



**DR. A P J ABDUL KALAM UNIVERSITY,  
INDORE**

**SYLLABUS**

*of*

**BACHELOR OF ENGINEERING**

**Mechanical Engineering**

**(Third Year -5th Semester), Grading System)**

# **DR. A P J ABDUL KALAM UNIVERSITY, INDORE**

## **Syllabus for Bachelor of Engineering**

### **Mechanical Engineering**

#### **List of Subject (Third Year (V SEMESTER), Grading System)**

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**Unit-I: System Concepts:** Types, definition & characteristics; supra & subsystems, key component; boundary & interface complexity; feedback (pull) & feed forward (push) controls, open flexible-adaptive system, computer as closed system, law of requisite variety; system coupling, stresses and entropy; functional & cross functional system; Steven Alter's nine element work system model and its comparison with IPO (input-processing-output) model, structure and performance of work systems leading to customer delight.

**Unit-II: Management:** Importance, definition and functions; schools of theories, knowledge driven learning organization and e-business; environment, uncertainty and adaptability; corporate culture, difficulties and levels of planning, BCG matrix, SWOT analysis, steps indecision making, structured and unstructured decision; dimensions of organizations, size/specialization, behavior formalization, authority centralization, departmentalization, span and line of control, technology and Minzberg organization typology, line, staff & matrix organization, coordination by task force, business process reengineering and process of change management, HR planning placement and training, MIS; attitudes and personality trait, overlap and differences between leader & manager, leadership grid, motivation, Maslow's need hierarchy and Herzberg two factor theory, expectation theory, learning process, team work and stress management.

**Unit-III: Marketing:** Importance, definition, core concepts of need want and demand, exchange & relationships, product value, cost and satisfaction (goods and services ) marketing environment; selling, marketing and societal marketing concepts; four P's, product, price, placement, promotion; consumer, business and industrial market, market targeting, advertising, publicity, CRM and market research.

**Finance:** Nature and scope, forms of business ownerships, balance sheet, profit and loss account, fund flow and cash flow statements, breakeven point (BEP) and financial ratio analysis, pay-back period, NPV and capital budgeting.

**Unit-IV: Productivity and Operations:** Productivity, standard of living and happiness, types of productivity, operations (goods and services) Vs project management, production processes and layouts, steps in method improvement, time measurement, rating and various allowances; standard time and its utility, predetermined motion and time method, product and process specification, TQM, cost of quality, introduction to lean manufacturing (JIT), QFD, TPM & six sigma quality.

**Unit V: Entrepreneurship :** Definition and concepts, characteristics, comparison with manager, classification, theories of entrepreneur, socio, economic, cultural and psychological; entrepreneur traits and behavior, roles in economic growth, employment, social stability, export promotion and indigenization, creating a venture, opportunity analysis competitive and technical factors, sources of funds, entrepreneur development program.

#### References:

- 1- Daft R; The new era of management; Cengage.
- 2- Bhat Anil, Arya kumar; Management: Principles ,Processes and Practices; Oxford higher edu.
- 3- Davis & Olson; Management Information System; TMH.
- 4- Steven Alter; Information systems, Pearson, [www.stevenalter.com](http://www.stevenalter.com)

**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, Polytropic and isentropic efficiencies.

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

**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

**Unit-I:** Basic Concepts of Measurement: General measurement system; Experimental test plan: variables, parameters, noise and interference, replication and repetition; Calibration: Static calibration, dynamic calibration, static sensitivity, range, accuracy, precision and bias errors, sequential and random tests; Presenting data: Rectangular coordinate format, semi-log, full-log formats. Measurement System Behavior: General model for a dynamic measurement system and its special cases: zero order, first order, and second order system, determination of time constant and settling time, phase linearity.

**Unit-II:** Statistics: Least square regression analysis and data outlier detection; Normal distribution and concept of standard deviation of the mean in finite data set, Uncertainty Analysis: Measurement errors; error sources: calibration, data acquisition, data reduction; Design stage uncertainty analysis; combining elemental errors; Bias & Precision errors; Error propagation, Higher order uncertainty analysis.

**Unit-III:** Temperature Measurement: Temperature standards, Temperature scales; Thermometry based on thermal expansion: Liquid in glass thermometers, Bimetallic Thermometers; Electrical resistance thermometry: Resistance Temperature Detectors, Thermistors; Thermoelectric Temperature Measurement: Temperature measurement with thermocouples, thermocouple standards. Pressure and Velocity Measurement: Relative pressure scales, pressure reference instruments, barometer, manometer, deadweight tester, pressure gauges and transducers, total and static pressure measurement in moving fluids Flow measurement: Pressure differential meters: Orifice meter, Venturi meter, roto-meter.

**Unit-IV:** Strain Measurement: Stress and strain, resistance strain gauges, gauge factor, strain gauge electrical circuits, multiple gauge bridge, bridge constant, apparent strain and temperature compensation, bending compensation. Motion, Force and Torque Measurement: Displacement measurement: Potentiometers, Linear variable differential transformers, rotary variable differential transformer; Velocity measurement: moving coil transducers; angular velocity measurement: electromagnetic techniques, stroboscopic measurement; Force measurement: load cells, piezoelectric load cells; Torque measurement: measurement of torque on rotating shafts, Power estimation from rotational speed and torque.

**Unit-V:** Introduction to control systems: Examples of control systems. Open loop and closed loop control, Mathematical modeling of dynamic systems: Transfer function, impulse response function, block diagram of closed loop system, block diagram reduction, Transient and steady state response analyses: First order systems, unit step and unit impulse response of first order systems, second order systems, unit step and unit impulse response of second order systems, transient response specifications, modeling of mechanical systems, modeling of electrical systems, signal flow graphs, modeling of fluid systems, liquid level systems, hydraulic systems, modeling of thermal systems.

**References:-**

1. Nakra and Chowdhry; Measurement and Control; TMH
2. Figiola RS & Beasley DE; Theory and Design for Mechanical Measurements; 3e John Wiley
3. Katsuhiko Ogata; Modern Control Engineering, 4e Pearson Education, New Delhi
4. Gopal; Control Systems Principles and Design; Tata McGraw Hill, New Delhi.
5. Backwith and Buck; Mechanical Measurements.
6. Swahney; Metrology and Instrumentation;

**Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)**

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

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

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

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

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

**References:**

1. Shingley J.E; Machine Design; TMH
2. Sharma and Purohit; Design of Machine elements; PHI
3. Wentzell Timothy H; Machine Design; Cengage learning
4. Mubeen; Machine Design; Khanna Publisher
5. Ganesh Babu K and Srithar k; Design of Machine Elements; TMH
6. Sharma & Agrawal; Machine Design; Kataria & sons
7. Maleev; Machine Design; List of Experiment (Pl. expand it): Designing and sketching of components contained in the syllabus



**Unit I:** Dynamics of Engine Mechanisms: Displacement, velocity and acceleration of piston; turning moment on crankshaft, turning moment diagram; fluctuation of crankshaft speed, analysis of flywheel.

**Unit II:** Governor Mechanisms: Types of governors, characteristics of centrifugal governors, gravity and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

**Unit III:** Balancing of Inertia Forces and Moments in Machines: Balancing of rotating masses, two plane balancing, determination of balancing masses (graphical and analytical methods), balancing of rotors, balancing of internal combustion engines (single cylinder engines, in-line engines, V-twin engines, radial engines, Lanchester technique of engine balancing.

**Unit IV:** Friction: Frictional torque in pivots and collars by uniform pressure and uniform wear rate criteria. Boundary and fluid film lubrication, friction in journal and thrust bearings, concept of friction circle and axis, rolling friction. Clutches: Single plate and multi plate clutches, Cone clutches.

**Unit V :** Belt drives; Velocity ratio, limiting ratio of tension; power transmitted; centrifugal effect on belts, maximum power transmitted by belt, initial tension, creep; chain and rope drives; Brakes: Band brake, block brakes, Internal and external shoe brakes, braking of vehicles. Dynamometer: Different types and their applications. Dynamic Analysis of Cams: Response of un-damped cam mechanism (analytical method), follower response analysis by phase-plane method, jump and cross-over shock.

**References:-**

1. Ambekar, AG; Mechanism and Machine Theory; PHI
2. Rattan SS; Theory of machines; TMH
3. Sharma and Purohit; Design of Machine elements; PHI
4. Bevan; Theory of Machines;
5. Ghosh and Mallik; Theory of Mechanisms and Machines; Affiliated East-West Press, Delhi
6. Norton RL; kinematics and dynamics of machinery; TMH
7. Grover; Mechanical Vibrations
8. Balaney; Theory of Machines by
9. Theory of Vibrations by Thomson

**List of Experiment (Expandable)( Measurement & control):**

- 1- Study of various temperature measuring devices; thermo couple, RTD, gas thermo meters.
- 2- Measuring velocity of fluid flow by Ventura meter/ orifice meter/ pitot-tube.
- 3- Measuring torque and power generated by a prime mover by using pony brake dynamometer.
- 4- Study of various pressure measuring devices like manometers, mercury in glass pressure gauge.
- 5- To develop a measuring device for fluid level measurement.

**List of Experiment (Pl. expand it):-**

Designing and sketching of components contained in the syllabus

**List of Experiment (Pl. expand it):-**

- 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

**List of Experiment (Pl. expand it):-**

1. Installation of J2SDK
2. Write a program to show Concept of CLASS in JAVA
3. Write a program to show Type Casting in JAVA
4. Write a program to show How Exception Handling is in JAVA
5. Write Programs to show Inheritance and Polimorphism.
6. Write a program to show Interfacing between two classes
7. Write a program to Add a Class to a Package
8. Write a program to demonstrate AWT.
9. Write a Program to show Data Base Connectivity Using JAVA
10. Write a Program to show "HELLO JAVA " in Explorer using Applet
11. Write a Program to show Connectivity using JDBC
12. Write a program to demonstrate multithreading using Java.
13. Write a program to demonstrate applet life cycle.

**Objective:** To develop conversation skills, group skills, persuasion skills, presentation skills, critical and creative thinking, emotional skills, positive thinking and vocational skills.

### **UNIT I Development of Proficiency in English**

- Practice on Oral and spoken communication skill & testing –
- voice & accent, voice clarity, voice modulation & intonation, word stress etc.
- Feedback and questioning Technique
- Objectiveness in Argument
- Development etiquettes and manners
- Study of different pictorial expression of non-verbal communication and its analysis

### **UNIT II Microsoft office**

- Microsoft word,
- Microsoft power point, Microsoft Excel,
- use of skype,
- use of internet

### **UNIT III Communication skills**

- Visual, nonverbal and aural communication,
- Understanding the communicative environment,
- Understanding the communicative environment,
- What to listen for and why,
- When to speak and how,
- Starting and sustaining a conversation

### **UNIT IV Communication skills Visual, nonverbal and aural communication**

- The world of visual culture
- Visual perception
- The aural: Its relevance and impact
- The body and the way it communicates
- The face, its expressions and what it says

### **UNIT V Concept of 4 method for presentation**

- Preparation & introduction
- Presentation
- Evaluation / feedback
- Summarization / Conclusion
- Presentation Skill practice
- Preparing in presentation
- Delivery of presentation

### **References**

1. E.H. Mc Grath: S.J.:Basic Managerial Skills for All (Published by Phi)

2. Allen Pease:Body Language(published by agreement and Pease international)

3. [Joan Lambert](#): microsoft Office 2016 Step by Step (Step By Step (microsoft))