



JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE

QUESTION BANK

1FY3-07: BASIC MECHANICAL ENGINEERING

CO1: Students will be able to **understand** the various machines and power transmission related to it.

CO2: Students will be able to **describe** the importance of mechanical engineering in any industry and to relate with various concepts in thermal based industry.

CO3: Students will be able to **understand** the refrigeration system and manufacturing process.

CO4: Students will be able to relate the industrial issues with the environment and to consider key concepts in engineering materials.

CO1- Power Transmission, IC engine, Pump

CO2- Introduction of Thermodynamics, Boiler, power plant, turbine, compressor

CO3-Refrigeration system and Air conditioning, Manufacturing Process

CO4- Heat treatment, engineering materials

CO1

1. Explain working of four stroke petrol engine with neat diagram.
2. Explain working of two stroke petrol engine with neat diagram.
3. Explain working of four stroke diesel engine with neat diagram.
4. Explain working of two stroke diesel engine with neat diagram.
5. Discuss the differences between four stroke and two stroke engines.
6. Explain with suitable sketches the working of four stroke C.I. engine.
7. Discuss the differences between spark ignition and compression ignition engines.
8. Obtain an expression for the air standard efficiency of an engine working on the Otto cycle.
9. Obtain an expression for the air standard efficiency of an engine working on the diesel cycle.
10. Explain the different part of I.C. Engine.
11. Explain with sketches the working of following:
 - (i) Carburetor
 - (ii) Fuel Injector
12. Describe the working of a fuel pump used in Diesel Engine with a neat sketch.
13. The bore and stroke of an engine working on the Otto cycle are 17cm and 30 cm respectively. The clearance volume is 0.001025 m^3 . Calculate the air standard efficiency.
14. Explain the classification of I.C.Engines.
15. Describe a battery ignition system with the help of a sketch.
16. Describe a magneto ignition system with the help of a sketch.
17. Compare the battery ignition with magneto ignition system.
18. Compare coil ignition system with magneto ignition system.
19. Write short note on governing of I.C. Engines.
20. What are the two main types of cooling systems? Explain them with diagram
21. A four stroke petrol engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance volume is 0.01052 m^3 . The initial pressure and temperature are 1 bar and 47°C . If the maximum pressure is limited to 25 bar, then find the efficiency of the cycle.
22. In an air standard Otto cycle, the compression ratio is 7 and the compression begins at 1 bar and 313K. the heat added is 2510 kJ/kg. Find the
 - (1). Maximum temp and pressure of the cycle
 - (2) Cycle efficiency and mean effective pressure.Take for air $C_v=0.718\text{kJ/kgK}$ and $R=287 \text{ J/kgK}$
23. Define:
 - (a) Stroke length
 - (b) Clearance volume
 - (c) Swept volume
 - (d) Compression ratio
 - (e) Mean effective Pressure
 - (f) Air standard efficiency

24. An engine working on Otto cycle has a clearance of 17% of stroke volume and initial pressure of 0.95 bar and temperature 30°C. If the pressure at the end of constant volume heating is 28 bar, find:
- Air standard efficiency
 - The max. Temp. in the cycle
 - Ideal mean effective pressure.
25. Explain the working of single acting reciprocating pump with neat diagram.
26. Explain the working of double acting reciprocating pump with neat diagram.
27. Explain the working of Centrifugal pump with neat diagram.
28. Write a short note on modes of power transmission.
29. Write various functions of power transmission.
30. Derive the expression for Length of open belt.
31. Derive the expression for Length of cross belt.
32. Derive the expression for slip of belt.
33. Compare slip and creep.
34. Derive an expression for velocity ratio of driven pulley to driving pulley.
35. Derive an expression for velocity ratio of driven pulley to driving pulley for compound belt.
36. Derive the expression for ratio of tensions on slack and tight side of flat belt.
37. Derive the expression for ratio of tensions on slack and tight side of v belt.
38. Derive the expression for Centrifugal tension.
39. An open belt drive connects two pulley 120 cm and 50 cm diameter, on parallel shaft 4 m apart. Maximum tension in the belt is 1855.3 N. The driver pulley of 120 cm diameter runs at 200 rpm. Determine the power transmitted. Take $\mu=0.3$.
40. A belt drive is required to transmit 10KW from a motor running at 400 rpm. The belt is 12 mm thick and has a mass density of 0.01 gm/mm³. Safe stress in the belt is not to exceed 2.5 N/mm². Diameter of driving pulley is 240 mm whereas the speed of driven pulley is 200 rpm. The two shafts are 2 m apart. Determine the width of the belt. Take $\mu=0.3$.
41. 3KW of power is transmitted by an open belt drive. The linear velocity of belt is 3m/s. The angle of lap of the smaller pulley is 150°. The coefficient of friction is 0.3. Determine the effect on power transmission in following cases:
- Initial tension in the belt is increased by 8%
 - Initial tension in the belt is decreased by 8%
 - Angle of lap is increased by 8% by use of idler pulley, for same speed and tension on tight side.
 - Coefficient of friction is increased by 8% by suitable dressing to friction surface of the belt.
42. Explain the types of belt drives.

43. Differentiate between V-belt and flat belt.
44. Explain advantage and disadvantage of v belt drive over flat belt drive.
45. Find the power transmitted by a belt running over a pulley of 500 mm diameter at 300 rpm. The coefficient of friction between belt and pulley is 0.24, angle of lap 150° and maximum tension in belt is 2.4525 KN.
46. A pulley 30 cm in diameter running at 200rpm is connected by a belt to another pulley at a distance of 3m, the second pulley has to run at 120 rpm. The belt is 5 mm thick. Allowing a slip of 3% between the belt and each pulley, determine the size of second pulley and % of total effective slip.
47. Suggest a method to transmit power from the driver shaft to driven shaft for the following cases:
 - (i) When the two shafts have the same axis.
 - (ii) When the two shafts are parallel
 - (iii) Between non parallel and non intersecting shafts.
48. Write short note on spur gear, spur rack and pinion, helical spur gear.
49. Write short note on straight bevel gear, Spiral bevel Gear, Zerol Bevel Gear.
50. Write short note on Hypoid Gear, Worm Gear.

CO2

1. Explain Zeroth law of Thermodynamics.
2. Explain First law of thermodynamics.
3. Explain the Second law of thermodynamics.
4. Derive the work done for following process:
 - a. Isochoric process
 - b. Isobaric process
 - c. Isothermal process
 - d. Adiabatic process
5. Differentiate between Homogenous and Heterogeneous system.
6. What are charle's law, Gay- Lussac's law & boyle's law?
7. What are the differences among open, close and isolated system?
8. Classify boiler and explain each type of boilers.
9. Differentiate between water tube and fire tube boiler.
10. Write the short note on Indian Boiler Act.
11. Describe working of Locomotive boiler with neat and clean diagram.
12. What are the characteristics of a good boiler?
13. What are the boiler mountings and accessories?
14. Explain the various types of boiler mountings with neat and clean diagram.
15. Explain the various types of boiler accessories with neat and clean diagram.
16. What is the working of economizer in power plant?
17. What is the working of air pre heater in power plant?
18. Describe the working of Benson boiler with neat and clean diagram.
19. Describe working of Lamont boiler with neat and clean diagram.

20. What are the advantages of high pressure boiler?
21. Describe working of Cochran boiler with neat and clean diagram.
22. Describe working of Lancashire boiler with neat and clean diagram.
23. Describe working of Babcock & Wilcox boiler with neat and clean diagram.
24. Give the classification of various types of power plant.
25. Briefly describe gas turbine power plant with neat diagram.
26. Briefly describe hydro electric power plant with neat diagram.
27. Write the short notes on solar energy.
28. Explain the working of wind energy with neat diagram.
29. Write the short notes on Tidal Power energy.
30. Write the short notes on Geothermal Power.
31. Write the short notes on OTEC energy.
32. List the conventional and non conventional power plant.
33. Briefly describe steam power plant with neat diagram.
34. Briefly describe diesel power plant with neat diagram.
35. Briefly describe nuclear power plant with neat diagram.
36. Compare nuclear fission and nuclear fusion.
37. What is global warming?
38. What is the use of a surge tank in a hydraulic power plant?
39. What is the main purpose of a condenser in steam power plant?
40. Give principle and working of steam turbine.
41. What are the main parts of a steam turbine?
42. Explain impulse turbine with diagram.
43. Explain reaction turbine with diagram.
44. What is the difference between impulse and reaction turbine?
45. Explain the different types of compressor.
46. What are the main components of an open cycle gas turbine?
47. Describe solar heater with an example.
48. What are the different types of nuclear fuels?
49. What is the function of electrostatic precipitator?
50. Explain with a neat sketch the working of a nuclear reactor.

CO3

1. What do you understand by refrigeration? What is the unit of refrigeration?
2. Explain the difference between heat pump and refrigerator.
3. Explain reversed Carnot cycle with neat diagram.
4. Explain reversed Brayton cycle with neat diagram.
5. Explain Bell- Coleman cycle with neat diagram
6. Describe the four general processes of refrigeration cycle.
7. Explain the principal and working of Electrolux refrigerator.
8. What are the properties of an ideal refrigerant? Explain.

9. Explain vapor compression refrigeration cycle with neat diagram.
10. Explain vapor absorption refrigeration cycle with neat diagram
11. State merits and demerits of an air refrigeration system.
12. Explain the different types of compressor
13. State the advantages of vapor absorption refrigeration system over vapour compression system.
14. How is a refrigerator's performance measured?
15. Compare and contrast the working of vapour compression and vapour absorption refrigeration systems?
16. Name the important components of a simple vapour compression system and indicate various processes on P-H and T-S diagram.
17. Explain the working of an ice plant with the help of a neat sketch.
18. Explain the working of a split air conditioner?
19. What are the advantages and disadvantages of thermoelectric cooling?
20. Explain the Electrolux refrigeration absorption system with neat diagram.
21. Explain the term air conditioning. What are the important factors which play a decisive role in air conditioning?
22. Define the following term :
 - a. Specific humidity
 - b. Absolute humidity
 - c. Relative humidity
23. How is air conditioning systems classified?
24. Define the following term :
 - a. Dry bulb temperature
 - b. Wet bulb temperature
 - c. Dew point temperature
25. Describe briefly with neat sketch a window type air conditioner.
26. Define the term 'by pass factor' used for heating or cooling and derive the expression for it.
27. What is pattern? Enlist its various types.
28. Enlist various types of pattern materials in detail.
29. What is the function of allowances? Explain its various types with neat sketch in detail?
30. Explain various types of moulding sands which are used in foundry.
31. Enlist various properties of moulding sand.
32. Explain the detail working procedure of green sand moulding with neat sketch.
33. What is casting defect? Explain any five types of casting defects with their remedies.
34. Write the classification of furnaces? Explain the working of cupola furnace and give its advantages and disadvantages.
35. Give the detail classification of various welding processes.
36. b) Write short note on welding, soldering, brazing and braze welding.

37. What are the main characteristics of hot working as compared to cold working processes?
38. What are the advantage and limitations of hot rolling
39. Explain following forming processes extrusion, wire and tube drawing processes.
40. Distinguish between wire drawing and tube drawing with sketches.
41. Explain the various operation performed by lathe machine.
42. Draw a sketch of shaper and explain its working.
43. What do you understand by the recrystallisation and recrystallisation temperature?
44. Explain:
 - (i) bending(ii) Drawing
45. Explain:
 - (i) Chemfering(ii) Boring
46. EDraw a sketch of a shaper and explain its working.
47. Describe with the help of a suitable diagram of principal parts of milling machine.
48. Difference between hot working and cold working processes.
49. Explain:
 - (i) Forging (ii) Rolling
50. Explain with the help of neat sketches the following hot working processes:
 - (i) Extrusion (ii) Spinning

CO4

1. How are solid solution classified? Give two examples for each.
2. Draw and explain unary phase diagram.
3. Draw and explain classification of binary phase diagram.
4. Draw the microstructure of steel?
5. Explain properties and application of cast iron.
6. What are the different types of cast irons? Draw the microstructure of any four types of cast irons. Give one application for each.
7. Explain with a phase diagram of eutectoid and peritectic reaction.
8. With neat sketches explain the mechanism of slip and twining. Also State the differences between them.

9. Define harden ability and explain Jominy End Quench test. How to use this Jominy end quench test data?
10. Explain Brinell hardness testing and its applications
11. What is Hardening? Discuss in detail on different hardening methods and mechanism. Compare hardening and annealing.
12. Write a short note on
 - (i) Carburising (ii) Nitriding (iii) Flame hardening (iv) Cyaniding
13. What is CCR? Write difference between Normalizing and Tempering
14. Write a short note on compositions and properties of the following steels:
 - a. Austenitic stainless steels
 - b. High speed steels
 - c. Martensitic stainless steels
 - d. Maraging steels
15. How will you classify brasses on the composition of zinc? Explain the properties and applications of the main types of brasses.
16. Explain the steps involved in precipitation hardening treatment.
17. What are stainless steels? What are the main characteristics of stainless steels?
18. Name different types of stainless steels and their main applications.
19. What are HSLA steels? How can high strength and toughness be attained in them?
20. Discuss the influence of each of the following alloying elements on the properties of steel:
 - (i) Molybdenum (ii) Chromium (iii) Manganese (iv) Vanadium

(v) Titanium (vi) Tungsten.

21. Discuss the characteristics of aluminium and also mention its alloys, their properties and uses.

22. Explain the properties and application of the PVC, PE, PTFE, and ABS

23. Give the detailed account on:

(i) Urea formaldehydes

(ii) Fibre reinforced plastics

(iii) Cellulose nitrate.

24. Explain PMMA.

25. What is polymerization? Describe addition polymerization and condensation polymerization.

26. How plastic materials are classified? Explain each classification.

27. Write brief notes on following traditional ceramics

(i) Clay products (ii) Glasses (iii) Cements (iv) Refractory

28. Describe the properties and applications of following structural ceramics

(i) Alumina

(ii) Partially stabilized zirconia

(iii) Silicon carbide (d) Silicon nitride (e) Sialon

29. Describe the structures, properties and applications of following commodity thermoplastic polymers:

(i) Polyethylene (ii) Polyvinylchloride (iii) Polystyrene

30. What do you mean by the term case-hardening?

31. What is meant by selective hardening technique?

32. What are some selective heating techniques employed for surface hardening?
33. What are the factors should be considered while selecting a quenching medium?
34. What are the effects of adding alloying elements on the mechanical properties of ferrous alloys?
35. What are the effects of lead and sulphur on the machinability of steels?
36. What determines whether a stainless steel is austenitic, ferritic or martensitic?
37. What are HSLA steels?
38. What are heat resisting steels and free-machining steels?
39. What are the features that make cast iron an important material?
40. 42. What are the effects of carbon on the properties of cast iron?
41. What is the influence of cooling rate on the properties of a cast iron?
42. Why do stainless steels lose their corrosion resistance when the chromium in solution drops below 12%?
43. What are the characteristics of plastics which account for their wide use as engineering materials?
44. What are the advantages do thermoplastics polymers have over thermosetting polymers, and vice versa?
45. List the properties and typical applications of PVC.
46. What is the effect of crystal structure and atomic radii on formation of solid solution between two metallic elements?
47. What is a phase or equilibrium diagram? What information may be obtained from an equilibrium diagram?
48. What are the three classes of plain steels?

49. Rate the order of effectiveness of the following quench media: oil, brine, water and molten salt.
50. What are compositions of: (i) brass (ii) Gun metal (iii) Bell metal (iv) bronze.
51. Explain the effects of adding the following alloying materials to steel:
(i) Si (ii) Mn (iii) Cr (iv) Co (v) W (vi) Ti
52. Write short notes on:
(i) Nitriding (ii) Cyaniding (iii) Carbo-nitriding
53. Explain Annealing, its principle and applications with example.
- 54.** Explain the different methods of heat treatment.
55. What is meant by Normalizing? How is it done? What are its effects on the properties of Steel?
56. Write short notes on:
(i) Hardening (ii) Quenching (iii) Tempering