplace transform, by R.V. Churchill
2. Higher Engineering Mathematics by B.V Ramanna, TMH
3. Advanced Engineering Mathematics by Kreysizig E, willey Eastern Limited.
4. Introductory Methods of Numerical Analysis by S.S. Sastry
5. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.

COURSE CONTENT & GRADE   (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	**P**	
BE/PTDC	**MACHINE DESIGN & CAD LAB**	ME-20L	Min "D"	Min "D"	5.0

MACHINE DESIGN & CAD LAB

(Suggested Exercise)

List of Experiment :
1. To Study S-N Curve for various Elements.
2. Design of Machine Elements for cyclic Loading.
3. Design of Bearings.
4. Design of Friction Clutch.
5. Design of a Shaft Subjected to Combined Loadings.
6. Design of Simple Band Brake.
7. Designing and sketching of components contained in the syllabus

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	**P**	
BE/PTDC	**DYNAMICS OF MACHINES LAB**	ME-22L	Min "D"	Min "D"	5.0

DYNAMICS OF MACHINES LAB

List of Experiment :

1- Study of various models of governors.
2- Study of gyroscopic motion and calculation of value of gyroscopic couple.
3- Study of various types of Cams and followers and drawing the cam profile with the help of test kit.
4- Study of various first order vibration systems.
5- To study working of friction clutches using models

COURSE CONTENT & GRADE   (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
BE/PTDC	**TURBO MACHINES LAB**	ME-29L	Min "D"	Min "D"	5.0

TURBO MACHINES LAB
(Suggested Exercise)

List of Experiment

1. Study the performances characteristics of Pelton Wheel
2. Study the performances characteristics of Francis Turbine
3. Study the performances characteristics of Kaplan Turbine
4. Calibration of multistage (Two) Pump & Study of characteristic of variable speed pump
5. To study the performance & details of operation of Hyd. Ram
6. Study of the characteristic of the Reciprocating pump
7. Designing and sketching of components contained in the syllabus

COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	**P**	
BE/PTDC	**PROFESSIONAL ACTIVITY**	ME-58L	Min "D"	Min "D"	5.0

PROFESSIONAL ACTIVITY
(Suggested Exercise)

- Student shall visit a nearby Industry and shall prepare a technical report suggesting some improvement in operation.
- Student shall Design and fabricate a new laboratory equipment. He shall prepare a design report.
- Student shall improve an existing lab equipment and prepare chart or lab manual .
- Student shall publish a review paper in some Indian Journal.
- Student shall make a report on an Industry employing latest technology/ Innovation.
- Student shall prepare a working model of a machine part.
- Student shall make a software/ comp. program for the Institute to enhance efficiency in its working.
- Student shall prepare a detailed project report to start a small-medium enterprise.
- A group of student shall register with the Industry cell and submit a report on work done there about Institute-Industry linkage.
- Experimental work on a new set of equipments.
- Seminar Presentation with a report submitted to the supervisor.