

**SUBJECT CODE NO:- H-158-A**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**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 clearly between positive and negative rake angle with neat sketch. 05
- b) The following equation for tool life has been obtained for HSS tool:  $VT^{0.13} \cdot F^{0.6} \cdot d^{0.3} = C$  08  
 A 60 min. tool life was obtained while cutting at  $V=40\text{m/min}$ ,  $f = 0.25\text{mm}$ ;  $d=2.0\text{mm}$ . Determine the effect on tool life if cutting speed, feed and depth of cut are increased by 25% individually and also taken together
- Q.2 a) Explain Flank and Crater wear 05
- b) Sketch and discuss the nomenclature of tap 08
- Q.3 a) Define tool life. Explain Taylor's tool life equation in detail. Enlist the various tool life criteria. 08
- b) Explain six point location principle followed in jig and fixture design 05
- Q.4 Design draw and dimension a drill jig for drilling hole of  $\phi 6$  in the finished component as Shown in fig.1 14

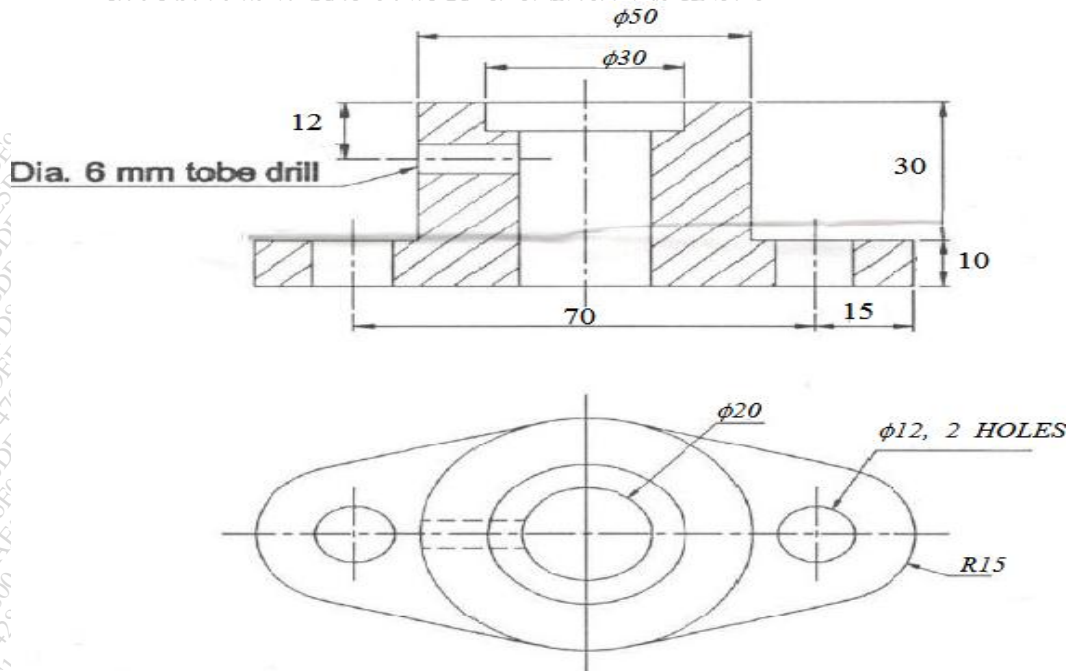


Fig.1

- Q.5 a) Explain the use of setting block and tennon in fixture 08  
 b) What is need of jig and fixture? Explain 05

**Section B**

- Q.6 a) Differentiate between compound die and combination die. 07  
 b) Define following press operation 06  
 i) Blanking  
 ii) Slitting  
 iii) Piercing

- Q.7 a) What is deep draw ability? 07  
 b) Explain “bending allowance” with Suitable sketch 06

- Q.8 a) Write short note on single impression dies. 08  
 b) How stock size is determined in open die farging. 06

- Q.9 Write notes on any two 14  
 i. Strip Layout  
 ii. Forming dies  
 iii. Farging dies

- Q.10 Calculate the blank Length to make the part as shown in figure 2. Also determine the bending force 13  
 if the ultimate tensile strength of material is  $3500\text{kg/cm}^2$  and die radius is 0.8mm. The bend length  
 being 120mm.

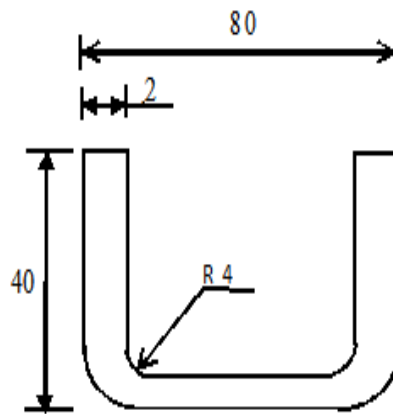


Fig.2

## FACULTY OF ENGINEERING AND TECHNOLOGY

T.E. (Mechanical)

Tool Engineering

(REVISED)

[Time: Three Hours]

[Max.Marks:80]

Please check whether you have got the right question paper.

- N.B
- 1) Q.4 & Q.8 are compulsory. Attempt any two questions from the remaining question of each section.
  - 2) Use drawing sheet for Q.4
  - 3) Assume suitable data and dimensions it required.
  - 4) All dimensions are in mm

**Section A**

- Q.1 a) During the orthogonal cutting operation, the following data has been observed: 08
- Uncut chip thickness  $t=0.15\text{mm}$   
 Cutting speed  $v=2\text{m/s}$   
 Chip thickness  $t_c=0.3\text{mm}$   
 Rake angle  $\alpha=10^\circ$   
 Width of cut  $b=6.2\text{mm}$   
 Cutting force  $F_c=575\text{ N}$   
 Thrust force  $f_t=250\text{ N}$   
 Determine: shear angle, the friction angle, shear stress along shear plane and the power for the cutting operation.
- b) Discuss various types of tool wear. 04
- Q.2 a) Define tool life. Explain Taylor's tool life equation in detail. Enlist the various tool life criteria. 08
- b) How does rake angle affect the life of cutting tool? 04
- Q.3 a) Explain in detail following drilling bushes with neat sketches 08
- i) Press fit bushing
  - ii) Renewable bushing
- b) Define jig and fixture. Why they are used. 04
- Q.4 Design draw and dimension a drill jig to drill two holes of  $\varnothing 10\text{mm}$  in a component as show in fig.1 16
- OR**
- Design and draw a milling fixture to mill the slot  $10 \times 10\text{mm}$  deep in a component shown in fig.2 16

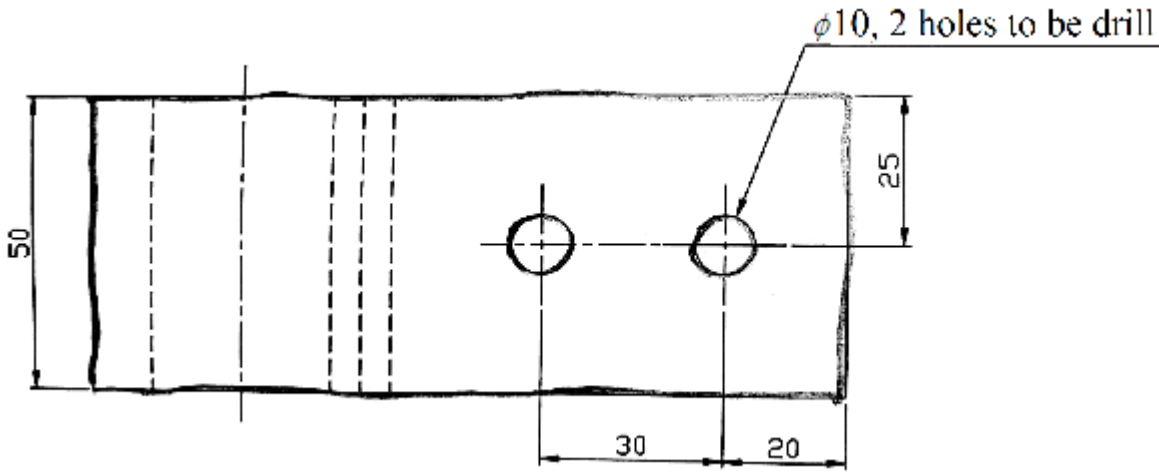
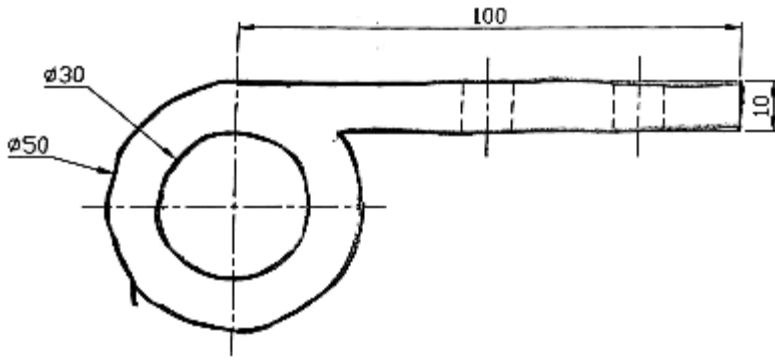
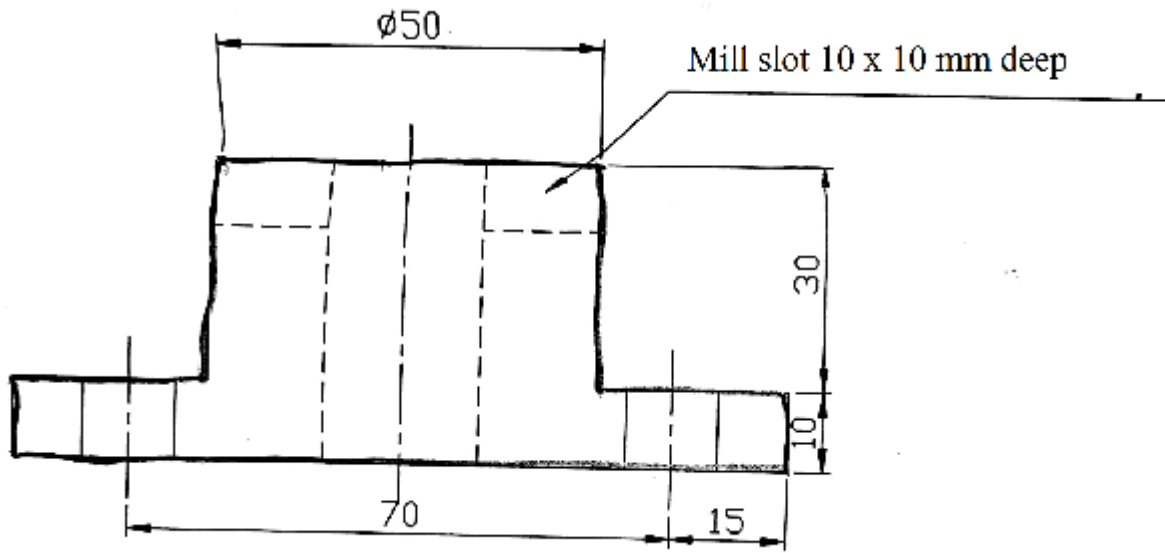


Fig.1



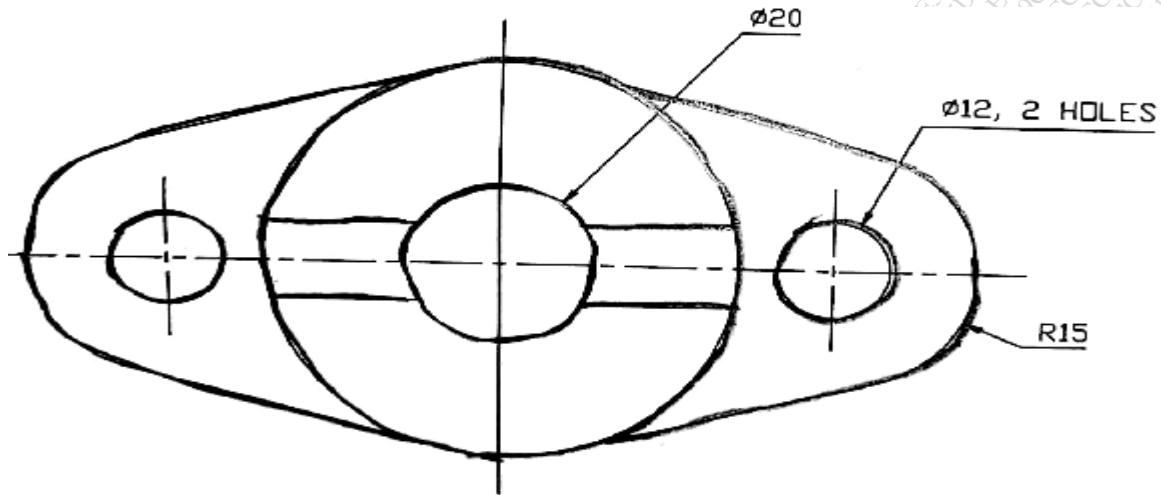


Fig.2

Section 'B'

- |     |  |    |
|-----|--|----|
| Q.5 | Draw neat sketches of following with nomenclature of their elements ( <u>Any Two</u> )   | 12 |
|     | i. Twist drill   |    |
|     | ii. Single point cutting tool  |    |
|     | iii. Pull type broach  |    |
| Q.6 | a) What is clearance? Explain its importance.  | 08 |
|     | b) Write short note on methods of punch holding.   | 04 |
| Q.7 | a) How the size of blank and number of draws are decided for drawing a cylindrical cup?  | 08 |
|     | b) Explain importance of bend allowance.   | 04 |
| Q.8 | a) Sketch and design progressive die to make a steel washer 40mm outside diameter with 20mm hole from 1.6mm thick sheet. The ultimate shear strength of material is 313N/mm <sup>2</sup> . Calculate | 16 |
|     | 1) Punch and die size  |    |
|     | 2) Maximum punch force   |    |
|     | 3) Draw two views of assembly  |    |

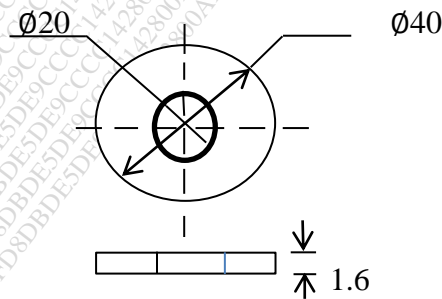


Fig.3

OR

- b) The symmetrical cup work piece is shown in figure 4 has to be made from cold rolled steel (yield strength  $427\text{N/mm}^2$ ) 0.8mm thick. Make the necessary calculation for designing the drawing die for this part. 16

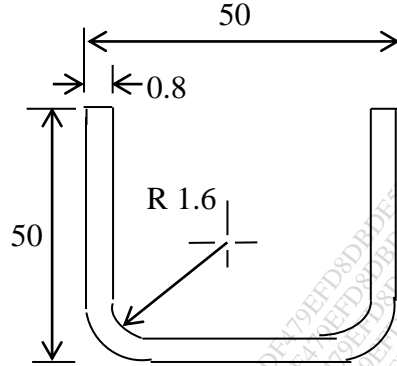


Fig.4

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**SUBJECT CODE NO: H-194**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**CAD/CAM/CAE**  
**(REVISED)**

[Time: Three Hours]

[Max.Marks:80]

- N.B Please check whether you have got the right question paper.
- i) Answer any three questions from each section.
  - ii) Assume suitable data whenever necessary.
  - iii) Figures to the right indicate full marks.
  - iv) Draw neat sketches wherever necessary.

**Section A**

- |     |  |    |
|-----|--|----|
| Q.1 | a. Explain how computer aided design procedure is superior to conventional design procedure?   | 07 |
|     | b. Explain the importance of manufacturing database in CAD applications.   | 06 |
| Q.2 | a. What is concatenation in transformation process explain with suitable example.  | 06 |
|     | b. Explain following modelling techniques.   | 07 |
|     | i) Parametric modelling  |    |
|     | ii) Constraint based modelling   |    |
| Q.3 | A – square with its vertices. A(3,2), B(8,2), C(8,7) and D(3,7) is defined in 2D space, perform the following transformations separately and show them on graph paper. | 13 |
|     | i) Translation in X-direction by 2 units & 1 unit in Y-direction.  |    |
|     | ii) Rotation about point A through an angle 90° anticlockwise, the axis of rotation is parallel to z-axis.   |    |
| Q.4 | a. Enlist different surface generation techniques & explain anyone in detail.  | 07 |
|     | b. Explain the characteristics of B-spline curves.   | 06 |
| Q.5 | Write short notes on following. ( <u>any three</u> )   | 14 |
|     | a. Bezier curve  |    |
|     | b. Product life cycle  |    |
|     | c. CAE   |    |
|     | d. Data input devices used in CAD systems  |    |
|     | e. Solid representation techniques used in CAD   |    |

**Section B**

- Q.6 a. Define FMS and explain various elements of FMS. 07  
 b. Define CIM and explain the concept of CIM industries. 06
- Q.7 a. Explain co-ordinate system for axis identification for following machines with neat sketch. 07  
 i) Lathe M/C  
 ii) Vertical milling M/C
- b. Explain following G codes & M codes. G04, G27, G54. 06
- Q.8 a. Explain different robot programming methods. 07  
 b. Enlist the applications of FEA software & explain any one in detail. 06
- Q.9 A profile milling operation is to be performed to generate the outline of the part and drill the holes; 13  
 as shown in figure 1, the part thickness is 15mm, cutter diameter as 10 mm dia & cutter speed  
 500 rpm, write down the complete ADT programme for it.

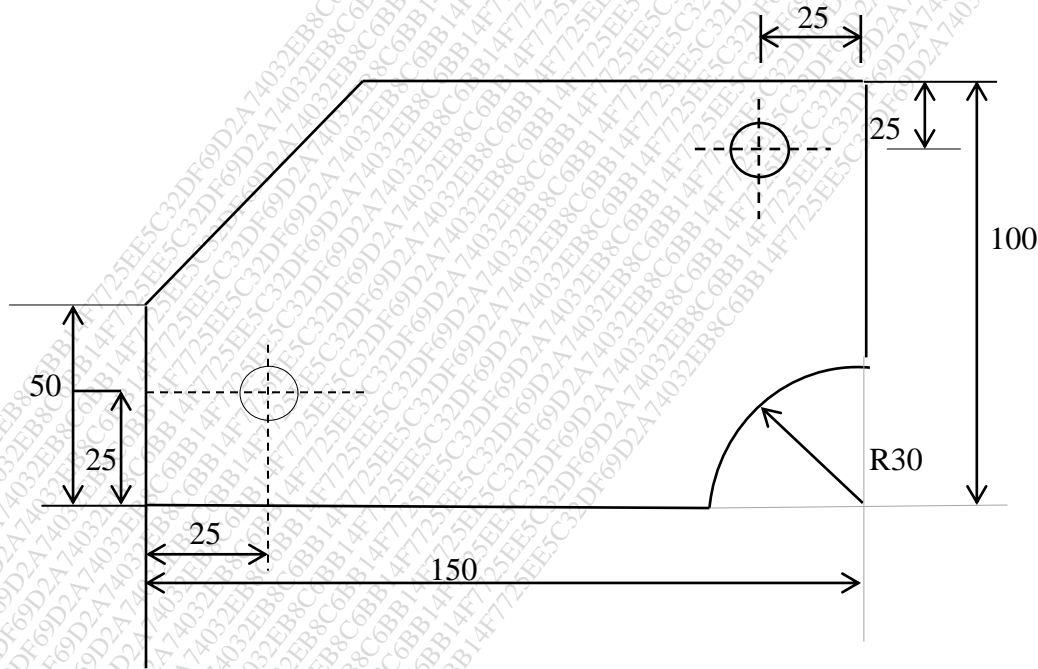


Figure.1

- Q.10 Write short notes on (any two) 14
- Group Technology
  - Fixed zero & floating zero
  - Forward kinematics in robots



Total No. of Printed Pages:03

**SUBJECT CODE NO: H-124**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**Heat Transfer**  
**(REVISED)**

[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. Figure to the right indicate full marks.
  - iii. Assume suitable data, if necessary.
  - iv. Use of non-programmable calculator is allowed.

**Section A**

- Q.1
- a) Derive the equation for temperature distribution and heat transfer rate, under one dimensional steady state heat conduction, for hollow cylinder. 06
  - b) A pipe ( $k = 180 \text{ W/m}^\circ\text{C}$ ) having inner and outer diameters 80mm and 100mm respectively is located in a space at  $25^\circ\text{C}$ . Hot gases at temperature  $160^\circ\text{C}$  flow through the pipe. Neglecting surface heat transfer coefficients, calculate: 07
    - i) The heat loss through the pipe per unit length.
    - ii) The temperature at a point halfway between the inner and outer surfaces.
- Q.2
- a) Hot air at a temperature of  $65^\circ\text{C}$  is flowing through a steel pipe of 120mm diameter. The pipe is covered with two layers of different insulating materials of thickness 60mm and 40mm and their corresponding thermal conductivities are  $0.24$  and  $0.4 \text{ W/m}^\circ\text{C}$ . The inside and outside heat transfer coefficients are  $60 \text{ W/m}^2 \text{ }^\circ\text{C}$  and  $12 \text{ W/m}^2 \text{ }^\circ\text{C}$ . The atmosphere is at  $20^\circ\text{C}$ , find the rate of heat loss from 60m length of pipe. 07
  - b) Derive the expression for critical thickness of insulation for a cylinder. 06
- Q.3
- a) Starting with boundary conditions, derive the expressions for temperature distribution along the length and heat flow rate for a very long fin using standard notations. 06
  - b) A longitudinal copper fin ( $k = 300 \text{ W/m}^\circ\text{C}$ ) 600mm long and 5mm diameter is exposed to air stream at  $20^\circ\text{C}$ . The convective heat transfer coefficient is  $20 \text{ W/m}^2 \text{ }^\circ\text{C}$ . If the fin base temperature is  $150^\circ\text{C}$ , determine: 07
    - i) The heat transferred and
    - ii) The efficiency of the fin.

- Q.4 a) 4800 kg/hr of water is heated from 30°C to 60°C by passing through a square duct of 30mm × 30mm. The duct is heated by condensing steam at 100°C on its outer surface. Find the length of the duct required. 07  
 Take properties of water: Density = 995 kg/m<sup>3</sup> ;  $\mu = 7.65 \times 10^{-4}$  kg/ms ;  
 $C_p = 4.174$  kJ/kgK,  $k = 0.623$  W/m°C , conductivity of duct material = 24 W/mK.  
 Use :  $Nu = 0.023 Re^{0.8} Pr^{0.4}$  for turbulent flow  
 $Nu = 4.36$  for laminar flow.
- b) Differentiate between Hydrodynamic boundary layer and Thermal boundary layer. 06

- Q.5 Write short notes on (Any two) 14
- i) Variable thermal conductivity
  - ii) Heat conduction through composite slab
  - iii) Grashoff Number & its significance

**Section B**

- Q.6 a) Explain film and drop wise condensation. 06  
 b) Explain with figure forced convection boiling. 07
- Q.7 a) State and explain Wien's displacement law. 06  
 b) Two large parallel plates with  $\epsilon = 0.5$  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 plates. Find the percentage reduction in net radiative heat transfer. 07
- Q.8 a) A chemical (specific heat = 3.2 kJ/kg K) enters a parallel flow heat exchanger at 150°C at a flow rate of 30,000kg/hr. Cooling water (specific heat = 4187 J/kg K) enters the heat exchanger at 20°C at a flow rate of 1000kg/min. Heat transfer area of the heat exchanger is 12m<sup>2</sup>. Over all heat transfer coefficient can be taken as 1000W /m<sup>2</sup> K. Find the effectiveness of the heat exchanger and outlet temperatures of both chemical and water. 07  
 b) Derive LMTD for counter flow heat exchanger, 06

- Q.9 a) Explain intensity of radiation and Lambert's cosine law. 06
- b) An oil cooler for a lubrication system has to cool 1000 kg/h of oil ( $c_p = 2.09 \text{ kJ/kg}^\circ\text{C}$ ) from  $80^\circ\text{C}$  to  $40^\circ\text{C}$  by using a cooling water flow of 1000 kg/h at  $30^\circ\text{C}$ . Give your choice for a parallel or counter flow heat exchanger, with reasons. Calculate the surface area of the heat exchanger, if the overall heat transfer coefficient is  $24 \text{ W/m}^2 \text{ }^\circ\text{C}$ . 07
- Q.10 Write explanatory notes on: (Any two) 14
- Types of heat exchanger
  - Radiation shield
  - Shape factor

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-315**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (MECH/PROD)**  
**Metallurgy & Materials**  
**(REVISED)**

[Time: Three Hours]

[Max. Marks: 80]

- N.B Please check whether you have got the right question paper.
- i) Solve any three questions, from each section.
  - ii) Figures to the right indicate full marks.
  - iii) Assume suitable data wherever required.
  - iv) Draw suitable diagram if required.

## Section A

- |     |  |    |
|-----|--|----|
| Q.1 | a) Discuss briefly with neat sketch different crystal structures.                              | 07 |
|     | b) Define APF. And find out it for BCC structure.  | 06 |
| Q.2 | a) Draw a neat sketch of Fe-C equilibrium diagram and explain all critical temperatures in it. | 07 |
|     | b) What is Hume Rothery's rules? Explain.  | 06 |
| Q.3 | a) Give comparison of Normalizing? v/s annealing   | 06 |
|     | b) What is hardenability ? Explain how it is measured.   | 07 |
| Q.4 | a) Explain with neat sketch different types of point defects.                                  | 07 |
|     | b) How and why tempering heat treatment is to be carried out?                                  | 06 |
| Q.5 | Write a note on (any two)  | 14 |
|     | a) Invariant reaction in iron-iron carbide diagram.  |    |
|     | b) Different methods of grain size measurement.  |    |
|     | c) Retained austenite  |    |

## Section B

- Q.6 a) Why alloying element are added in steel? List them and also state the effect of alloying elements. 07
- b) What is Martensitic stainless steel? Explain and gives its properties and application. 06
- Q.7 a) How malleable cast iron produced? Explain different types of malleable CI. 08
- b) Explain HSLA. 05
- Q.8 a) Explain aluminium bronzes . Give its properties and uses. 07
- b) Write a note on “properties and application of Magnesium and it’s alloys”. 06
- Q.9 a) Explain Bottom-up and top-down approach to synthesis of nanomaterials . 07
- b) What is composite ? Explain metal-Matrix composite 06
- Q.10 Write a note on (any two) 14
- a) Grey CI & its properties and application.
- b)  $\alpha - \beta$  brass and important brasses from this group.
- c) Glasses & its properties and application.

Total No. of Printed Pages:03

**SUBJECT CODE NO:- H-294**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (MECH/PROD)**  
**Theory of Machines-II**  
**(REVISED)**

[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) Assume suitable data wherever necessary

**Section A**

- Q.1 A) Define the term- 05
- i. Pitch circle
  - ii. Addendum & dedendum
  - iii. Working depth
  - iv. Back lash
  - v. Path of contact
- B) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with  $20^\circ$  pressure angle, 12mm module & 10mm addendum 08  
 Find:-
- i. Length of path contact
  - ii. Arc of contact
  - iii. Contact ratio
- Q.2 A) What do you understand by interference of involute gears? 05
- B) A pinion of 20 involute teeth & 125mm pitch circle diameter drives a rack. The addendum of both pinion & rack is 6.25mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find length of the arc contact & minimum number of teeth in contact at a time. 08
- Q.3 A) Derive the expression for the speed of the proell governor. 06
- B) In an engine governor of the porter type, the upper & lower arms are 200mm & 250mm respectively and pivoted on the axis of rotation. The Mass of central load is 15kg; the mass of each ball is 2kg. and friction of the sleeve together with the resistance of the operating gear is equal to a load of 24N at the sleeve. If the limiting inclination of the upper arms to the vertical are  $30^\circ$  and  $40^\circ$ . Find, taking friction into account, range of speed of the governor. 08

- Q.4 A) Explain in details coefficient of fluctuation of energy & coefficient of fluctuation of speed in case of flywheel 08
- B) Explain the term:- 05
- Height of governor
  - Equilibrium speed
  - Mean equilibrium speed
  - Maximum & minimum equilibrium speeds
  - Sleeve lift
- Q.5 A) Explain the effect of gyroscopic couple on Naval ship during steering & pitching. 06
- B) A four wheel trolley car of mass 2500kg runs on a rails, which are 1.5m apart & travel around a curve of 30m radius at  $24\text{km/hr}$ . The rails are at the same level. Each wheel of the trolley is 0.75m in diameter and each of the two axles is driven by a motor running in a direction opposite to that of the wheels at a speed of five times the speed of rotation of a wheel. The moment of inertia of each axle with gear & wheel is  $18\text{kg} - \text{m}^2$ . Each motor with shaft & gear pinion has mass moment of inertia  $12\text{kg} - \text{m}^2$ . The centre of gravity of the car is 0.9m above the rail level. Determine the vertical force exerted by each wheel on the rails taking into consideration the centrifugal and gyroscopic effects. 07

### Section B

- Q.6 A) Derive the expression for torque transmitting capacity of single plate clutch considering uniform pressure theory. 06
- B) A multiple disc clutch has five plates having four pairs of active friction surfaces. If the intensity of pressure is not to exceed  $0.127\text{N/mm}^2$ ; find the power transmitted at 500r.p.m. The outer & inner radii of friction surfaces are 125mm & 75mm respectively. Assume uniform wear & take coefficient of friction=0.3 08
- Q.7 A) What is centrifugal tension in a belt? How does it affect the power transmitted? 05
- B) The reduction of a speed from 240rpm to 120rpm is desired by the use of chain drive. The number of teeth on the driving sprocket is 20. Find the number of teeth on the driven sprocket. If the pitch circle diameter of the driven sprocket is 600mm and centre to centre distance between the two sprockets is 800mm, determine the pitch and length of the chain. 08
- Q.8 A) What do you mean by viscous damping. 05
- B) A machine mounted on springs and fitted with dash pot has a Mass of 60kg. There are three springs each of stiffness  $12\text{N/mm}$ . The amplitude of vibration reduces from 45 to 8mm in two complete oscillations. Assuming that damping force varies as the velocity, determine 08
- Damping coefficient
  - Ratio of frequency of damped and undamped vibrations
  - Periodic time of damped vibration

- Q.9 A) What are the different causes & effects of vibration 05
- B) Derive the equation of motion & natural frequency for a simple pendulum using energy method. 08

- Q.10 Write a short notes on:
  - A) Length of open belt drive 04
  - B) Multi plate clutch 04
  - C) Friction laws 05



Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-266**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**Industrial Hydraulics and Pneumatics**  
**(REVISED)**

[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) Assume suitable data wherever necessary.

**Section A**

- Q.1 a) What do you mean by fluid technology and explain desirable properties of oils used in hydraulic system. 08  
 b) Explain continuity equation and Bernoulli's theorem in detail. 05
- Q.2 Draw the following symbols 13  
 i) Hydraulic pump and motor  
 ii) Pneumatic compressor  
 iii) Hydraulic unloading valve  
 iv) Sequence valve  
 v) Double ended cylinder  
 vi) Quick exhaust valve
- Q.3 a) What is a pump? What are different types of pump. Explain any one 08  
 b) With a neat sketch explain the construction and working of screw compressor. 05
- Q.4 a) Explain construction and working of Double acting cylinder & single acting cylinders 08  
 b) Write a short note on lobe compressor 05
- Q.5 Write a short note on (any three) 14  
 i) Difference between pump and motor  
 ii) Gerotor pump  
 iii) Hydraulic sump  
 iv) Accumulators

## Section B

- Q.6 a) Explain different types of flow control valve used in pneumatic system. 05
- b) What are the different type of DCV? State their application by using symbolic representation 08
- Q.7 In a production process , work piece are to be fed into a jig from a gravity magazine by using a double acting cylinder feeding takes place when a push button is pressed and return automatically to it's start position after the work piece has reached the jig position. Explain the working of the circuit. 13
- Q.8 A huge steel door is installed in a deep mining tunnel . This door may be opened or closed by two push buttons , either from outside or inside . Explain the working of the circuit. 13
- Q.9 What is PLC ? How is it used in electrohydraulic and electropneumatic system? state it's advantages and limitation. 13
- Q.10 Write short note on (any three) 14
- Meter in & meter out circuit.
  - Piping in hydraulic ( and pneumatic)
  - Limit switches
  - Refrigeration air drier separation
  - Relays

Total No. of Printed Pages:03

**SUBJECT CODE NO:- H-349**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**Fluid Mechanics**  
**(REVISED)-II**

[Time: Three Hours]

[Max.Marks:80]

N.B Please check whether you have got the right question paper.

- N.B
- i) Attempt any three questions from each Section.
  - ii) Assume suitable data, if necessary.
  - iii) Draw a neat labelled sketch wherever necessary.

**SECTION A**

Q.1 a) A circular plate 3 meter diameter is submerged in water. It's greatest and least depths are below the surfaces being 2 meter and 1 meter respectively. Find the total pressure on front face of the plate and the position of centre of pressure. 06

b) State and derive hydrostatic law. 07

Q.2 a) Derive 3 dimensional continuity equations in Cartesian co-ordinates for steady, incompressible flow. 09

b) The velocity components in a 2 – dimensional flow are 04

$$u = \frac{y^3}{3} + 2x - x^2y$$

$$v = xy^2 - 2y - \frac{x^3}{3}$$

Show that these components represent a possible case of an irrotational flow.

Q.3 a) Derive Bernoulli's equation stating its assumption. 06

b) A nozzle of diameter 20 mm is fitted to a pipe of diameter 40 mm. Find the force exerted by the nozzle on the water which is flowing through the pipe at the rate of  $1.2m^3/min$ . 07

Q.4 a) Calculate the dynamic viscosity of oil, which is used for lubrication between a square plate of size  $0.8 \times 0.8m$  and an inclined plane with angle of inclination  $30^\circ$ . The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm. 07

b) Define 06

1. Surface tension
2. Streamline
3. Centre of pressure

- Q.5 Write short notes on any two of the following questions. 14
- Different types of fluid flow.
  - Pressure measuring instruments.
  - Principle and working of Venturimeter.

**SECTION B**

- Q.6 Derive the equation for drag force on a flat plate due to boundary layer also called as Von Karman momentum integral equation. 13
- Q.7 a) 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 150 mm diameter and its diameter is suddenly enlarged to 300 mm. the height of water level in the tank is 8m above the centre of pipe. Considering all losses of head which occur, determine the rate of flow.  
Take  $f = 0.01$  for both sections of pipe. 08
- b) Derive Darcy weisbach equation for friction losses in pipes. 05
- Q.8 Using Buckingham's pie theorem, show that the discharge  $Q$  consumed by an oil ring is given by 13

$$Q = Nd^3 \phi \left[ \frac{\mu}{\rho N d^2}, \frac{\sigma}{\rho N^2 d^3}, \frac{w}{\rho N^2 d} \right]$$

Where  $d$  is the internal diameter of the ring,  $N$  is rotational speed,  $\rho$  is density,  $\mu$  is viscosity,  $\sigma$  is surface tension and  $w$  is the specific weight of oil.

- Q.9 a) The resisting force  $R$  of a supersonic plane during flight can be considered as dependent upon the length of the aircraft  $l$ , velocity  $V$ , air viscosity  $\mu$ , air density  $\rho$  and bulk modulus of air  $K$ . Express the functional relationship between these variables and the resisting force. Use Rayleigh's method of dimensional analysis. 05
- b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by 08
- $$\frac{u}{U} = \frac{y}{\delta}$$
- Where  $u$  is the velocity at a distance  $y$  from the plate and  $u=U$  at  $y=\delta$ , where  $\delta$ =boundary layer thickness.
- Also calculate the value of  $\frac{\delta^*}{\theta}$

Q.10 Write short notes on any 2 of the following questions.

14

- a. Boundary layer separation and control.
- b. Significance of non-dimensionless number
- c. Reynold's experiment.

Total No. of Printed Pages:03

**SUBJECT CODE NO: H-350**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**Fluid Mechanics & Machinery**  
**(REVISED)-I**

[Time: Three Hours]

[Max.Marks:80]

N.B Please check whether you have got the right question paper.

- i) Attempt any three questions from each Section.
- ii) Assume suitable data, if necessary.
- iii) Draw a neat labelled sketch wherever necessary.

**SECTION – A**

- Q.1 a) Find the kinematic viscosity of oil having density  $981 \text{ kg/m}^3$ . The shear stress at a point in oil is  $0.2452 \text{ N/m}^2$  and velocity gradient at that point is 0.2 per second. 06
- b) Find the volume of water displaced and position of centre of buoyancy for a wooden block of width 2.5m and depth 1.5m, when it floats horizontally in water. The density of wooden block is  $650 \text{ kg/m}^3$  and its length 6.0m. 07
- Q.2 a) Derive 3 dimensional continuity equation for a steady, incompressible flow in Cartesian coordinates. 08
- b) A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of water. The pressure at inlet is  $17.658 \text{ N/cm}^2$  and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take  $C_d = 0.98$ . 05
- Q.3 The pressure difference  $\Delta p$  in a pipe of diameter  $D$  and length  $l$  due to turbulent flow depends on the velocity  $V$ , viscosity  $\mu$ , density  $\rho$  and roughness  $k$ . Using Buckingham's  $\Pi$  theorem obtain an expression for  $\Delta p$ . 13
- Q.4 a) A partially submerged body is towed in water. The resistance  $R$  to its motion depends on the density  $\rho$ , the viscosity  $\mu$  of water, length  $l$  of the body, velocity  $v$  of the body and the acceleration due to gravity  $g$ . show using Rayleigh's method, that the resistance to the motion can be expressed in the form 08
- $$R = \rho L^2 V^2 \phi \left[ \left( \frac{\mu}{\rho v L} \right) \left( \frac{lg}{V^2} \right) \right]$$
- b) Write down the significance of non- dimensional number. 05
- Q.5 Answer any two of the following questions. 14
- a) Explain the applications of CFD
  - b) State and derive Pascal's law.
  - c) Write a note on stability of floating and submerged body.

SECTION – B

- Q.6 a) A jet of water of diameter 50 mm moving with a velocity of 25 m/s impinges on a fixed curved plate tangentially at one end at an angle of  $30^\circ$  to the horizontal. Calculate the resultant force of the jet on the plate if the jet is deflected through an angle of  $50^\circ$ . Take  $g = 10\text{m/s}^2$ . 06
- b) A Kaplan turbine develops 24647.6 kW power at an average head of 39m. Assuming a speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine. 07
- Q.7 A four stage centrifugal pump has four identical impellers, keyed to the same shaft. The shaft is running at 400 rpm and the total manometric head developed by the multistage pump is 40m. The discharge through the pump is  $0.2\text{m}^3/\text{s}$ . The vanes of each impeller are having outlet angle as  $45^\circ$ . If the width and diameter of each impeller at outlet is 5cm and 60 cm respectively, find the manometric efficiency. 13
- Q.8 a) With a neat sketch explain the construction and working of Hydraulic torque converter. 06
- b) What is priming? Why is it necessary? 03
- c) Define the terms 04
- 1) Suction head
  - 2) Delivery head
  - 3) Static head
  - 4) Manometric head.
- Q.9 a) Explain construction and working of Francis turbine. 06
- b) A jet of water of diameter 50mm strikes a fixed plate in such a way that the angle between the plate and the jet is  $30^\circ$ . The force exerted in the direction of the jet is 1471.5N. Determine the rate of flow of water. 07
- Q.10 Answer any two of the following questions. 14
- a) Write a note on cavitation in pumps.
  - b) Explain construction and working of centrifugal pump.
  - c) Classify turbines and explain Pelton turbine with a neat sketch.

Total No. of Printed Pages:03

**SUBJECT CODE NO:- H-419**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (MECH/PROD)**  
**Design of Machine Elements-I**  
**(REVISED)**

[Time: Three Hours]

[Max. Marks: 80]

- N.B
- Please check whether you have got the right question paper.
- i) Solve any three questions from each section.
  - ii) Figure to right indicates full marks.
  - iii) Assume suitable data if required and state it clearly.

**Section A**

- |     |   |    |
|-----|---|----|
| Q.1 | a) Define the following terms <ol style="list-style-type: none"> <li>i) Elasticity</li> <li>ii) Plasticity</li> <li>iii) Factor of safety</li> <li>iv) Stress</li> <li>v) Strain</li> <li>vi) Creep</li> </ol>  | 06 |
|     | b) Explain in detail classification of machine design.  | 07 |
| Q.2 | a) Derive the torsion equation for shaft subjected to twisting movement only.   | 05 |
|     | b) A mild steel bracket as shown in figure 1 is subjected to pull of 5000N acting at 45° to horizontal axis. The bracket has rectangular section whose depth is twice the thickness. Find the cross-sectional dimensions of bracket if the permissible stress in material of bracket is limited to 42MPa. | 08 |

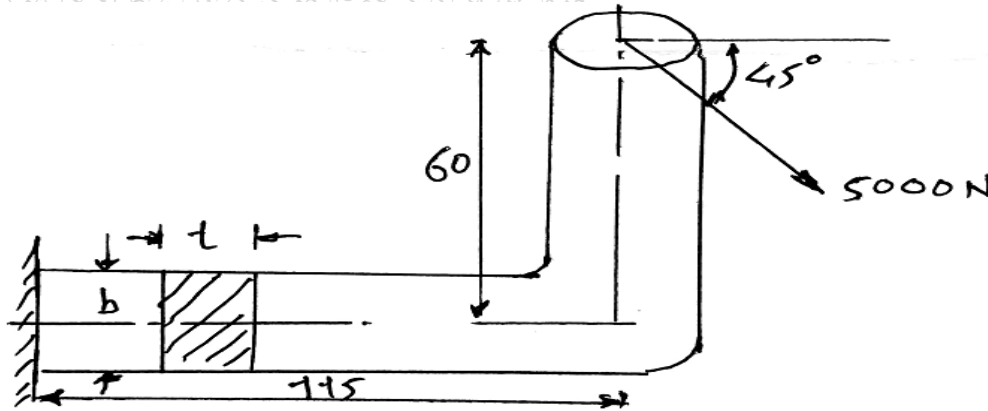


Figure 1.

- Q.3 Draw a neat sketch and explain in detail design procedure of knuckle joint

13



Q.4 Design a cast iron protective type flange. coupling to transmit 16Kw at 900 rpm from an electric motor to a compressor. The service factor may be assumed as 1.3 .Following permissible stresses may be used. 13

Shear stress for shaft , bolts and key=40MPa.

Crushing stress for bolts and key =80MPa.

Shear stress for cast iron flange=8MPa

Q.5 Write short note on . 14

- i) Bolts of uniform strength
- ii) Asthetic and Ergonomic consideration in design
- iii) Write the designation of following
  - a) 20C8
  - b) Fe290
  - c) X20Cr18Ni2
  - d) XT110Mo10Co8

**Section B**

Q.6 a) Derive the shear stress equation for Helical spring of circular wire  $\tau = k(8WD)/\pi d^3$  04

- b) A loaded narrow gauge rail car weighting 2100 Kg and moving at 1.25 m/s velocity is brought to rest by a bumper consist of two helical compression springs of spring index 6. In bringing rail car to rest both the bumper spring gets compressed by 145mm, spring steel has permissible shear stress of  $420\text{N/mm}^2$  and  $G=84 \times 10^3 \text{ N/mm}^2$  09
- i. Determine diameter of spring wire
  - ii. Mean coil diameter
  - iii. Number of turns of spring coil
  - iv. Free length
  - v. Solid length.

Q.7 A cantilever beam made of cold drawn carbon steel of circular cross section as shown in figure 2 is 200 mm long is subjected to a load which varies from- F to 3F. Determine the maximum load that this member can withstand for an indefinite life using a factor of safety as 2. Fatigue stress concentration factor 1.3 , assume the following values ultimate stress = $550\text{N/mm}^2$  , yield stress  $470\text{N/mm}^2$  endurance limit= $275\text{N/mm}^2$ . Size factor ( $K_{\text{size}}$ ) =0.85, surface finish factor ( $K_{\text{surface}}$ )=0.89 13

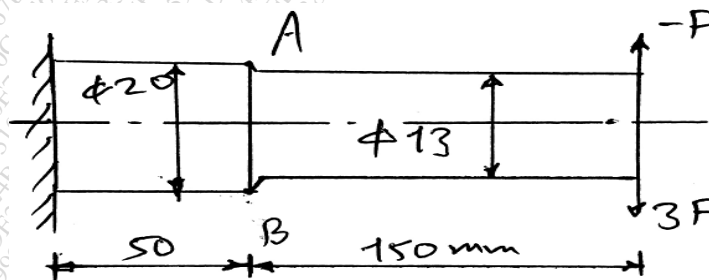


Figure 2.

Q.8 A bracket is riveted to a column by 6 rivets of equal size as shown in figure 3. It carries a load of 13 65KN at a distance of 200mm from centre of the column. If the maximum shear stress in the rivet is limited to 155MPa. Determine the diameter of rivet.

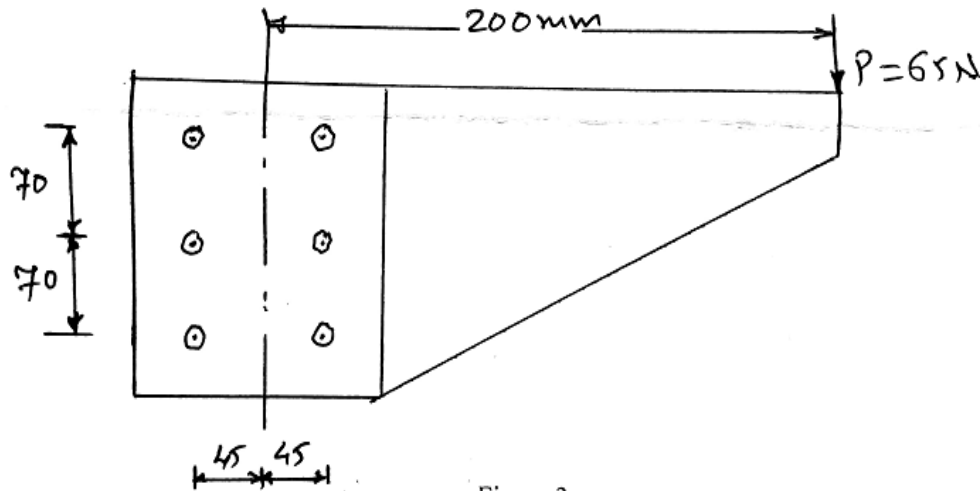


Figure 3.

- Q.9 a) What are the different causes of failure of riveted joint? 06  
 b) Derived the shear stress equation for parallel fillet weld joint loaded eccentrically 07
- Q.10 a) Write a short note on following: 14  
 i) Parallel and series combination of spring  
 ii) Method to reduce stress concentration  
 iii) Surge in spring.

Total No. of Printed Pages:02

**SUBJECT CODE NO:- H-384**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (Mechanical)**  
**Industrial Management & Engineering Economics**  
**(REVISED)**

[Time: Three Hours]

[Max. Marks: 80]

Please check whether you have got the right question paper.

N.B

- i) Attempt any three from each section.
- ii) Figures to the right Indicates full marks.
- iii) Assume suitable data, if necessary and state them clearly.

**Section A**

- |     |  |    |
|-----|--|----|
| Q.1 | a) Enlist the various levels of managements and discuss any one in detail?   | 07 |
|     | b) Enlist the functions of an Entrepreneur and explain any one in detail?  | 06 |
| Q.2 | a) Enlist Deming's 14 points of TQM. Explain any one in detail?  | 07 |
|     | b) Define Entrepreneurship. List down the various schemes for promoting Entrepreneurship. Explain any one in detail? | 06 |
| Q.3 | a) Explain project organization with its advantages?   | 07 |
|     | b) Differentiate between Private Limited and Public Limited organization?  | 06 |
| Q.4 | a) Explain the role of personnel manager in organization?  | 07 |
|     | b) Explain importance of job specification?  | 06 |
| Q.5 | Write short notes on any three:-   |    |
|     | a) Principles of management (any two)  | 05 |
|     | b) Management of change.   | 05 |
|     | c) Succession planning.  | 04 |
|     | d) Functions of Trade Union.   | 04 |
|     | e) Job description.  | 04 |

**Section B**

- |     |  |    |
|-----|--|----|
| Q.6 | a) Enlist types of cost and explain any one in detail?                       | 07 |
|     | a) Explain in detail inventory cost relationship with the help of a diagram? | 06 |
| Q.7 | a) Define and give an example for Monopoly and perfect competition?          | 08 |
|     | b) Explain Law of Demand with the help of an example?                        | 05 |

- Q.8 a) One item is required at the rate of 2000 units per year. Cost of ordering is RS.20/- per order and inventory carrying cost is 30% of the cost of material per unit per year. Cost of material is Rs.2/- per unit. No shortages are allowed. Find
- i. EOQ
  - ii. Re-order Point, if lead time is of two weeks and
  - iii. Annual Inventory Cost
- b) Enlist types of elasticity of demand. Explain any Two with the help of diagram?
- Q.9 a) Enlist reasons of replacement? Explain any one method of replacement analysis?
- b) Explain payback period method with the help of suitable example?
- Q.10 Write short notes on any three:-
- a) ABC Analysis
  - b) Demand function.
  - c) Profitability Index Method.
  - d) Types of depreciation.
  - e) Importance of Inventory Managements.

08  
05  
07  
06  
05  
05  
04  
04  
04

Total No. of Printed Pages:3

**SUBJECT CODE NO:- H-104**  
**FACULTY OF ENGINEERING AND TECHNOLOGY**  
**T.E. (MECH/PROD)**  
**Design of Machine Elements - II**  
**(REVISED)**

[Time: Three Hours]

[Max.Marks:80]

- N.B Please check whether you have got the right question paper.
- i) Attempt any three questions from each section.
  - ii) Assume suitable data, if necessary.
  - iii) Use of non-programmable calculator & design data book is allowed.

## Section- A

- Q.1 An 80mm diameter steel pinion meshes with a C.I. gear 240mm diameter with 20° Stub involute teeth. The pinion rotating with 1200 r.p.m. transmit 15 KW. Determine the module of teeth & necessary face width. Base your design on Lewis equation and check it for wear strength and dynamic tooth load. Given that 14
- $$b=10m, kV= \frac{6}{6+V} \quad Y=0.175 - \frac{0.841}{t}$$
- for dynamic load  $e = 16 + 1.25 (m+0.25\sqrt{d})$  microns  
 &  $C=81$  KN/m per 10 microns  
 $\sigma_b$  for cast steel (i.e. pinion) =140 MPa  
 $r_b$  for CI (i.e. gear)=55 MPa.  
 Pinion and gear are hardened to 350 BHN and 250 BHN respectively.
- Q.2 Two helical gears having  $14\frac{1}{2}^\circ$  normal pressure angle & helix angle of  $23^\circ$  connect two parallel shafts. The pinion has 48 teeth the gear ratio is 5:1 and module is 3mm. BHN for pinion is 250 and that of gear 200. The face width is 50mm. Determine the wear strength of gears if they are made of steel with safe bending stress of 120 MPa. Also determine the power the drive can transmit at 2500 rpm of pinion. 13
- Q.3 For a Worm & Worm wheel the centre distance is given as 225m. Worm is made of hardened steel and rotates at 1250 r.p.m. Worm transmit power to phosphor bronze gear ( $r_b=55$ MPa) with a transmission ratio of 15. The teeth on gear are 20° full depth involute ( $y=0.125$ .) Determine all the design parameters & recommend the safe power that the drive can transmit. 13
- Q.4 A leather faced cone clutch is to transmit 30 HP at 600 r.p.m. From an electric motor to an air compressor. If the intensity of pressure is  $1.1 \text{ kg/cm}^2$  and  $\mu = 0.2$ . Calculate the following 13
- (a) Shaft diameter
  - (b) Face width
  - (c) Minimum axial force
  - (d) Spring dimension

- Q.5 Write short note on (Any three) 13
- (a) Formative number of teeth in helical gear
  - (b) Bevel gear force analysis
  - (c) Gear trains
  - (d) Centrifugal clutch.

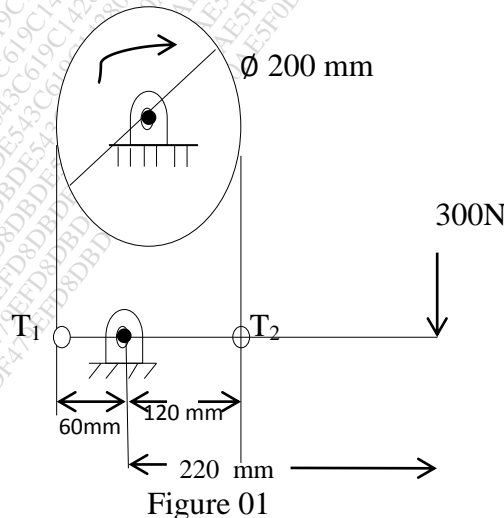
Section-B

- Q.6 (a) Explain the Petroff's equation 06  
 (b) A Journal bearing 75mm long supports a load of 7.5 kN on a 50mm diameter Journal 08  
 assuming at 740 r.p.m. The diametral clearance is 0.0693mm. Determine the necessary  
 viscosity of the oil if the bearing temperature is not exceed 77°C while operating in a still air  
 at 21°C.  
 Given that  $W=0.484$  for lift  
 Bearing operating in still air

- Q.7 (a) Discuss the applications of various type of rolling contact bearings. 04  
 (b) A single row deep groove ball bearing is subjected to a radial force of 8 kN and a thrust 09  
 force of 3 kN. The value of X and Y factors are 0.56 & 1.5 respectively. The shaft rotates at  
 1200 r.p.m. The diameter of the shaft is 75mm & bearing No.6315 ( $C=112000N$ ) is selected  
 for this applications.  
 (i) Estimate the life of this bearing with 90% reliability.  
 (ii) Estimate the reliability for 20,000 hr. life

- Q.8 (a) Explain the step by step procedure of selecting belt from manufactures catalogue. 06  
 (b) A leather belt having density 1000 kg / m<sup>3</sup> has a maximum stress of 2.1 mpa. Determine the 07  
 maximum power that can be transmitted by a belt 250mm x 11mm in cross section if the  
 ratio of belt tensions is 2.

- Q.9 A differential band brake shown in figure -01 Assume  $\mu = 0.3$  13
- (a) Determine the tensions in the band, if the braking torque of 200 Nm is applied to the drum,  
 for the given direction of rotation.
  - (b) Further design the band with  $\sigma_{safe} = 70$  MPa.
  - (c) Also calculate the heat generated during braking, if drum rotates at 150 r.p.m.



Q.10 Write short note on (Any three)

- (a) Compare V-belt & flat belt
- (b) Optimum design
- (c) Compare sliding contact bearing & rolling contact bearing
- (d) Heat dissipation in brakes.