

Total No. of Printed Pages: 02

SUBJECT CODE NO H-1451
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-VI)
Internal Combustion Engines
[Revised]

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

- N.B
1. Solve any three questions from each section; Q. No. 1 and Q. No. 6 are compulsory.
 2. Use of non-programmable calculator is allowed.
 3. Figures to the right indicate full marks.
 4. Assume suitable data if necessary.

Section A

- Q.1 Answer any five of the following:- 10
- a) What are the factors which affect the process of carburetion?
 - b) What is stoichiometric ratio? Explain in brief.
 - c) What is auto-ignition of fuel and pre-ignition of fuel?
 - d) What are different types of combustion chambers used in SI engine?
 - e) What are the basic ignition systems used in SI engines?
 - f) Draw valve timing diagram for four stroke petrol engine?
- Q.2 a) Describe with neat sketch a simple carburetor, what are the additional devices added to make it a complete carburetor? 07
- b) Derive an expression for air/fuel ratio through a carburetors taking compressibility of air into account (Exact analysis) 08
- Q.3 a) Explain abnormal combustion in SI engines with the help of neat sketches. 07
- b) Explain in detail the stages of combustion in CI engine with the help of neat sketches. 08
- Q.4 a) Explain battery ignition system with the help of neat sketch. 07
- b) Explain with the help of neat sketches the working of splash lubrication system and full pressure lubrication system. 08
- Q.5 a) Define mean effective pressure, volumetric efficiency, specific fuel consumption of an engine. 05
- b) A four cylinder engine running at 1200 rpm delivers 20kW. The average torque when one cylinder was cut is 110 Nm. Find the indicated thermal efficiency if the calorific value of the fuel is 43MJ/kg and engine uses 360 grams of gasoline per Kwh. 10

Section B

- Q.6 Answer any five of the following :- 10
- What are the various methods for measurement of brake power?
 - How is the volumetric efficiency derived during a trial on IC Engine?
 - Explain the limitations of turbo-charging.
 - Differentiate between dry sump and wet sump lubrication system.
 - What is mist lubrication system?
 - What are the requirements of a good cooling system used in IC Engine?
- Q.7 08
07
- Explain Bosch fuel pump with the help of neat sketch.
 - Explain typical automatic injector with the help of neat sketch.
- Q.8 08
07
- Explain different methods of supercharging with the help of neat sketches.
 - Explain different methods of turbo charging with the help of neat sketch.
- Q.9 07
08
- Explain VTEC engine with the help of neat sketch.
 - Explain CRDi system with the help of neat sketch.
- Q.10 08
07
- What are different methods used for exhaust gas oxidation? Explain catalytic converter system with the help of neat sketch.
 - Explain exhaust gas recirculation (EGR) method with the help of neat sketch.

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-1466
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-VI)
Computational Techniques
[Revised]

[Time: Two Hours]

[Max.Marks: 40]

Please check whether you have got the right question paper.

- N.B
1. Use of non-programmable calculator is allowed.
 2. Q.No.1 and Q.No.5 are compulsory.
 3. Figures to the right indicate full marks.
 4. Attempt any two questions from the remaining questions from each section.

Section A

Q.1 Answer the following multiple-choice questions: 06

- a) If x is the true value of a quantity and x_1 is its approximate value, then the relative error is:

- I. $|x_1 - x|/x_1$
- II. $|x - x_1|/x$
- III. $|x_1/x|$
- IV. $x/|x_1 - x|$

- b) In case of Bisection method, the convergence is:

- I. Liner
- II. Non-liner
- III. Quadratic
- IV. Cubic

- c) Solutions of simultaneous no-linear equations can be obtained using:

- I. Method of Iteration
- II. Newton-Raphson method
- III. Bisection Method
- IV. All of the above

Q.2 Enlist and explain types numbers and associated errors with suitable examples. 07

Q.3 Find the smallest positive root of the function (x is in radians) $x^2 |\cos \sqrt{x}| = 5$ using the Secant method. 07

Q.4 Use Gauss Jacobi's iterative method to solve following set of equations: 07

$$\begin{aligned} 10x + y - z &= 11.19 \\ x + 10y + z &= 28.08 \\ -x + y + 10z &= 35.61 \end{aligned}$$

Section B

- Q.5 Answer the following multiple-choice questions: 06
- The n^{th} divided difference of a polynomial of degree n is:
 - Zero
 - A constant
 - A variable
 - None of these
 - Whenever Trapezoidal rule is applicable, Simpson's $1/3^{\text{rd}}$ rule also be applied
 - True
 - False
 - Runge-Kutta method is self-starting method?
 - True
 - False
- Q.6 If P is the pull required to lift a load W by means of a pulley block, find a linear law of the form $P = mW + c$ connecting P and W , using following data: 07
- | | | | | |
|-----|----|----|-----|-----|
| P | 12 | 15 | 21 | 25 |
| W | 50 | 70 | 100 | 120 |
- Where P and W are taken in Kg – wt. compute when $W = 150\text{kg}$
- Q.7 A curve is given by the following table: 07
- | | | | | | | | |
|-----|---|---|-----|-----|---|-----|-----|
| x | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| y | 0 | 2 | 2.5 | 2.3 | 2 | 1.7 | 1.5 |
- The coordinates of C.G. of the area bounded by the curve, the end ordinates and the x -axis is given by $A\bar{x} = \int_0^6 xy \, dx$, where A is the area. Find \bar{x} using Simpson's $1/3^{\text{rd}}$ Rule.
- Q.8 Apply Runge-Kutta fourth order method to find an approximate value of y when $x = 0.2$, give 07
- that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-578
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (CGPA) (Sem-II)
Tool Engineering
[Revised]

[Time: Four Hours]**[Max.Marks: 80]**

- N.B Please check whether you have got the right question paper.
- 1) Q.No.4 and Q. No. 8 are compulsory. Attempt any two questions from remaining of each Section.
 - 2) Solve Q.No.4 on drawing sheet.
 - 3) Assume suitable data and dimensions if necessary.
 - 4) All dimensions are in mm.
- Section A**
- | | | |
|-----|--|----------|
| Q.1 | a) Differentiate between orthogonal and oblique cutting.
b) Differentiate between negative and positive rake angles. How does rake angle affect the life of cutting tool? | 06
06 |
| Q.2 | a) In orthogonal cutting operation, cut of 2.5mm wide was made with 0.26mm feed and 0.5m/s cutting speed using a HSS tool having 10° rake angle the chip thickness ratio is found to be 0.6 the cutting force is 1200 N and the feed thrust force 340N determine chip thickness, shear plane angle, resultant force, coefficient of friction on face of tool friction force and normal force and chip shearing force and normal force on the shear plane, specific energy.
b) What is rake angle? Explain its importance while machining hard material. | 06
06 |
| Q.3 | a) What is mean by fool proofing as applied to jig and fixture? How it can be achieved?
b) Write note on:
1) Why jig and fixture are called production tool.
2) Explain design principles for Drill Bushing. | 06
06 |
| Q.4 | Design and Draw drill jig to drill two holes dia 16mm in finished component. | 16 |

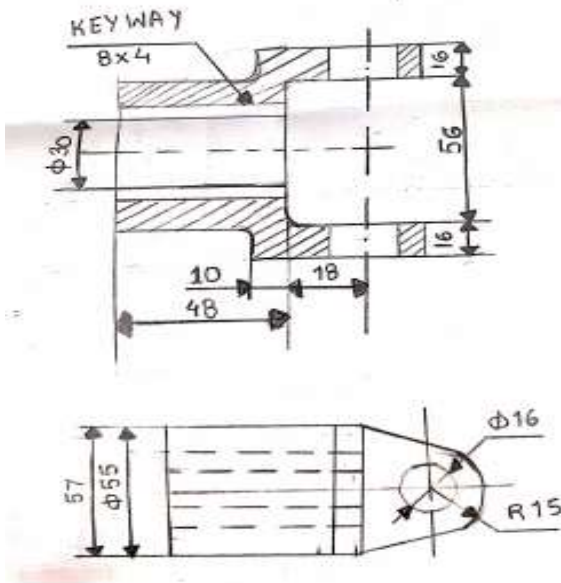
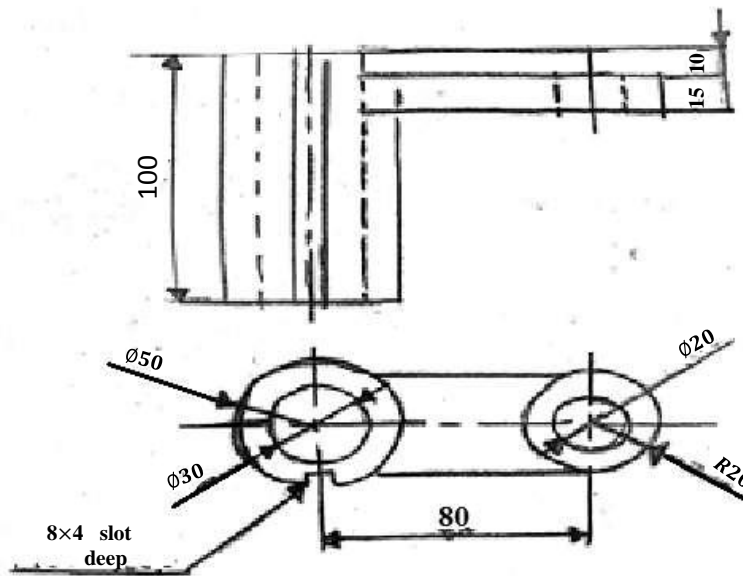


Figure.1

OR

Design draw and dimension a milling fixture to mill a slot of size $8 \times 4 \text{ mm}$ the component shown in fig.

16

Figure.2
Section B

Q.5 Draw neat sketches of the following with nomenclature of their elements.
i) Internal Broach ii) Twist Drill iii) Single point cutting tool

12

- Q.6 a) Explain with neat sketches the following basic die-cutting operations. 06
 i) Perforating ii) Notching
 b) Write short on “press terminology and press selection”. 06
- Q.7 a) Explain the various methods employed to reduce the forces during sheet metal blanking and piercing operation. 06
 b) Write short note on strip layout give suitable example. 06
- Q.8 Design either a compound or progressive die to blank the work piece shown in figure 3 design should include 16
 i) Design of punches and die openings
 ii) Strip layout (s) and center of pressure
 iii) Force calculation
 iv) Assembly drawing of die
 Assume: thickness of blank = 2.4 mm and shear strength = 420 N/mm²

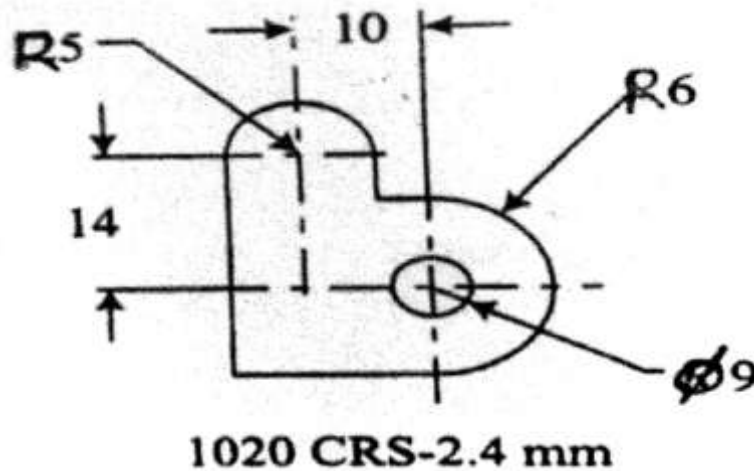


Figure 3
OR

A shell shown in figure 4 has a height of 48 mm and a diameter of 48 mm the corner radius is 2 mm and work piece material is medium carbon steel (yield strength 335N/mm²) and is 1 mm thick. 16
 Design die for drawing operation.

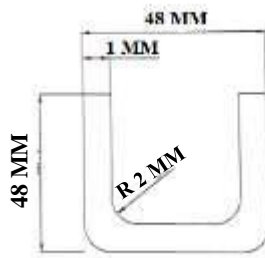


Figure 4

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-585
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECHANICAL) (CGPA) (Sem-II)
CAD/CAM
[Revised]

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

N.B.:1) Q. No. 1 and Q. No. 6 are compulsory.

2) Solve any two questions from remaining questions from each Section.

3) Assume suitable data, if required.

Section A

- Q.1 Solve any five. 10
- Define the term CAI and list down its applications.
 - Define the term Rapid Prototyping.
 - State applications of CAD.
 - Enlist hardware configuration required for graphic software.
 - What is composite transformation?
 - Enlist modern solid modeling techniques.
 - State functions of graphics system.
 - What is cell decomposition?
- Q.2 a) Explain Homogeneous and Concatenated representation. 06
- b) A triangle ABC is defined in a 2D graphic system by its vertices A(2,2), B(5,2) and C(5,5) perform the following transformation on this triangle and represent it. 09
- Translation \rightarrow 2 units in x-direction and 3 units in y-direction.
 - Rotate the original triangle by 45° in anticlockwise direction about the origin.
- Q.3 a) Differentiate between wire frame modeling and solid modeling. 08
- b) Discuss the advantages of parametric representation over nonparametric representation. 07
- Q.4 a) Explain in short 07
- Translation
 - Scaling
 - Rotation
 - Reflection
- b) Explain sweep representations. 08
- Q.5 Write short notes on (any three) 15
- CAAP (Computer Aided Assembly Planning)
 - PLM Flow chart for CAD and CAM
 - Constructive solid geometry
 - Ground rules for selection of graphics software

Section B

- Q.6 Solve any five. 10
- What are NC coordinate systems?
 - State disadvantages of DNC.
 - State NC motion Control systems.
 - State robot physical configuration.
 - What are elements of FMS?
 - Enlist types of end effectors?
 - State Industrial applications of CIM.
 - State types of automation.
- Q.7 15
- a) Write down the manuscript of the manual part programme for the drilling operation to be performed on a square plate of 90 mm side. Six equidistant holes of 10 mm diameter are to be drilled on the PCD of 60mm. The center of the pitch circle is coinciding with the center of the plate, use the following information:-
- Use TAB sequential format.
 - Thickness of the plate is 20 mm.
 - Specify the dimensional/ travels/ increments in microns.
 - Assume suitable starting point
- Q.8 08
- a) Explain basic robot motion.
- b) Discuss Stereolithography. 07
- Q.9 05
- a) What is APT? Explain.
- b) A profile milling operation is to be performed to generate the outline of the part as shown in fig. 1. The part thickness is 15 mm, cutter diameter is 14 mm and cutter speed is 500rpm. Write down the complete APT programme consisting of:-
- Geometry statements to define the geometry
 - Motion statements to perform the profile milling
 - Auxiliary statements
 - Post processor statements

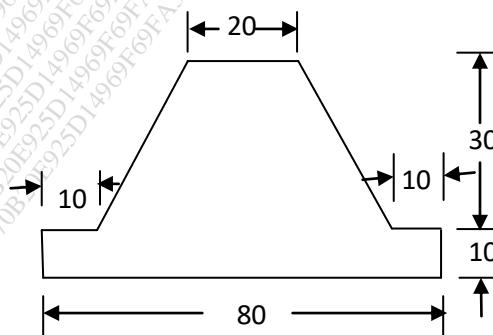


Fig.1

Q.10 Write short notes on (any three)

- a) Comparison of DNC with CNC
- b) End effectors
- c) CNC controllers
- d) Merits and demerits of GT

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1004
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech/Prod) (Sem-VI)
Design of Machine Element-II
[Old]

[Time: Three Hours]

[Max. Marks: 80]

N.B

Please check whether you have got the right question paper.

- Question no.1 from Section A and Question no.6 from section B are compulsory and solve any two questions from remaining from each section.
- Assume additional data if required.
- Use of non-programmable calculator is allowed.

Section A

Q.1 Attempt any five of the following 10

- a. The root angle of a bevel gear is equal to
 - (a) pitch angle – addendum angle
 - (b) pitch angle + addendum angle
 - (c) pitch angle – dedendum angle
 - (c) pitch angle+ dedendum angle
- b. The minimum number of teeth on the pinion in order to avoid interference for 20° stub system is
 - (a) 12
 - (b) 14
 - (c) 18
 - (d) 32
- c. In worm gears, the angle between the tangent to the thread helix on the pitch cylinder and the plane normal to the axis of worm is called
 - (a) pressure angle
 - (b) lead angle
 - (c) helix angle
 - (d) friction angle
- d. The cone clutches have become obsolete because of
 - (a) Small cone angles
 - (b) exposure to dirt and dust
 - (c) difficulty in disengaging
 - (d) all of these
- e. A jaw clutch is essentially a
 - (a) Positive action clutch
 - (b) cone clutch
 - (c) friction clutch
 - (d) disc clutch
- f. In which type of gear trains, shaft axes which are mounted by gear wheels have relative motion between them?
 - (a) Compounded gear train
 - (b) Simple gear train
 - (c) Epicyclic gear train
 - (d) Reverted gear train

Q.2 A 15 kW and 1200 r.p.m. motor drive a compressor at 300 r.p.m. through a pair of spur gears having 20° stub teeth. The center to center distance between the shafts is 400 mm. The motor pinion is made of forged steel having an allowable static stress as 210 MPa, while the gear is made of cast steel having allowable static stress as 140 MPa. Assuming that the drive operates 8

to 10 hours per day under light shock conditions, find from the standpoints of strength, 1. Module; 2. Face width and 3. Number of teeth and pitch circle diameter of each gear. Check the gears thus designed from the consideration of wear. The surface endurance limit may be taken as 700 MPa.

- Q.3 A) A soft surface cone clutch transmits a torque of 200 N-m at 1250 r.p.m. The larger diameter of the clutch is 350 mm. The cone pitch angle is 7.5° and face width is 65mm. If the coefficient of friction is 0.2, find: 1. the axial force required to transmit the torque; 2. the axial force required to engage the clutch; 3. the average normal pressure on the contact surfaces when the maximum torque is being transmitted; and 4. the maximum normal pressure assuming uniform wear. 10
- B) What are the considerations in designing a friction clutch? Why it is necessary to dissipate the heat generated when clutches operate? 05
- Q.4 A single stage helical gear reducer is to receive power from a 1440 r.p.m., 25 kW induction motor. The gear tooth profile is involute full depth with 20° normal pressure angle. The helix angle is 23° , number of teeth on pinion is 20 and the gear ratio is 3. Both the gears are made of steel with allowable beam stress of 90 MPa and hardness 250 B.H.N. 15
- (a) Design the gears for 20% overload carrying capacity from standpoint of bending strength and wear.
- (b) If the incremental dynamic load of 8 kN is estimated in tangential plane, what will be the safe power transmitted by the pair at the same speed?
- Q.5 A) Give a complete design analysis of a single plate clutch, with both sides effective, of a vehicle to transmit 22 kW at a speed of 2800 r.p.m. allowing for 25% overload. The pressure intensity is not to exceed 0.08 N/mm^2 and the surface speed at the mean radius is not to exceed 2000 m/min. Take coefficient of friction for the surfaces as 0.35 and the outside diameter of the surfaces is to be 1.5 times the inside diameter. The axial thrust is to be provided by 6 springs of about 24 mm coil diameter. For spring material, the safe shear stress is to be limited to 420 MPa and the modulus of rigidity may be taken as 80 GPa. 15

Section B

- Q.6 Attempt any five of the following 10
- a. Crowning of a pulley is done to
- (a) Prevent the slipping of a belt (b) To increase the tension of a belt
- (c) To increase the angle of contact (d) None of the above
- b. The centrifugal tension (T_c) in the belt is given by
- (a) $T_c = m \times v^2$ (b) $T_c = 2m \times v^2$ (c) $T_c = m / v^2$ (d) $T_c = 2m / v^2$
- Where m = mass of belt per unit length, v = velocity of belt in m/s
- c. In which of the following drives, there is no slip
- (a) Open belt drive (b) Crossed belt drive (c) Rope drive (d) Chain drive

- d. The following type(s) of bearing(s) have no rolling element.
 (a) Thrust bearing (b) Linear bearing (c) Journal bearing (d) All of the above
- e. Hydrostatic bearing enters Hydrodynamic state when the journal is
 (a) Stationary (b) Rotating (c) Both 'a' and 'b' (d) None of the above
- f. Which of the following is not expressed by primary design equation?
 (a) Functional parameters (b) Material parameters (c) Geometrical parameters
 (d) None of the above

- Q.7 A) Derive the relation for the ratio of driving tensions of a V-belt 07
 08
 B) Power is transmitted between two shafts by a V-belt whose mass is 0.9 kg/m length. The maximum permissible tension in the belt is limited to 2.2 kN. The angle of lap is 170° and the groove angle 45° . If the co-efficient of friction between the belt and pulleys is 0.17; find 1. Velocity of the belt for maximum power; and 2. Power transmitted at this velocity.
- Q.8 A 8 mm thick leather open belt connects two flat pulleys. The smaller pulley is 300 mm 15
 diameter and runs at 200 r.p.m. The angle of lap of this pulley is 160° and the coefficient of friction between the belt and the pulley is 0.25. The belt is on the point of slipping when 3 kW is transmitted. The safe working stress in the belt material is 1.6 N/mm^2 . Determine the required width of the belt for 20% overload capacity. The initial tension may be taken equal to the mean of the driving tensions. It is proposed to increase the power transmitting capacity of the drive by adopting one of the following alternatives:
 1. by increasing initial tension by 10%, and
 2. By increasing the coefficient of friction to 0.3 by applying a dressing to the belt.
 Examine the two alternatives and recommend the one which will be more effective.
 How much power would the drive transmit adopting either of the two alternatives?
- Q.9 A) A rolling contact bearing is subjected to the following work cycle: 10
 (a) Radial load of 6000 N at 150 r.p.m. for 25% of the time; (b) Radial load of 7500 N at 600 r.p.m. for 20% of the time; and (c) Radial load of 2000 N at 300 r.p.m. for 55% of the time.
 The inner ring rotates and loads are steady. Select a bearing for an expected average life of 2500 hours.
- B) Explain how the following factors influence the life of bearing: 05
 (a) Load (b) Speed (c) Temperature (d) Reliability
- Q.10 A) Explain the terms in brief: a) preferred numbers b) interchangeability 08
 B) A 100 mm long and 60 mm diameter journal bearing supports a load of 2500 N at 600 07
 r.p.m. If the room temperature is 20°C , what should be the viscosity of oil to limit the bearing surface temperature to 60°C ? The diametral clearance is 0.06 mm and the energy dissipation coefficient based on projected area of bearing is $210 \text{ W/m}^2/^\circ\text{C}$.

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1016
FACULTY OF SCINCE AND TECHNOLOGY
T.Y.B.Tech.(Mech) (Sem VI)
Fluid Mechanics & Machinerics
[OLD]

[Time: Three Hours]

[Max.Marks:80]

N.B

Please check whether you have got the right question paper.

- (i) Question No.1 and Question No.6 are compulsory.
- (ii) Solve any three questions from each section.
- (iii) Use of non-programmable calculator is allowed.
- (iv) Assume suitable data wherever required.
- (v) Figures to the right indicate full marks.

Section A

- Q.1 Solve any five: 10
- a) Define the following coefficients: coefficient of velocity & co-efficient of contraction.
 - b) Define Vena – contracta.
 - c) Define the terms: drag and lift.
 - d) What do you mean by ‘Terminal velocity of a body’?
 - e) What is Magnus effect? Why is it known as Magnus effect?
 - f) Explain the term, ‘dimensionally homogeneous equation’.
 - g) State Buckingham’s Π -theorem. Why this theorem is considered superior over Rayleigh’s method of dimensional analysis?
- Q.2 (a) Differentiate between large and a small Orifice. Obtain an expression for discharge through a large rectangular orifice. 08
- (b) A circular tank of diameter 1.25m contains water upto a height of 5m. An orifice of 50mm diameter is provided at its bottom. If $C_d = 0.62$, find the height of water above the orifice after 1.5 minutes. 07
- Q.3 (a) What is the expression for the drag on the sphere, when the Reynold’s number of the flow is upto 0.2? Hence prove that the coefficient of drag for sphere for this range of the Reynold’s number is given by $C_D = \frac{24}{Re}$, where Re =Reynold’s number. 08
- (b) Calculate the diameter of the Parachute to be used for dropping an object of mass 100 kg so that the maximum terminal velocity of dropping is 5m/s. The drag co-efficient for the parachute, which may be treated as hemispherical is 1.3. The density of air is 1.216 kg/m^3 . 07
- Q.4 (a) What are the methods of dimensional analysis? Describe the Rayleigh’s method for dimensional analysis. 08
- (b) The efficiency ‘ η ’ of a fan depends upon density ‘ ρ ’, dynamic viscosity ‘ μ ’ of the fluid, angular velocity ‘ ω ’, diameter ‘ D ’ of the rotor and discharge ‘ ϕ ’. Express ‘ η ’ in terms of 07

dimensionless parameters.

Q.5 Write Short notes on (any three):

- Types of similarities
- Dimensionless numbers and their significances.
- Experimental determination of hydraulic coefficients.
- Classification of orifices.
- Repeating variables in dimensional analysis.

15

Section - B

Q.6 Solve any five:

- Differentiate between the turbines and pumps.
- Define the term 'Governing of a turbine'.
- What is draft tube? What are its functions?
- What is priming? Why is it necessary?
- Define cavitation. What are the effects of cavitation?
- How does specific speed of a centrifugal pump differ from that of a turbine?
- How does volute casing differ from a vortex casing for the centrifugal pump?

10

Q.7 (a) Obtain an expression for the force exerted by a jet of water on an inclined fixed plate in the direction of jet.

08

(b) Find the force exerted by a jet of water of diameter 100 mm on a stationary flat plate, when the jet strikes the plate normally with a velocity of 30 m/s.

07

Q.8 (a) How will you classify the turbines?

05

(b) A Pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 liters/s under a head of 30 meters. The buckets deflect the jet through an angle of 160° . Calculate the power given by water to the runner and the hydraulic efficiency of the turbine.

10

Q.9 (a) With a neat sketch, explain the principle and working of centrifugal pump.

07

(b) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water.

08

Q.10 (a) Describe briefly the function of various components of Pelton turbine with a neat labeled sketch.

08

(b) Explain with the help of neat sketches, how multistage pumps are used to produce high heads and high discharge.

07

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1042
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y.B.Tech.(Mech.) (Sem VI)
Engineering Metallurgy
[OLD]

[Time: Three Hours]**[Max.Marks:80]**

N.B

Please check whether you have got the right question paper.

- i) Q.No.1 from section A and Q.No.6 from section B are compulsory.
- ii) In all attempt three questions from section A and three questions from section B.
- iii) Figures to the right indicate full marks.
- iv) Assume suitable data, if and wherever necessary.

Section A

- | | | |
|-----|--|----------|
| Q.1 | Answer any five from the following: | 10 |
| | <ul style="list-style-type: none"> i) What is strain hardening? ii) Define the following properties of a materials: <ul style="list-style-type: none"> a) Stiffness b) Tensile strength iii) Why the Fe-C diagram is drawn only up to 6.67% C? iv) What are the characteristics of Pearlite? v) Define : <ul style="list-style-type: none"> a) Primitive cell b) Space lattice vi) Identify the following: <ul style="list-style-type: none"> a) AISI 1020 b) 20Mn Cr1 vii) Draw neat sketch of BCT type of crystal structure. viii) State modified Gibbs phase rule. | |
| Q.2 | <ul style="list-style-type: none"> a) What are the different crystal defects? Explain with neat sketch. b) What is hardness of a material? Compare the relative advantages and disadvantages of Vickers and Brinell hardness tests. | 10
05 |
| Q.3 | <ul style="list-style-type: none"> a) Explain with neat sketch an isomorphous system of a binary alloy with suitable example by applying lever rule to it. b) Explain Allotropy in steels. | 10
05 |
| Q.4 | <ul style="list-style-type: none"> a) What are critical temperatures with respect to Fe-C diagram? Explain their significance. b) Explain the effect of non-equilibrium cooling on the critical temperatures and Fe- C diagram. | 08
07 |
| Q.5 | <ul style="list-style-type: none"> a) Give classification of steels according to: <ul style="list-style-type: none"> i) Carbon content ii) Fe-C diagram | 08 |

- iii) Alloying elements
- b) Explain with neat sketch a peritectic reaction with a suitable example.

07

Section B

- Q.6 Answer any five from the following: 10
- What is retained austenite?
 - State the advantages and limitations of nitriding over carburizing.
 - What is temper embrittlement? How it is avoided?
 - What are the characteristics of malleable iron?
 - Give two applications of copper.
 - Give the chemical composition of:
 - Invar
 - Cartridge brass
 - What is the function of silicon in cast iron?
 - What is red brass and yellow brass?
- Q.7 a) What is tempering of steels? Why it done after hardening of steels? Explain briefly the different tempering process. 08
b) Explain briefly the conventional annealing process. 07
- Q.8 a) How stainless steels are classified? How chromium makes it corrosion resistant. 08
b) What is the effect of increasing zinc content on the properties of brasses? 07
- Q.9 a) Classify various surface/ case hardening methods and explain any one of them with advantages and disadvantages. 09
b) What are the factors affecting the microstructure of the cast iron? 06
- Q.10 Write short notes on any three of the following. 15
- Alluminium alloys and their applications
 - Bronze and their types
 - High carbon high chromium tool steel
 - Babbitts

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1067
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y.B.Tech.(Mech) (Sem VI)
Modern Management Technique
[OLD]

[Time: Three Hours]**[Max.Marks: 80]**

- N.B
- i. Please check whether you have got the right question paper.
 - ii. Q.1 & Q.6 are compulsory.
 - iii. Attempt any two from the remaining questions from each section.
 - Assume additional data if necessary.

Section A

- | | | |
|-----|--|----------|
| Q.1 | Attempt any five | 10 |
| | <ol style="list-style-type: none"> a) Explain the purpose of FAST analysis b) What do you mean by value control c) What is PDCA? d) Explain concept of POKAYOKE e) State advantages of JIT (any two) f) Define Agile manufacturing | |
| Q.2 | <ol style="list-style-type: none"> a) What is meant by pull system? With suitable example b) What is KANBAN? Explain types of KANBAN | 08
07 |
| Q.3 | <ol style="list-style-type: none"> a) What is lean manufacturing? Explain small-lot production b) Explain the concept of lean maintenance | 08
07 |
| Q.4 | <ol style="list-style-type: none"> a) What is your opinion about implementation of JIT in Indian scenario b) What is cellular manufacturing | 08
07 |
| Q.5 | <ol style="list-style-type: none"> a) What is reconfigurable machining system b) What is push system? State its disadvantages | 08
07 |

Section B

- | | | |
|-----|--|----------|
| Q.6 | Attempt any five. | 10 |
| | <ol style="list-style-type: none"> a) What is basic concept of TPM b) State any two advantages of SCM c) State any two stages of TPM development d) Differentiate between data and information e) State and explain any two ego states f) Explain the concept of cross communication | |
| Q.7 | <ol style="list-style-type: none"> a) What is JOWHARI window? State and explain its advantages. b) What is decision making? How it is useful in management. | 08
07 |

- Q.8 a) Which are decision making tools? Explain any one tool 08
b) Explain any one qualitative tool in decision making 07
- Q.9 a) Explain the pillars of TPM 08
b) Explain with an example the concept of overall equipment effectiveness 07
- Q.10 a) Explain different types of communications. 08
b) Describe the role of MIS in an organization 07

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-1176
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech.(Mech/Prod) (Sem-V)
Design of Machine Element-I
[Old]

[Time: Three Hours]

[Max. Marks: 80]

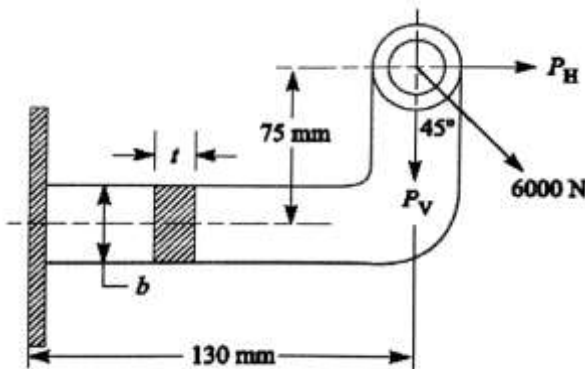
N.B

Please check whether you have got the right question paper.

- i. Question no. 1 from section A and Question no. 6 from section B are compulsory and solve any two questions from remaining from each section
- ii. Assume additional data if required.
- iii. Use of non-programmable calculator is allowed.

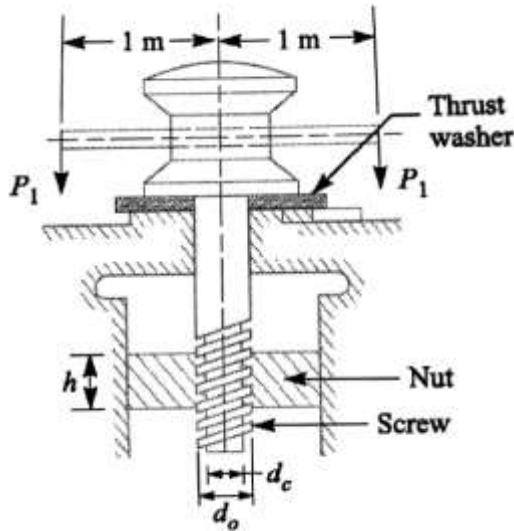
Section A

- Q.1 Attempt **any five** of the following 10
- a) Define the terms: Adaptive Design and New Design
 - b) Explain in short: i) Maximum Principal strain theory ii) Distortion energy theory
 - c) What is mechanical joint? Write the applications of cotter joint.
 - d) Draw the force distribution diagram of cotter pin under bending.
 - e) What is a key? State its function.
 - f) What is self-locking property of threads and where it is necessary?
 - g) Why are square threads preferable to V-threads for power transmission
- Q.2 A mild steel bracket as shown in figure is subjected to a pull of 6000N and acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross sectional dimension of the bracket, if the permissible stress in the material of the bracket is limited to 60 Mpa. 15



- Q.3 Design and draw a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. 15
- Q.4 A sluice gate weighting 10 kN raised and lowered by means of square threaded screws, as shown in Figure. The frictional resistance induced by water pressure against the gate when it is in its lowest position is 4000N. The outside diameter of the screw is 60 mm and pitch is 10 mm. The outside and inside diameter of washer is 150 mm and 50 mm respectively. The 15

coefficient of friction between the screw and nut is 0.1 and for the washer and seat is 0.12.
Find: 1. The maximum force to be exerted at the ends of the lever raising and lowering the gate, 2. Efficiency of the arrangement, and 3. Number of threads and height of nut, for allowable bearing pressure of 7 N/mm^2 .



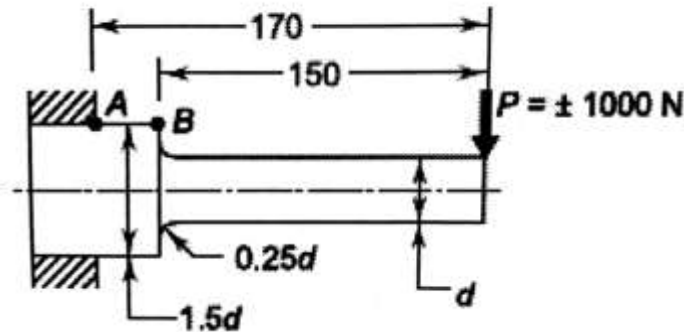
- Q.5 a) Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 r.p.m. The allowable shear stress in the shaft is 40 Mpa and the angle of twist is not to exceed 1° in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa. 10
- b) Explain the design procedure of muff coupling. 05

Section B

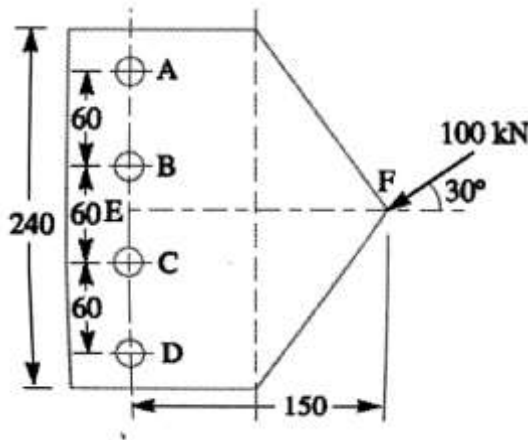
- Q.6 Attempt **any five** of the following. 10
- Draw the diagram representing Soderberg, Goodman and Gerber Lines.
 - Define the terms: i) fatigue stress concentration factor and ii) Fatigue
 - What are the methods to reduce stress concentration?
 - What are advantages and disadvantages of welded joint?
 - What do you mean by riveted Joint? Give its classification.
 - Define the terms: i) Spring Index and ii) Surge in spring
 - Write the equations for resultant stiffness of two springs connected in series and parallel.

- Q.7 It is desired to design a valve spring of I.C. engine for the following details : a) Spring load when valve is closed = 80 N b) Spring load when valve is open = 100 N c) Space constraints for the fitment of spring are : Inside guide bush diameter = 24 mm Outside recess diameter = 36 mm d) Valve lift = 5 mm e) Springs steel has the following properties : Maximum permissible shear stress = 350 Mpa, Modulus of rigidity = 84 kN/mm^2 Find : 1. Wire diameter; 2. Spring index; 3. Total number of coils; 4. Solid length of springs; 5. Free length of springs; 6. Pitch of the coil when additional 15 percent of the working deflection is used to avoid complete closing of coils. 15

- Q.8 A cantilever beam made of cold drawn steel 20C8 (ultimate stress = 540 MPa) is subjected to a completely reversed load of 1kN as shown in figure. The notch sensitivity factor at the fillet can be taken as 0.85 and expected reliability is 90%. Determine the diameter of the beam for a life of 10000 cycles. Take $K_a = 0.78$, $K_b = 0.85$, $K_c = 0.897$ and $\sigma_e = 0.5\sigma_u$ 15



- Q.9 A bracket in the form of a plate is fitted to a column by means of four rivets A, B, C and D in the same vertical line, as shown in figure. $AB = BC = CD = 60$ mm. E is the mid-point of BC. A load of 100 kN is applied to the bracket at a point F which is at a horizontal distance of 150 mm from E. The load acts at an angle of 30° to the horizontal. Determine the diameter of the rivets which are made of steel having a yield stress in shear of 240 MPa. Take a factor of safety of 1.5. What would be the thickness of the plate taking an allowable bending stress of 125 MPa for the plate, assuming its total width at section ABCD as 240 mm? 15



- Q.10 A) Derive the equation for weld joint subjected to torsional moment.
B) Explain the design procedure of semi elliptical leaf spring. 07
08

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1197
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech/Prod) (Sem-V)
Theory of Machines-II
[Old]

[Time: Three Hours]**[Max.Marks: 80]**

Please check whether you have got the right question paper.

- N.B 1) Q.No.1 from section A and Q.No.6 from section B are compulsory.
 2) Solve any two questions from the remaining in each section.

Section A

- Q.1 Attempt any five 10
- i) Explain the term and derive the expression for power the Effort of governor.
 - ii) Explain the terms related spur gear (any one)
 - i. Pressure angle, and
 - ii. Backlash
 - iii) What is Herringbone gear? What is its significance
 - iv) Describe the effect of gyroscopic couple on ship
 - v) Explain the hunting of governor
 - vi) Explain the Isochronism of governor
 - vii) Define reactive gyroscopic couple
- Q.2 a) Explain the term interference and undercutting. 05
- b) Two gears of module 4mm have 24 and 33 teeth. The pressure angle is 20° and each gear has 10 a standard addendum of one module. Find the length of arc of contact and the maximum velocity of sliding if the pinion rotates at 120 r.p.m.
- Q.3 a) Explain the term height of the governor. Derive an expression for the height in the case of a Watt governor. What are the limitations of a Watt governor? 05
- b) Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form; module = 4mm, addendum = one module, pressure angle = 20° . The pinion rotates at 90 r.p.m. determine 10
- i) The number of teeth on the pinion to avoid interference on it and the corresponding number of teeth on the wheel,
 - ii) The length of path and arc of contact,
 - iii) The number of pairs of teeth in contact, and
 - iv) The maximum velocity of sliding

- Q.4 a) Explain the effect of gyroscopic couple on Aircrafts. 05
- b) The turbine rotor of a ship has a mass of 2000 kg and rotates at a speed of 3000 rpm. 10
clockwise when looking from a stern. The radius of gyration of the rotor is 0.5 m. Determine the gyroscopic couple and its effects upon the ship when the ship is steering to the right in a curve of 100 m radius at a speed of 16.1 knots (1 knot = 1855 m/hr). Calculate also the torque and its effects when the ship is pitching in simple harmonic motion, the bow falling with its maximum velocity. The period of pitching is 50 seconds and the total angular displacement between the two extreme positions of pitching is 12° . Find the maximum acceleration during pitching motion.
- Q.5 In a Hartnell governor, the lengths of ball and sleeve arms of a bell crank lever are 120 mm and 100 mm respectively. The distance of the fulcrum of the bell crank lever from the governor axis is 140 mm. Each governor ball has mass of 4 kg. The governor runs at a mean speed of 300 rpm, with the ball arms vertical and sleeve arms horizontal. For an increase of speed of 4 percent, the sleeve moves 10 mm upwards. Neglecting friction, find: 15
- The minimum equilibrium speed if the total sleeve movement is limited to 20 mm.
 - The spring stiffness

Section B

- Q.6 Attempt any five 10
- Define forced vibrations
 - What is the coefficient of maximum fluctuation speed
 - What is function of flywheel? How does it differ from governor
 - Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed' in the case of flywheels.
 - What do you understand by transmissibility
 - State the laws of fluid friction
 - Explain the limiting angle of friction.
- Q.7 a) Prove that the maximum fluctuations of energy $\Delta E = 2Cs$ 05
 E = Mean kinetic energy of the flywheel and Cs Coefficient of fluctuation of speed.
- b) A multi-cylinder engine is to run at a speed of 600 rpm. On drawing the turning moment 10
diagram to a scale of 1 mm = 250 N-m and 1 mm = 3° , the areas above and below the mean torque line in mm^2 are : +160, -172, +168, -191, +197, -162 The speed is to be kept within $\pm 1\%$ of the mean speed of the engine. Calculate the necessary moment of inertia of the flywheel. Determine the suitable dimensions of a rectangular flywheel rim if the breadth is twice its thickness. The density of the cast iron is 7250 kg/m^3 and its hoop stress is 6 MPa. Assume that the rim contributes 92% of the flywheel effect.
- Q.8 a) Derive from first principles an expression for the effort required to raise a load with a screw 05
jack taking friction into consideration.
- b) The spindle of a screw jack has single start square threads with an outside diameter of 45 10

mm and a pitch of 10 mm. the spindle moves in a fixed nut. The load is carried on a swivel head but is not free to rotate. The bearing surface of the swivel head has a mean diameter of 60 mm. the coefficient of friction between the nut and screw is 0.12 and that between the swivel head and the spindle is 0.10. Calculate the load which can be raised by efforts of 100 N each applied at the end of two levers each of effective length of 350 mm. Also determine the velocity ratio and the efficiency of the lifting arrangement.

- Q.9 a) Establish an expression for the natural frequency of free transverse vibrations for a simply supported beam carrying a number of point loads, by energy method 05
- b) The mass of a single degree damped vibrating system is 7.5 kg and makes 24 free oscillations in 14 seconds when disturbed from its equilibrium position. The amplitude of vibration reduces to 0.25 of its initial value after five oscillations. Determine: 10
- Stiffness of the spring,
 - Logarithmic decrement, and
 - Damping factor, i.e. the ratio of the system damping to critical damping.
- Q.10 Write a short notes (any three) 15
- Causes and effects of vibrations
 - Logarithmic decrement
 - Whirling speed
 - Viscous Damping

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1230
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-V)
CAD/CAM/CAE
[Old]

[Time: Three Hours]**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
1. Question 1 from section A and Question 6 from section B are compulsory.
 2. Solve any two from remaining from each section.
 3. Figures to the right indicate full marks

Section A

Q.1 Solve any five :

10

1. For generating Coons patch we require
 - a) A set of grid points on surface
 - b) A set of control points
 - c) Four bounding curves defining surface
 - d) Two bounding curves and a set of grid control points
2. In computer aided drafting practice, an arc is defined by
 - a) Two end points only
 - b) Center and radius
 - c) Radius and one end point
 - d) Two end points and center
3. The screen is scanned from left to right. Top to bottom all the time to generate graphics by:
 - a) Raster scans
 - b) Radom scan
 - c) Vector scan
 - d) Stoke writing
4. What is sweep representation?
5. Explain concept of hidden line removal.
6. Explain concept of shading.

- Q.2
- a) Explain the role of CAD, CAM and CIM in design process. 07
 - b) Explain role of database and DBMS in CAD / CAM. 08

- Q.3
- a) Explain the geometric modeling techniques for CAD system. 07
 - b) Explain ground rules for design of graphics software? Explain in brief. 08

- Q.4
- a) Explain solid representation techniques. 07
 - b) Explain homogeneous coordinate system. Also discuss its significance. 08

- Q.5 Write a short note on any three:
- CSG
 - FEA
 - Hidden line removal
 - Concatenation method

15

Section B

- Q.6 Solve any five:

10

- What are basic NC motion control systems?
- What are different criteria to form machine cell?
- Enlist and explain types of FMS?
- In a 2D CAD package, clockwise circular arc of radius 5, specified from P1 (15,10) to P2 (10,15) will have its center at
 - (10, 10)
 - (15, 10)
 - (15, 15)
 - (10,15)
- The axes of turning machine are:
 - Z and X- axes
 - X and Y – axes
 - Z and Y – axes
 - X, Y and Z – axes
- Which of the following is correct sequence for TAB sequential format NC programming?
 - Sequence no – X coordinate - Y coordinate – Z coordinate – Feed – Speed – M word
 - Sequence no – X coordinate - Y coordinate – Z coordinate – Speed – Feed – M word
 - Sequence no – X coordinate – Y coordinate – Z coordinate – Feed – Speed – G word
 - Sequence no – X coordinate – Y coordinate – Z coordinate – Speed – Feed – G word

- Q.7
- What is Adaptive control in machining system?
 - Explain in brief constructional features of CNC machines.

07

08

- Q.8
- Enlist and explain the categories of machine cells in group technology along with neat diagram.
 - Explain Robotics.

07

08

- Q.9
- Write a short note on Flexible Manufacturing System.
 - Write a short note on CAPP.

07

08

Q.10 Write a short note of any three

15

- a) Robot programming languages
- b) PLM
- c) CIMS
- d) DNC

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-1265
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y.B.Tech.(Mech) (Sem-V)
Production Management
[OLD]

[Time: Three Hours]**[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B

- 1) Que. No. 1 and 6 are compulsory.
- 2) Solve any two questions from the remaining in each Section.
- 3) Figures to the right indicate full marks.

Section A

- | | | |
|-----|---|----------|
| Q.1 | Attempt any five from the following:- | 10 |
| | <ol style="list-style-type: none"> a) Define the term PPC. b) Enlist the causes of depreciation. c) Define Prime Cost. d) What is retractional flow? e) Define simplification. f) Enlist the objectives of plant layout. | |
| Q.2 | <ol style="list-style-type: none"> a) Explain in detail Break Even analysis. b) Explain job production with suitable example. | 07
08 |
| Q.3 | <ol style="list-style-type: none"> a) Explain the objectives of long term and short term forecasting. b) What are the different types of plant layout? Explain any one in detail. | 07
08 |
| Q.4 | <ol style="list-style-type: none"> a) A product is manufactured in the batches of 200. The direct material cost is Rs.6000, direct labour cost is Rs.2500 and factory overhead changes Rs. 900. If the selling expenses are 25% of the factory cost. What should be the selling price so that profit is 15% of total cost? b) Enlist and explain various methods of calculating depreciation. | 07
08 |
| Q.5 | <ol style="list-style-type: none"> a) Explain product layout with suitable example. b) What are the flow lines? Explain basic horizontal flow lines. | 07
08 |

Section B

- | | | |
|-----|---|----|
| Q.6 | Attempt any five of the following:- | 10 |
| | <ol style="list-style-type: none"> a) Define the term standard time. b) What are the objectives of scientific purchasing? c) What is contingency allowance? d) Define method study. | |

- e) Define the term 'Therbligs'.
- f) Explain the principle of 'Contanerisation'.
- Q.7 a) Explain the factors that affect the selection of material handling equipment. 07
b) What are the objectives and functions of purchase department? 08
- Q.8 a) Explain the need for training and motivation. 07
b) Enlist the different methods of 'Merit Rating' explain any one in detail. 08
- Q.9 a) Explain the procedure for work measurement. 07
b) Explain method study in detail. 08
- Q.10 a) Explain codification of material and its objectives. 07
b) Explain the steps involved in purchasing order. 08

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1300
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech.(Mech) (Sem-V)
I.C. Engine & Turbines
[Old]

[Time: Three Hours]

[Max.Marks: 80]

- N.B Please check whether you have got the right question paper.
- 1) Solve any three questions from each section Q. No. 1 and Q. No. 6 are compulsory.
 - 2) Figure to the right indicates full marks.
 - 3) Assume suitable data if necessary.
 - 4) Use of non – programmable calculator is permitted.

SECTION – A

- Q.1 Answer any five of the following. 10
- a) Why a very rich mixture is required for maximum power?
 - b) What is petrol injection?
 - c) What are the factors which affect the process of carburetion?
 - d) What are the factors which affect the tendency to detonate?
 - e) Does the flame front exist in CI engine? Explain.
 - f) What is meant by octane and cetane number of fuel?
- Q.2 a) Derive an expression for air/ fuel ratio taking compressibility into account. 07
b) Describe battery ignition system with the help of neat sketch. 08
- Q.3 a) Discuss the following important designs of overhead valve combustion: 07
i) Bath – tub type
ii) Wedge type
b) Explain phenomenon of diesel knock. Compare it with the phenomenon of detonation in SI engines. 08
- Q.4 a) Discuss the basic requirements of a spark – ignition system. 05
b) A simple jet carburetor is required to supply 6 kg air per minute and 0.45 kg of fuel of density 740 kg/m³. The air is initially at 1.013 bar and 27°C. Calculate the throat diameter of the choke for a flow velocity of 92 m/s. velocity coefficient =0.8. If pressure drop across the fuel meter in g orifice is 0.75 of that at the choke, calculate orifice diameter assuming Cd=0.60.
- Q.5 a) Explain in brief the air – craft carburetion system. 05
b) The following readings are obtained from a test on a single cylinder oil engine working on the Two stroke cycle: 10
Engine speed = 300 rpm, Net Brake Torque = 500 Nm.
Indicated mean effective pressure = $4.9 \times 10^5 \text{ N/m}^2$, fuel consumption 5 kg/ min,
temperature rise of cooling water = 55k, specific capacity of water =4.1868 KJ/Kg K,
Cylinder bore = 200 mm, stroke = 250 mm.
Calculate:
a) The mechanical efficiency.

- b) The specific fuel consumption
- c) Draw up an energy balance in kw, if the calorific value of fuel is 44000 KJ/Kg.

SECTION – B

- Q.6 Answer any five from the following. 10
- a) What is the major advantage of ethanol with alcohol gasoline blends?
 - b) What are the effects of engine speed on the exhaust emission?
 - c) What are the effects of intercooling on performance of gas turbine?
 - d) What do you mean by compounding of steam turbine? What are the methods of compounding?
 - e) Define blade efficiency and stage efficiency of steam turbines.
 - f) What do you understand by the term turbocharging?
- Q.7 a) Discuss different losses in steam turbine. 03
- b) The following data relate to a single stage impulse turbine: 12
- Stage impulse turbine:
 Steam velocity -600 m/s
 Blade speed – 250 m/s
 Nozzle angle - 20°
 Blade outlet angle - 25°
 Neglecting the effect of friction.
 Calculate the work developed by the turbine for the steam flow rate of 20 kg/s.
 Also calculate the axial thrust on the bearings.
- Q.8 a) Derive the expression for efficiency and specific work output for a simple gas turbine cycle in 07 terms of pressure ratio.
- b) Describe with a sketch a typical gas in turbine combustion chamber. 08
- Q.9 a) Explain pressure compounding of steam turbine with neat sketch. 08
- b) What are different methods of turbo charging? Explain any two in detail. 07
- Q.10 a) Explain i) vane Blower ii) centrifugal compressor type of superchargers. 05
- b) What are the supercharging limits for SI and CI engines? 05
- c) Write theory of simple ideal gas turbine with the help of neat sketch. 05

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1349
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y.B.Tech.(Mech/Prod) (Sem-V)
Industrial Management
[OLD]

[Time: Two Hours]**[Max.Marks:40]**

- N.B Please check whether you have got the right question paper.
- i) Q.No.1 from section A and Q.No.6 from section B are compulsory.
 - ii) Solve any two questions from the remaining in each section.
 - iii) No study material or any kind of book are allowed during the examination.
 - iv) Any kind of gadgets are not allowed during the examination.
 - v) Assume suitable data, if necessary and state them clearly.

Section A

- | | | |
|-----|--|----|
| Q.1 | Attempt any six of the following: | 06 |
| | <ol style="list-style-type: none"> 1) Define managers. 2) Enlist types of business organization. 3) Name any two evaluation theories. 4) What is individual proprietorship? 5) Define ethics. 6) Define joint stock company. 7) Define sustainable development. 8) Enlist types of managers. | |
| Q.2 | Explain the evaluation of management theory. | 07 |
| Q.3 | Explain direct action and indirect action environment. | 07 |
| Q.4 | Explain Functional Organization. | 07 |
| Q.5 | Explain the concept of globalization and also, explain how it affects everyone in present scenario. | 07 |

Section B

- | | | |
|-----|--|----|
| Q.6 | Attempt any six of the following: | 06 |
| | <ol style="list-style-type: none"> 1) Define value. 2) Enlist types of training. 3) What is near accident? 4) Define elasticity of demand. 5) Define price. 6) What is the maximum hours allotted for a worker in a single day according to Industrial Act, 1948? 7) Define merit rating. 8) Enlist types of job evaluation. | |

- Q.7 Explain what causes accident and the action required to avoid it. 07
- Q.8 Explain the concept of accounting system and how it affects the financial management. 07
- Q.9 Explain the concept of self and time management. 07
- Q.10 Explain various provisions and rights provided in the Industrial Act, 1948. 07

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-1381
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech.(Mech) (Sem-V)
Design of Machine Element-I
(Revised)

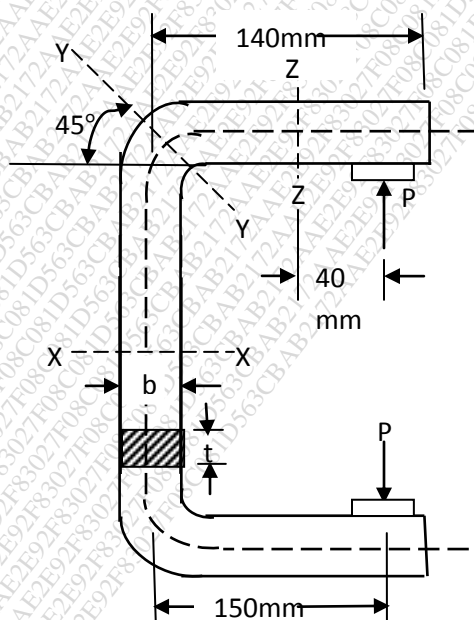
[Time: Three Hours]

[Max.Marks:80]

- N.B
- Please check whether you have got the right question paper.
- 1) Question no.1 from Section A and Question no.6 from Section B are compulsory and solve any two questions from remaining from each section.
 - 2) Assume additional data if required.
 - 3) Use of non-programmable calculator is allowed.

Section A

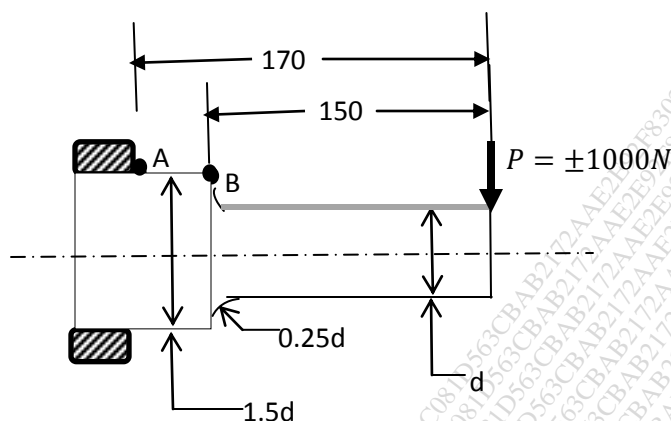
- Q.1 Attempt any five of the following: 10
- a) Draw the flow chart explaining basic procedure of machine design.
 - b) Explain in short: i) Maximum Principal strain theory ii) Maximum shear stress theory
 - c) Distinguish between cotter joint and knuckle joint.
 - d) Draw the force distribution diagram of cotter pin under bending.
 - e) What is a key? State its functions.
 - f) What is self locking property of threads and where it is necessary?
 - g) Why are square threads preferable to V-threads for power transmission.
- Q.2 C-clamp as shown in figure, carries a load $P=25$ kN. The cross-section of the clamp at X-X is rectangular having width equal to twice thickness. Assuming that the clamp is made of steel casting with an allowable stress of 100 MPa, find its dimensions. Also determine the stresses at sections Y-Y and Z-Z. 15



- Q.3 Design a cotter joint to connect two MS rods for a pull of 30 kN. If maximum permissible stresses are 55 MPa, 40 MPa and 70 MPa in tension, shear and crushing respectively. Draw a neat sketch of the joint. 15
- Q.4 Design a screw jack for lifting a load of 50 kN through a height of 0.4 m. The screw is made of steel and nut of bronze. Sketch the front sectional view. The following allowable stresses may be assumed for steel: Compressive stress = 80 MPa; Shear stress = 45 MPa For bronze: Tensile stress = 40 MPa; Bearing stress = 15 MPa Shear stress = 25 MPa. The coefficient of friction between the steel and bronze pair is 0.12. The dimensions of the swivel base may be assumed proportionately. The screw should have square threads. Design the screw, nut and handle. The handle is made of steel having bending stress 150 MPa (allowable). 15
- Q.5 Design a bushed-pin type flexible coupling for connecting a motor shaft to a pump shaft for the following service conditions: Power to be transmitted = 40 kW; speed of the motor shaft = 1000 r.p.m; diameter of the motor shaft = 50 mm; diameter of the pump shaft = 45 mm. The bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 N/mm² and 25 MPa respectively. 15

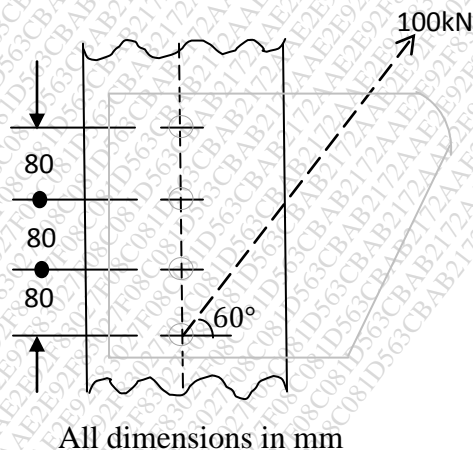
Section B

- Q.6 Attempt any five of the following: 10
- Draw the diagram representing Soderberg, Goodman and Gerber Lines.
 - Define the terms: i) Fatigue Stress concentration factor and ii) Endurance Limit
 - Enlist the causes for stress concentration factor.
 - What are advantages and disadvantages of welded joint?
 - What do you mean by riveted Joint? Give its classification.
 - Define the terms: i) Spring Index and ii) Free length of spring
 - When the Wahl's factor used for spring design? Write its formula.
- Q.7 It is desired to design a valve spring of I.C. engine for the following details: 15
- Spring load when valve is closed = 80 N
 - Spring load when valve is open = 100 N
 - Space constraints for the fitment of spring are : Inside guide bush diameter = 24 mm
Outside recess diameter = 36 mm
 - Valve lift = 5 mm
 - Spring steel has the following properties: Maximum permissible shear stress = 350 MPa, Modulus of rigidity = 84 kN/mm². Find: 1. Wire diameter; 2. Spring index; 3. Total number of coils; 4. Solid length of spring; 5. Free length of spring; 6. Pitch of the coil when additional 15 percent of the working deflection is used to avoid complete closing of coils.
- Q.8 A cantilever beam made of cold drawn steel 20C8 (ultimate stress = 540 MPa) is subjected to a completely reversed load of 1 kN as shown in figure. The notch sensitivity factor at the fillet can be taken as 0.85 and expected reliability is 90%. Determine the diameter of the beam for a life of 10000 cycles. Take $k_a = 0.78$, $K_b = 0.85$, $K_c = 0.897$ and $\sigma_e = 0.5 \sigma_u$ 15



- Q.9 A bracket in the form of a plate is fitted to a column by means of four rivets of the same size, as shown in Fig. 9.39. A load of 100 kN is applied to the bracket at an angle of 60° to the horizontal and the line of action of the load passes through the centre of the bottom rivet. If the maximum shear stress for the material of the rivet is 70 MPa, find the diameter of rivets. What will be the thickness of the plate if the crushing stress is 100 MPa?

15



- Q.10 A) Derive the equation for weld joint subjected to torsional moment.

07

- B) A locomotive semi-elliptical laminated spring has an overall length of 1 m and sustains a load of 70 kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100 mm width. All the leaves are to be stressed to 400 MPa, when fully loaded. The ratio of the total spring depth to that of width is 2. $E=210 \text{ kN/mm}^2$. Determine: 1) The thickness and width of the leaves.
2) The initial gap that should be provided between the full length and graduated leaves before the band load is applied.
3) The load exerted on the band after the spring is assembled.

08

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1388
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-V)
Production Management
(Revised)

[Time: Three Hours]

[Max.Marks:80]

- N.B Please check whether you have got the right question paper.
- i) Q. No.1 and 6 are compulsory.
 - ii) Solve any two questions from the remaining in each section.
 - iii) Figures to the right indicate full marks.

Section A

- Q.1 Attempt any five from the following questions: 10
- (a) What is retractional flow?
 - (b) Define simplification, standardization and specialization.
 - (c) Define productivity.
 - (d) Define capacity.
 - (e) Enlist the objectives of forecasting.
 - (f) Enlist the types of production.
- Q.2
- a) Explain the functions of PPC. 07
 - b) How the company policy affects the product development and design. 08
- Q.3
- a) What are the different types of plant layout? Explain any one along with its advantages & disadvantages. 07
 - b) The sales of newspaper in first 7 months of 2018 are as 08
- | Month | Jan | Feb | Mar | April | May | Jun | Jul |
|-------|-------|-------|-------|-------|-------|-------|-------|
| Sales | 78670 | 78730 | 81968 | 80329 | 79784 | 78968 | 79210 |
- By using regression analysis technique
- i) Establish the equation of straight line.
 - ii) Project the forecast for the month of Aug 2018.
 - iii) Calculate trend value.
- Q.4
- a) What is the importance of Productivity and how the measurement of Productivity is done? 07
 - b) Explain the factors affecting capacity planning. 08
- Q.5
- a) Explain the functional aspect of product development and design. 07
 - b) Explain the principles of good plant layout. 08

Section B

- Q.6 Attempt any five from the following questions: 10
- Define the term Job evaluation.
 - Define the term Standard time.
 - What is contingency allowance?
 - Enlist different functions of inventory control.
 - What are the objectives of scientific purchasing?
 - Define method study.
- Q.7 a) 'Material Handling is necessary evil' Explain. 07
- b) Discuss in detail about centralized and decentralized purchasing. 08
- Q.8 a) Write a short note on 'Therbligs'. 07
- b) Explain the flow process chart with suitable example. 08
- Q.9 a) What are the types of maintenance? Explain in detail. 07
- b) Explain the need for training and motivation. 08
- Q.10 a) What are the objectives and functions of maintenance management? 07
- b) Explain the vendor selection and rating. 08

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1395
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-V)
Heat Transfer
(Revised)

[Time: Three Hours]

[Max.Marks:80]

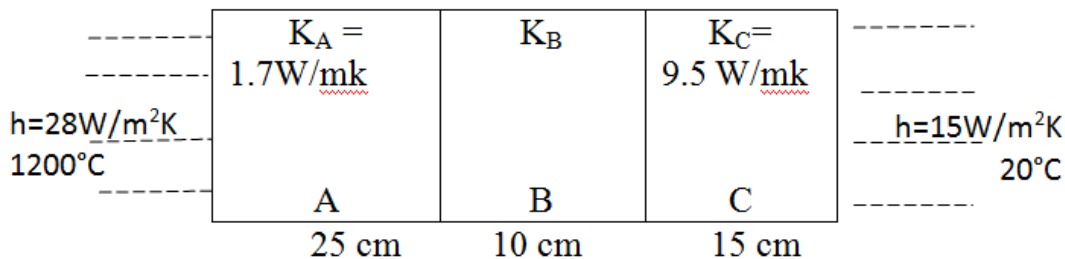
N.B

Please check whether you have got the right question paper.

- i) Question No.1 & 6 are compulsory. Attempt three questions from each section.
- ii) Answers to two sections must be written separately.
- iii) Assume suitable data if required.
- iv) Use of Heat transfer data book permitted.

Section A

- Q.1 Solve any five of the following 10
- a) Define modes of heat transfer with corresponding basic governing equations.
 - b) What is mean by unsteady heat conduction? Give one example.
 - c) Define critical radius of insulation. What is the critical radius for sphere?
 - d) What is mean by overall heat transfer coefficient? Give its equation for plane wall.
 - e) Enlist the factors affecting thermal conductivity?
 - f) Give the reason for using heisler charts.
- Q.2 07
- a) Derive General heat conduction equation in Cartesian coordinates.
 - b) A composite wall made of three layer as shown in Fig. Determine conductivity of layer 'B' 08
and temperature at all surfaces, if the inner surface is at 1080°C



- Q.3 07
- a) Derive the expressions for temperature variations and heat transfer when heat conducted at steady state in radial direction through hollow sphere.
 - b) A long hollow cylinder ($K = 0.5 \text{ W/m}^{\circ}\text{C}$) of 5 cm inner radius and 15 cm outer radius has a heat generation rate of 1000 W/m^3 . The outer surface is maintained at a temperature of 50°C . If maximum temperature occurs at radius of 10 cm, determine the temperature at the inner surface and maximum temperature in the cylinder. 08

- Q.4 a) Define Biot No and Fourier No. state significance of it. 05
 b) A copper ball of 8 cm diameter initially at a uniform temperature of 350°C is suddenly placed in an environment at 90°C. Heat transfer coefficient between ball and fluid is 100W/m²K. Calculate the time required for the ball to reach a temperature of 150°C. Also find the rate of cooling after 1 hour. Take for copper, Cp=0.383 kJ/Kg.K, ρ=8954 Kg/m³, K= 386 w/mK. 10
- Q.5 a) Derive temperature distribution and heat transfer equation for fin having insulated tip. 08
 b) A rod of 10 mm diameter and 80 mm Length with thermal conductivity 16W/m°C protrudes from a surface at 160°C. The rod is exposed to the air at 30°C with convection coefficient of 25W/m²°C. How does the heat flow from this rod get affected if the same material volume is used for two fins of the same length? Assume short fin with end insulated. 07

Section B

- Q.6 Solve any five of the following 10
 a) Enlist the criterion on which heat exchangers are classified.
 b) Differentiate between local and average heat transfer coefficient.
 c) State the reason for using NTU method over LMTD method.
 d) Define Lambert's Cosine law.
 e) Define Nusselt No. and Prandtl No.
 f) Give the application of boiling and condensation.
- Q.7 a) Differentiate between the mechanism of filmwise and dropwise condensation. 08
 b) A steam pipe 50 mm diameter and 2.5 m long has been placed horizontally and exposed to still air at 25°C. If the pipe wall temperature is 295°C determine the rate of heat loss. At the mean temperature of 160°C, the thermophysical properties of air are:
 $K = 3.64 \times 10^{-2} \text{ W/m}^\circ\text{C}$, $\nu = 30.09 \times 10^{-6} \text{ m}^2/\text{s}$,
 $\text{Pr} = 0.682$ and $\beta = \frac{1}{160+273} = 2.31 \times 10^{-3} \text{ perK}$. 07
- Q.8 a) Derive LMTD expression for counter. How heat exchanger. 07
 b) A counter flow heat exchanger to cool 0.8 kg/s of air from 45°C to 150°C. The cooling is accomplished by a stream of cooling water that enters the system with 0.75 Kg/s flow rate and 8°C temperature. If the overall heat transfer coefficient is 35W/m²K. What heat exchanger area is required? If water flow is reduced to half keeping air flow rate same, what will be change in area? 08
- Q.9 a) State and prove the following laws of radiation 08
 i) Kirchoff's law
 ii) Stefan boltzmans law
 b) Two large parallel with ε= 0.5 each are maintained at different temperatures and are exchanging heat only by radiation. Two equally large radiation shields, with surface emissivity 0.05 are introduced in parallel to the plate. Find the percentage reduction in net radiative heat transfer. 07

Q.10

- Differentiate between Laminar and Turbulent flow
- Write a short note on response of thermocouple.
- Explain the effect of fouling on heat exchanger design.

05

05

05

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1402
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y.B.Tech.(Mech) (Sem-V)
CAD/CAM/CAE
(Revised)

[Time: Three Hours]**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
1. Q.No.1 from section A and Q.No.6 from section B are compulsory.
 2. Solve any two from remaining from each section.
 3. Figures to the right indicate full marks.

Section A

- | | | |
|-----|--|----------|
| Q.1 | Solve any five: | 10 |
| | <ol style="list-style-type: none"> a) Explain the meshing techniques in FEA. b) What are types of geometric modeling? c) Discuss applications of geometric transformation. d) The use of computers to draw plans for a product or service applying pre-programmed parameters that describe the desired finished product is called: <ol style="list-style-type: none"> A. Computer aided engineering B. Computer aided manufacturing C. Computer aided design D. Flexible manufacturing system. e) In AutoCAD software, following is not command under modification panel <ol style="list-style-type: none"> A. Line B. Rotate C. Trim D. Offset f) For modeling of door panel of a car, which modelling technique is used: <ol style="list-style-type: none"> A. Wireframe modelling B. Surface modelling C. Solid modelling D. Fashion modelling | |
| Q.2 | <ol style="list-style-type: none"> a) Explain software configuration of graphics system. b) Draw and explain role of CAD/CAM/CAE in design process. | 07
08 |
| Q.3 | <ol style="list-style-type: none"> a) Explain the general methods to solve any engineering problem. b) Write a short note solid modeling technique. | 07
08 |

Q.4 Rectangle ABCD is define in 2D space by its end points as (3,3) (9,3) (9,8) and (3,8). Rectangle is scaled about a fixed point B by factor 1.25 and also show graphically. 15

Q.5 a) Explain discretization process in FEA. 07
b) Explain free and mapped meshing. 08

Section B

Q.6 Solve any five: 10

- a) Cellular manufacturing is also known as
 - A. Manufacturing Technology
 - B. Production Technology
 - C. Group Technology
 - D. None of the above
- b) In Opitz system, 2nd digit indicates
 - A. Type and Shape
 - B. External shape and external shape elements
 - C. External plane surface finishing
 - D. Auxiliary hole and gear teeth
- c) The following cell formation technique is based on Component shape and design?
 - A. Production flow analysis
 - B. Component flow analysis
 - C. Composite component
 - D. Simulation
- d) Explain fixed and floating zero concept
- e) Explain RFID
- f) Explain 3D printing applications

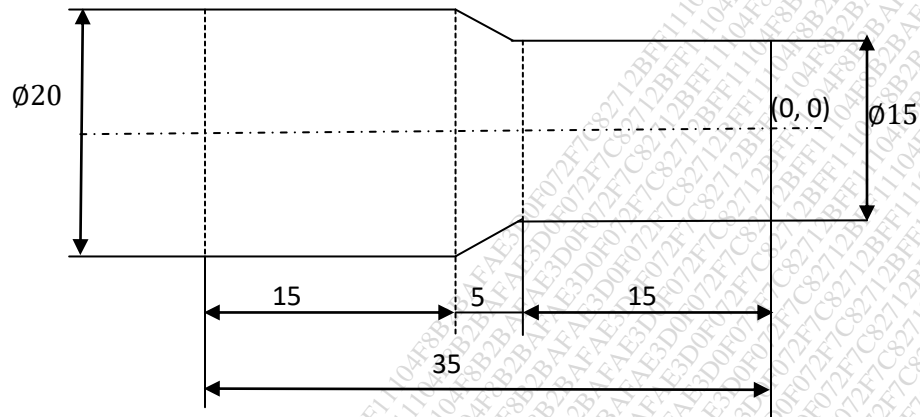
Q.7 a) Write down NC/CNC machine tool components. 07
b) What are different APT statements? Explain. 08

Q.8 a) What is CIMS? 07
b) Explain Robot programming methods. 08

Q.9 a) Explain 3D printing technologies. 07
b) What are types of FMS? Explain. 08

Q.10 Write a manual part program for the raw material size is 20 mm dia bar, the operations involved are: 15

1. Facing
2. Turn upto 15 mm dia. over 15 mm length
3. Taper turning



Total No. of Printed Pages:4

SUBJECT CODE NO:- H-1409
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-V)
Theory of Machines
(Revised)

[Time: Four Hours]

[Max.Marks:80]

N.B

- Please check whether you have got the right question paper.
- Q.No.1 from section A and Q.No.6 from section B are compulsory.
 - Solve any two questions from the remaining in each section

Section A

- Q.1 Attempt any two. 10
- Define the term by stating one example each (any two)
 a. Kinematic link b. Inversion C. Mechanism.
 - State and explain Kennedy's Theorem.
 - Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links? Move in the same and opposite directions?
 - What is the degree of freedom of a mechanism? How is it determined?
- Q.2 The mechanism, as shown in Fig.1 has the dimensions of various links as follows : $AB = DE = 150$ mm, $BC = CD = 450$ mm; $EF = 375$ mm. The crank AB makes an angle of 45° with the horizontal and rotates about A in the clockwise direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the fixed point D , which is connected to AB by the coupler BC . The block F moves in the horizontal guides, being driven by the link EF . 15
- Determine :
- Velocity of the block F ,
 - Angular velocity of DC , and
 - Rubbing speed at the pin C which is 50 mm in diameter.

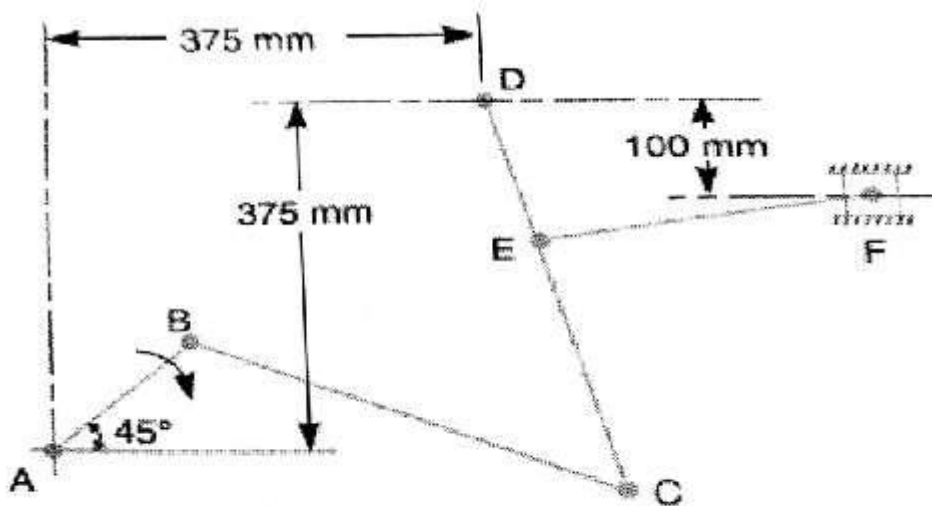


Fig.1

Q.3 A mechanism, as shown in fig.2 has the following dimensions: $OA = 200 \text{ mm}$; $AB = 1.5 \text{ m}$; $BC = 1500 \text{ mm}$; $CD = 500 \text{ mm}$ and $BE = 400 \text{ mm}$. Locate all the instantaneous centers. If crank OA rotates uniformly at 120 rpm . Clockwise, Find

1. The velocity of B , C and D ,
2. The angular velocity of the links AB , BC and CD .

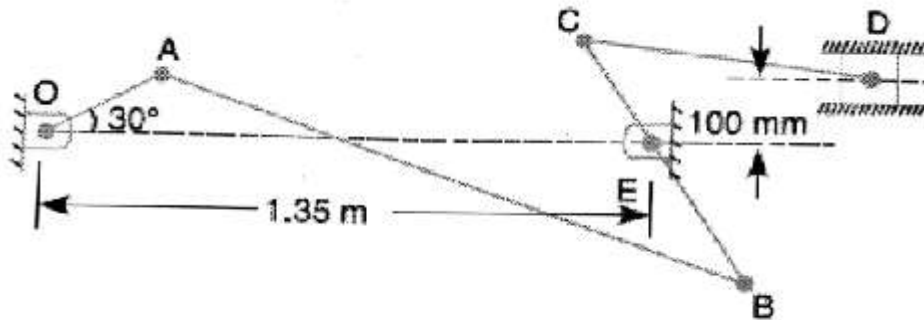


Fig.2

Q.4 In the mechanism, as shown in Fig.3, the crank OA rotates at 20 r.p.m. Anticlockwise and gives motion to the sliding block B and D . The dimensions of the various links are $OA = 300 \text{ mm}$; $AB = 1200 \text{ mm}$; $BC = 450 \text{ mm}$ and $CD = 450 \text{ mm}$. For the given configuration, Determine :

1. Velocities of sliding at B and D ,
2. Angular velocity of CD ,
3. Linear acceleration of D , and
4. Angular acceleration of CD .

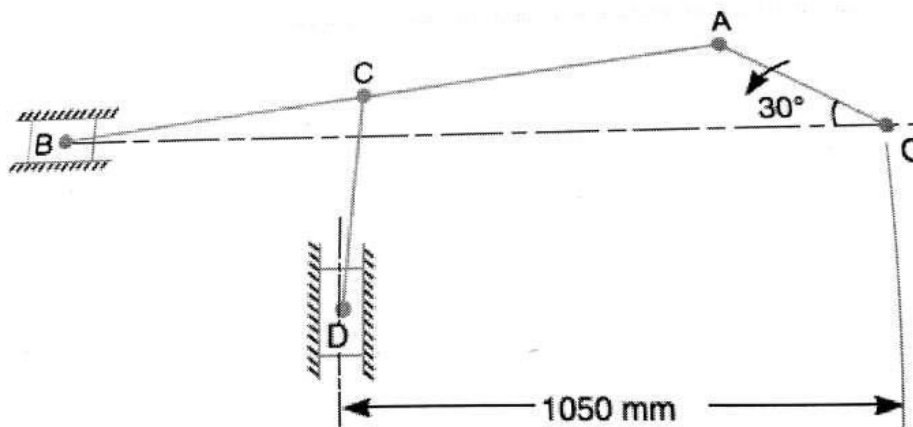


Fig.3

- Q.5 A mechanism of a crank and slotted lever quick return motion is shown in Fig.4 If the crank rotates counter clockwise at 120 r.p.m., determine for the configuration shown, the velocity and acceleration of the ram D. Also determine the angular acceleration of the slotted lever. Crank, $AB = 150$ mm; Slotted arm, $OC = 700$ mm and link $CD = 200$ mm. 15

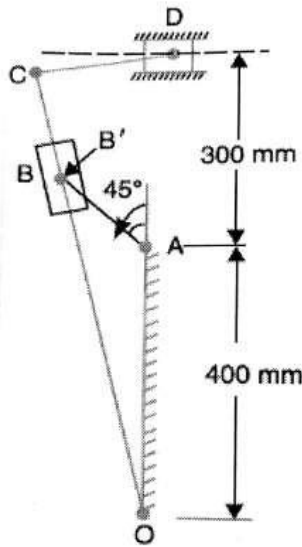


Fig.4

Section B

- Q.6 Attempt any two. 10
- Explain Maximum Fluctuation of Energy.
 - What do you mean by primary and secondary unbalance in reciprocating engines?
 - Distinguish between brakes & dynamometers.
 - Explain with sketches the different types of cams and followers.
- Q.7 Draw a cam profile to drive an oscillating roller follower to the specifications given below: 15
- Follower to move outwards through an angular displacement of 20° during the first 120° rotation of the cam;
 - Follower to return to its initial position during next 120° rotation of the cam;
 - Follower to dwell during the next 120° of cam rotation.
- The distance between pivot center and roller center = 120 mm; distance between pivot center and cam axis = 130 mm; minimum radius of cam = 40 mm; radius of roller = 10 mm; inward and outward strokes take place with simple harmonic motion.
- Q.8 In a spring loaded governor of the Hartnell type, the mass of each ball is 1 kg, length of vertical arm of the bell crank lever is 100 mm and that of the horizontal arm is 50 mm. The distance of fulcrum of each bell crank lever is 80 mm from the axis of rotation of the governor. The extreme radii of rotation of the balls are 75 mm and 112.5 mm. The maximum equilibrium speed is 5 percent greater than the minimum equilibrium speed which is 360 rpm. Find, neglecting obliquity of arms, initial compression of the spring and equilibrium speed corresponding to the radius of rotation of 100 mm. 15

- Q.9 A shaft is supported in bearing 1.8 m apart and projects 0.45 m beyond bearings at each end. The shaft carries three pulleys one at each end and one at the middle of its length. The mass of end pulleys is 48 kg and 20 kg and their center of gravity are 15 mm and 12.5 mm respectively from the shaft axis. The center pulley has a mass of 56 kg and its center of gravity is 15 mm from the shaft axis. If the pulleys are arranged so as to give static balance, Determine : 15
1. Relative angular positions of the pulleys, and
 2. Dynamic forces produced on the bearings when the shaft rotates at 300 r.p.m.
- Q.10 An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. the rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and $\frac{2}{3}$ of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. Find the fluctuation in rail pressure under one wheel, variation of tractive effort and the magnitude of swaying couple at a crank speed of 300 r.p.m. 15

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1419
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y.B.Tech.(Mech) (Sem-V)
Elective-II Mechatronics
(Revised)

[Time: Two Hours]

[Max.Marks:40]

Please check whether you have got the right question paper.

N.B

1. Solve three questions from each section.
2. Questions No.1 and 5 are compulsory.
3. Figures to the right indicate full marks.
4. Assume suitable data, if necessary and state them clearly.

Section A

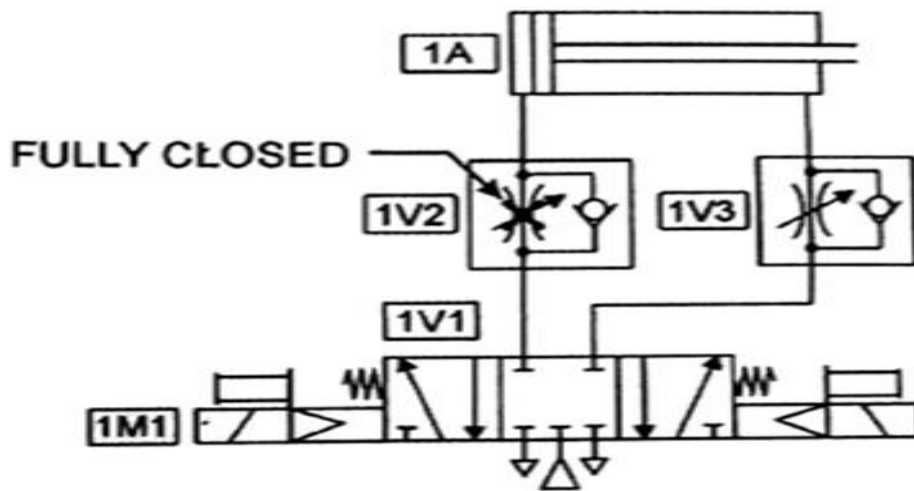
- | | | |
|-----|---|----------|
| Q.1 | <p>Solve any three.</p> <ol style="list-style-type: none"> 1. Draw components of mechatronics system. 2. When temperature rises resistance of negative temperature coefficient thermistor-----. <li style="padding-left: 20px;">a) Increases b) Decreases c) Zero d) Infinity 3. Not all proximity sensors are 'non-contact type' sensors. <li style="padding-left: 20px;">a) True b) False 4. DAQ stands for ----- <li style="padding-left: 20px;">a) Data Acquisition system <li style="padding-left: 20px;">b) Data Analysis system <li style="padding-left: 20px;">c) Data Analysis and Quantization <li style="padding-left: 20px;">d) None of above 5. Which of following is active sensor? <li style="padding-left: 20px;">a) Thermistor b) LVDT c) Thermocouple d) Encoder | 06 |
| Q.2 | <ol style="list-style-type: none"> a) Draw and explain vision sensor. b) Explain construction and working of thermo-couple. | 03
04 |
| Q.3 | <ol style="list-style-type: none"> a) What is difference between analog and digital signals? Explain with example. b) Explain construction and working of inductive proximity sensors. | 03
04 |
| Q.4 | <ol style="list-style-type: none"> a) What is data acquisition system? Explain in briefly. b) Draw and explain architecture of 8051 microcontroller. | 04
03 |

06

Solve any three.

-
- The diagram illustrates a hydraulic circuit for a single-acting cylinder. The cylinder (1) is connected to a reservoir. Two flow control valves (2) are installed in the lines leading to the cylinder's ports. A relief valve (3) is set to maintain a maximum system pressure, indicated by pressure gauge P3. The pump (4) is a solenoid pump, and its output is monitored by pressure gauge 5. The pump is driven by a motor (7) through a coupling. Pressure gauge 6 is located at the pump's outlet. The pump's output is split: one line goes to the cylinder, and the other line goes to a solenoid valve (5) that controls the pump's operation. The solenoid valve is actuated by a pressure signal from the cylinder's port B, which is monitored by pressure gauge 6.

2



- | | | |
|-----|---|----|
| Q.6 | a) Explain construction and working of stepper motor. | 04 |
| | b) Draw neat diagram of 'one –way flow control valve' and '3/2 single solenoid spring return direction control valve', in detail. | 03 |
| Q.7 | a) Draw and explain PLC signal flow diagram in detail. | 04 |
| | b) What are PLC capabilities? Explain. | 03 |
| Q.8 | a) Write a PLC ladder program for START and STOP of a motor, using two push buttons and explain working of program. | 04 |
| | b) What is OP-AMP? Explain briefly. | 03 |

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-1437
FACULTY OF SCIENCE AND TECHNOLOGY
T Y B.Tech. (Mech.) (Sem-VI)
Design of Machine Element-II
[Rev]

[Time: Three Hours]**[Max. Marks:80]**

- N.B.:
- Please check whether you have got the right question paper.
 - Question no.1 from section A and Question no. 6 from section B are compulsory and solve any two questions from remaining from each section.
 - Assume additional data if required.
 - Use of non-programmable calculator is allowed.
 - Use of design data book is permissible.

Section – A

- Q.1 Solve any five of the following questions 10
- a. Illustrate the system of involute gear tooth.
 - b. Draw a neat sketch of force analysis diagram for helical gear.
 - c. Write the equation of velocity ratio of flat belt drive with i) slip ii) creep.
 - d. Write the equation for mean radius of frictional clutch using uniform pressure and uniform wear theory.
 - e. Illustrate the effect of semi-cone angle on disengagement of cone clutch
 - f. Why the length of crossed belt drive is more than open belt drive?
- Q.2 a. A 15 kW and 1200 r.p.m. motor drives a compressor at 300 r.p.m. through a pair of spur gears having 20° stub teeth. The centre to centre distance between the shafts is 400 mm. The motor pinion is made of forged steel having an allowable static stress as 210 MPa, while the gear is made of cast steel having allowable static stress as 140 MPa. Assuming that the drive operates 8 to 10 hours per day under light shock conditions, find from the standpoint of strength, 1. Module; 2. Face width and 3. Number of teeth and pitch circle diameter of each gear. Check the gears thus designed from the consideration of wear. The surface endurance limit may be taken as 700 MPa. 12
- b. Draw a force analysis representing diagram for bevel gear. 03
- Q.3 A pair of parallel helical gears consists of 24 teeth pinion rotating at 5000 rpm and supplying 2.5 kW power to a gear. The speed reduction is 4:1. The normal pressure angle and helix angle are 20° and 23° respectively. Both gears are made of hardened steel ($S_{ut} = 750 \text{ N/mm}^2$). The service factor and the factor of safety are 1.5 and 2 respectively. The gears are finished to meet the accuracy of Grade 4 (total tooth error $e = 8.33 \times 10^{-3}$) 15
- (i) In the initial stages of gear design, assume that the velocity factor accounts for the dynamic load and that the face width is ten times the normal module. Assuming the pitch line velocity to be 10 m/s, estimate the normal module.
 - (ii) Select the first preference value of the normal module and calculate the main dimensions of the gears.
 - (iii) Determine the dynamic load using Buckingham's equation and find out the effective load for the above dimensions. What is the correct factor of safety for bending?

- (iv) Specify surface hardness for the gears, assuming a factor of safety of 2 for wear consideration.

- Q.4 a) Two shafts whose centers are 1 meter apart are connected by a V-belt drive. The driving pulley is supplied with 95 kW power and has an effective diameter of 300 mm. It runs at 1000 r.p.m. while the driven pulley runs at 375 r.p.m. The angle of groove on the pulleys is 40° . Permissible tension is 400 mm^2 cross-sectional area belt is 2.1 MPa. The material of the belt has density of 1100 kg/m^3 . The driven pulley is overhung, the distance of the centre from the nearest bearing being 200 mm. The coefficient of friction between belt and pulley rim is 0.28. Estimate the number of belts required. 08
- b) Construct an expression for the length of open belt drive. 07
- Q.5 a) A cone clutch is to be designed to transmit 7.5 kW at 900 r.p.m. The cone has a face angle of 12° . The width of the face is half of the mean radius and the normal pressure between the contact faces is not to exceed 0.09 N/mm^2 . Assuming uniform wear and the coefficient of friction between the contact faces as 0.2, find the main dimensions of the clutch and the axial force required to engage the clutch. 08
- b) Establish a formula for the frictional torque transmitted by a single plate clutch using uniform pressure theory. 07

Section – B

- Q.6 Solve any five of the following questions 10
- What do you mean by simplex, duplex and triplex chain drive?
 - Write the applications of wire rope drive.
 - What is the condition for artificial cooling requirement in bearing?
 - Give the relation between pitch and pitch circle diameter of chain drive.
 - What do you mean by hydrodynamic bearing and hydrostatic bearing?
 - Differentiate between boundary element method & finite element method.
- Q.7 a) Design a journal bearing for a centrifugal pump from the following data: 10
Load on the journal = 20 kN; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg/m-s ; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N/mm^2 .
Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C . Heat dissipation coefficient = $1232 \text{ W/m}^2/^\circ\text{C}$.
- b) Explain with a neat plot the importance of the bearing characteristic curve. 05
- Q.8 a) Design a roller chain to transmit power from a 20 kW motor to a reciprocating pump. 12
The pump is to operate continuously 24 hours per day. The speed of the motor is 600 r.p.m. and that of the pump is 200 r.p.m.
- b) Give the classification of wire rope. How the wire ropes are designated? 03

- Q.9 A single-row deep groove ball bearing is used to support the lay shaft of a four speed automobile gear box. It is subjected to the following loads in respective speed ratios: 15

Particulars	Axial load (N)	Radial load (N)	% time engaged
First Gear	3250	4000	1%
Second Gear	500	2750	3%
Third Gear	50	2750	21%
Fourth Gear	Nil	Nil	75%

The lay shaft is fixed to the engine shaft and rotates at 1750 rpm. The static and dynamic load carrying capacities of the bearing are 11600 and 17600 N respectively. The bearing is expected to be in use for 4000 hours of operation. Find out the reliability with which the life could be expected.

- Q.10 a) Explain the steps used in finite element analysis (FEA) to solve engineering problem. 05
b) Explain the steps involved in optimal design procedure in optimization methods. 10

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-1444
FACULTY OF SCIENCE AND TECHNOLOGY
T.Y. B.Tech. (Mech) (Sem-VI)
Materials and Metallurgy
[Rev]

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

- i. Answer three questions from each section.
- ii. Question no.1 and 6 are compulsory.
- iii. Figures to the right indicate full marks.
- iv. Assume suitable data, if and wherever necessary.

SECTION -A

- | | | |
|-----|---|----------|
| Q.1 | Answer any five from the following: | 10 |
| | <ol style="list-style-type: none"> i) What are polymer quenchants? ii) Define the following properties of a material: <ol style="list-style-type: none"> a) Creep strength b) Toughness iii) What is substitutional solid solution? Give one example. iv) What are the characteristics of martensite? v) Define: <ol style="list-style-type: none"> a) Lignancy b) Atomic packing factor. vi) Identify the following: <ol style="list-style-type: none"> a) AISI 1080 b) 95 Cr 5 Mo 1 vii) What is isomorphous system? viii) What is lever rule? ix) Draw a stress – strain curve for mild steel. | |
| Q.2 | <ol style="list-style-type: none"> a) What are the different types of crystal defects? Explain with neat sketch. b) State the advantages of Rockwell hardness test over the other tests of hardness measurement. | 08
07 |
| Q.3 | <ol style="list-style-type: none"> a) Draw a neat sketch of phase diagram of a binary eutectic alloy and explain its characteristics. b) What is coring? How it is eliminated. | 08
07 |
| Q.4 | <ol style="list-style-type: none"> a) Explain the Normalizing heat treatment process with its merits and demerits. b) What are the uses of eutectic alloys? | 09
06 |
| Q.5 | <ol style="list-style-type: none"> a) Draw a neat labeled Fe- C diagram and explain the characteristics of different phases and reactions in it with neat sketch. b) Explain briefly how steels are specified. | 10
05 |

SECTION - B

- Q.6 Answer any five from the following: 10
- What is meant by smart materials?
 - What do you mean by flame hardening of steels?
 - What are the different types of quenching mediums?
 - What are the characteristics of stainless steels?
 - Give two applications of HCHC steels.
 - What is a super alloy? How does it differ from stainless steel?
 - What is a red hardness in tool steels?
 - What are satellites?
 - What do you understand by Austenitic stainless steels?
- Q.7 a) What is carburizing? Explain in brief the different methods of carburizing. 08
b) What are the defects in heat treatment of steels? 07
- Q.8 a) What is grey cast iron? Briefly explain the properties and applications of grey cast iron. 07
b) Give the classification of cast iron. Mention any two applications of each. 08
- Q.9 a) What is brass? Draw the phase diagram showing different phases of brass in it and explain its importance. 10
b) Give composition and uses of following alloys: 05
i) Cartridge brass.
ii) Brazing brass.
- Q.10 Write short notes on any three of the following. 15
a) Seasoned cracking of brasses
b) Zirconium alloys
c) High speed tool steel
d) Malleable cast iron
e) Metal matrix composites

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-104
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECH/PROD) (Sem-II)
Design of Machine Elements - II
[OLD]

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
1. Attempt any three questions from each section.
 2. Assume suitable data, if necessary.
 3. Use non – programmable calculator and design data book is allowed.

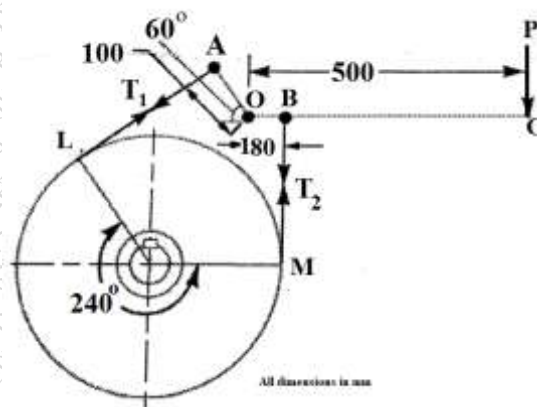
Section -A

- Q.1 It is required to design a spur gear with 20° full depths involute teeth based on Lewis equation. 13
 The velocity factor is to be used to account for dynamic load. The pinion shaft is connected to a 15kW, 1450 rpm motor. The starting torque of the motor is 150% of the rated torque. The speed reduction is 4:1. The pinion as well as the gear is made of plain carbon steel 40C8 ($\sigma_{ut} = 600 \text{ N/mm}^2$). The factor of safety can be taken as 1.5. Design the gears and specify their dimensions and suggest surface hardness for the gears.
- Q.2 A pair of helical gears is to transmit 15kW. The teeth are 20° stub in diametral plane and have a 13
 helix angle of 45° . The pinion runs at 10000 r.p.m. and has 80mm pitch diameter. The gear has 320mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618 \text{ MPa}$.
- Q.3 A multiple disk clutch consists of steel and bronze plates transmits 12kW at 1200 rpm. The inner 13
 and outer diameter of discs being 100mm and 160mm respectively. The engagement factor is 1.2. the coefficient of friction between contracting plates is 0.16 and maximum intensity of pressure is 0.25 mpa using uniform wear uniform pressure conditions. Also find the required number of steel and bronze plates.
- Q.4 a) What is a clutch? Discuss the various types of clutches giving at least one practical 06
 application for each.
 b) The contact surfaces in a cone clutch have an effective diameter of 80mm. the semi- 07
 angle of the cone 15° and coefficient of friction is 0.3. Find the torque required to produce slipping of the clutch, if the axial force applied is 200N. The clutch is employed to connect an electric motor, running uniformly at 900 r.p.m. with a flywheel which is initially stationary. The flywheel has a mass of 14 kg and its radius of gyration is 160mm. calculate the time required for the flywheel to attain full – speed and also the energy lost in slipping of the clutch.
- Q.5 Write short notes on (any three) 14
- i) Gear material for worm and worm wheel speed reducer.
 - ii) Advantages of helical gear over spur gear.

- iii) Thermal consideration in worm gear
- iv) Classification of clutch. Explain one in detail.

Section – B

- Q.6 Power of 60kW at 750 r.p.m. is to be transmitted from an electric motor to compressor shaft at 300 r.p.m. by V- belts. The approximate larger pulley diameter is 1500mm. the approximate Centre distance is 1650mm, and overload factor is to be taken as 1.5. Give a complete design of the belt drive. A belt with cross – sectional area of 350mm^2 and density 1000 kg/m^3 and having an allowable tensile strength 2 MPa is available for use. The coefficient of friction between the belt and the pulley may be taken as 0.28. the driven pulley is overhung to the extent of 300 mm. form the nearest bearing and is mounted on a shaft having a permissible shear stress of 40 MPa with the help of a key. The shaft, the pulley and the key are also to be designed. 13
- Q.7 Full journal bearing of 50mm diameter and 100mm long has a bearing pressure of 1.4N/mm^2 . The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametric clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s . the room temperature is 35°C . find: 13
1. The amount of artificial cooling required, and
 2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C . Take specific heat of the oil as $1850\text{J /kg}^\circ\text{C}$.
- Q.8 A deep groove ball bearing has a dynamic capacity of 20500 N and it operates on the following work cycle of different radial loads:- 6000N at 250rpm for 20% of time, 9000N at 500 rpm for 25% of time and 3600N at 400 rpm for remaining time. Assume that the loads are steady and the inner race rotates; find the average life of bearing in hours. 13
- Q.9 A differential band brake is operated by a lever of length 500mm. the brake drum has diameter of 500mm and the maximum torque on the drum is 1000 N-m. The band brake embraces $2/3^{\text{rd}}$ of the circumference. One end of the band is attached to a pin 100mm from the fulcrum and the other end to another pin 80mm from the fulcrum and on the other side of it when the operating force is also acting. If the band brake is lined with asbestos fabric having a coefficient of friction 0.3, find the operating force required. Design the steel band, shaft, key, lever and fulcrum pin. The permissible stresses may be taken as 70MPa in tension, 50 MPa in shear and 20 MPa in bearing. The bearing pressure for the brake lining should not exceed 0.2N/mm^2 . 13



Q.10 Write short notes on (Any Three) :

- i) Important factors to be considered in brake design.
- ii) Gear materials and its selection
- iii) Types of belts, belts materials and criteria for its selection
- iv) Rope drive

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-124
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-II)
Heat Transfer
[OLD]

[Time: Three Hours]

[Max.Marks: 80]

- N.B Please check whether you have got the right question paper.
- 1) Solve any three question from each Section.
 - 2) Figure to right indicate full marks.
 - 3) Assume suitable data, if necessary.
 - 4) Use of Heat & Mass transfer data book & Non Programmable Calculator.
- Section A**
- Q.1 a) Derive the generalized heat conduction equation in Cartesian Co-ordinates under unsteady state with heat generation. 06
- b) A cold storage room has walls made of 220 mm of brick's on the outside 90 mm of plastic foam and finally 16 mm of wood on inside. The outside & Inside air temperatures are 25°C & -3°C respectively. If the inside & outside heat transfer coefficients are respectively 30 & 11 $W/m^2°C$, and the thermal conductivity of brick, foam & wood are 0.99, 0.022 & 0.17 $W/m°C$, respectively. Determine
- i) The rate of heat removal by refrigeration if the total wall area is 85m²;
 - ii) The temperature of the inside surface of the brick.
- Q.2 a) Explain estimation of error in temperature measurement in a thermometer well? 06
- b) A mercury thermometer placed in oil well is required to measure the temperature of compressed air flowing in a pipe. The wall is 140 mm long and made of steel (K= 50w/m°C) of 1 mm thickness. The temp recorded by the well is 100°C. While the pipe wall temp is 50°C. Heat transfer coefficient between air & well wall is 30 $W/m^2°C$. Estimate true temp of air. 07
- Q.3 A vertical plate measuring 180 mm × 180 mm and at 50°C is exposed to atmosphere at 10°C. Compare the free convection heat transfer from this plate with that which would result due to forced convection over the plate at a velocity equal to twice the maximum velocity which would occur in free convection boundary layer. 13
- Q.4 a) Differentiate between Natural & Forced Convection? 06
- b) With neat sketch explain The Boundary Layer on flat plate. 07
- Q.5 Write any two (Short Notes) 14
- a) Thermal Contact Resistance
 - b) Significance of BiotNumber & Fourier Number
 - c) Effectiveness & efficiency of Fin

Q.6 a) Write a note on film wise and drop wise condensation? 06
b) Draw the pool boiling curve & explain six regimes of pool boiling curve. 07

Q.7 a) State & Prove Kirchoff's Law of Radiation. 05
b) Consider two large parallel plates one at $t_1 = 727^\circ\text{C}$ with emissivity $\varepsilon_1 = 0.8$ and 08
other at $t_2 = 227^\circ\text{C}$ with emissivity $\varepsilon_2 = 0.4$. An aluminium shield with an emissivity
 $\varepsilon_s = 0.05$ on both sides is placed between plates. Calculate the percentage reduction
in heat transfer rate between the two plates as a Result of the shield.
Use $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^4$

Q.8 Derive an expression for LMTD of parallel flow heat exchanger stating the assumption made? 13

Q.9 The following data relate to parallel flow heat exchanger in which air is heated by hot exhaust 13
gases.

- * Heat transferred/hr = 155450 kJ
- * Inside heat transfer coefficient } = $120 \text{ W/m}^2\text{C}$
- * Outside heat transfer coefficient } = $95 \text{ W/m}^2\text{C}$
- * Inlet & Outlet temp of the hot fluid } = 450°C & 250°C
- * Inlet & Outlet temp of the cold fluid } = 60°C & 120°C
- * Inside and outside dia of tube } = 50 mm & 60 mm
- * Calculate the length of the tube?

Q.10 Write any two(Short Notes) 14

- i) Black, White & Grey Body
- ii) Fouling & fouling factor
- iii) Shape factor

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-158A
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-II)
Tool Engineering
[OLD]

[Time: Three Hours]

[Max.Marks:80]

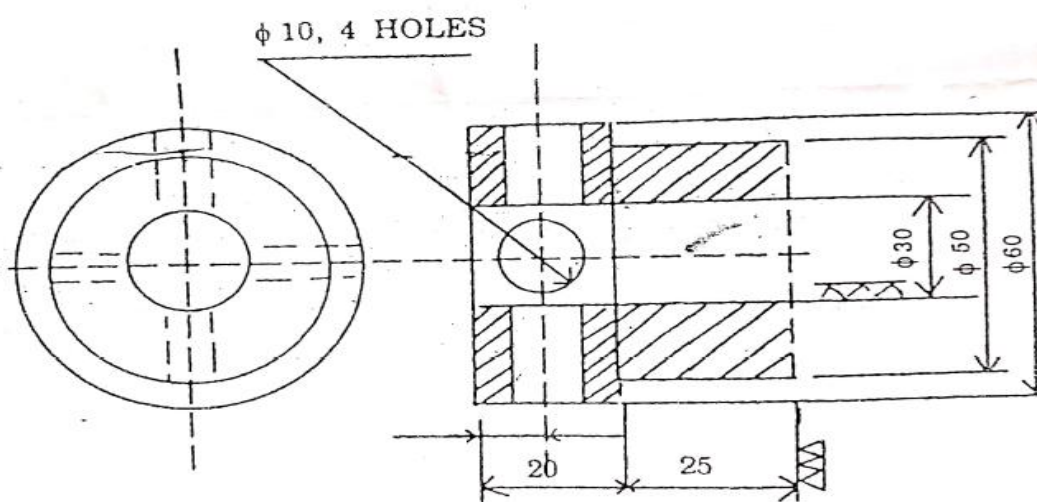
Please check whether you have got the right question paper.

N.B

1. Attempt any three questions from each section
2. Assume suitable data and dimensions if required
3. All dimensions are in mm

Section -A

- | | | |
|-----|--|----|
| Q.1 | a) Differentiate between orthogonal and oblique cutting | 05 |
| | b) The following equation for tool life has been obtained for HSS tool | 08 |
| | $VT^{0.14} f^{0.7} d^{0.8} = C$ | |
| | A 40min tool life was obtained while cutting at $V=30\text{m/min}$, $f=0.2\text{ mm/rev}$ & $d=2.5\text{mm}$ | |
| | Determine the effect on tool life if the cutting speed, feed and depth of cut are increased by 25% individually and also taken together. | |
| Q.2 | a) Draw Merchant force circle. Enlist the forces act in it | 05 |
| | b) Describe with neat sketch nomenclature of reamer. | 08 |
| Q.3 | a) Discuss Taylor's relationship for cutting speed, tool life. Also write down Modified Taylor's tool life equation | 08 |
| | b) What is fool proofing? Explain with neat sketch | 05 |
| Q.4 | Design a drill jig for given component shown in figure .1 - 4 Holes of $\phi 10$ | 14 |



- Q.5 a) Explain in detail various types of locating devices. 08
b) Write a short note on indexing devices. 05
- Section – B
- Q.6 a) Differentiate between compound die and progressive die 07
b) Define following press operation 06
i) Nibbling
ii) Notching
iii) Piercing
- Q.7 a) With neat sketch explain types of bending 07
b) Write note on 'deep drawability'. 06
- Q.8 a) Write a note on open die forging. 08
b) Differentiate between single impression and multi impression die 06
- Q.9 Write notes on (any two) 14
i) Knockout
ii) Forging dies
iii) Spring back
- Q.10 A cup of 50mm in diameter and 75mm deep is to be drawn from 1.2mm thick drawing steel with 13 tensile strength of 320 N/mm^2 . The corner radius is negligible determine
a) Blank diameter
b) Number of drawing operation
c) Force for the first draw with 40 % reduction

Total No. of Printed Pages:04

SUBJECT CODE NO:- H-159-B
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-II)
Tool Engineering
[OLD]

[Time: Four Hours]**[Max.Marks: 80]**

- N.B Please check whether you have got the right question paper.
- 1) Q. No. 4 and Q. No.8 are compulsory. Attempt any two questions from the remaining questions of each Section.
 - 2) Solve Q.No.4 on drawing sheet.
 - 3) Assume suitable data and dimensions if necessary.
 - 4) All dimensions are in mm.

Section A

- | | | |
|-----|---|----|
| Q.1 | a) Name and describe the basic types of chips. | 06 |
| | b) Explain 3-2-1 principle of location. | 06 |
| Q.2 | a) During orthogonal turning operation on a work piece of diameter 120mm at 80 m/min cutting speed with take angle 15° , the width of the cut and the chip thickness are 0.4 mm and 0.3 mm respectively. The feed during the operation was 0.2 mm/rev. if the cutting force and the thrust force are 1200N and 300N, respectively. Calculate the shear angle, friction angle, shear stress and shear strain. | 06 |
| | b) Explain merchant's circle diagram used for force analysis in orthogonal cutting. | 06 |
| Q.3 | a) Explain the condition recommend for the use of positive and negative rake angles in cutting tools. | 06 |
| | b) Draw the neat sketches of following:- | 06 |
| | 1) Swinging latch | |
| | 2) Strap clamp | |
| | 3) Fixed renewable bush | |
| Q.4 | Design a drill jig to drill 10 mm holes in the work piece as shown in figure 1. | 16 |
| | a) Draw minimum two views of assembly of jig. | |
| | b) Draw the detailed drawing of jig plate and bush. | |
| | c) Represent bill of material (BOM) | |

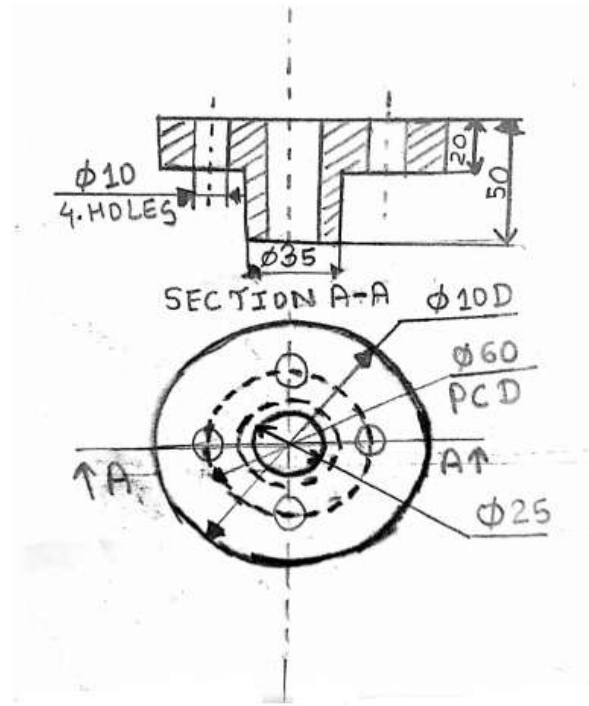
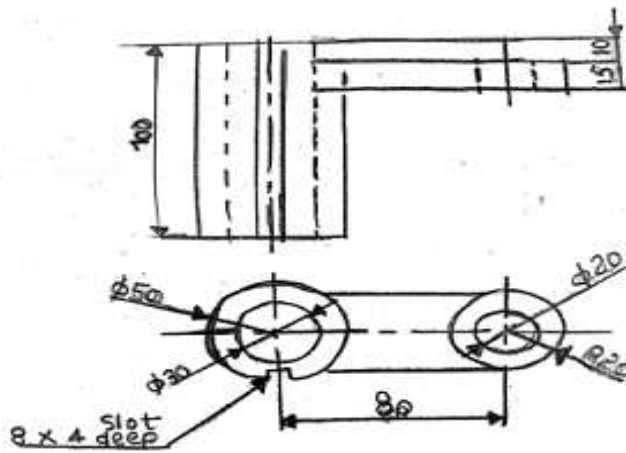


Figure 1

OR

Design draw and dimension a milling fixture to mill a slot of size 8×4 mm in the component shown in fig. 16



Section B

- Q.5 Draw neat sketches of the following with nomenclature of their elements (any two) 12
- Internal Broach
 - Single point cutting tool
- Q.6 a) Explain with neat sketches the following basic die-cutting operations: 06
- Embossing
 - Notching
- b) What is meant by die clearance? Is the clearance placed on the punch or die opening 06
for a blanking operation and piercing operation? Explain with neat sketches.
- Q.7 a) Differentiate between compound & progressive press tool? 06
- b) Write short note on strip layout give suitable example. 06
- Q.8 Design either a compound or progressive die to blank the work piece shown in figure 3. 16
Design should include
- Design of punches and die openings
 - Strip layout (s) and center of pressure
 - Force calculation
 - Assembly drawing of die.
- Assume:- thickness of blank = 1.2 mm and shear strength = 420 N/mm²

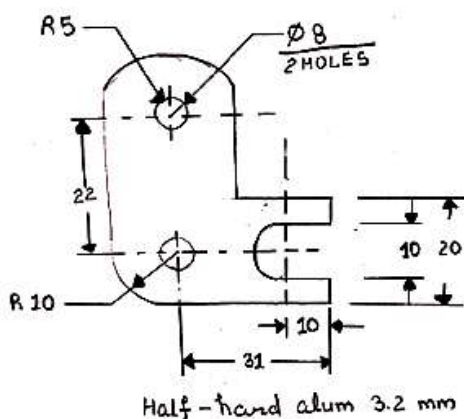


Figure 3

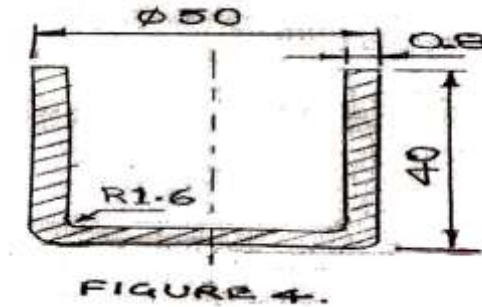
OR

Figure 4 shows a symmetrical – cup work piece with a shell height of 40 mm and a shell diameter of 50 mm. the corner radius is 1.6 mm, the work piece materials is 1020. Cold rolled steel with 0.8 mm thickness. And tensile strength 315 N/mm². Calculate the following

- Blank size and percent reduction
- Draw ratio

16

- iii) Radius on punch and die
- iv) Die clearance and draw pressure. Also sketch the assembly drawing of first stage draw die.



Total No. of Printed Pages:2

SUBJECT CODE NO:- H-194
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-II)
CAD/CAM/CAE
[Revised]

[Time: Three Hours]

[Max. Marks:80]

N.B.

Please check whether you have got the right question paper.

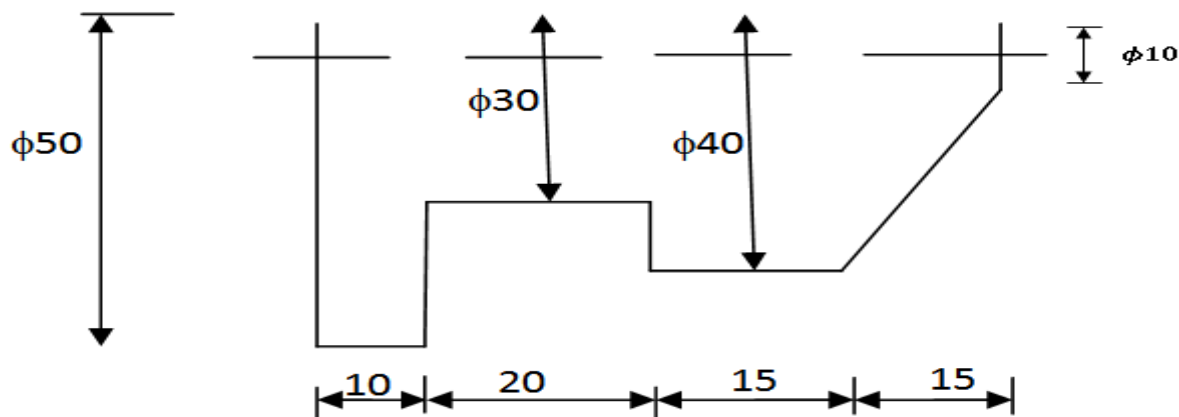
1. Solve three questions from each section.
2. Figure to the right indicate full marks.

Section A

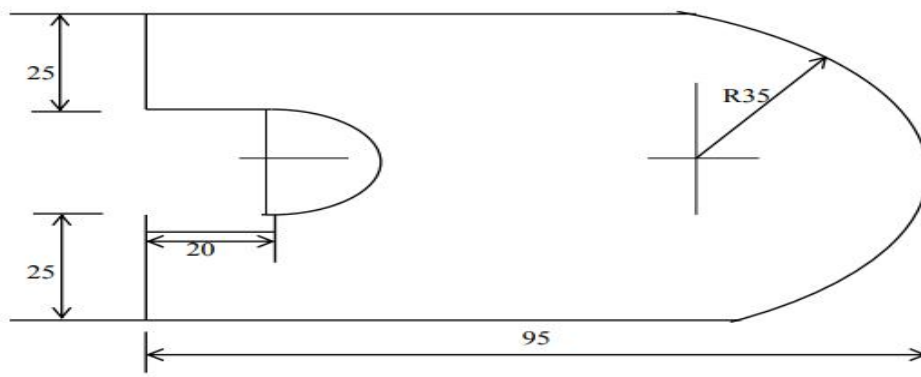
- | | | |
|-----|--|----|
| Q.1 | a. Explain the principle of Concurrent engineering and discuss how it differs from traditional manufacturing. | 06 |
| | b. Discuss the impact of computers on various activities of product cycle. | 07 |
| Q.2 | a. Enlist various cursor control devices used in CAD and explain any two of them. | 07 |
| | b. Discuss various functions to be performed by graphics package. | 06 |
| Q.3 | A rectangle is defined in 2D space by its end points P(1,1), Q(6,1), R(6,6)& S(1,6). Express them in 13 matrix notation and perform the following transformations and show it graphically. | |
| | 1) Scale it by a factor of 1.5 | |
| | 2) Rotate it by 90° about origin | |
| Q.4 | a. Explain the role played by CSG in solid modeling and the various operations to be carried over to construct the 3-D geometry. | 07 |
| | b. Compare CSG technique against B-rep technique of solid modeling | 06 |
| Q.5 | Write short note (Attempt any three): | 14 |
| | a. GKS | |
| | b. Wire frame and solid modeling | |
| | c. Bezier curves | |
| | d. CIM | |

Section B

- Q.6 a. Describe NC procedure. 05
 b. Write a manual part program manuscript for turning the component shown in fig. on CNC 08
 lathe machine using suitable machining data. Stock size is $\phi 52$ mm.



- Q.7 Write a manual part program for machining a cast iron work piece to achieve the dimensions as shown in figure below. Assume the thickness of work piece as 10mm. 13



- Q.8 a. Sketch and describe various physical configuration of industrial robot. 07
 b. Explain the different types of sensors used in robot examples. 06
- Q.9 a. Describe the benefits of computer aided process planning. 06
 b. Describe the technique of group technology. 07
- Q.10 Write short note (Attempt any three): 14

- a. DNC
 b. Robot sensors
 c. Group technology.
 d. NC co-ordinate and axes

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-294
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECH/PROD) (Sem-I)
Theory of Machines-II
[OLD]

[Time: Three Hours]

[Max.Marks: 80]

Please check whether you have got the right question paper.

N.B

1. Solve any three question from each section.
2. Assume suitable data wherever necessary.

Section A

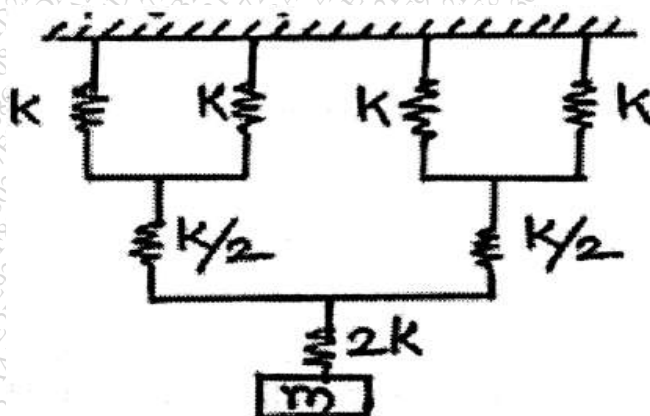
- Q.1 a) Explain the different methods of avoiding interference in gears. 04
- b) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 30 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2m/s assuming addendum as standard and equal to one module, find:
 1) The angle turned through by pinion when one pair of teeth is in mesh; and
 2) The maximum velocity of sliding. 09
- Q.2 a) Define terms related to worm and worm gears::Lead, Lead Angle & Axial pitch. 04
- b) In a spiral gear drive connecting two shafts, the approximate centre distance is 400mm and the speed ratio=3. The angle between the two shafts is 50° and the normal pitch is 18mm. The spiral angle for the driving and driven wheels are equal. Find :1. Number of teeth on each wheel, 2. Exact centre distance and 3. Efficiency of the drive if friction angle $=6^\circ$. 09
- Q.3 a) Explain the term height of the governor. Derive an expression for the height in the case of a Watt governor. 04
- b) A Proell governor has all four arms of length 305mm. The upper arms are pivoted on the axis of rotation and the lower arms are attached to a sleeve at a distance of 38 mm from the axis. The mass of each ball is 4.8kg and are attached to the extension of the lower arms which are 102mm long. The mass on the sleeve is 45kg. The minimum and maximum radii of governor are 165 mm and 216mm, Assuming that the extensions of the lower arms are parallel to the governor axis at the minimum radius, find the corresponding equilibrium speeds. 09
- Q.4 a) What is the function of a flywheel? How does it differ from that of a governor? 04
- b) The turning moment diagram for a multi cylinder engine has been drawn to a scale 1mm=600N-m vertically and 1mm= 3° horizontally. The intercepted areas between the output torque curve and the mean resistance line, taken in order from one end, are as follows : +52, -124, +92, -140, +85, -72 and + 107mm², when the engine is running at a speed of 600r.p.m If the total fluctuation of speed is not to exceed $\pm 1.5\%$ of the mean, 09

find the necessary mass of the flywheel of radius 0.5m.

- Q.5 a) What do you understand by gyroscopic couple? Derive a formula for its magnitude. 05
- b) A four wheeled motor car of mass 2000kg has a wheel base 2.5m, track width 1.5m and height of centre of gravity 500mm above the ground level and lies at 1metre from the front axle. Each wheel has an effective diameter of 0.8 m and a moment of inertia of 0.8kg-m^2 . The drive shaft, engine flywheel and transmission are rotating at 4 times the speed of road wheel in a clockwise direction when viewed from the front, and is equivalent to a mass of 75kg having a radius of gyration of 100mm. if the car is taking a right turn of 60m radius at 60km/h find the load on each wheel. 09

Section – B

- Q.6 a) Explain the working of centrifugal clutch with neat sketch. 05
- b) A multi plate clutch has three pairs of contact surfaces. The outer and inner radii of the contact surface are 100mm and 50mm respectively. The maximum axial spring force is limited to 1 kN. If coefficient of friction is 0.35 and assuming uniform wear, find the power transmitted by the clutch at 1500r.p.m. 08
- Q.7 a) Obtain an expression for the length of a belt in an open belt drive. 05
- b) A pulley is driven by a flat belt, the angle of lap being 120° . The belt is 100mm wide by 6mm thick and density 1000kg/m^3 . If the coefficient of friction is 0.3 and the maximum stress in the belt is not to exceed 2MPa, find the greatest power which the belt can transmit and the corresponding speed of the belt. 08
- Q.8 a) Derive a differential equation of motion for spring mass system using energy method. 04
- b) Determine the natural Frequency in Hz of system as shown Take , Mass $m=5000\text{kg}$; stiffness of spring , $K=200\text{N/mm}$ 09



- Q.9 a) Explain the term 'dynamic magnifier' 05
- b) A machine of mass 75kg is mounted on springs and is fitted with a dashpot to damp out vibrations. There are three springs each of stiffness 10N/mm and it is found that the amplitude of vibration diminishes from 38.4mm to 6.4 mm in two complete oscillations. Assuming that the damping force varies as the velocity, Determine: 1. The resistance of the dashpot at unit velocity; 2. The ratio of the frequency of the damped vibration to the frequency of the un damped vibration; and 3. The periodic time of the damped vibration. 09
- Q.10 a) What are the different components of Vibratory system? 04
- b) Single cylinder vertical petrol engine of total mass 300kg is mounted upon a steel chassis 09 frame and causes a vertical static deflection of 2mm. The reciprocating parts of the engine has a mass of 20kg and move through a vertical stroke of 150mm with simple harmonic motion. A dashpot is provided whose damping resistance is directly proportional to the velocity and amounts to 1.5kN per metre per second. Considering that the steady state of vibration is reached; determine: 1. The amplitude of forced vibrations when the driving shaft of the engine rotates at 480 r.p.m., and 2. The speed of the driving shaft at which resonance will occur.

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-315
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECH/PROD) (Sem-I)
Metallurgy and Materials
[OLD]

[Time: Three Hours]**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
1. Question 5 & 10 are compulsory.
 2. Solve THREE questions from each section.
 3. Figure to the right indicate full marks.

Section -A

- | | | |
|-----|---|----|
| Q.1 | a. Explain procedure of finding Miller Indices. Draw miller indices for plane (110) and (121). | 07 |
| | b. Discuss line defects and point defect with neat sketches. | 08 |
| Q.2 | a. What is a grain size? Write explanatory notes ASTM grain size measuring methods. | 07 |
| | b. Describe the construction of the phase diagram for two metals completely soluble in liquid state and insoluble in solid state. | 08 |
| Q.3 | a. Discuss properties of austenite and ferrite present in steel. | 07 |
| | b. Write the eutectoid reaction in Fe – Fe ₃ C system and find the amount of different phases at the eutectoid point. | 08 |
| Q.4 | a. Discuss austempering and martempering heat treatment process. | 07 |
| | b. What is hardenability and how it is measured? Differentiate between Hardening and Tempering. | 08 |
| Q.5 | Write short note on following (Any two) | 10 |
| | a. Gibbs Phase Rule | |
| | b. Subzero Treatment | |
| | c. TTT diagram | |

Section – B

- | | | |
|-----|--|----|
| Q.6 | a. Discuss characteristics, properties and application Low carbon steels, Medium Carbon steels and High carbon steels. | 07 |
| | b. What do you mean by ferrite stabilizer and austenite stabilizer? | 08 |
| Q.7 | a. Explain the effects of phosphorus, Manganese and cooling rate on the microstructure of cast iron. | 07 |
| | b. Classify stainless steels? Enumerate their properties and applications. | 08 |
| Q.8 | a. How nodular cast iron is manufactured? Give the properties and applications. | 07 |

- b. Define Brass? What are the types of brasses? Explain the properties and application of any two of them?

08

Q.9

- a. Discuss characteristics, properties and application of cermet's and glass.
b. Discuss different types of fibers and matrices used in fiber composite materials.

07

08

Q.10 Write short note on following (any two)

10

- a. Nano materials
b. Aluminum alloy
c. Tool steel.

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-349
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-I)
Fluid Mechanics
[OLD]

[Time: Three Hours]**[Max.Marks:80]**

Please check whether you have got the right question paper.

- N.B
1. Q. No. 5 and Q. No. 10 are compulsory. Attempt any two questions from the remaining questions of each section.
 2. Use of non – programmable calculator is permitted.
 3. Assume suitable missing data.

Section – A

- | | | |
|-----|--|----|
| Q.1 | A. Define fluid mechanics & explain properties of fluids in detail. | 05 |
| | B. Determine the intensity of shear of an oil having viscosity = 1 poise. The oil is used for lubricating the clearance between a shaft of diameter 10 cm and its journal bearing. The clearance is 1.5 mm and the shaft rotates at 150 rpm. | 08 |
| Q.2 | A. Explain the relationship between pressures with neat sketch. | 05 |
| | B. What are the gauge pressure and absolute pressure at a point 3m below the free surface of a liquid having a density of $1.53 \times 10^3 \text{ kg/m}^3$, if the atmospheric pressure is equivalent to 750mm of mercury? The sp. gr. of mercury is 13.6 and density of water = 1000 kg/m^3 . | 08 |
| Q.3 | A. How to determine / calculate the total pressure (F) and centre of pressure (h^*). | 05 |
| | B. Determine the total pressure on a circular plate of diameter 1.5m which is placed vertically in water in such a way that the centre of the plate is 3m below the free surface of water. Find the position of centre of pressure also | 08 |
| Q.4 | A. Explain the conditions of equilibrium of a floating and sub – merged bodies. | 05 |
| | B. A solid cylinder of diameter 4m has a height of 4m. Find the metacentric height of the cylinder, if the specific gravity of the material of cylinder = 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable. | 08 |
| Q.5 | Write a short note on any two | 14 |
| | <ol style="list-style-type: none"> 1) Surface Tension and Capillarity 2) Pascal's Law 3) Types of fluid flow 4) Practical applications of Bernoulli's equation | |

Section – B

- Q.6 A. Explain the displacement thickness in detail. 05
- B. For the velocity profile for laminar boundary layer flows given as, $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ find an expression for boundary layer thickness (δ), shear stress (τ_0) and coefficient of drag (C_D) in terms of Reynold number. 08
- Q.7 A. Explain Momentum thickness (θ) in detail. 05
- B. For the velocity profile $\frac{u}{U} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$ find the thickness of boundary layer at the end of plate and the drag force on one side of a plate 1m long and 0.8m wide when placed in water flowing with a velocity of 150 mm/sec. calculate the value of coefficient of drag also. Take μ for water = 0.01 poise. 08
- Q.8 A. Explain in detail the types of similarities (similitude) 08
- B. A 7.2m height and 15m long spillway –discharges $94 \text{ m}^3/\text{s}$. discharge under a head of 2m. If a 1:9 scale model of this spillway is to be constructed, determine model dimensions head over spillway model and the model discharge. If model experiences a force of 7500N (764.53 kg.f), determine force on the prototype. 05
- Q.9 A. Explain with neat sketch :- Hydraulic Gradient and Total Energy Line. 05
- B. A horizontal pipe line 40m long is connected to a water tank at one end, and discharges freely into the atmosphere at the other end. For the first 25m of its length from the tank, the pipe is 150mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take $f = 0.01$ for both sections of the pipe. 08
- Q.10 Write a short note on any two 14
- 1) Classification of models.
 - 2) Minor energy losses
 - 3) Dimensionless Numbers.
 - 4) Momentum thickness

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-350
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-I)
Fluid Mechanics & Machinery
[OLD]

[Time: Three Hours]**[Max.Marks: 80]**

N.B

Please check whether you have got the right question paper.

- 1) Attempt any three questions from each section.
- 2) Assume suitable data if necessary.
- 3) Draw neat labeled sketch wherever necessary.

Section A

- | | | |
|-----|---|----|
| Q.1 | a) Find the specific gravity of a fluid having viscosity 0.05 poise and kinematic viscosity 0.035 stokes. | 07 |
| | b) State and prove the Hydrostatic law. | 06 |
| Q.2 | a) State Bernoulli's theorem for steady, flow of an incompressible fluid. Enlist the applications of Bernoulli's theorem and derive an expression for velocity using a pitot tube. | 07 |
| | b) An oil of sp.gr.0.8 is flowing through a venturimeter inlet diameter 20cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal orificemeter. Take Cd=0.6. | 06 |
| Q.3 | a) In a compressor, the frictional torque T in the impeller depends on diameter D, rotational speed N, fluid density ρ and viscosity μ . Using Buckingham's π theorem, obtain an expression for torque. | 08 |
| | b) Define: Euler's number, Weber's number. What are their significance for fluid flow problems? | 05 |
| Q.4 | a) A solid cylinder of diameter 4.0 m has a height of 3m. Find the meta-centric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder=0.6. Comment on the stability of cylinder. | 08 |
| | b) State the governing equations of CFD. | 05 |
| Q.5 | Answer any two of the following questions: | 14 |
| | a) Explain the phenomenon of capillarity with examples. Derive an expression for capillary rise or fall. | |
| | b) Stability of floating and submerged bodies. | |
| | c) Venturimeter | |

Section B

- Q.6 a) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find: 08
 i) Force on the plate
 ii) Work done
 iii) Jet Efficiency
 b) A Pelton wheel has mean bucket speed 35 m/s with jet of water flowing at the rate of $1\text{ m}^3/\text{s}$ Under head of 270 m. The bucket deflects the jet through an angle of 170° . Calculate power delivered to the runner and hydraulic efficiency. Assume $C_v = 0.98$ 05
- Q.7 a) A centrifugal pump is running at 1000 rpm. The outlet vane angle of impeller is 30° and velocity of flow at outlet is 3 m/s. The pump is working against a head of 30 m and discharge through the pump is $0.3\text{ m}^3/\text{s}$. If the manometric efficiency of the pump is 75%. Determine: 08
 i) The diameter of the impeller
 ii) Width of impeller at outlet
 b) What is priming? Why is it necessary? 05
- Q.8 a) Explain the construction and working of hydraulic press. 05
 b) A conical draft tube having inlet and outlet diameters 1m and 1.5m discharge water at outlet with a velocity of 2.5m/s. The total length of the draft tube is 6m and 1.20m of the length of draft tube is immersed in water. If the atmospheric pressure head is 10.3m of water and loss of head due to friction in the draft tube is equal to $0.2 \times$ velocity head at outlet of the tube, find : 1) pressure head at inlet, and 2) efficiency of the draft tube. 08
- Q.9 a) Explain the construction and working of centrifugal pump with the help of neat sketch. 07
 b) What is the function of draft tubes used in turbines? Name the types of draft tubes. 06
- Q.10 Write short notes on any two: 14
 a) Efficiencies related to centrifugal pump
 b) Hydraulic crane
 c) Francis Turbine

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-535
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECHANICAL) (Sem-I)
Fluid Mechanics And Machines
[Revised]

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

1. Questions No 1 & 6 are compulsory.
2. Solve any two questions from remaining each section A and B.
3. Figures to the right indicate full marks.
4. Draw diagrams or graphs wherever required.
5. Assume suitable data if necessary.

Section -A

- Q.1 Answer any five of the following: 10
- a) State and prove pascal's law.
 - b) Derive expression for total pressure force for a horizontally immersed surface.
 - c) Define the terms metacenter and metacentric height.
 - d) Define circulation in fluid kinematics.
 - e) What are the limitations of the Bernoulli's equation?
 - f) Calculate the specific weight and specific gravity of a liquid having a volume of 6m^3 and weight of 44KN.
 - g) Convert 3.5bar pressure into equivalent mercury column.
- Q.2 a) State and prove Bernoulli's equation the water is flowing through a tapering pipe having diameters 300mm and 150mm at section 1 and 2 respectively the discharge through the pipe is 40 litres/sec. the section 1 is 10m above datum and section 2 is 6m above datum find the intensity of pressure at section 2 if that at section 1 is 400 kN/m^2 . 08
- b) A circular plate 3m diameter is immersed in water in such a way that its greatest and least depth are below free surface at 4m and 1.5m respectively. Determine the total pressure on one face of the plate and position of the centre of pressure. 07
- Q.3 a) A solid cube of sides 0.5m each is made of a material of relative density 0.5.the cube floats in a liquid of relative density 0.95 with two of its faces horizontal. Examine its stability also define buoyancy and centre of buoyancy. 07
- b) State Bernoulli's theorem and its applications for steady flow of an incompressible fluid, also derive an expression for Bernoulli's theorem from Euler's equation of motion. 08
- Q.4 a) The angle of a reducing bend is 60° (that is deviation from initial direction to final directions) its initial diameter is 300mm and final diameter 150mm and is fitted in a pipeline carrying a discharge of 360liters/sec. the pressure at the commencement of the 08

bend is 2.943 bar the friction loss in the pipe bend may be assumed as 10% of kinetic energy at exit of the bend determine the force exerted by the reducing bend.

- b) State and explain the newton's law of viscosity A 400mm diameter shaft is rotating at 200rpm in a bearing of length 120mm if the thickness of oil film is 1.5mm and the dynamic viscosity of the oil is 0.7 N.s/m^2 determine 07
- Torque required to overcome friction in bearing.
 - Power utilized in overcoming viscous resistance.
- Assume a linear velocity profile

- Q.5 a) Derive the continuity equation in cylindrical polar coordinates. 08
b) Explain circulation and vorticity in fluid kinematics. 07

Section – B

- Q.6 Attempt any five of the following: 10

- What are repeating variables? How are these selected in dimensional analysis?
- A jet of water of diameter 40mm moving with a velocity of 30m/s strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet water in the direction of the jet if the jet is deflected through an angle of 120° at the outlet of the curved plate.
- Give the comparison between impulse and reaction turbine.
- State the function of nozzle and spear in a pelton turbine.
- State hydraulic function of casing which is used for centrifugal pump.
- What do you mean by net positive suction head (NPSH)?
- List the methods of preventing the separation of boundary layer.

- Q.7 a) A francis turbine with an overall efficiency of 76% is required to produce 150KW it is working under a head of 8m the peripheral velocity $= 0.25 \sqrt{29h}$ and the velocity of flow at inlet is $0.95 \sqrt{29h}$. the wheel runs at 150rpm and the hydraulic losses in the turbine are 20% of the available energy Assuming radial discharge determine. 08

- The guide blade angle,
- The wheel vane angle at inlet
- Diameter of the wheel at inlet and
- Width of the wheel at inlet

- b) Define the specific speed of a turbine? Derive the expression for the specific speed .discuss the range of specific speed for various types of turbines. 07

- Q.8 a) Why multistage centrifugal pumps are essential? Explain various arrangements of multistage pumps with their merits. 08

- b) A three stage centrifugal pump has impellers 400mm in diameter and 20mm wide at outlet the vanes are curved back at the outlet at 45° and reduce the circumferential area by 10% the monomeric efficiency is 90% and the overall efficiency is 80% the pump is running at 1000rpm and delivering $0.05\text{m}^3/\text{sec}$ determine 07
- I) Head generated by the pump.
 - II) Shaft power required to run the pump.

- Q.9 a) The pressure drop Δp generated by a pump of a given geometry is known to depend upon the impeller diameter D , the rotational speed N , the fluid discharge Q the fluid density ρ and viscosity μ . Obtain the dimensionless form of the functional relationship by Buckingham pi theorem 08
- b) What are applications of model testing?
Enumerate different laws on which models are designed for dynamic similarity where are they used? 07
- Q.10 a) Explain velocity potential function and stream function also derive laplace equation. 08
- b) Explain circulation and vorticity. 07

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-384
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (Sem-I)
Industrial Management & Engineering Eco.
[OLD]

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

N.B

1. Solve any three questions from each section
2. Figure to the right indicate full marks.

Section -A

Q.1	a) 'Management is getting things done through people? Comment	07
	b) Explain Dr. Deming's 14 points of TQM	06
Q.2	a) Discuss the concept and process of Management by objectives (MBO)?	07
	b) Explain the various schemes for the entrepreneurship development?	06
Q.3	a) Explain Partnership type of ownership.	07
	b) Explain the advantage and disadvantages of Co- operative type of organization?	06
Q.4	a) Explain the scope and functions of Human resource management (HRM).	07
	b) Explain the recruitment process with its objectives? State the factors affecting it?	06
Q.5	Write short notes on (any three)	
	a) Six sigma	05
	b) Line organization	05
	c) Function of Trade union	04
	d) Job description	04
	e) Matrix organization	04

Section – B

Q.6	a) What are the different elements of cost?	07
	b) Explain the scope and importance of financial Management?	06
Q.7	a) What are the importance and objectives of inventory control?	07
	b) Explain in details perfect competition?	06
Q.8	a) What is economics? Explain micro and macro-economic analysis?	07
	b) Explain Law of supply with the help of suitable example?	06
Q.9	a) What is Internal Rate of Return (IIR) method?	07
	b) What is depreciation? What are its types?	06

- Q.10 Write short notes on (any three)
- a) Monopoly
 - b) ABC analysis
 - c) Reasons of Replacement
 - d) Economic order Quantity
 - e) Profitability Index method

05
05
04
04
04

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-419
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECH/PROD) (Sem-I)
Design of Machine Elements-I
[OLD]

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

N.B.:i) Solve any three questions from each section.

ii) Figures to right indicate full marks.

iii) Assume suitable data, if necessary.

Section– A

- | | | |
|-----|---|----------|
| Q.1 | a) Explain in detail the basic procedure for design of machine element.
b) State the meaning of following designation
i) 26 crMo2 ii) 55C4 iii) WM400 | 06
06 |
| Q.2 | Design a cotter joint used to connect two co axial rods subjected to a load of 35KN. The components are made of 3008 ($S_{yt}=400$ MPa). Design the joint and specify the major dimensions. | 12 |
| Q.3 | Derive the expressions for the torque requirement for lifting and lowering load by power screw. | 12 |
| Q.4 | Design a muff coupling two connect two steel shaft transmitting 25KW power at 360 rpm. The shafts and key are made of plain carbon steel 3008 ($S_{yt}=S_{yc}=400$ N/mm ²). The sleeve is made of grey cast iron FG200 ($S_{ut}=200$ N/mm ²). The factor of safety for shaft and key is 4. For sleeve the factor of safety is 6 based on ultimate strength. | 12 |
| Q.5 | Write Short Notes on (Any Four)
a) Ergonomic consideration in design
b) Selection and use of theories of Failure
c) Preferred series
d) Flexible coupling
e) Design classification | 16 |

Section – B

- | | | |
|-----|---|----------|
| Q.6 | a) Explain stress concentration in detail.
b) A bar of circular cross section is subjected to alternating tensile force varying from a minimum of 200KN to maximum of 500 KN. It is to be manufactured of material with ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using Factor of safety 3.5 related to ultimate tensile strength and 4 related to endurance limit and stress concentration Factor of 1.65 for fatigue load. Use Goodman straight line as basis of design. | 04
08 |
| Q.7 | A welded connection of steel plate as shown in Figure 1. It is subjected to an eccentric load of 50 KN. Determine the size of weld if permissible shear stress in weld is not to exceed 80N/mm ² . | 12 |

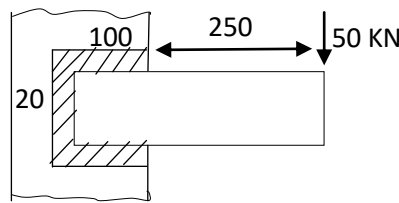


Figure. 1

- Q.8 Design a close coiled helical compression spring for a service load ranging from 2250N to 2750N. The axial deflection of the spring for the load range is 6mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity $G=84 \text{ KN/mm}^2$. Neglect effect of stress concentration. Draw the neat sketch showing major dimension of spring. 12
- Q.9 A semi elliptic leaf spring consist of 2 extra full length leaves and 6 graduated length leaves, including the master leaf. Each leaf is 7.5mm thick and 50 mm wide. The centre to centre distance between two eyes is 1m. The leaves are prestressed in such a way that when load is maximum, stress induced in all the leaves are equal to 350 N/mm^2 . Determine the maximum force that spring can withstand. 12
- Q.10 Write Short Note (Any Four) 16
- Eccentrically loaded riveted joint
 - Nipping of Spring
 - Notch sensitivity and Endurance limit
 - Modified Goodman Diagram
 - Surging and Buckling of Spring

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-521
FACULTY OF SCIENCE & TECHNOLOGY
T.E. (Mechanical) (CGPA) (Sem-I)
Design of Machine Elements - I
[Revised]

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

- N.B.: i) Q. No.1 and 6 are compulsory.
 ii) Solve any two questions from remaining in each section.
 iii) Assume suitable data if necessary.

Section – A

- Q.1 Solve any five 10
- Enlist the steps involved in design of machine element.
 - Explain Factor of safety.
 - Explain the following
 $26Cr_4MO_2$, FeE400
 - State maximum shear stress theory of Failure.
 - Define lever? What are its types
 - Give applications of cotter joint and knuckle joint.
- Q.2 A mild steel bracket as shown in fig.1 is subjected to a pull of 6000N acting at 45° to its horizontal axis. The bracket has a rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of the bracket, if permissible stress in the material of the bracket is limited to 60 MPa. 15

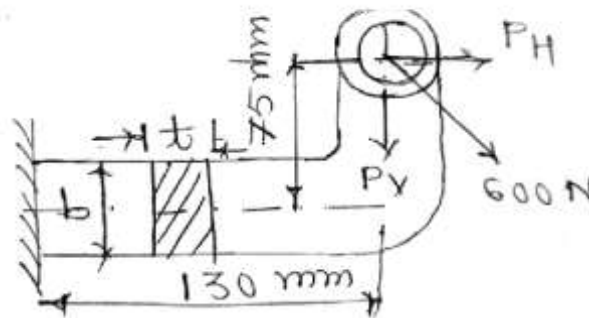
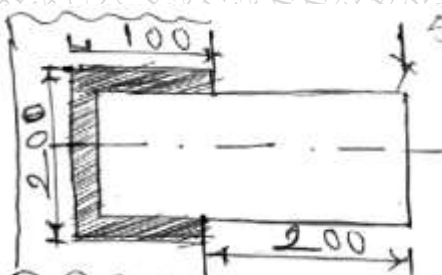


Fig.1

- Q.3 Design a socket and spigot joint used to connect two co axial shafts subjected to a tensile Force of 25KN. The material to be selected for joint is 30C8 ($S_{yt}=400MPa$). Draw neat sketch and specify major Dimensions. 15
- Q.4 Explain with neat sketch, design procedure for rigid flange coupling. 15
- Q.5 The cutter of a broaching machine is pulled by a square threaded screw of 55mm external diameter and 10 mm pitch. The operating nut takes the axial load of 400N on a Flat surface of 60 mm and 90 mm internal and external diameters respectively. If the coefficient of Friction is 0.15 for all contact surfaces on the nut. Determine the power required to rotate the operating nut when the cutting speed is 6 m/min. Also find the efficiency of the screw. 15

Section – B

- Q.6 Solve any Five 10
- Difference between Failure due to static load and Fatigue Failure.
 - Explain Notch Sensitivity Factor.
 - Draw the sketch – Transverse Fillet parallel Fillet
 - Enlist types of Failure in riveted joint
 - Draw neat sketch – Multi leaf spring.
 - Explain – solid length, Free length for Helical coil spring.
- Q.7 A simply supported beam has a concentrated load at the centre which fluctuates from a value of P to $4P$. The span of the beam is 500 mm and its cross section is circular with diameter of 60mm. Taking for the beam material stress of 700 MPa, a yield stress of 500 MPa. Endurance limit of 330 MPa for reversed bending, and a factor of safety of 1.3, Calculate the maximum value of P . Take a size factor of 0.85 and a surface finish factor of 0.9. 15
- Q.8 A welded connection of steel plate as shown in fig.2. It is subjected to an eccentric Force of 50 KN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 N/mm^2 . 15
- 
- Q.9 Design a close coiled helical compression spring for a service load ranging from 2250N to 2750N. The axial deflection of spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 MPa and modulus of rigidity $G=84 \text{ KN/mm}^2$. Also draw a fully dimensioned sketch of the spring. 15
- Q.10 A helical compression spring of the exhaust valve mechanism is initially compressed with a pre-load of 375N. When spring is further compressed and the valve is fully opened, the torsional shear stress in the spring wire should not exceed 750 N/mm^2 . Due to space limitations, the outer diameter of the spring should not exceed 42 mm. The spring is to be designed for minimum weight. Calculate the wire diameter and mean coil diameter of spring. 15

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-528
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECHANICAL) (CGPA) (Sem-I)
Materials And Metallurgy
[Revised]

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
1. Question 1 & 6 are compulsory
 2. Attempt any two questions from remaining four questions from each section.
 3. Figure to the right indicate full marks.

Section -A

- | | | |
|-----|--|----------|
| Q.1 | Solve any five from following (any five) | 10 |
| | <ol style="list-style-type: none"> a) State Gibb's phase rule. b) Distinguish between ordered and disordered solid solution c) What is bainite? d) What is plastic deformation? e) Define atomic packing factor and coordination number f) Draw sketches of frenkel defect and Schottky defect. g) What is coring? h) What are different types of carburizing? | |
| Q.2 | <ol style="list-style-type: none"> a) Explain procedure of finding Miller Indices. Draw miller indices for plane (100) and (101) b) Discuss point defects and line defect with neat sketches. | 07
08 |
| Q.3 | <ol style="list-style-type: none"> a) Describe the construction of the phase diagram for two metals completely soluble in liquid state and insoluble in solid state. b) Draw a neat sketch of Fe-Fe₃C diagram and label all temperatures and phases in it. | 07
08 |
| Q.4 | <ol style="list-style-type: none"> a) What do you mean by full annealing heat treatment process? Discuss its advantages and disadvantages. b) What is surface hardening? Why is it required? Explain any one technique. | 07
08 |
| Q.5 | <ol style="list-style-type: none"> a) Write short note on Sub-zero Treatment. b) Discuss Austempering and Martempering heat treatment process. | 07
08 |

Section – B

- | | | |
|------|--|----|
| Q.6 | Solve any five from following (any five) | 10 |
| | a) Write composition of Muntz metal. | |
| | b) How nickel molybdenum steels are designated? | |
| | c) Which cast iron contains graphite flakes? | |
| | d) Give properties of nanomaterials | |
| | e) What is Inconel? | |
| | f) Write the properties of aluminum | |
| | g) What do you mean by FRP composites? | |
| | h) Why are fiber glass reinforced composites used extensively? | |
| Q.7 | a) What do you mean by ferrite stabilizer and austenite stabilizer? | 07 |
| | b) Discuss characteristics, properties and application Low carbon steels, Medium carbon steels and High carbon steels. | 08 |
| Q.8 | a) How nodular cast iron is manufactured? Give its properties and applications. | 07 |
| | b) Classify cast iron. Explain the factors affecting the microstructure of cast iron | 08 |
| Q.9 | a) What are brasses? How are they classified? Give the composition, properties and applications of any three of them. | 07 |
| | b) Discuss about Aluminum alloys and its types. | 08 |
| Q.10 | a) Discuss characteristics, properties and application of cermets and glass. | 07 |
| | b) Discuss Bottom-up and Top –down approaches of Nano- Technology | 08 |

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-542
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (MECHANICAL) (Sem-I)
Theory of Machine- II
[Revised]

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

- N.B.: 1) Question no. 1 & 6 are compulsory.
 2) From remaining four questions, attempt any two questions from each section.
 3) Assume suitable data, whenever necessary.
 4) Use of non-programmable calculator is permitted.

Section A

- Q.1 Solve any five: 10
- Define pressure angle. State the significance of pressure angle.
 - State "Law of gearing".
 - Define Length of path of contact. Give its formula.
 - What is gear train? Enlist types of gear train.
 - Define steering & Pitching of ship.
 - Explain gyroscopic effect on rolling of ship.
 - Define:- Helix angle & Lead angle
- Q.2 a) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 & gear ratio is 2. If the pitch expressed in module is 5mm & pitch line speed is 1.2 m/s, assuming addendum as standard & equal to one module, find 10
- Angle turned through by pinion when one pair of teeth is in mesh; and
 - Maximum velocity of sliding
- b) Differentiate between involute and cycloidal tooth profiles. 05
- Q.3 a) Deduce an expression for the maximum efficiency of spiral gears. 07
- b) The center distance between two meshing spiral gears is 260 mm & angle between the shafts is 65° . The normal circular pitch is 14 mm and gear ratio is 2.5. The driven gear has a helix angle of 35° , find: 08
- Number of teeth on each gears
 - Exact center distance
 - Efficiency of spiral gears, assuming friction angle to be 5.5° .
 - Maximum efficiency
- Q.4 a) Explain the effect of gyroscopic couple on ship for steering, pitching & rolling. 08
- b) The moment of inertia for an aeroplane air screw is 20 kgm^2 & speed of rotation is 1000rpm clockwise when viewed from the front. The speed of flight is 200km/hr. Find the gyroscopic rotation of air screw on the aeroplane when it makes a left hand turn on a path of 150m radius & right hand turn on a path of 150m radius. 07
- Q.5 a) Explain interference in involute gears. 05
- b) Derive an expression for gyroscopic couple. 05
- c) Explain merits and demerits of helical gears over spur gears. 05

Section B

- Q.6 Define the following (any five) 10
- Sensitiveness of a governor
 - Isochronism of a governor
 - Coefficient of fluctuation of energy
 - Creep of belt
 - Logarithmic decrement
 - Transverse vibration
 - Free vibrations
- Q.7 a) Draw the turning moment diagram of a single cylinder double acting steam engine. 05
- b) Each arm of a porter governor is 250mm long. The upper and lower arms are pivoted to links of 40 mm & 50 mm respectively from the axis of rotation. Each ball has a mass of 5 kg and sleeve mass is 50 kg. The force of friction on the sleeve of the mechanism is 40 N. Determine the range of speed of the governor for the extreme radii of 125 mm & 130 mm. 10
- Q.8 a) A leather belt is required to transmit 7.5 kW from a pulley 1.2 m diameter running at 250 rpm. The angle embraces is 165° and coefficient of friction as 0.3. If safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m^3 & thickness of belt as 10 mm, determine width of the belt taking centrifugal tension into account. 08
- b) Derive an expression for ratio of driving tensions for flat belt drive. 07
- Q.9 a) Derive an expression for natural frequency of undamped spring mass system using equilibrium method. 06
- b) A machine mounted on springs and fitted with dashpot has a mass of 60 kg. There are three springs, each having stiffness of 12N/mm. The amplitude of vibrations reduces from 45 to 8 mm into two complete oscillations. 09
- Assuming that the damping force varies as a velocity. Determine:-
- Damping coefficient
 - Ratio of frequencies of damped and undamped vibrations.
 - Periodic time of damped vibrations.
- Q.10 a) What is centrifugal tension in a belt? How does it affect the power transmission? 05
- b) Explain with neat sketch, the inertia governor. 05
- c) Explain seismic instrument with neat sketch. 05

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-549
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (CGPA) (Sem-I)
Modern Management Techniques
[Revised]

[Time: Three Hours]

[Max. Marks:80]

Please check whether you have got the right question paper.

N.B.:1) Question No.1 and 6 are Compulsory.

2) Five Questions in each Section.

3) From remaining four Questions, attempt any two Questions from each section.

Section – A

- | | | |
|-----|---|----------|
| Q.1 | Attempt any five:- (2 marks each) | 10 |
| | <ul style="list-style-type: none"> a) What is Management? b) Define – Kaizen c) Define – Kanban d) Define – Lean Production e) Define – Value and waste f) What is Quality? g) What is the Importance of Management. | |
| Q.2 | <ul style="list-style-type: none"> a) Explain the functions of Management. b) Explain POKA YOKE process with example. | 08
07 |
| Q.3 | <ul style="list-style-type: none"> a) Explain Toyota Production System. b) What are the characteristics of Management? | 08
07 |
| Q.4 | <ul style="list-style-type: none"> a) Explain Lean Manufacturing Process in detail? b) Explain Eight Mudass. | 08
07 |
| Q.5 | <ul style="list-style-type: none"> a) Explain Fishbone diagram and Histogram. b) Explain Basic Elements of JIT. | 08
07 |

Section – B

- | | | |
|-----|---|----------|
| Q.6 | Attempt any Five:- (2 Marks each) | 10 |
| | <ul style="list-style-type: none"> a) Define – 5' S b) What is PDCA Cycle. c) Define – Overall Equipment Efficiency d) What is MTBF. e) Define:- Quality of Work Life. f) Define – Creativity and Innovation g) Define – Availability. | |
| Q.7 | <ul style="list-style-type: none"> a) Explain 8 Pillars of TPM. b) What is Black Hat Thinking? | 08
07 |

- Q.8 a) A Plant is operating on Three-Shift Basis. Time not available due to various reasons including preventive maintenance = 21 Hours per week. The unit produced 10,000 pieces of the item in a week, which contained 100 defectives. The Machine was operated at 80% of its capacity on an average. The Capability of the process is to produce 11,000 pieces per week. Calculate the overall Equipment efficiency. 08
- b) Explain the Concept of lateral Thinking. 07
- Q.9 a) Explain the steps involved in TPM. 08
- b) Explain Six Thinking Hats. 07
- Q.10 a) Explain DMAIC process. 08
- b) Explain Six Sigma. 07

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-564
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (CGPA) (Sem-II)
Design Of Machine Elements – II
[REV]

[Time: Three Hours]**[Max. Marks: 80]**

Please check whether you have got the right question paper.

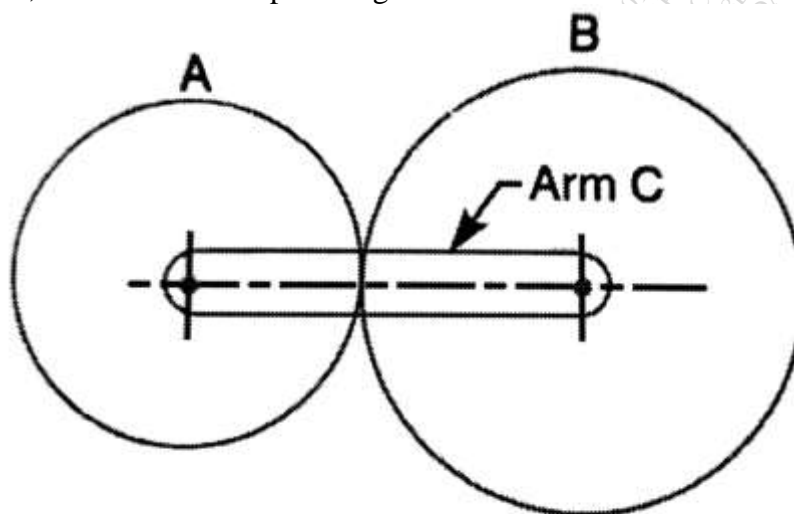
N.B

- i) Q. No. 1 and Q. No. 6 are compulsory.
- ii) Solve any two questions from remaining in each section.
- iii) Assume suitable data if necessary.
- iv) Design data book is allowed.

SECTION - A

- Q.1** Solve any five 10
- I) What are the types of gear failure?
 - II) How gears are classified?
 - III) Enlist various types of gear trains?
 - IV) Define formative number of teeth in helical gears.
 - V) Write down the Torque equation of single plate clutch for uniform wear and uniform pressure theory.
 - VI) What are the various forces acting on worm and worm gears?
 - VII) Write a note on efficiency of worm gear.
- Q.2** A pair of spur gear with 20° full depth involute teeth is used to transmit 25 kW at 900 rpm of the pinion. The gear ratio is 6.25:1, the material for pinion is plain cast steel with permissible static stress of 103 MPa and for gear cast iron with permissible static stress of 55 MPa wear load factor 1.3 N/mm^2 and dynamic load factor for carefully cut gear with 0.036 mm error $C=282 \text{ kN/m}$. Determine module, face width from the stand point of beam strength, dynamic load and wear. Use minimum number of teeth on pinion as 18. Assume $K_v = \frac{3}{3+v}$ and $y=[0.154-(0.912/(\text{No. of teeth}))]$. 15
- Q.3** A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° , while the helix angle is 25° . The face width is 60mm and the normal module is 4 mm. the pinion as well as the gear is made of steel 40C8 (Sut = 600 N/mm²) and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. 15
- Q.4** In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 rpm in the 15

clockwise direction, what will be the speed of gear B?

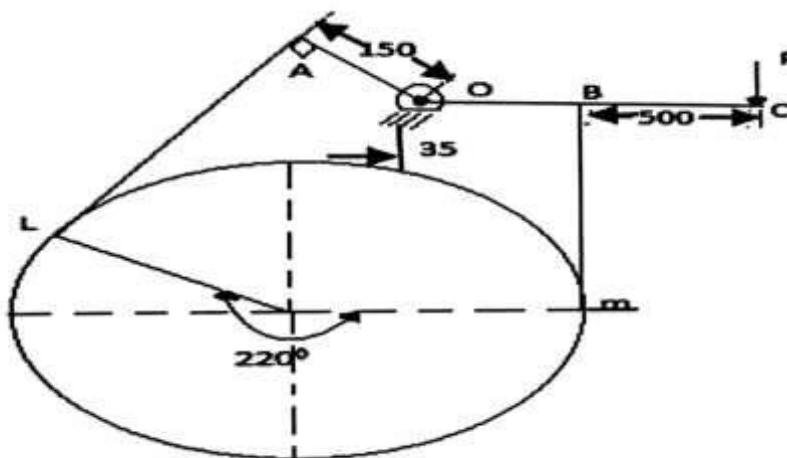


- Q.5 A) What are the advantages of single plate clutch over multiplate clutch? Why multiplate clutch is preferred in two wheeler bikes. 05
- B) A multiple disc clutch consisting of steel and bronze plates is to transmit 5 KW at 800 rpm. The inner and outer diameter of disc are 60 mm and 130 mm respectively. The engagement factor may be taken as 1.5, $\mu = 0.2$ intensity of pressure is limited to 0.3 N/mm^2 . Determine the required number of steel and bronze plates. Assume uniform wear theory. 10

SECTION – B

- Q.6 Solve any five 10
- Classify Brakes? State one application of each type of brake
 - Important factors to be considered in brake design.
 - What are the various belt materials and criteria for its selection?
 - Compare between V-belt drive and flat belt drive.
 - Compare sliding contact bearing and rolling contact bearing.
 - Define hydrodynamic bearing.
 - Justify centrifugal tension has no effect on power transmitted.
- Q.7 A flat belt is required to transmit 30 kW from a pulley of 1.5m effective diameter running at 300 r.p.m. The angle of contact is spread over $11/24$ of the circumference. The coefficient of friction between the belt and pulley surface is 0.3. Determine, taking centrifugal tension into account, width of the belt required. It is given that the belt thickness is 8 mm, density of its material is 1100 kg/m^3 and the related permissible working stress is 2.5 MPa. 15
- Q.8 A differential band brake as shown in fig has an angle of contact of 220° . The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. This is sustains a torque of 350Nm and the coefficient of friction between the band and the drum is 0.3. Find. 15
- The necessary force (P) for the clockwise and anticlockwise rotation of the drum.

- b) The value of "OA" for the brake to be self-locking when the drum rotates clockwise.



- Q.9 A 100 mm diameter shaft operating at 2000 rpm is supported in a 140 mm long full journal bearing subjected to a radial load of 43KN. Operating temperature of oil is limited to 80°C and surrounding air temperature is 40°C. Assume $ZN/p = 30 \times 10^{-6}$. Using McKee and Lasche equation, determine coefficient of friction, bearing pressure H_g and H_d and viscosity Z of the lubricant. Assume Practical value of $r/c = 100$ 15
- Q.10 A) State the desirable properties of good lubricating oil. 05
 B) A deep groove ball bearing has a dynamic capacity of 20500 N and it operates on the following work cycle of different radial loads :- 10
 6000N at 250 rpm for 20% of time.
 9000N at 500 rpm for 25% of time.
 3600N at 400 rpm for remaining time.
 Assume that the loads are steady and the inner race rotates, find the average life of bearing in hours.

Total No. of Printed Pages:03

SUBJECT CODE NO:- H-571
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Mechanical) (CGPA) (Sem-II)
Heat Transfer
[Revised]

[Time: Three Hours]

[Max.Marks: 80]

N.B

Please check whether you have got the right question paper.

- 1) Questions no. 1 and 6 is compulsory.
- 2) Solve any two questions from Section A and Section B.
- 3) Figures to the right indicate full marks.
- 4) Draw diagrams or graphs wherever required.
- 5) Assume suitable data if necessary.

Section A

- Q.1 Attempt any five of the following: 10
- 1) State Fourier law of Heat conduction.
 - 2) Define convection heat transfer.
 - 3) Define Effectiveness of fin.
 - 4) Define Thermal conductivity and its unit.
 - 5) What are Heisler charts?
 - 6) What is diffusivity?
 - 7) Define Nusselt number.
- Q.2 a) What is critical thickness of insulation? Derive an expression of critical radius for cylinder. 07
- b) A furnace wall is made of three layers of thicknesses 250 mm, 100 mm and 150 mm with thermal conductivities of 1.65, k, and 9.2 W/m°C respectively. The inside is exposed to gases at 1250°C with convective heat transfer coefficient of 25 W/m² °C and the inside surface is at 1100°C, the outside surface is exposed to air at 25°C with convective coefficient of 12 W/m² °C. 08
- Determine:
- i) The unknown thermal conductivity 'k',
 - ii) The overall heat transfer coefficient,
 - iii) All surface temperatures.
- Q.3 a) Show that $Q = \sqrt{P \times h \times k \times A_{cs}} \times (T_0 - T_a) \times \tanh(m \times 1)$ for fin insulated at the tip. Starting with boundary condition. 07
- b) A steel tube of diameter 120 mm carries steam at a temperature of 330°C. A thermometer pocket of iron (k= 50 W/m°C) of inside diameter 15 mm and 1 mm thick is used to measure the temperature. The thermometric error is 0.5 percent. If the tube wall temperature is 40°C. Take $h = 110 \text{ W/m}^2 \text{ °C}$. 08
- i) Estimate the length of the pocket necessary to measure the temperature within this error, suggest a suitable method of locating the thermometer pocket.

- ii) What will be the actual error in temperature measurement in °C if depth of immersion 55 mm only and the pipe wall temperature is 40°C ?

- Q.4 a) Air is flowing over a flat plate 5m long and 2.5 m wide with velocity of 4 m/s at 15°C. 08
If $\rho' = 1.208 \text{ kg/m}^3$ and $\nu' = 1.47 \times 10^{-5} \text{ m}^2/\text{s}$, calculate:
- Length of plate over which the boundary layer is laminar, and thickness of the boundary layer (laminar).
 - Shear stress at the location where boundary layer ceases to be laminar, and
 - Total drag force on the both sides on that portion of plate where boundary layer is laminar.
- b) A steam pipe 60 mm in diameter is covered with 20 mm thick layer of insulation 07
which has a surface emissivity of 0.92. The surface temperature of insulation is 75°C and the pipe is placed in atmospheric air at 25°C. Considering heat loss both by radiation and natural convection, calculate:
- The heat loss from 5 m length of the pipe;
 - The overall heat transfer coefficient and heat transfer coefficient due to radiation alone.

- Q.5 Write short notes on (Solve any two) 15
- Hydrodynamic boundary layer and thermal boundary layer.
 - Heat transfer through single Hollow Cylinder.
 - Lumped heat capacity method.

Section B

- Q.6 Attempt any five of the following 10
- Define Stefan Boltzmann law.
 - What is burnout point?
 - What is heat exchanger?
 - Define Emissivity.
 - Define the term 'Boiling'.
 - Define shape factor.
 - What do you mean by Fouling in heat exchanger?

- Q.7 a) Explain briefly the various regimes of saturated pool boiling. 07
b) Consider two large parallel plates one at $T_1 = 727^\circ\text{C}$ with emissivity $\varepsilon_1 = 0.8$ and 08
other at $T_2 = 227^\circ\text{C}$ with emissivity $\varepsilon_2 = 0.4$. An aluminium radiation shield with an emissivity, $\varepsilon_s = 0.05$ on both sides is placed between the plates. Calculate the percentage reduction in heat transfer rate between the two plates as a result of the shield. Use $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^4$.

- Q.8 a) Derive the LMTD for Counter flow heat exchanger. 07
b) A steam enters in counter flow heat exchanger, dry saturated at 10 bar and leaves at 08
350°C. The mass flow of steam is 800 kg/min. The gas enters the heat exchanger at 650°C and mass flow rate is 1350 kg/min. If the tubes are 30 mm diameter and 3 m long, determine the number of tubes required. Neglecting the resistance offered by metallic tubes. Use following data:

For steam: $T_{sat} = 180^\circ\text{C}$ (at 10 bar); $C_{ps} = 2.71 \text{ kJ/kg}^\circ\text{C}$; $h_s = 600 \text{ W/m}^2^\circ\text{C}$.

For gas: $C_{pg} = 1 \text{ kJ/kg}^\circ\text{C}$; $h_g = 250 \text{ W/m}^2^\circ\text{C}$.

- Q.9 a) The effective temperature of a body having an area of 0.1 m^2 is 627°C . Calculate : 08
- Intensity of normal radiation,
 - The Total rate of energy emission and
 - The wavelength of maximum monochromatic emissive power.
- b) What is Intensity of radiation? Prove that $I = \frac{E}{\pi}$ 07
- Q.10 a) A chemical having specific heat of 3.3 kJ/kg K flowing at rate of 20000 kg/hr enters a 08
- parallel flow heat exchanger at 120°C . The flow rate of cooling water is 50000 kg/hr with an inlet temperature of 20°C . The heat transfer area is 10 m^2 and overall heat transfer coefficient is $1050 \text{ W/m}^2\text{K}$. Find:
- Effectiveness of heat exchanger,
 - The outlet temperature of water & chemical
- b) Explain Film and drop wise condensation. 07