Total No. of Questions : **08** Roll No. : 0701.....

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branches for NEP-2020 : CM/ME & for AICTE : CE/CM/ME)

MA-3401 / MA-3301 MATHEMATICS - III

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Find the Laplace transform for the following :

(i) $e^{-2t}\sin 3t\cos 2t$. (ii) $\frac{1-\cos at}{t}$.

(b) Find the inverse Laplace transform for the following :

(i) $\frac{s-2}{s\,(s+2)(s-1)}$. (ii) $\log\left(\frac{s+a}{s+b}\right)$.

2(a) Find the inverse Laplace transform $\frac{s}{(s^2+4)(s^2+9)}$ by using convolution theorem.

(b) Solve the differential equation $\frac{d^2y}{dt^2}-3\frac{dy}{dt}+2y=e^{-t}$, with $y(0)=1$ and $y'(0)=0$ by using Laplace transform.

3(a) Solve $x^2(y-z)p+y^2(z-x)q=z^2(x-y)$.

(b) Solve $x^2p^2+y^2q^2=1$.

4(a) Solve the boundary value problem

$$\frac{\partial^2 u}{\partial t^2}=a^2\frac{\partial^2 u}{\partial x^2};\ 0<x<l;t>0$$

with $u(0,t)=0, u(l,t)=0$ and $u(x,0)=0, u_t(x,0)=sin^3\left(\frac{\pi x}{l}\right)$

(b) Solve $\frac{\partial^2 z}{\partial x^2}-5\frac{\partial^2 z}{\partial x\partial y}+\frac{\partial^2 z}{\partial y^2}=e^{x+y}$.

5(a) Assume that 50% of all engineering students are good in mathematics. Determine the probabilities that among 18 engineering students :

(i) exactly 10 (ii) at least 10 (iii) at most 8

(iv) at least 2 and at most 9 are good in mathematics.

(b) A manufacturer of television set known that on an average 5% of their product is defective. They sell television in consignment of 100 and guarantees that not more than 2 set will be defective. What is the probability that the TV set will fail to meet the guaranteed quality?

6(a) Find Karl Pearson's coefficient from the following data:

Ht. in inches	57	59	62	63	64	65	55	58	57
Weight in lbs	113	117	126	126	130	129	111	116	112

(b) The equations of two regression lines are $7x-16y+9=0$ and $5y-4x-3=0$. Find the coefficient of correlation and the mean of x and y.

P.T.O.

7(a) A manufacturer claimed that at least 95% of the equipment which he supplied to a factory conformed to specifications. An experiment of a sample of 200 piece of equipment revealed that 18 were faulty. Test the claim at 5% los

(b) The average marks scored by 32 boys is 72 with a S.D. of 8. While that for 36 girls is 70 with a S.D. 6. Does this data indicate that the boys perform better than girls at 5% los?

8(a) A sample of 26 bulbs gives a mean life of 990 hours with a S.D. of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not up to the standard?

(b) Ten soldiers participated in a shooting competition in the first week. After intensive training the participated in the competition in the second week. Their scores before and after training age given below :

Scores before	67	24	57	55	63	54	56	68	33	43
Scores after	70	38	58	58	56	67	68	75	42	38

Do the data indicate that the soldiers have been benefited by the training?

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-3401 / ME-3301 THERMODYNAMICS

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. All questions carry equal marks. Use of Steam Tables/Mollier Diagram is permitted. Assume suitable data only if necessary.

1(a) Define thermodynamic systems and explain its various types with the help of suitable examples. ***08***

(b) Define work transfer in thermodynamics. A tank containing air is stirred by a paddle wheel. The work input to the paddle wheel is 9000 kJ and the heat transferred to the surroundings from the tank is 3000 kJ. Determine : ***06***

(i) The work transfer and (ii) Change in the internal energy of the system.

2(a) Write the statement of zeroth law of thermodynamics and derive the property obtained from this law. Apply the steady flow energy equation in deriving equation for a Nozzle. ***08***

(b) In a test of water cooled air compressor, it is found that the shaft work required to drive the compressor is 180 kJ/kg of air delivered. The enthalpy of leaving air is 80 kJ/kg more than that of entering and that the increase in enthalpy of circulating water is 82 kJ/kg. Compute the amount of heat transfer to the atmosphere from the compressor per kg of air and sketch the process. ***06***

3(a) Write the statements of II law of thermodynamics and prove the equivalence of the statements. ***08***

(b) A fish freezing plant requires 50 tons of refrigeration. The freezing temperature is $-40^{o}C$ while the ambient temperature is $35^{o}C$. If the performance of the plant is 15% of the theoretical reversed Carnot cycles working within the same temperature limits then calculate the power required. Take 1 ton of refrigeration = 210 kJ/min. ***06***

4(a) Explain the following terms applied in steam formation on T-s diagram : ***08***

(i) Sensible heat (ii) Latent heat
(iii) Enthalpy of wet steam (iv) Superheated steam.

(b) Find the internal energy of 1 kg of steam at a pressure of 9.5 bar, when the condition of steam is ***06***

(i) wet with dryness fraction of 0.90
(ii) dry and saturated and
(iii) superheated, the degree of superheat being $60^{o}C$.

The specific heat of superheated steam at constant pressure is 2.01 kJ/kg K.

P.T.O.

5(a) What do you understand by the term 'equation of state'? Discuss any one equation of state applied to the real gases and then calculate its constants. ***08***

(b) 1 kg of Methane has a temperature of 30°C and a pressure of 100 bar. Compute the volume using : (i) Van der Waals' equation (ii) Perfect gas equation. ***06***

The value of constants for Methane are

$a = 362850 Nm^4/(kg-mol)^2$ and $b = 0.0423 m^3/kg-mol$.

6(a) Discuss the thermodynamic relations and derive the Maxwell equations using it. ***08***

(b) Which theorem has given the statement that the total entropy of a mixture of gases is the sum of the partial entropies. Prove the theorem. ***06***

7(a) Derive an expression to determine the air standard thermal efficiency of Otto cycle. ***08***

(b) In an air standard diesel cycle, the compression ratio is 16. Compression begins at 0.15 MPa, 42°C. The heat added is 1.775 MJ/Kg. Find : ***06***

(i) the maximum temperature of the cycle,
(ii) the work done per Kg of air,
(iii) the cycle efficiency,
(iv) the cut-off ratio and
(v) the mean effective pressure of the cycle.

8 Write short notes on **any two** : ***7*2***

(i) Explain first law of thermodynamics in a cycle and in a process
(ii) Derivation of steady flow energy equation (S.F.E.E) on per unit mass basis
(iii) Description of Experimental setup of Throttling Calorimeter to determine dryness fraction of steam

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-3402 / ME-3302 THEORY OF MACHINES

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks. Draw neat and clean diagrams in support of your answer.

1(a) Explain giving example different types of kinematic pairs. ***07***

(b) What do you mean by constrained motion? What are the different types of constrained motion? ***07***

2(a) Describe Peaucellier mechanism with neat sketch. Prove that the tracing point describes a straight line. ***07***

(b) Explain about equivalent linkage in short. ***07***

3 A four bar chain is represented by a quadrilateral ABCD in which AD is fixed and is 20cm long. The crank AB 6.25 cm long rotates in a clockwise direction at 95.5 rpm and drives link CD 11.25cm long by means of the connecting link17.5cm long. Draw the velocity and acceleration diagrams when angle BAD = 60^o and B and C lie on the same side of AD. Determine the angular velocity and angular acceleration of links BC and CD. ***14***

4(a) Deduce expressions for the exact and approximate lengths of belt in an open belt drive. ***07***

(b) What are various types of brakes? Describe briefly. ***07***

5(a) Write in brief about effect of braking on four wheeler. ***07***

(b) With a neat sketch, describe the principle and working of a Bevis-Gibson flash light dynamometer. ***07***

6(a) Explain the terminology of gear teeth. ***07***

(b) State and prove law of gearing. ***07***

7 An epicyclic gear train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on a star shaped planet carrier C. the size of different toothed wheels are such that the planet C rotates at $1/5^{th}$ of the speed of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 Nm. Determine : ***14***

(i) number of teeth on different wheels of the train and
(ii) torque necessary to keep the internal gear stationary.

8 Draw the profile of a cam operating a knife-edge follower from the following data : ***14***

(i) Follower to move outward through a distance of 20mm during 120^o of cam rotation.
(ii) Follower to dwell for next 60^o of cam rotation.
(iii) Follower to return to its initial position during 90^o of cam rotation.
(iv) Follower to dwell for the remaining 90^o of cam rotation.

The cam is rotating clockwise at a uniform speed of 500rpm. The minimum radius of the cam is 40mm and the line of stroke of the follower is offset 15mm from the axis of the cam and the displacement of the follower is to take place with uniform and equal acceleration and retardation on both the outward and the return strokes.

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Total No. of Questions : **07** Roll No. : 0701.....

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-3403 / ME-3303 MACHINE DESIGN AND DRAWING

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt all questions.

1(a) Define the following : ***06***

(i) Fundamental deviation (ii) Tolerance grade (iii) Systems of dimensioning.

(b) Draw the drawing conventions for the following machine parts : ***08***

(i) Square end on shaft (ii) slotted head (iii) Bearings
(iv) Compression spring with circular cross section.

OR

2(a) Draw the "sectional representation" and "appropriate symbol" for the following forms of weld : (i) Single-U butt (ii) Double-J butt (iii) Single-V butt (iv) Seam welding (v) Spot welding. ***06***

(b) Draw the top view and sectional front view of a triple riveted double cover chain type butt joint. Take thickness of the plate 16 mm, thickness of cover plates 12 mm and diameter of rivet 10 mm. Assume other dimensions. ***08***

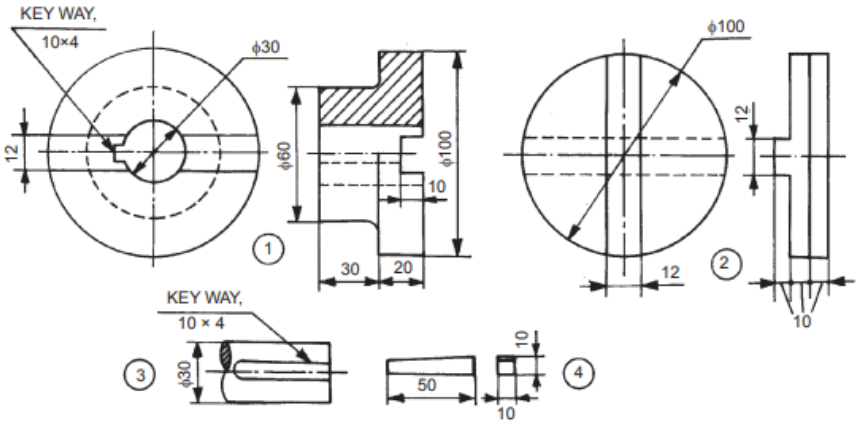
3 A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa. ***14***

OR

4 Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. ***14***

Tensile stress = compressive stress = 50 MPa; Shear stress = 35 MPa and
Crushing stress = 90 MPa.

5 ***Fig.1*** shows details of Oldham coupling. Draw the following assembled elevation full in section views : ***42***



Parts list

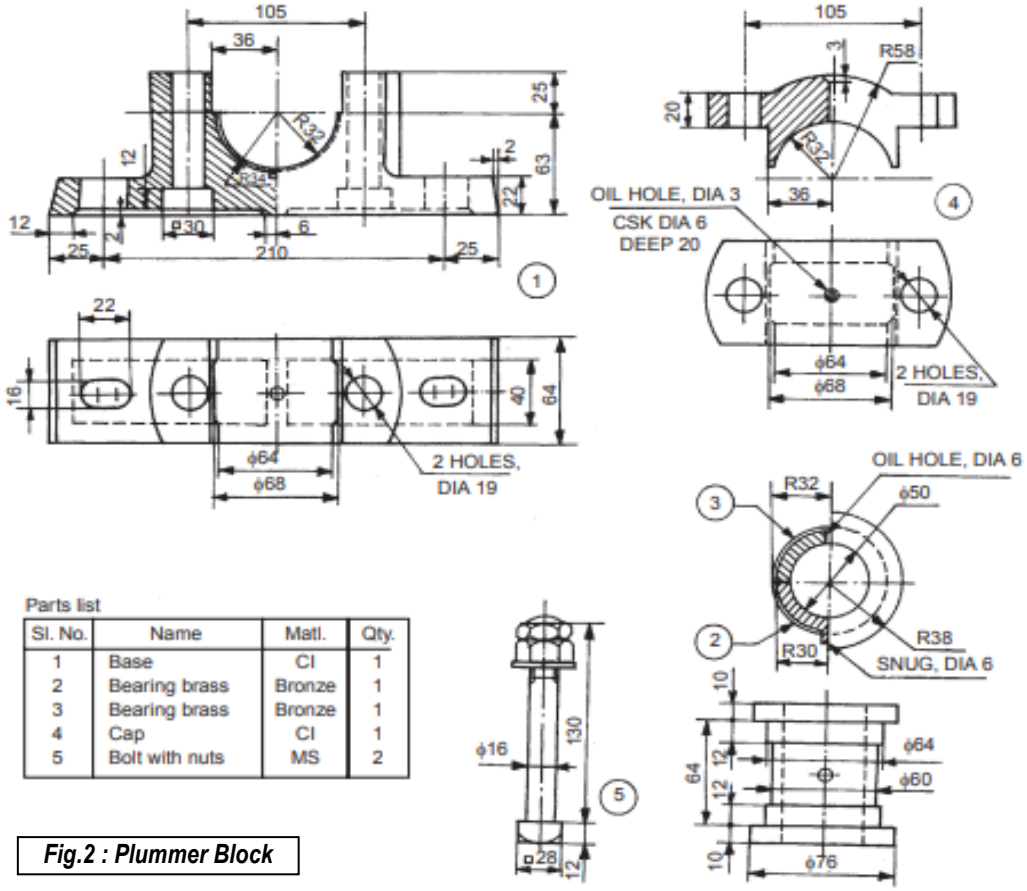
Sl. No.	Name	Matl.	Qty.
1	Flange	MS	2
2	Disc	MS	1
3	Shaft	MS	2
4	Key	MS	2

Fig.1 : Oldham Coupling

OR

P.T.O.

6 ***Fig.2*** shows details of Plumer block. Draw the following assembled Elevation full in ***42*** section views : (i) Elevation full in section (ii) Plan.



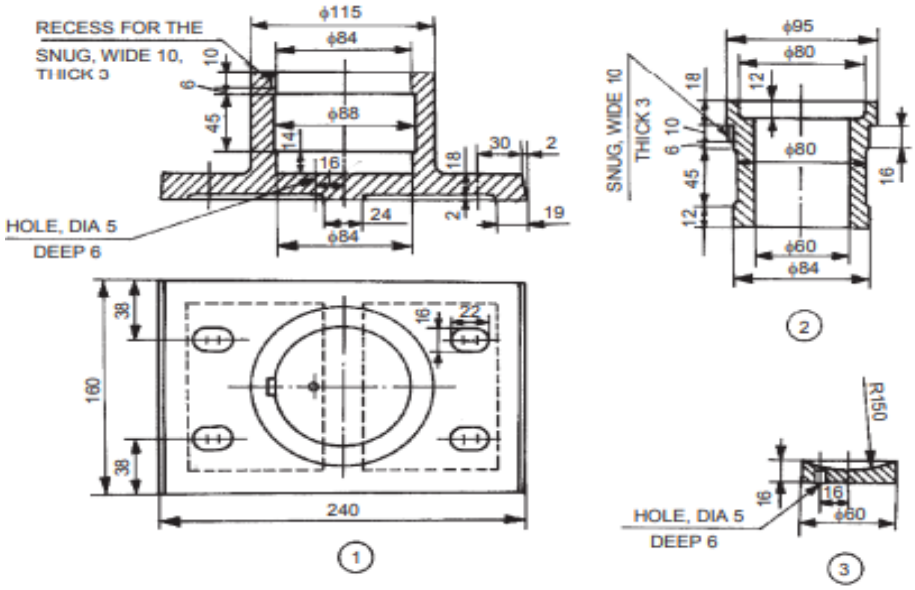
Parts list

Sl. No.	Name	Matl.	Qty.
1	Base	CI	1
2	Bearing brass	Bronze	1
3	Bearing brass	Bronze	1
4	Cap	CI	1
5	Bolt with nuts	MS	2

Fig.2 : Plummer Block

OR

7 ***Fig.3*** shows the details of Foot-Step Bearing. Draw the assembled front view full in ***42*** section.



Parts list

Sl. No.	Name	Matl.	Qty.
1	Body	Cast iron	1
2	Bush	Brass	1
3	Disc	P Bronze	1
4	Shaft	Mild steel	1
5	Pin	Mild steel	1

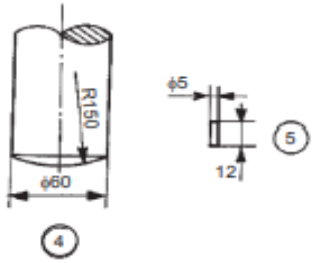


Fig.3 : Details of Foot Step Bearing

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Total No. of Questions : **08** Roll No. : 0701.....

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Mechanical Engineering)

ME-3404 / ME-3304 MATERIAL SCIENCE AND METALLURGY

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Assume suitable data if needed.

1(a) Describe with examples : ***08***

(i) Unit Cell (ii) Atomic Packing factor
(iii) Atomic radius (iv) Miller Indices

(b) Calculate the Atomic Radius for : ***06***

(i) Simple cubic structure (ii) BCC structure (iii) FCC structure.

2(a) Discuss various types of bonds occurring in a crystal. ***07***

(b) What are the defects and imperfections found in a crystal? Describe them with neat sketches. ***07***

3(a) Write short notes on the following : ***07***

(i) Fatigue Fracture (ii) Critical resolved shear stress.

(b) Differentiate between : (i) Cold and Hot working (ii) Slip and Twinning. ***07***

4(a) What do you understand by terms, primary creep, secondary creep and tertiary creep? ***07***

(b) Distinguish between the term recovery and recrystallisation involved in the process of heating cold worked metal. ***07***

5(a) Discuss in brief : (i) Hume-Rothery's rules (ii) Gibs phase rule. ***06***

(b) Explain Iron-carbon equilibrium diagram. ***08***

6(a) What are objectives of annealing? What are different annealing processes? ***07***

(b) Differentiate between hardening, normalizing and tempering. ***07***

7(a) Discuss. How do thermoplastics differ from thermosetting plastic materials? ***07***

(b) Differentiate between white and grey Cast Iron. What is the composition of bearing metal? ***07***

8(a) What are the advantages and limitations of powder metallurgy? ***06***

(b) Write short notes on : (i) Sintering (ii) Non Destructive Testing ***08***

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