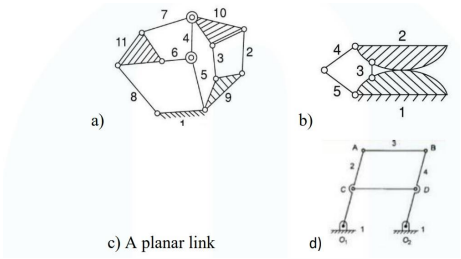
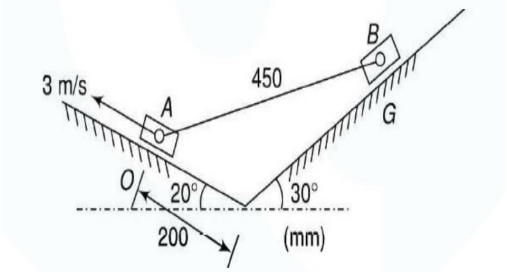
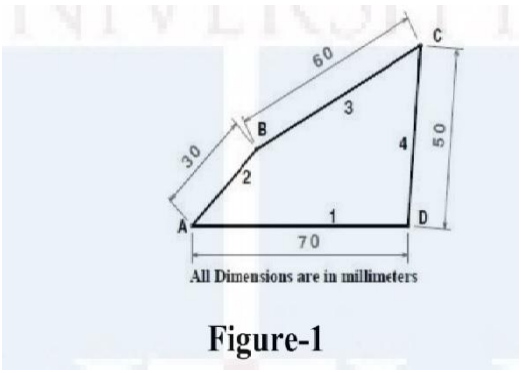
S5 - MECHANICAL QUESTION BANK 2022

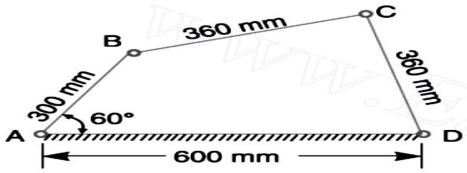
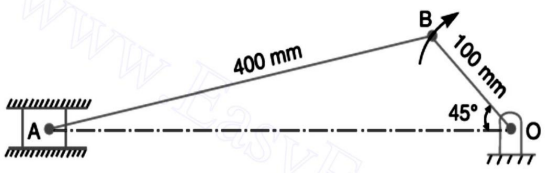
Questions compiled by

DEPARTMENT OF MECHANICAL ENGINEERING

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY TECHNICAL CAMPUS, KILIMANOOR, THIRUVANATHAPURAM

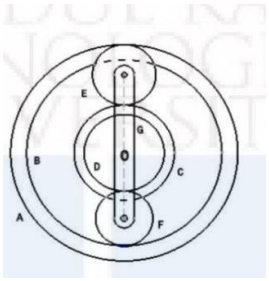
CODE: MET 301	COURSE NAME: MECHANICS OF MACHINERY	Credit: 4
Q.No	**Module I**	**Marks**
1	 Find the degrees of freedom of the above cases	14
2	 For the position of the mechanism shown in figure, find the velocity of the slider B for the given configuration if the velocity of the slider A is 3m/s	14
3	What is kinematic chain? State the conditions required for a kinematic chain to execute constrained motion.	3
4	Differentiate between a machine and structure	3
5	Sketch the Peaucellier straight line motion mechanism and prove that the tracing point describes a straight line path	7
6	What is meant by inversion of a mechanism? Describe with suitable sketches the inversions of a double slider- crank chain	14
7	What is meant by inversion? Explain with neat figures, the different inversions of four bar mechanism.	14
8	Define the following terms: i) Kinematic link ii) Kinematic pair iii) Kinematic chain iv) Mechanism	3
9	Classify kinematic pair with examples.	3
10	State and prove Kennedy's theorem.	3
11	A slider crank mechanism has lengths of the crank and the connecting rod equal to 200 mm and 200 mm respectively. Locate all the instantaneous centres of the mechanism for the position of the crank when it has turned through 30o from the inner dead centre. Also find the velocity of the slider and the angular velocity of the connecting rod if the crank rotates at 40 rad/sec	7
12	Differentiate constrained kinematic chain unconstrained kinematics chain.	3
13	Write the equation for Grubler's criterion to a plane mechanism.	3
14	Define: Kinematic pair, Give classification of Kinematic pair with neat sketch.	7
15	State and explain Grashof's criterion	7
16	Explain degree of freedom with neat sketch. Also explain Grumbler's criterion	7
17	Sketch and describe the working of whit-worth Quick return motion mechanism.	7
18	Explain various inversion of a single slide-crank mechanism with the help of example.	7
19	Explain the following: 1. Rubbing Velocity 2. Instantaneous center 3. Mechanical Advantage	7

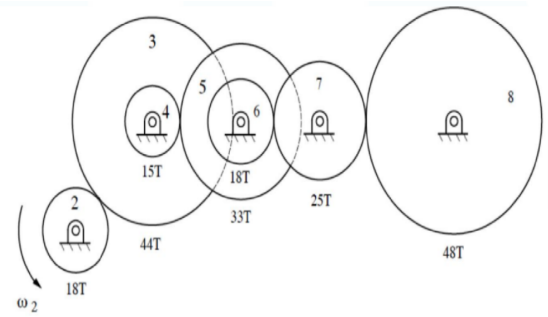
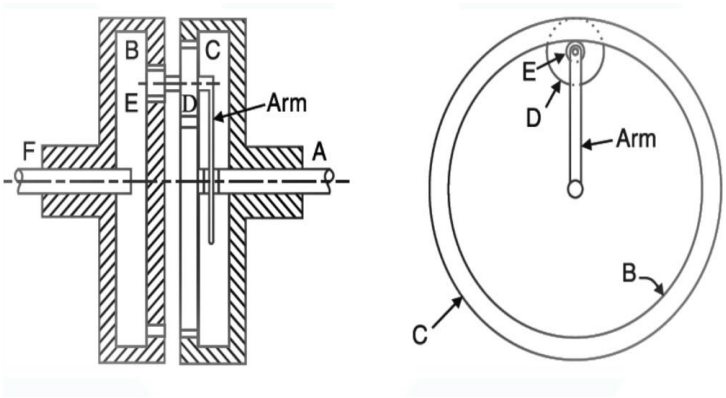
20	Explain instantaneous centre method for finding out the velocity of a point on link.	7
21	What are the applications of single slider crank mechanism	3
22	Give some examples for kinematics pairs	3
23	What is movability?	3
24	What is meant by transmission angle?	3
25	Write down the Grashof's Law for a four bar mechanism?	3
26	Whether a cycle chain is kinematic chain or not	3
27	What is resistant body?	3
28	Differtiate machine and mechanism	3
29	Write the application of Kutzbach criterion and Grubler's criterion to plane mechanism.	14
30	Locate all the instantaneous centres of the slider crank mechanism as shown in Figure. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: (i) Velocity of the slider A, and (ii) Angular velocity of the connecting rod AB.	14
31	Define Actual Mechanical Advantage	3
32	Describe the mechanism obtained by inversions of four bar chain	14
33	In a crank and slotted lever quick return motion mechanism, the distancebetween the fixed centres is 240mm and the length of the driving crank is 120mm. find the inclination of the slotted bar with the vertical in the extreme position and time ratio of cutting stroke to the return storke. If the length of the slotted bar is 450mm, find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.	14
34	State Kennedy's theorem	3
35	Describe the motion of the following items as pure rotation, pure translation or complex planar motion. a) The hand of a clock b) The pen in an XY plotter c) connecting rod of an IC engine	7
36	 Figure-1 Draw the inversions of the mechanism shown in Figure 1 which leads to double crank, double rocker and crank rocker mechanisms. Describe the nature of motion of each link in each case also	14
37	The crank of a slider crank mechanism rotates clockwise at a constant speed of 300rpm. The crank is 150 mm and the connecting rod is 600 mm long. Determine: 1. Linear velocity and acceleration of the midpoint of the connecting rod, and 2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position.	14

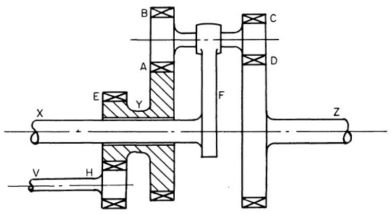
38	 In a pin jointed four bar mechanism, as shown in Figure, AB = 300 mm, BC=CD=360 mm, and AD = 600 mm. The angle BAD = 60°. The crank AB rotates uniformly at 100 rpm in clockwise. Locate all the instantaneous centres and find the angular velocity of the link BC.	14
39	Locate all the instantaneous centres of the slider crank mechanism as shown in Figure. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: (i) Velocity of the slider A, and (ii) Angular velocity of the connecting rod AB.	14
Q.No	**Module II**	**Marks**
1	PQRS is a four-bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm; QR = 175 mm; RS = 112.5 mm; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of link QR.	14
2	Draw the displacement, velocity and acceleration diagrams of simple harmonic motion	3
3	Derive equation for velocity, acceleration, max. velocity and max. acceleration for simple harmonic motion.	7
4	A cam is to be designed for a knife edge follower with the following data : 1) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2) Dwell for the next 30°. 3) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4) Dwell during the remaining 180°. Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm.	14
5	 Following is the data for a circular arc cam working with a flat faced reciprocating follower: Minimum radius of the cam = 40 mm; angle of lift = 75°; lift= 24 mm; Nose radius = 8 mm; Speed of the cam = 420rpm. Determine the main dimensions of the cam and the acceleration of the follower at the (i) beginning of the lift (ii) end of contact with the circular flank (iii) beginning of contact with the nose (iv) apex of nose.	14

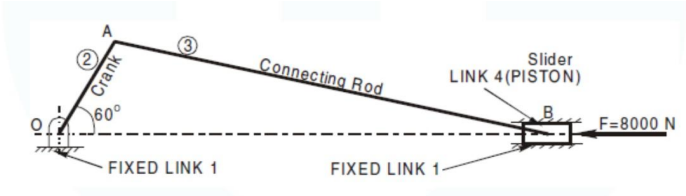
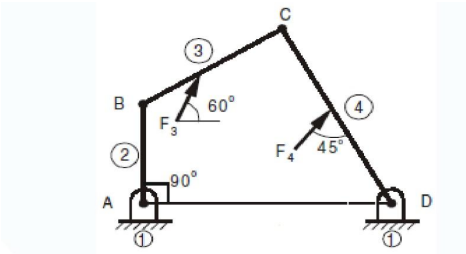
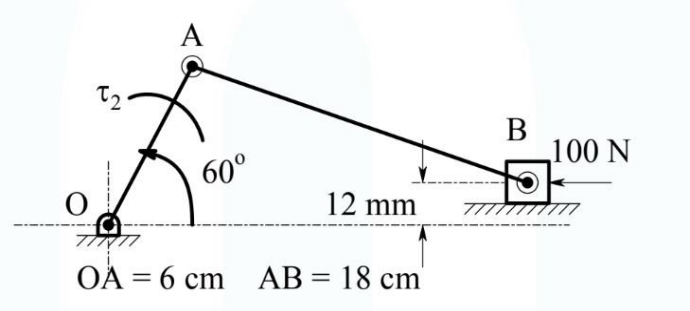
6	What do you mean by Coriolis component of acceleration? How is its direction found out?	3
7	Define the following terms as applied to a cam with a neat sketch i) Prime circle ii) Pressure angle	7
8	Derive the expression for velocity and acceleration when the follower moves with simple harmonic motion	7
9	Sketch the displacement, velocity and acceleration diagrams of a cam follower which moves with cycloidal motion.	7
10	Define polynomial cam. What are its advantages?	3
11	A flat faced follower is operated by a symmetrical circular cam with the straight line path of the follower passing through the cam axis. The least diameter of the cam is 40mm, lift is 12mm, total angle of action is 160o .The cam rotates at 500rpm. If the period of acceleration is 60% of the retardation during lift, determine (i) the main dimensions of the cam. (ii) maximum acceleration and retardation during the lift.	14
12	What is pressure angle of a cam? Discuss its importance in cam design.	3
13	How are cams and followers classified? Describe in detail.	14
14	Obtain the profile of a disc cam operating roller follower having the following motions; Cam lifts the follower for 120o with SHM followed by 30o dwell. During next 150o follower is lowered with uniform acceleration and deceleration and then dwell. Assume minimum radius of cam as 25mm, lift as 30mm and roller diameter 15mm	14
15	Why is a roller follower preferred over knife edge follower	3
16	Design a cam profile to suit the situations for the follower such as SHM, dwell, constant velocity, uniform acceleration cycloidal motion etc	7
17	A cam rotating at 150 rpm operates a reciprocating follower of radius 2.5 cm. The follower axis is offset by 2.5 cm to the right. The least radius of the cam is 5 cm and the stroke of the follower is 5 cm. ascent and descent with take place by uniform acceleration and retardation. Ascent take place during 75° and descent during 90° of cam rotation. Dwell between ascent and descent is 60°. Draw the cam profile. Also sketch velocity and acceleration diagrams and mark salient values.	14
18	Draw profile of a cam operating a knife edge follower for the following data : Maximum lift of the follower = 4.5 cm Angle for rise of follower with SHM = 150o Angle for dwell period after rise = 60o Angle for return of the follower with uniform velocity = 100o Least radius of the cam = 3 cm The cam rotates at a uniform velocity of 120 rpm. Determine the maximum velocity and acceleration of the follower during rise and return	14
19	A cam is rotating at uniform speed of 1200 rpm in the clockwise sense. It operates a roller following of 20 mm diameter with the data given as follows : Minimum diameter of the cam = 60 mm Maximum lift = 50 mm Angle for rise with equal uniform acceleration and retardation = 120o Angle for dwell after rise = 60o Angle for return with equal uniform acceleration and retardation = 90o Draw the cam profile for : (a) the follower axis passes through the cam centre, and (b) the follower axis is offset to the right by 10 mm. Determine maximum acceleration and maximum velocity of the follower during rise and return.	14
20	A uniformly rotating cam operates a flat faced nushroom follower. Draw cam profile for the following data : Lift of the follower = 30 mm Base circle radius of the cam = 30 mm Angle for ascent (rise) with cycloidal motion = 120o Dwell angle after ascent = 30o Return angle of the follower with uniform acceleration and retardation for retardation being twice the acceleration = 120	14
21	Differentiate Pitch point and Trace Point	3

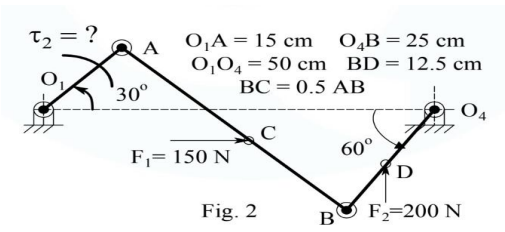
22	A cam is to be given the following motion to a knife edge follower: 1: outstroke during 600 of the cam rotation; 2: Dwell for next 300 of cam rotation ; 3: Return stroke during next 600 of cam rotation; 4: Dwell for remaininf 2100 of cam rotation. The stroke of the follower is 6cm. the folloewer moves with uniform velocity during outsroke and return stroke. Draw the displacment diagram fo the follower. Solution: Data given: $\theta a = 600$, $\theta d1 = 300$, $\theta r = 600$, $\theta d2 = 2100$, lift or stroke = 6cm	14
23	A disc with base circle radius of 50 mm is operating a roller follower with SHM. The lift is 25mm angle of ascent 1200 , dwell 90°, and dwell during the remaining period. The cam rotates at 300 rpm. Find the maximum velocity and acceleration during ascent. The roller radius is 10mm. Draw the ca profile when the line of reciprocation of follower passes through the cam axis.	14
24	A cam is to give the following motion to a KNIFE-EDGED-FOLLOWER:1.Out stroke during 60° of cam rotation; 2. Dwell for the next 30° of cam rotation; 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with UNIFORM VELOCITY during both the out stroke and return stroke. Draw the profile of the cam when (a) The axis of the follower passes through the axis of the cam shaft, and (b) The axis of the follower is offset by 20 mm from the axis of the cam shaft.	14
25	Outstroke during 60°of cam rotation: 2. Dwell for the next 30° of cam rotation: 3. Return stroke during next 60° of cam rotation, and 4. Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with UNIFORM VELOCITY during both the outstroke and return strokes. Draw the profile of the cam when (a) the axis of the follower passes through the axis of the cam shaft, and (b) the axis of the follower is offset by 20 mm from the axis of the cam shaft.	14
26	Draw the cam profile for following conditions: Follower type = roller follower, in-line; lift = 25mm; base circle radius = 20mm; roller radius = 5mm; out stroke with UARM, for 1200 cam rotation; dwell for 600 cam rotation; return stroke with UARM, for 900 cam rotation; dwell for the remaining period. Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 1200 rpm in clockwise direction.	14

27	Draw the cam profile for following conditions: Follower type = roller follower, off set to the right of cam axis by 18mm; lift = 35mm; base circle radius = 50mm; roller radius = 14mm; out stroke with SHM in 0.05sec; dwell for 0.0125sec; return stroke with UARM, during 0.125sec; dwell for the remaining period. During return stroke, acceleration is 3/5 times retardation. Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 240 rpm.	14
28	Draw the cam profile for following conditions: Follower type = oscillating follower with roller as shown in fig.; base circle radius = 20mm; roller radius = 7mm; follower to rise through 400 during 900 of cam rotation with cycloidal motion; dwell for 300; return stroke with cycloidal motion during 1200 of cam rotation; dwell for the remaining period. Also determine the max. velocity and acceleration during outstroke and return stroke, if the cam rotates at 600 rpm.	14
29	A push rod of valve of an IC engine ascends with UARM, along a path inclined to the vertical at 600. The same descends with SHM. The base circle diameter of the cam is 50mm and the push rod has a roller of 60mm diameter, fitted to its end. The axis of the roller and the cam fall on the same vertical line. The stroke of the follower is 20mm. The angle of action for the outstroke and the return stroke is 600 each, interposed by a dwell period of 600. Draw the profile of the cam.	14
30	Define tangent cam	3
31	Explain offset follower. ..	3
32	Define pressure angle with respect to cams	3
Q.No	**Module III**	**Marks**
1	For the case of gears, What is meant by i) Pressure angle, ii) Circular pitch, iii) Module.	3
2	 In an epicyclic gear train as shown in Figure 4 the internal wheels A and B and the compound wheels C & D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G.E gears with A and C and F gears with B and D. All wheels have the same module and the number of teeth are: Tc = 28, TD = 26, TE = TF = 18 i) Sketch the arrangement ii) Find the number of teeth on A and B iii) If the arm G makes 100 r.p.m clockwise and A is fixed, find the speed B iv) If the arm G makes 100 r.p.m clockwise and wheel A makes 10 r.p.m counter clockwise, find the speed of wheel B	14
3	Derive equation for path of contact and arc of contact of mating gears.	7
4	Two 20o gears have a module pitch of 5mm. The number of teeth on the pinion 20 and the gear ratio is 2. If the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module i) The angle turned through by pinion when on ii) The maximum velocity of sliding	14
5	What is meant by interference and undercutting in involute gears? What are the methods to avoid interference of gears?	14
6	What is a gear train?Explain the different types of gear trains.	14

7	 Find the angular velocity of gear 8 if the angular velocity of gear 2 is 800 rpm in the direction shown below:	3
8	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 instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of gear B?	14
9	Two gear wheels mesh externally and are to give a velocity ratio of 3 to 1. The teeth are of involute form, module is 6 mm, addendum is one module, and pressure angle is 20°. The pinion rotates at 90 rpm. Determine (i) The number of teeth on the pinion to avoid interference and the corresponding number of teeth on the wheel (ii) The length of path of contact and arc of contact (iii) The number of pairs of teeth in contact, and (iv) The maximum velocity of sliding.	14
10	 An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels; D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A, co-axial with F. If the wheels have the same pitch and the shaft A makes 800 r.p.m., what is the speed of the shaft F?	3
11	What are the main gear tooth profiles that satisfy the law of gearing? Compare them.	3
12	Two involute spur gears with pressure angle 20o have a velocity ratio of 3.The module is 3mm and the addendum is equal to 1.1 module. If the pinion rotates at120rpm, determine the minimum number of teeth on each wheel to avoid interference and the contact ratio.	7
13	State and derive the law of gearing.	7

14	 In the epicyclic train shown in figure, the wheels A and E (30 teeth) are fixed to a sleeve Y which is free to rotate on spindle X. B (24 teeth) and C (22 teeth) are keyed to a shaft which is free to rotate in a bearing on arm F. D (70 teeth) is attached to the output shaft Z. All teeth have the same pitch. The shaft X makes 300 rev/min and the shaft V 100 rev/min in the same direction. The wheel H has 15 teeth. Determine the speed and direction of rotation of Z.	14
15	Design a four bar crank rocker to give 45° of rocker motion with a time ratio of 1:1.25 with 45° output rocker motion. (9 marks) b) Design a slider crank mechanism to coordinate two positions of the input link and the slider for the following angular and linear displacement of the input link and slider respectively. θ12 = 30° & S12 = 100 mm	14
16	Explain the different tasks involved in the kinematic synthesis of mechanisms.	3
17	Explain the different types of synthesis	7
18	Explain what do you mean by structural error?	3
19	Explain the overlay method of synthesis.	7
20	Explain the two-position synthesis of a slider crank mechanism.	3
21	Derive a relation for Freudenstein's equation for the synthesis of mechanisms.	14
22	Design a slider crank mechanism to coordinate three positions of the input crank and the output slider for the following data using graphical method and explain the procedure. θ12 = 30°, S12 = 40mm, θ13 = 60°, S13 = 96mm	14
23	Synthesize a four-bar linkage using Freudenstein's equation to satisfy in one of its positions. The specification of position θ, velocity ω and acceleration α are as follows: θ2 = 60°, ω2 = 5 rad/s; α2 = 2 rad/s2; θ4 = 90°; ω4 = 2 rad/s; α4 = 7rad/s2	14
24	What are precision points? Explain the Chebyshev spacing of precision points.	7
25	Define kinematic synthesis. Explain the various steps involved in kinematic synthesis?	7
26	Explain 2 position and 3 position synthesis of a four bar mechanism by assuming suitable dimensions.	7
27	What are coupler curves? Explain their role in synthesis.	3
28	Explain the procedure for any one of the methods to design a four link mechanism to coordinate two positions of the input crank and the output rocker.	7
29	How precision points are obtained using Chebychev spacing?	7
30	Design a four bar mechanism to generate the function y=2x2 where x varies from 2 to 4 with an interval of 1. Assume input angle to vary from 40o to 120o and output angle to vary from 60o to 132o.The length of fixed link is 1m.	14
31	Define the following terms(a) Limit positons (b) Dead centers (c) Function generator (d) Path generator	7
32	Explain the overlay method for synthesis.	7
33	Explain the procedure for any one of the methods to design a four link mechanism to coordinate two positions of the input crank and the output rocker.	14
34	Define law of gearing.	3
35	Define reverted gear train and state its applications.	7
Q.No	**Module IV**	**Marks**
1	Explain the effect of gyroscopic couple on aeroplane while it takes a right turn viewing from rear end	7
2	A uniform disc of 150 mm diameter has a mass of 5 N. It is mounted on one end of an arm of length 50cm. The other end of the arm is free to rotate in a universal bearing. If the disc rotates about the arm with a speed of 400rpm anticlockwise looking from the front, with what speed will it precess about the vertical axis?	7

3	 A Slider-crank mechanism as shown in figure is given below. The force acting on slider is 8000 N. Calculate the driving torque. The dimensions of links are: OA = 200 mm ; AB = 800 mm and □BOA = 60o	14
4	The dimensions of a four-link mechanism are: AB = 400mm, BC = 600mm, CD = 500mm, AD = 900 mm and □DAB = 60o. AD is the fixed link. E is a point on the link BC such that BE = 400mm and CE = 300mm (BEC clockwise). A force of 150 □□□o N acts on DC at a distance of 250mm from D. Find the required input torque on the link AB for static equilibrium of the mechanism.	14
5	In a vertical IC engine, the connecting rod is 4.5 times the crank. The mass of the reciprocating parts is 1.20kg and the stroke of the piston is 140mm. The engine runs at 2000 rpm. If the net load on the piston due to gas pressure is 2kN when the crank has turned through an angle of 60o from the top dead centre, determine the (i) Thrust in the connecting rod, (ii)Thrust on the piston walls, (iii)Tangential force on the crank pin, (iv)Torque on the crankshaft	14
6	 A four bar mechanism as shown in Figure, is subjected to two forces, F3 = 2000N at 60o from horizontal at midpoint of link 3 and F4 = 4000 N at 45o from link 4 at midpoint of link 4. The dimensions of links are as under: AB = 0.3 m, BC = 0.4 m, CD = 0.45 m and AD = 0.6 m. Perform static force analysis and determine resisting torque on link 2 using superposition method.	14
7	A slider crank mechanism of crank radius 60mm and connecting rod length 240mm is acted upon by 2kN gas force at its piston. Calculate the torque to be applied on the crank to make the mechanism in static equilibrium, when the crank makes 600 with the line of stroke.	14
8	The piston diameter of an internal combustion engine is 125 mm and the stroke is 220 mm. The connecting rod is 4.5 times the crank length and has a mass of 50kg. The mass of the reciprocating parts is 30kg. The centre of mass of the connecting rod is 170mm from the crank pin centre and the radius of gyration	14
9	State and explain D'Alembert's principle.	3
10	 The applied load on the piston of an offset slider-crank linkage shown in Fig.1 is 100 N, and the coefficient of friction between the slider and the guide is 0.27, using graphical method determine the magnitude and sense of torque □2 applied on OA for the static equilibrium of the linkage.	3

11	 Fig. 2 Fig. 2 shows a four bar linkage on which various forces acting and their directions are shown. Determine the magnitude and direction of the torque applied on the link O1A to keep the equilibrium of the linkage. Also determine the magnitude and direction of the forces transmitted to the frame of the linkage. Use Matrix method.	14
12	What do you mean by dynamic equivalent .system? Explain	7
13	Define static force analysis.	3
14	Differentiate between static and dynamic equilibrium	3
15	Define applied and constraint forces.	3
16	Differentiate between static force analysis and dynamic force analysis.	3
17	State the principle of superposition.	3
18	What is gyroscopic torque?	3
19	What is meant by expression friction circle?	3
20	What is meant by turning moment diagram or crank effort diagram?	7
21	What are the causes and effect of vibration?	7
22	What is the effect of gyroscopic couple on rolling of ship? Why?	7
23	The rotor of a turbine yatch rotates at 1200rpm clockwise when viewed from stern. The rotor has a mass of 750 kg and radius of gyration of 250mm.Find the maximum gyroscopic couple transmitted to the hull when yacht pitches with a maximum angular velocity of 1 rad/s.What is the effect of this couple?	14
Q.No	**Module V**	**Marks**
1	A Single cylinder vertical engine has a bore of 40 cm and a stroke of 50 cm. The connecting rod is 120cm long. The mass of reciprocating parts is 150kg. On the expansion stroke with the crank at 30o from the top dead centre the gas pressure is 1 Mpa. If the engine runs at 300rpm, determine a. Net force acting on the piston b. Resultant load on the gudgeon pin c. Thrust on the cylinder walls	14
2	Four masses A, B, C and D revolves at equal radii and equally spaced along a shaft. The mass B is 7kg and the radii of C and D make angle s of 90° and 240° respectively with the radius of B. Find the Magnitude of masses A, C and D and angular position of A, so that the system may be completely balanced.	14
3	Derive an expression for the natural frequency of the free longitudinal vibration by (i) Equilibrium method, (ii) Energy method, (iii) Rayleigh's method.	14
4	A steel shaft 100mm in diameter is loaded and support in shaft bearing 0.4m apart. The shaft carries three loads: first mass 12kg at the centre, second mass 10kg at a distance 0.12m from the left bearing and third mass of 7kg at a distance 0.09m from the right bearing. Find the value of the critical speed by using Dunker ley's method if E = 2X1011N/m2	14
5	The data for three rotating masses are given below: M1=4kg r1=75mm 1=45 M2=3kg r2=85mm 2=135 M3=2.5kg r3=50mm 3=240 Determine the amount of counter mass at a radial distance of 65mm required for their static balance.	14
6	A steel shaft 100mm in diameter is loaded and support in shaft bearing 0.4m apart. The shaft carries three loads: first mass 12kg at the centre, second mass 10kg at a distance 0.12m from the left bearing and third mass of 7kg at a distance 0.09m from the right bearing. Find the value of the critical speed by using Dunker ley's method if E = 2X1011N/m2 .	14

7	A rotating shaft carries four unbalanced masses 20 kg,11kg,18kg and 12 kg at radii 8cm,5cm,6cm and 7cm respectively. The 2nd, 3rdand 4th masses revolve in planes 10cm,15cm and 18 cm respectively measured from the plane of the first mass and are angularly located at 70o,120o and 270o respectively measured anticlockwise from the first mass looking from this mass end of the shaft. The shaft is dynamically balanced by two masses, both located at 6cm radii and revolving in planes midway between those of 1st and 2nd masses and midway between those of 3rd and 4th masses. Determine graphically the magnitudes of the masses and their respective angular positions.	14
8	A three cylinder single acting engine has its cranks set equally at 120° and it runs at 600 r.p.m. The torque-crank angle diagram for each cycle is a triangle for the power stroke with a maximum torque of 90 N-m at 60° from dead centre of corresponding crank. The torque on the return stroke is sensibly zero. Determine 1. Power developed. 2. Coefficient of fluctuation of speed, if the mass of the flywheel is 12 kg and has a radius of gyration of 80 mm 3. Coefficient of fluctuation of energy 4. Maximum angular acceleration of the flywheel.	14
9	A shaft carries four masses A, B , C and D of magnitude 250kg, 350kg, 480kg and 250kg respectively and revolving at radii 64mm, 60mm, 50mm, and 64mm in planes measured from A at 300mm, 400mm, and 700mm. The angles between the cranks measured anticlockwise are A to B 45o, B to C 70o, C to D 120o. The balancing masses are placed in planes P and Q. The distance between the planes A and P is 100mm, between P and Q is 400mm and between Q and D is 200mm. If the balancing mass Q revolve at a radius of 100 mm, and balance mass P revolve at a radius of 150mm, find their magnitudes and angular positions.	14
10	What is the whirling speed of a shaft? Explain	7
11	Explain the method of balancing of several masses in different planes.	7
12	Explain the balancing of several masses rotating in same plane by Graphical Method.	7
13	Why is balancing of rotating parts necessary for high speed engines? Explain clearly the terms	7
14	static balancing and dynamic balancing. State the necessary conditions to achieve them.	7
15	What are the reasons for unbalance in rotating machine elements? Give two practical examples of v	7
16	What is meant by field balancing? Explain the procedure in detail.	7
17	A statically balanced system need not to be dynamically balanced always. Justify the statement.	7
18	Explain the balancing of several masses rotating in same plane by Graphical Method.	7
19	What is static and dynamic balancing	7
20	Four masses A, B, C & D are completely balanced. Masses C & D makes an angle of 900 and 1950 respectively with that of mass B in the counterclockwise direction. The rotating masses have the following properties: masses at B, C & D are 25 Kg, 40 Kg and 35 Kg respectively with their radii of rotations are 200 mm, 100 mm & 180 mm respectively. The radius of rotation of mass A is 150 mm. Planes B & C are 250 mm apart. Determine the (i) mass A and its angular position with that of mass B, (ii) position of all the planes relative to plane of mass A.	14
21	A rotating shaft carries four unbalanced masses A=20 kg, B=15kg, C=18kg and D=12kg. The mass centers are 50, 60, 70 and 60 mm respectively from the axis of the shaft. The second, third and fourth masses rotates in planes 100, 150 and 300 mm respectively measured from the plane of first mass and at angular locations of 60º, 120º, and 280º respectively, measured clockwise from the first mass. The shaft is dynamically balanced by two masses, both located at 50mm radii and revolving in planes midway between those of first and second masses and midway between those of third and fourth masses. Determine the balancing masses and their angular positions	14
22	The four masses m1, m2 m3 and m4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 mm are 200 kg, 300 kg, 240 kg and 260 kg in magnitude respectively. The angles between the successive masses are 45˚, 75˚ and 135˚ respectively. Find the position and magnitude of the balance mass required, if its radius of rotation is 200 mm. Use analytical method.	14
23	Explain why the reciprocating masses are partially balanced.	3
24	Explain Primary and Secondary Unbalanced Force Due to Reciprocating Masses	3
25	Partial balancing of Primary Unbalanced Force in Reciprocating Engine	3
26	How and why are reciprocating masses balanced in a piston-cylinder assembly? Why reciprocating masses are partially balanced?	3
27	What is Hammer blow? Derive an expression for limiting speed required for hammer blow.	3
28	Write down short note on ‘Variation of Tractive Force’.	3

29	Derive the expressions for variation of tractive force, for an uncoupled two cylinder locomotive engine	7
30	What are inline engines? How these engines are balances	7
31	What is a secondary balancing of inline multi cylinder engines?	7
32	Derive the expressions for primary and secondary unbalanced forces in a V -Engine.	7
33	Explain concept of Balancing of V engines.	7
34	Explain the direct and reverse crank method for determining unbalanced forces in radial engines.	7
35	Explain concept of Direct and Reverse Crank	**7**

CODE MET303	COURSE NAME: THERMAL ENGINEERING	Credit: 4
Q.No	**Module I**	**Marks**
1	Explain Rankine cycle with help of a T-S diagram.	3
2	Differentiate between fire tube boiler and water tube boiler	3
3	List the difference between throttle governing and nozzle governing	3
4	Steam at a pressure of 15 bar and 250 ^{o}C is expanded through a turbine to a pressure of 4 bar. It is then reheated at constant pressure to initial temperature of 250 ^{o}C and finally expanded to condenser pressure of 0.1 bar. Calculate efficiency of the cycle. What will be the efficiency if reheating is not employed? Pump work can be neglected.	8
5	Derive the expression for mass flow rate of steam through a nozzle and obtain the critical pressure ratio	6
6	With the help of a neat figure explain the working of a Benson boiler. What are its merits over other boilers?	8
7	With the help of T-s and p-h diagram explain the significance of binary vapour cycle	6
8	Explain the methods of increasing the thermal efficiency of a Rankine cycle	10
9	Compare the characteristic features of a fire tube boiler and water tube boiler	10
10	A simple rankine cycle works between pressure 28 bar and 0.06 bar, the initial condition of the steam being dry saturated. Calculate the cycle efficiency.	10
11	List one advantage and one disadvantage of the reheat cycle and of the regenerative cycle	2
12	In a reheat Rankine cycle, steam at a pressure of 40 bar and 300°C is expanded through a turbine to a pressure of 4 bar. It is then reheated at a constant pressre to 300°C and then expanded to 0.1 bar. Estimate the work done per kg of steam flowing through the turbine,the amount of heat supplied during the reheat process and the cycle efficiency. Neglet pump work	8
13	Dry saturated steam enters a frictionless adiabatic nozzle with negligible velocity at a temperature of 300°C. It is then expanded to a pressure of 40 bar. For a mass flow rate of 2kg/s, calculate the exit velocity of the steam. Use mollier chart	3
14	With the aid of a neat sketch, explain the working of a Cohran Boiler	7
15	Explain the metastable flow in a nozzle with h-s diagram	3
Q.No	**Module II**	**Marks**
1	Explain degree of reaction of a steam turbine.	3
2	Derive the condition for maximum efficiency of a reaction turbine	6
3	With the help of figures enumerate the difference between pressure compounding and velocity compounding of steam turbines	8
4	What do you meant by reheat factor? List the parameters influencing the value of reheat factor	4
5	In an impulse steam turbine, steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20o and the mean blade velocity is 400 m/s. The inlet and outlet blade angles are equal. The blade velocity coefficient is 0.8. The mass of steam flowing through the turbine per hour is 950 kg. Calculate: (i) Blade angles. (ii) Relative velocity of steam entering the blades. (iii) Tangential force on the blades. (iv) Power developed. (v) Blade efficiency	10
6	Discuss the methods of energy transfer in impulse and reaction turbines	10
7	What is meant by reheat factor?List the parameters inflencing the value of reheat factor	3
8	Derive the condition for maximum efficiency of a reaction turbine	7
9	In a equiangular, simple impulse turbine , steam issues from the nozzle with a velocity of 900 m/s. Nozzle angle is 20° and mean blade velocity is 360 m/s. Assuming frictionless blades, for a mass flow rate of 1000kg/min, calculate the blade angles, the power developed in kW and the blade efficiency	7
10	Draw the combined velocity diagram for a moving blade of a single stage impulse steam turbine. Clearly denote all the components	4

Q.No	Module III	Marks
1	With the help of a diagram explain turbocharging.	3
2	Explain the procedure of Morse test	3
3	With the help of a neat figure explain the working of Wankel engine. Mention its merits and demerits over conventional IC engines	9
4	Discuss the effect of variable specific heat in actual cycle of IC engines	5
5	The following observations were recorded during a trial of a four stroke single cylinder diesel engine for a trial duration of 30 min. Fuel consumption is 4 liters, Calorific value of fuel 43 MJ/kg, specific gravity of the fuel = 0.8, average area of indicator diagram = 8.5 cm2 , length of indicator diagram = 8.5 cm, spring constant= 5.5 bar/cm, brake load = 150 kg, spring balance reading = 20 kg, effective brake wheel diameter = 1.5 m, speed = 200 rpm, cylinder diameter = 30 cm, stroke = 45 cm. Calculate i) indicate power ii) brake power iii) mechanical efficiency iv) specific fuel consumption in kg/kWh and v) indicated thermal efficiency	10
6	Explain the concept of charge stratification in IC engines	4
7	Compare a 2 stroke and 4 stroke engines. Which engine do you prefer for two wheelers? Why?	10
8	Explain the working of a Rotary Engine and Stratified Charge Engine	10
9	Explain turbo charging and super charging. How does it affect the engine performance and pollution levels?	10
10	A-four cylinder petrol engine has an output of 4.8 kW at 180 rpm. A Morse test is carried out and the brake torque readings with each cylinder cutt-off in turn are 177 Nm. 170 Nm. 169 Nm and 173 Nm respectively. For normal running at this speed ,the specific fuel is 42MJ/kg. Calculate the mechanical efficiency and brake thermal efficiency of the engine.	6
11	Explain the supercharging of engines	6
12	Sketch the heat balance curves for CI engine at constant speed and discuss the nature of curve	4
Q.No	**Module IV**	**Marks**
1	Discuss about pollutants coming from a CI engine	3
2	What do you meant by Octane number?	3
3	With the help of pressure-crank angle diagram explain different stages of CI engine combustion	8
4	Explain the phenomenon of detonation in SI engine based on autoignition theory	6
5	With the help of figures compare different types of SI engine combustion chambers	8
6	Discuss any two emission control methods employed in reducing the emission of CI engine	6
7	Define Flash point,Fire point,Calorific value,volatility and carbon residue of a fuel	10
8	Compare the various stages of combustion in SI and CI engine with p-θ diagram	10
9	Write four desirable properties of an SI engine fuel	4
10	What is meant by pre- ingition? Does pre-ignition occur in CI engine? Justify your answer	3
11	Name the stages of combustion in a CI engine and explain with the aid of a pressure -crank angle diagram	7
12	List any 2 methods for reducing NOx emmision and discuss their basic priciple	5
13	Name the factors affecting detonation in SI engine and discuss their effect	5
14	Explain octane rating and cetane rating?	4
Q.No	**Module V**	**Marks**
1	Why reversed Carnot cycle is practically impossible to execute?	3
2	Define bypass factor and mention its significance	3
3	A freezer of 20 TR capacity has evaporator and condenser temperature of -30 o C and 25 o C respectively. The refrigerant R-12 is sub-cooled by 4 o C before entering the expansion valve and is superheated by 5 o C before entering the evaporator. If a six cylinder single acting compressor with stroke equal to bore running at 1000 rpm. is used. Determine i) COP ii) Theoretical piston displacement per minute iii) Theoretical bore and stroke	9

4	Derive an expression for COP of a Reversed Brayton cycle for air refrigeration system	5
5	2.5 kg of air is cooled and dehumidified from 30 o C DBT, 40% RH to 15 o C DBT & 80% RH in a cooling and dehumidifying coil. Find (i) ADP, (ii) Bypass Factor and (iii) Heat Transfer. If bypass factor is halved keeping the ADP same find (iv) exit air condition and (v) Heat Transfer	10
6	Define i) DPT ii) RH ii) SHF and iv) ADP	4
7	Define the terms: (i) Refrigeration (ii) Coefficient of Performance and (i)) Ton of Refrigeration. State the major applications of refrigeration	5
8	Describe any one refrigeration technique for the production of very low temperature using a neat diagram.	5
9	Draw the T-s and p-h plots of actual vapour compression refrigeration cycle and highlight its differences from a simple vapour compression refrigeration cycle.	5
10	What is an air washer; show in a representative psychrometric chart the various psychrometric processes that can be performed using an air washer.	5
11	With the help of schematic and T-s diagrams describe the working of a Bell Coleman Refrigeration cycle	5
12	State merits and demerits of a vapour compression system over air refrigeration system. Also illustrate the effects of wet and dry compression on the COP	5
13	What are the different factors that affect the human comfort? Sketch a typical comfort chart?	5
14	Differentiate between comfort and industrial air conditioning process.	5
15	Give the classification of air conditioning systems. With a schematic diagram describe a winter air conditioning system	5

CODE MET305	COURSE NAME: INDUSTRIAL & SYSTEMS ENGINEERING	Credit: 4
Q.No	**Module I**	**Marks**
1	What are the functions of Industrial Engineering?	6
2	What are the human factors to be considered while designing a new product?	4
3	Describe the procedure followed while designing a product.	8
4	How inventories are classified and costs associated by inventories?	8
5	A manufacturer has to supply 10,000 units of product annually. The unit cost is Rs. 2 and it costs Rs.36 to place an order. The inventory carrying cost is estimated at 9% of average inventory investment. Determine 1. EOQ 2.Optimum number of orders to be placed per annum. 3. Minimum total cost of inventory	8
6	What are the principles of good product design	4
7	The fixed cost of producing a product in a company is Rs. 8,00,000. Variable cost per unit of the product is Rs. 30. Each unit of the product is going to be sold at a price of Rs. 180. Determine the breakeven point of this product.	8
8	What do you understand by the terms prototype and model?	4
9	What are the opposing costs in inventory control? Represent them in a neat sketch, showing the total cost curve also.	3
10	Define ergonomics. What are its objectives? Elaborate on how ergonomics finds application in work system design.	3
11	Explain 'Break-even analysis' with a neat sketch, clearly explaining the terms involved in it. Derive a mathematical expression for break-even quantity.	8
12	Explain the following: 1) Standardization 2) Simplification and 3) Diversification.	14
13	Derive the expression for EOQ and total inventory cost for purchasing model without shortage.	8
14	Explain with an example how a successful product connect with user on the three levels 'useful' 'usable' and 'desirable'.	3
15	Describe functional design and design for production.	4
16	Explain function analysis in the context of value engineering with the help of an example.	3
Q.No	**Module II**	**Marks**
1	Describe the role played by the materials management function in enabling an organisation to achieve profitability	14
2	List various types of material handling equipments	4
3	Classify various material handling equipments used in a manufacturing company and explain in detail about any four category	5
4	Differentiate between P system and Q system with neat sketches.	7
5	What is meant by quantity discount?	4
6	A retailer procures batteries for quartz watches and sells them to watch repair shops. The price paid by the retailer varies on the basis of the quantities of batteries procured by him. The quantity and the price/unit pattern offered to him are given below: The monthly demand for the batteries is 600 units. The storage cost is 15% of unit cost of the battery and the cost of ordering is Rs.30 per order. Determine the optimum quantity to be ordered by the retailer so that the total cost of procurement is minimum.	10
7	How aggregate planning is done in a manufacturing enterprise?	5
8	What are the principles of material handling systems	5
9	What are the criteria for the choice of a type of material handling equipment?	3
10	Describe the factors responsible for replacing a equipment in working condition.	3
11	What is unit load in material handling? How unit load can be accomplished?	3
Q.No	**Module III**	**Marks**

1	Define ‘Job Satisfaction’.	3
2	Describe the causes of poor industrial relations.	3
3	What is meant by ‘collective bargaining’?	3
4	Describe the causes and effects of industrial disputes and how it can be eliminated	4
5	What are the methods of elimination of fatigue?	3
6	List any five objectives of Trade union.	5
7	Trace the history of Trade unionism.	5
8	Explain conditions to be met for maintaining good industrial relations.	5
9	Describe the causes of poor industrial relations.	7
10	Define industrial psychology. What are its aims and objectives?	7
11	Why communication in industry is considered as an important function?	7
12	What is meant by industrial fatigue? What is the nature and effect of fatigue? What are the methods of eliminating fatigue?	14
13	Elaborate on worker’s participation in management.	14
14	Objectives of labour welfare in an industry	6
15	Discuss some labour welfare measures undertaken by organisation in recent days	6
16	A trade union is an instrument of industrial democracy explain	5
17	Describe direct and indirect cost associated with accidents	4
18	Define industrial accidents and its effect in productivity	4
19	Characteristics of collective bargaining and explain safety programme and safety committee	5
Q.No	**Module IV**	**Marks**
1	Compare the inventory levels in conventional and lean manufacturing systems	3
2	Expand the Japanese terms of 5S	5
3	Describe the basic elements of lean manufacturing	4
4	Describe the components of agile manufacturing system	3
5	List the measures that are used to measure innovation in agile production system	4
6	How do strategic linkages aid the organisation to acquire agility?	3
7	Describe the characteristics of agile manufacturing	8
8	Describe the key processes of “Customer Relationship Management”	4
9	What is lean manufacturing? Name the seven main wastes being dealt with in lean manufacturing.	7
10	Define agile manufacturing and list four objectives of agile manufacturing	8
11	Explain the concept of ‘Agile manufacturing. How agile and six sigma differs? Explain the steps to become agile by an ordinary firm	14
12	What are the principles of Lean Manufacturing.	8
13	Compare conventional manufacturing with Lean manufacturing	4
Q.No	**Module V**	**Marks**
1	Enumerate ERP implementation stages.	3
2	With the aid of a block diagram, explain the construction and working of ERP framework.	3
3	Describe ERP related technology	3
4	State the evolution of ERP.	3
5	What is Online Analytical Processing?	3
6	With the aid of a block diagram, explain the construction and working of ERP framework.	7
7	Explain the differences between ‘Business Engineering’ and ‘Business Process Reengineering	7
8	List any six benefits of ERP implementation.	3
9	What do you understand by Customer Relationship Management (CRM)?	3
10	What is ERP? List any seven benefits of ERP implementation?	7
11	Explain the concept of ‘Business Intelligence’.	3

12	Explain OLAP. Explain any one practical application of OLAP by choosing and illustrating any one suitable business	7
13	Describe the concept of supply chain management, with the help of a practical example. Draw a neat sketch of the supply chain network of that example.	7
14	What are the emerging trends in ERP?	5
15	What are the myths about ERP?	4

CODE MET307	COURSE NAME: MACHINE TOOLS AND METROLOGY	Credit: 4
Q.No	**Module I**	**Marks**
1	What are the use of face plate and angle plate in a lathe?	3
2	What is trepanning? Explain with a sketch.	3
3	Calculate the power required for cutting a steel rod of 50mm in diameter at 200rpm Assume cutting force of 160 kgf	3
4	Define “Side relief” and “End relief” angle.	3
5	Define cutting ratio of the shaper	3
6	Define lapping	3
7	Define machineability of metal.	3
8	Define the cutting speed, feed and machining time for drilling	3
9	Define the orthogonal and oblique cutting.	3
10	Explain the nose radius?	3
11	Give the specification of a lathe	3
12	How are boring machines classified?	3
13	How do you define tool life?	3
14	How does the process of shaping differ from planing?	3
15	What are all conditions for using positive rake angle?	3
16	What are the advantages of automatic lathes?	3
17	What are the advantages of using a collect chuck?	3
18	What are the different types of lathe machines?	3
19	What are the different types on Lathe oprations	3
20	What are the favorable factors for continuous chip formation?	3
21	What are the favorable factors for discontinuous chip formation?	3
22	What are the functions of feed rod and lead screw?	3
23	What are the important characteristics of materials used for cutting tools?	3
24	What are the parts of a lathe machine?	3
25	What are the uses of shaping machine?	3
26	What do you know about straight fluted drill and fluted drill?	3
27	What does reaming mean in drilling?	3
28	What is a lathe machine?	3
29	What is an apron?	3
30	What is counter boring in drilling?	3
31	What is Lathe machine application?	3
32	What is meant by “swing of the lathe”?	3
33	What is shear plane?	3
34	What is single spindle automatic lathe?	3
35	What is Swiss type automat?	3
36	What is the effect of back rack angle and mention the types?	3

37	What is the purpose of a mandrel? How many types of mandrels is there in common use?	3
38	What Metal Cutting ?	3
39	Which mechanism is used in slotting machine?	3
40	Why is it essential that the cutting point of the tool should be level with the spindle center while machining taper on a work piece?	3
41	Why reaming operation is performed?	3
42	Why was power chucks developed?	3
43	Differentiate semi-automatic and automatic lathe	7
44	Distinguish between Capstan lathe and Turret lathe	7
45	Draw a drill signature, name the important angles and explain their each function and explain planning of guide gibs	7
46	Explain the following parts of lathe? (a) Lathe bed (b) Carriage	7
47	How lathe machine works?	7
48	List any four methods by which taper turning is done in a center lathe	7
49	List out the various types of lathe	7
50	Mention four different types of chucks used in a machine shop	7
51	Mention the differences between shaper and planer	7
52	Mention the operations performed by a planner	7
53	Name any four work holding devices in shaper	7
54	State the differences between a vertical shaper and slotters	7
55	What are the specifications of the Lathe machine?	7
56	What are the types of boring machines?	7
57	What are the various mechanisms are used for a automatic feeding in lathes?	7
58	What are the various thread cutting methods?	7
59	What is called carrier plate and lathe dog?	7
60	What is chip and mention its different types?	7
61	What is the difference between a lathe and a milling machine?	7
62	What is the difference between a shaper machine and a planer machine?	7
63	What is the difference between capstan and turret lathe?	7
64	What is the difference between drilling and boring?	7
65	What is the difference between shaper and planner?	7
66	What is the difference between tapping and drilling?	7
67	What is tool signature?	7
68	Write the advantages of automat over conventional lathes	7
69	Write the differences between drilling and tapping	7
70	Draw a sketch of a crank shaper, mark the important parts and explain their functions. Explain how the quick return mechanism works.	14
71	What are the attachments used on a center lathe and what purpose do they serve	14
72	How is feeding done on a shaping machine?	
Q.No	**Module II**	**Marks**

1	Briefly describe the importance of quill mechanism	3
2	Define Climb milling	3
3	Define conventional milling	3
4	Define milling cutter	3
5	How do you classify milling cutters?	3
6	How many types of milling operations are there?	3
7	List out the various milling operations	3
8	Name different types of Knee and Column type milling machines	3
9	Name different types of production milling machines	3
10	Name principal parts of knee and column type milling machine	3
11	Name the materials used for milling cutters	3
12	What are the differences between drilling and reaming?	3
13	What are the limitations of a milling machine?	3
14	What do you mean by differential indexing?	3
15	What do you understand by Gang milling?	3
16	What is a planer type milling machine?	3
17	What is a shell mill?	3
18	What is a side milling cutter?	3
19	What is a universal milling machine?	3
20	What is plain milling cutter?	3
21	What is straddle milling?	3
22	What is the difference between up milling and down milling?	3
23	What is the function of a milling machine?	3
24	What materials can be milled?	3
25	Why is milling a versatile machining process?	3
26	What's the difference between grinding wheel dressing and truing	7
27	With a sketch, show the rake angle of the milling cutter and chip breaker.	7
28	Differentiate conventional and climb milling?	7
29	Explain in detail with neat sketches of a) Slot and groove milling, b) profile milling c) thread milling	7
30	Explain the principle of working of a centreless grinding machine	7
31	What are ‘Through Feed’, ‘In Feed’, and ‘End Feed’ in centreless grinding operations?	7
32	What are the parts of milling machine?	7
33	What is milling machine and its types?	7
34	What is the need of better surface finish and how honing, lapping and burnishing process are different in its features and roughness obtainable, explain with sketches	7
35	What is the working principle of milling machine?	7
Q.No	**Module III**	**Marks**
1	Define gear shaving	3
2	For which of the following operations, broaching can be used?	3

3	Give any three differences between gear bobbing and gear milling?	3
4	List four applications of broaching machines	3
5	State the principle involved in gear shaping?	3
6	What are the advantages of gear hobbing?	3
7	What are the principal types of broaching machines?	3
8	What are the types of gear?	3
9	What are the various methods of shaping the gear blank?	3
10	What is broaching?	3
11	What is gear finishing? Why it is done?	3
12	Why broaching process is long and laborious?	3
13	Why chip breakers are provided on the broach?	3
14	Why neck section provided in the pull type broaches are made shorter in diameter?	3
15	Why push type broaches are made shorter in length?	3
16	Write the advantages of gear shaping (Generating)?	3
17	What is the principle of Gear shaping? Explain.	7
18	Write a note on gear errors.	7
19	Explain axial hobbing process?	7
20	What are the various methods used for measuring the gear tooth thickness?	7
21	What is the main advantage of broaching over shaping process?	7
22	Why are gear finishing processes required? Write down the advantages and limitations of gear shaving and gear lapping process with neat sketches.	7
23	Describe the different methods of manufacturing various types of gears i. Performing ii. Producing gear teeth by machining iii. Finishing gear teeth	14
Q.No	**Module IV**	**Marks**
1	Differentiate between precision and accuracy.	3
2	Explain the process of wringing of slip gauges.	3
3	Define error	3
4	Distinguish between static and random error?	3
5	Explain Taylor principle in gauge design	3
6	Explain the concept of interchangeability?	3
7	Explain the concept of selective assembly?	3
8	Explain the construction and working principle of Limit Gauge with sketch	3
9	Explain the need of angle gauges	3
10	How flatness is tested?	3
11	How is Sine bar calculated?	3
12	List different types of fits?	3
13	Name any two materials commonly used for gauges	3
14	What are clearance fits?	3
15	What are fits?	3
16	What are limit gauges?	3

17	What are the factors affecting the accuracy of the measuring system?	3
18	What are the instruments used for measurement?	3
19	What are the three types of fits?	3
20	What are the types of mechanical gauges?	3
21	What are the various possible sources of errors in measurements? What do you understand by systematic error and random errors?	3
22	What is meant by angular measurement?	3
23	What is meant by limits and fits?	3
24	Why do slip gauges stick together?	3
25	Why is a sine bar not suitable for measuring angle above 45?	3
26	Why is an allowance different from a tolerance?	3
27	Write short note on “Systematic errors”	3
28	Write short notes on the classification of error	3
29	Determine limit dimensions for a clearance fit between mating parts of diameter 40 mm, providing a minimum clearance of 0.10 mm with a tolerance on the hole equal to 0.025mm and on shaft 0.05mm using both systems	7
30	Discuss all the principles of achieving accuracy. Explain all types of errors.	7
31	What are slip gauges used for?	7
32	What are the 3 types of tolerances?	7
33	What is difference between allowance and clearance?	7
34	What is difference between tolerance and allowance?	7
Q.No	**Module V**	**Marks**
1	Write the importance of cut off length in surface roughness measurement	3
2	Define the effective diameter of thread	3
3	Explain drunken error in screw threads	3
4	Explain Tomlinson surface meter	3
5	List any four possible causes of error in CMM	3
6	List some of the applications of laser interferometer	3
7	Mention the disadvantages of CMM	3
8	Name the two corrections to be applied for the measurement of effective diameter	3
9	Name the type of accuracy specifications used for CMM	3
10	Name the various types of pitch errors found in screw	3
11	What are the advantages of laser interferometer?	3
12	What are the applications of the collimator?	3
13	What are the errors in screw threads?	3
14	What are the measurement of effective diameter	3
15	What is angle of thread	3
16	What is meant by “Best size wire” in screw thread measurement?	3
17	what is Rz value?	3
18	Explain the principle of measurement by light wave interference method.	7
19	Define Interferometers?	7

20	Define screw thread micrometer?	7
21	Define the following terms in surface texture measurements: - (i) Primary Texture.(ii) Secondary Texture.(iii) Lay(iv) Sampling Length	7
22	Describe a method to find out flatness of a surface plate	7
23	Describe the method of evaluating roughness using (i) Peak to valley high method (ii) C.L.A. method.	7
24	Discuss the application of computer aided inspection	7
25	Discuss the different types of probes used in CMM	7
26	Explain the construction and principle of CMM	7
27	Explain the different types of interferometer?	7
28	Explain the various steps in the machine vision system	7
29	How straightness, flatness and roundness are measured	7
30	Name the various method of measuring the minor diameter of the thread	7
31	State the application of CMM in machine tool metrology	7
32	What are the types of CMM?	7
33	What is a Function of Tool maker's microscope?	7
34	What is an application of Tool maker's microscope?	7
35	What is an optical projector?	7
36	What is CMM?	7
37	What is collimators?	7
38	what is profile thread gauges?	7
39	what is r.m.s value?	7
40	what is thread pitch diameter	7
41	what is Tool maker's microscope	7
42	With a neat sketch explain Johansson Mikrokator	7
43	Explain the construction and working principle of AC laser interferometer	14
44	Explain the construction and working principle of Tomlinson surface meter with neat diagram	14
45	How are CMMs classified with respect to constructional features? Sketch andstate their main applications, merits and demerits	14
46	With a neat sketch explain the working of an autocollimator with neat diagram?	14

CODE HUT300	COURSE NAME: INDUSTRIAL ECONOMICS AND FOREIGN TRADE	Credit: 3
Q.No	**Module I**	**Marks**
1	What is Industrial Economics ?	3
2	Why does an economic problem arise ?	3
3	What are the basic economic problems ?	3
4	Explain Production possibility curve?	3
5	Explain consumer equilibrium ?	3
6	What should be percentage change in price a product if the sale is to be increased by 50% and its price elasticity of demand is 2. ?	3
7	Demand function of a product is given as D = 50-2p and supply function S + 20 + 3p. What will be the equilibrium price and quantity of the product.	3
8	Explain consumer surplus?	3
9	Explain producer surplus?	3
10	. Explain Dead weight loss.	3
11	Difference between micro and macroeconomics?	3
12	What are the merits and demerits of Joint stock companies?	7
13	A consumer purchases 50 units of commodity when its price is Rs.8/- per unit. In the next month he purchased 60 units at the same price. this was due to an increase in the price of another commodity y from Rs.10to 12. Calculate cross elasticity of demand and interpret the result.	7
14	Explain the concepts consumer surplus and producer surplus.	7
15	Suppose the govt. imposes a tax on a commodity where the tax burden is met by the consumers. Draw diagram and explain dead weight loss. Mark consumer surplus, producer surplus, tax revenue and dead weight loss in the diagram	7
16	Prepare a utility schedule showing units of consumption, total utility and marginal utility. Point out any three limitation of the law	7
17	How is elasticity of demand measured according to the percentage method? How is the measurement of elasticity of demand useful for the government.	7
18	Define the cross elasticity of demand a tea manufacturing company was able to sell 800kg of the price of coffee was Rs 70 per kg. Later they were able to sell 9000 kg when the price of coffee became Rs80 per kg. Calculate the cross elasticity of demand for tea. Are the commodities substitute or complimentary?	7
19	Define price elasticity of demand. A company producing soft drink is selling its product for Rs.22. It sells 1000 units, and then increases the price to Rs.24. Now sales fall to 900 units. What is the price elasticity of soft drink? Is the demand elastic or inelastic? Why?	7
20	With the help of diagram explain Deadweight loss	7
Q.No	**Module II**	**Marks**
1	In the production function $\theta = 2L^{1/2} K^{1/2}$ If L + 36 how many units of capital one needed to produce 60 units of output.	3
2	In the short run AVC <P <AC. Will the firm produce or shut down ? Give reason ?	3
3	Explain Returns to scale OR Long run production function	3
4	Define Isoquants	3
5	Explain Isocost line	3
6	Explain Expansion path	3
7	Explain Cobb-Douglas production function	3
8	Differentiate explicit cost and implicit cost	3
9	Explain Sunk cost	3
10	Explain Profit Volume Ratio. (PV Ratio)	3
11	Explain shut down point in the short run	3

12	What is margin of safety? What happens when margin of safety is low ?	7
13	Explain Profit Volume Ratio. (PV Ratio)	3
14	Explain shutdown point with the help of diagram	7
15	What are internal and external economics of scale.	7
16	Suppose monthly fixed cost of a firm is Rs.40000 and its monthly total variable cost is Rs. 60000. i. If the monthly sales is Rs.120000 estimate contribution and break even sales. ii. If the firm wants to get a monthly profit of Rs.40000 what should be the sales? iii. The total cost function of a firm is given as TC=100+50θ- θ2+ θ3. Find marginal cost when output equals 5 units.	7
17	Explain Law of variable Proportions with a diagram.	7
18	Explain marginal Revenue and Average Revenue in perfect competition and imperfect competition with graph	7
19	Define isoquant curve. Explain properties of isoquant curve.	7
20	The total sales of a manufacturing firm are Rs.20000 in this year. Its variable costs one Rs. 8000 where its fixed costs are Rs.6000 for that year. Find out the break-even point of this firm.	7
21	What are the advantages of large-scale production? Explain producer equilibrium with the help of a diagram.	7
22	Explain producer equilibrium with the help of isoquants and is cost line. What is expansion path.	7
Q.No	**Module III**	**Marks**
1	What is collusive oligopoly?	3
2	What is non-price competition under Oligopoly ?	3
3	What is collusive oligopoly?	3
4	What is non-price competition under Oligopoly ?	3
5	What is Predatory pricing?	3
6	. What is Price skimming?	3
7	Give examples of non-price competition under oligopoly?	3
8	Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.	3
9	Make comparison between monopoly and perfect competition.	3
10	Explain Price rigidity under oligopoly with the help of kinked demand curve.	7
11	With the help of a diagram explain equilibrium under monopolistic competition.	7
12	Distinguish between monopoly and Oligopoly.	7
13	Explain linked demand curve model.	7
14	What are the features of Monopolistic competition?	7
15	Explain the equilibrium of a firm earning super normal profit under monopolistic competition.	7
Q.No	**Module IV**	**Marks**
1	What are important economic activities under primary	3
2	Explain the GNP Deflator.	3
3	Explain demand pull inflation	3
4	Explain cost push inflation.	3
5	Distinguish between a bond and a share?	3
6	Distinguish between NSE and BSE	3
7	Distinguish between NIFTY and SENSEX	3
8	Distinguish between Demat Account and Trading Account	3
9	GDP of a country = 1500 crores, Depreciation =150 Crores NFIA= 50 crores. Estimate GNP,NDP and NNP	7

10	Distinguish between money market and capital market ?	7
11	Give examples of non-price competition under oligopoly?	7
12	Explain the equilibrium of a firm earning supernormal profit under monopolistic competition.	7
13	Explain Price rigidity under oligopoly with the help of linked demand curve.	7
14	Make comparison between monopoly and perfect competition.	7
15	Distinguish between monopoly and Oligopoly.	7
16	With the help of a diagram explain equilibrium under monopolistic competition.	7
17	Explain linked demand curve model.	7
18	What are the different types of Non-price competition under oligopoly	7
19	What are the features of Monopolistic competition?	7
20	Explain the equilibrium of a firm earning super normal profit under monopolistic competition.	7
Q.No	**Module V**	**Marks**
1	What is free trade?	3
2	What is Devaluation?	3
3	Explain the J-curve effect?	3
4	Suppose the sum of elasticity of export and import is less than one. What will be the effect of devaluation?	3
5	What are the merits of quota restrictions?	
6	Explain Marshall- Learner condition.	3
7	How is National income estimated under Product method and expenditure method	3
8	What are the monetary and fiscal policy measures to control inflation?	3
9	What is international trade? List out the advantages of foreign trade ?	3
10	What is SENSEX and NIFTY?	7
11	Estimate GDPmp. GNPmp and National income. Private consumption expenditure - 2000 (in 000 crores) Govt. Consumption - 500 NFIA - (300) Investment - 800 Net Export - 700 Depreciation - 400 Net internal tax - 300	7
12	From the given below estimate Gross National Product, Net National Product and National Income. GDP - 5000 (in 100 billion) NFIA - 50 Indnet - 70 Subsidies- 20 Depreciation- 30 Explain comparative cost advantage	7
13	From the data given below estimate the NDP using Item Rs Consumption Expenditure 3000 Investment Expenditure 2000 Govt. Expenditure 700 Exports 600 Imports 300 Intermediate consumption 2000 Wages and Salaries 2000 Rent 500 Interest 500 Profit 1000	7
14	Income method and expenditure method.	7

15	What are the arguments in favour of free trade?	7
16	What are the tariff barriers? Explain its impact on the economy.	7
17	Explain absolute advantages theory with the help of an example	7
18	What are the advantages of foreign trade?	7

CODE: MCN301	COURSE NAME: **Disaster Management**	Credit: 3
Q.No	**Module I**	**Marks**
1	What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?	7
2	What are disasters? What are their causes?	7
3	Explain the different types of cyclones and the mechanism of their formation	7
4	Explain with examples, the difference between hazard and risk in the context of disaster management	7
5	Explain the following terms in the context of disaster management (a) exposure (b)resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment	14
6	Explain the differences between hazards and disasters	3
7	Write short note on green house effect	3
8	Define the terms : disaster prevention,disater mitigation,disaster preparedess.	**7**
9	Explain about various layers of atmosphere based on temperature variation.	**7**
10	Explain about ozone layer.what are the major constitutents that causes ozone layer depletion.	**7**
11	Define the term monsoon.briefly explain about the classifcation of Indian monsoon.	**7**
Q.No	**Module II**	**Marks**
1	What is hazard mapping? What are its objectives?	7
2	What is participatory hazard mapping? How is it conducted? What are its advantages?	7
3	Explain the applications of hazard maps	7
4	Explain the types of vulnerabilities and the approaches to assess them	7
5	Define the terms risk,vulnerability and crisis	3
6	Write short note on vulnerabiliy assesment	7
7	Explain about various methods of Representing Vulnerability	7
8	Explain the term disaster risk assesmet.what are the main components in disaster risk assesment.	7
9	Define the term hazard.list out the major types of hazards with brief explanation.	7
10	Explain about hazard Mapping Using Geographic Information System (GIS)	
Q.No	**Module III**	**Marks**
1	Explain briefly the concept of ‘disaster risk’	7
2	List the strategies for disaster risk management ‘before’, ‘during’ and ‘after’ a disaster	7
3	What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy	7
4	Explain about the core elements in disaster management cycle	7
5	Write short note on the term disaster risk reduction (DRR).	7
6	Explain about the types of disaster responses	7
7	What are the steps to effective disaster communication?	7
8	Explain about various types of Disaster Preparedness.	7
9	What are the requirements for an effective response.	3
10	Explain about the objectives of disaster response.	3
Q.No	**Module IV**	**Marks**
1	What is disaster prevention? Distinguish it from disaster mitigation giving examples	7
2	What are the steps to effective disaster communication? What are the barriers to communication?	7
3	Explain capacity building in the context of disaster management	7
4	Briefly explain the levels of stakeholder participation in the context of disaster risk reduction	7
5	Explain the importance of communication in disaster management	3
6	How are stakeholders in disaster management identified?	7
7	What are the effective Ways of Promoting Stakeholder Participation in DRR ?	7
8	Benefits and Cost of Stakeholder participation in DRR	7
9	Explain about various disaster communication methods	7
10	Define the term crisis.alsom explain about the four stages of crisis reaction.	7
Q.No	**Module V**	**Marks**
1	Briefly explain the levels of stakeholder participation in the context of disaster risk reduction	7
2	Explain the importance of communication in disaster management	7

3	Explain the benefits and costs of stakeholder participation in disaster management	7
4	How are stakeholders in disaster management identified?	3
5	Explain the salient features of the National Policy on Disaster Management in India	7
6	Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction	7
7	What are Tsunamis? How are they caused?	7
8	Explain the earthquake zonation of India	3
9	Suggest suitable methods to prevent landslides in Kerala	3
10	Explain about the major epidemics in India.	7