G 2085 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2010

Fourth Semester

ENGINEERING MATHEMATICS—III (CMELRPTANUS)

(Common for all Branches)

[2008 admissions—Regular/2007 admissions—Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Answer **one** *full question from each module.*
Statistical tables permitted.

Module 1

I. (a) Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + y = \sin 4x \sin 2x$. (7 marks)

(b) Solve $\left(D^2 - 2D + 1\right) y = e^{-2x} \cos 2x + \left(2x^2 + 1\right) e^x$. (7 marks)

(c) Solve $x^2y'' + 5xy' + 4y = \cos(2 \log x)$. (6 marks)

Or

II. (a) Solve $\left(D^2 + 1\right) y = \left(x^2 - 1\right) \cos 2x$. (7 marks)

(b) Solve by the method of variation of parameters $y'' + y = \text{cosec } x$. (6 marks)

(c) Solve the system of simultaneous linear equations

$$(5D + 4)x - (2D + 1)y = e^{-t}$$
$$(D + 8)x - 3y = 5e^{-t}$$

where $D = d/dt$. (7 marks)

Module 2

III. (a) Form the partial differential equation from $z = (x - a)^2 + (y - b)^2$. (6 marks)

(b) Solve $\left(x^2 - y^2 - z^2\right) p + 2xyq = 2xz$. (7 marks)

(c) Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \sin x \cos 2y$. (7 marks)

Or

Turn over

IV. (a) Solve $\left(p^2+q^2\right)y = qz$. (6 marks)

(b) Solve $\frac{\partial^3 z}{\partial x^3} - 3\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^3 z}{\partial y^3} = e^{x+2y}$. (7 marks)

(c) Find the solution of the one-dimensional wave equation using the method of separation of variables. (7 marks)

Module 3

V. (a) Express $f(x) = \begin{cases} 1, & \text{for } 0 \le x \le \pi \\ 0, & \text{for } x > \pi \end{cases}$ as a Fourier sine integral and hence evaluate $\int_0^\infty \frac{1-\cos(\pi\lambda)}{\lambda} \sin(\lambda x)\, d\lambda$. (10 marks)

(b) Find the Fourier cosine transform of $f(x) = \frac{1}{\left(1+x^2\right)}$ and hence derive the Fourier sine transform of $\phi(x) = \frac{x}{\left(1+x^2\right)}$. (10 marks)

Or

VI. (a) Find the Fourier transform of $f(x) = \begin{cases} 1-x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$ and hence evaluate $\int_0^\infty \left\{\frac{x\cos x - \sin x}{x^3}\right\} \cos\left(\frac{x}{2}\right) dx$. (8 marks)

(b) Find the Fourier sine transform of $\frac{1}{x\left(x^2+a^2\right)}$. (6 marks)

(c) Find the Fourier cosine transform of $e^{-x^2/2}$. (6 marks)

Module 4

VII. (a) Define binomial distribution. Find the mean and variance of the binomial distribution. (10 marks)

(b) In a normal distribution 7 % of the items are under 35 and 10 % of the items are above 55. Find the mean and variance of the distribution. (10 marks)

Or

VIII. (a) The probability that a pen manufactured by a company will be defective is 0.15. A random sample of 10 pens are chosen. What is the probability that in the sample (i) not more than one is defective ; (ii) at least 7 are good ; and (iii) all are good. (10 marks)

(b) Fit a Poisson distribution for the following data and hence calculate the theoretical frequencies:—

x :	0	1	2	3	4	5
f :	142	156	69	27	5	1

(10 marks)

Module 5

IX. (a) A normal population has a mean 0.1 and S.D. 2.1. Find the probability that the mean of a sample of size 900 will be negative. (10 marks)

(b) A random sample of size 18 is taken from a normal population with mean 28 and variance 49. Find the probability that the sample variance S^2 will be less than the population variance. (10 marks)

Or

X. (a) In a random sample of size 500, the mean is found to be 20. In another independent sample of size 400, the mean is 15. Could the samples have been drawn from the same population with S.D. 4. (10 marks)

(b) In a large city A, 20 % of a random sample of 900 school boys had a slight physical defect. In another city B 18.5 % of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant. (10 marks)

[5 × 20 = 100 marks]

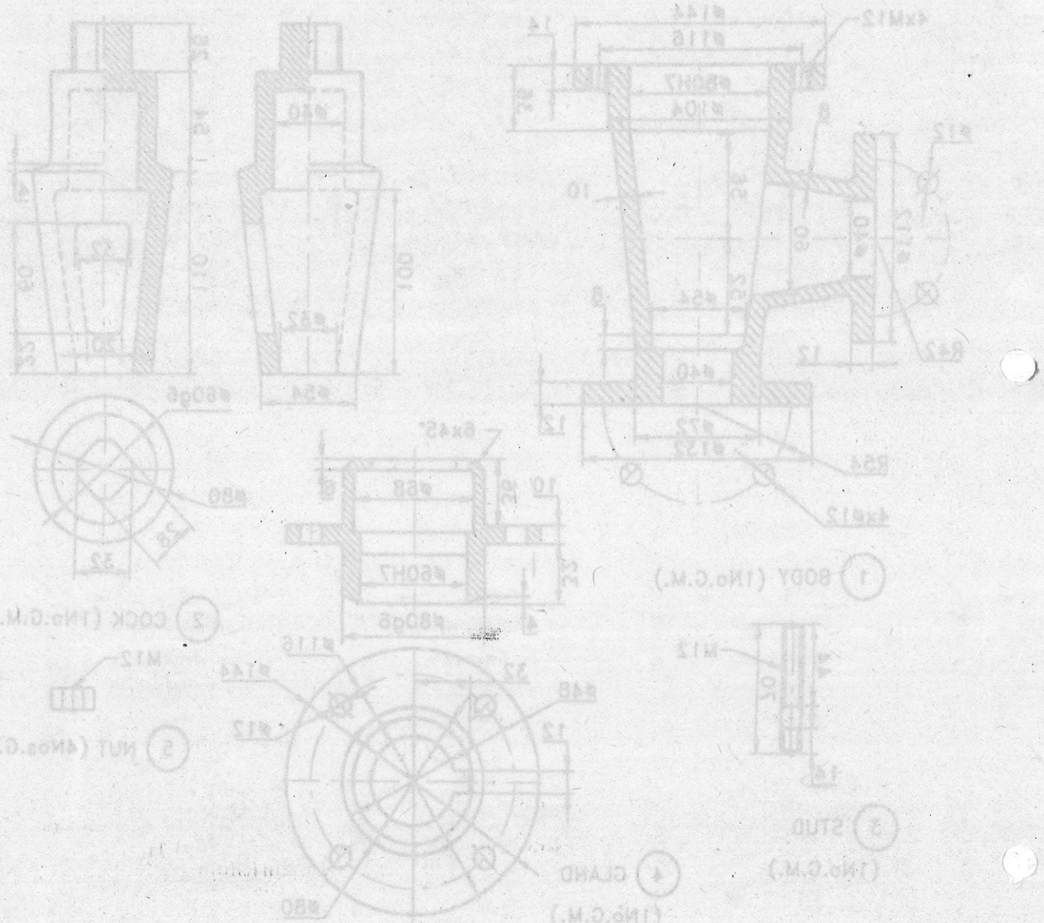

Fig. 2

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B.TECH. DEGREE EXAMINATION, MAY 2010

Fourth Semester

Branch : Mechanical Engineering

MACHINE DRAWING—II

(2008 admissions—Regular/2007 admissions—Improvement/Supplementary)

Time : Four Hours Maximum : 100 Marks

Answer **all** *questions.*

Missing data, if any, may be suitably assumed.

1. Fig.1 shows (on page 2) the component details of a four jaw chuck of a lathe. Assemble the components and prepare :

   (i) A top half sectional elevation. (20 marks)

   (ii) An end view from the tail stock side. (20 marks)

2. Fig. 2 shows (on page 3) the component details of a blow-off-cock. Assemble the components and prepare :

   (i) A right half sectional elevation. (40 marks)

   (ii) Full plan. (20 marks)

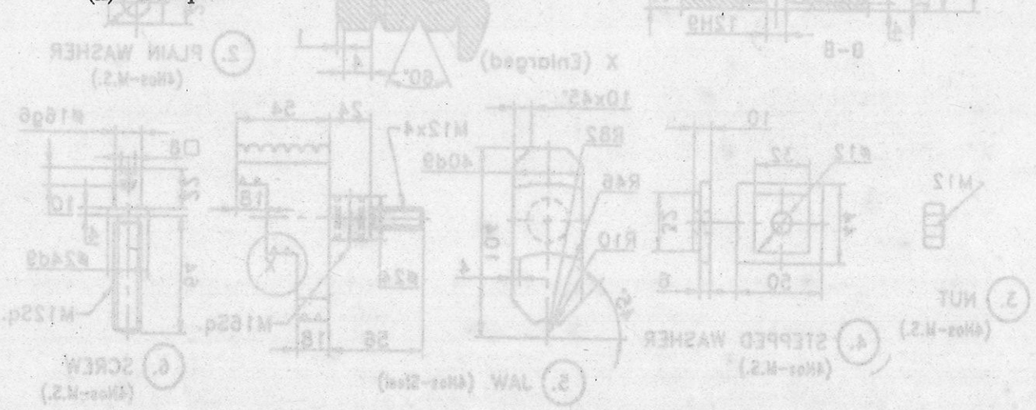

Fig. 1

Turn over

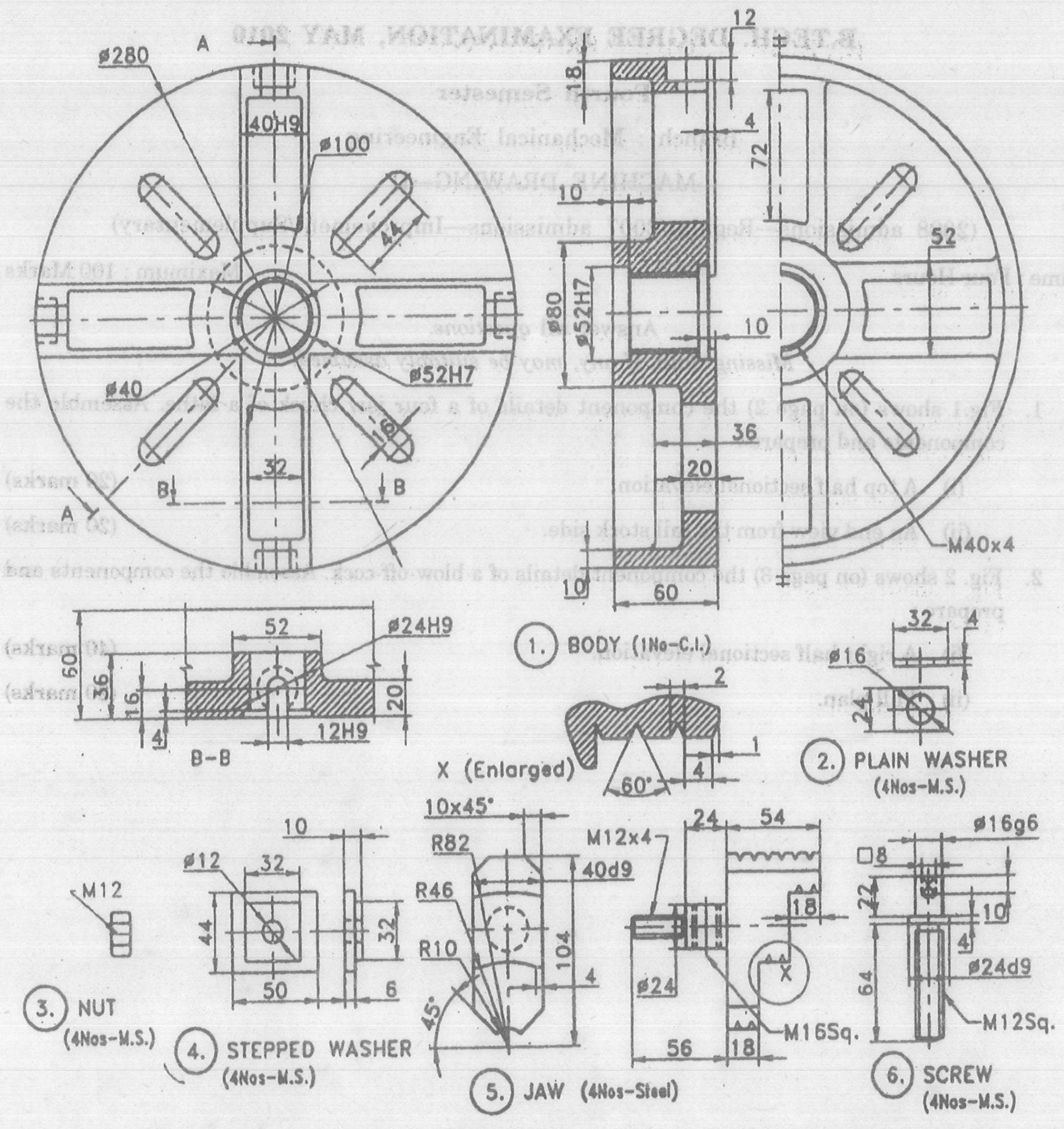
1. BODY (1No-C.I.)
2. PLAIN WASHER (4Nos-M.S.)
3. NUT (4Nos-M.S.)
4. STEPPED WASHER (4Nos-M.S.)
5. JAW (4Nos-Steel)
6. SCREW (4Nos-M.S.)
X (Enlarged)
B-B
M40x4
M12x4
M16Sq.
M12Sq.

fig 1

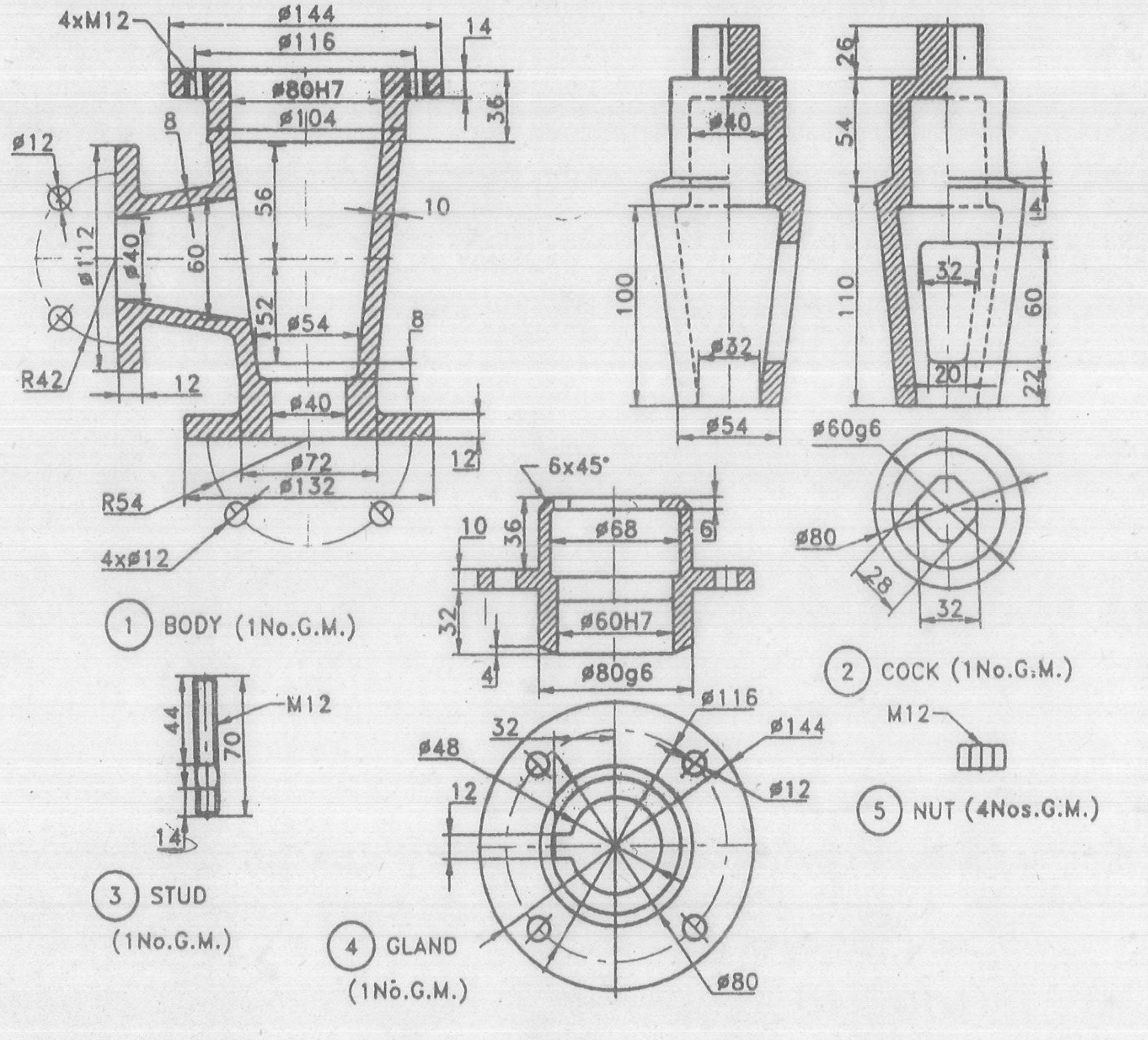
1 BODY (1No.G.M.)
2 COCK (1No.G.M.)
3 STUD (1No.G.M.)
4 GLAND (1No.G.M.)
5 NUT (4Nos.G.M.)
4xM12
4xø12
M12

fig 2

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B.TECH. DEGREE EXAMINATION, MAY 2010

Fourth Semester

Branch : Mechanical Engineering

HYDRAULIC MACHINES (M)

(2008 admissions—Regular/2007 admissions—Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Define dynamic force. How is it distinguished from Hydrostatic Pressure ?
2. What are the limitations of dimensional analysis ?
3. Explain the constructional features of Pelton wheel.
4. What are the functions of a draft tube ?
5. What are the functions of volute casing of a centrifugal pump ?
6. What is meant by Net Positive Suction Head ? What is its significance ?
7. What is "resonance" in reciprocating pumps ? How is it avoided ?
8. What are the factors affecting cavitation in pumps and turbines ?
9. Explain the working of a Gear Pump.
10. Sketch and explain the working of a hydraulic lift.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. A jet of water 5 cm in diameter is moving at 15m/sec. It strikes a flat plate which is inclined at 30° to the jet. Find the force on the plate in the direction of the jet, when :

    (a) The plate is stationary.

    (b) The plate is moving at 3m/s in the direction of jet.

(12 marks)

Or

Turn over

12. Discuss the various dimensionless groups in fluid mechanics and fluid machinery. Under what circumstances is each of these groups important.

(12 marks)

13. The mean bucket speed of a Pelton turbine is 14 m/s. The rate of flow of water supplied by the jet under a head of 45 m is 800 lit/sec. If the jet is deflected by the buckets at an angle of 165° find the HP and the efficiency of turbine.

(12 marks)

Or

14. (a) What is meant by cavitation ? How and when does it occurs in water Power plants ?

(b) Describe some methods to avoid cavitation in water turbines.

(c) Sketch and name the different types of draft tubes and state which one of them give the maximum efficiency.

(12 marks)

15. (a) Define specific speed of a Centrifugal Pump and derive an equation for the same.

(b) Explain with sketches the working of a single-stage centrifugal pump.

(12 marks)

Or

16. A Centrifugal Pump having a overall efficiency of 75% delivers 1820 litres of water per minute to a height of 18 m through a pipe of 10 cm diameter and 90 metres length. If f = 0.012, calculate the HP to drive the pump.

(12 marks)

17. Describe with the help of indicator diagrams how the acceleration and friction in suction and delivery pipes effect the work done by a reciprocating pump.

(12 marks)

Or

18. A single acting reciprocating pump has a cylinder bore of 15 cm and stroke of 22.5 cm. The suction pipe is 11.25 cm in diameter and 20 m long. Assuming no air vessel is fitted on the suction side of the Pump, find the maximum permissible suction lift if the pump speed is 30 r.p.m.

(12 marks)

19. (a) Explain with the help of a neat sketch, the principle and working of a hydraulic intensifier.

(b) Explain the working of Vane pump.

(12 marks)

Or

20. (a) Explain different hydraulic symbols used in hydraulic circuits.

(b) Sketch and explain radial piston pump.

(12 marks)

[5 × 12 = 60 marks]

G 2087 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2010

Fourth Semester

Branch : Mechanical Engineering

THEORY OF MACHINES—I (M)

[2008 admissions—Regular/2007 admissions—Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 4 *marks.*

1. Explain the principle of Whitworth quick return motion mechanism.
2. Explain the principle of elliptical trammels.
3. Explain the synthesis of four bar mechanism.
4. What do you mean by dimensional synthesis ? Explain.
5. Explain the principle of Pantograph.
6. Briefly explain any two approximate straight line mechanisms.
7. Explain the principle of differential band brake.
8. Explain the principle of internal expanding brake.
9. Explain interference in Gears.
10. Derive the condition for minimum number of teeth on the pinion in order to avoid interference.

(10 × 4 = 40 marks)

Part B

Answer **all** *questions.*

Each question carries 12 *marks.*

11. In a crank and slotted lever quick return motion mechanism, the distance between fixed centres is 240 mm. and the length of the driving crank is 120 mm. Find the inclination of the slotted bar with the vertical in the extreme position and the time ratio of cutting stroke to the return stroke. If the length of the slotted bar is 450 mm., find the length of the stroke if the line of stroke passes through the extreme positions of the free end of the lever.

Or

12. In a slider crank mechanism, the crank is 480 mm. long and rotates at 20 rad/s. in counterclock wise direction. The length of the connecting rod is 1.6 m. When the crank turns 60° from inner dead centre, determine :

    (i) Velocity of the slider.

    (ii) Velocity of a point E located at a distance 450 mm. on the connecting rod extended.

Turn over

(iii) Position and velocity of a point F on the connecting rod having the least absolute velocity.

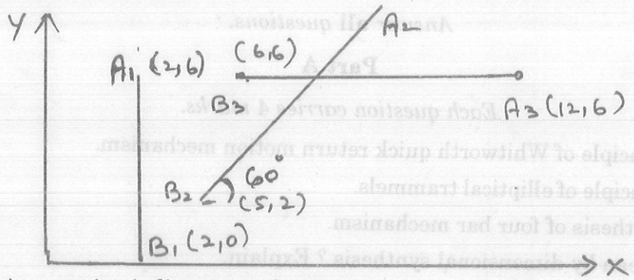
(iv) Angular velocity of the connecting rod.

(v) Velocities of rubbing at the pins of the crank shaft, crank and cross head having diameters 80, 60 and 100 mm. respectively.

13. Determine the proportions of four bar mechanism by using three precision points to generate $y = x^{1.5}$, where x varies between 1 and 4. Assume $\theta_s = 30°$, $\Delta\theta = 90°$, $\Delta\phi = 90°$ and $\phi_s = 90°$. The length of the fixed link is 25 mm.

Or

14. Synthesize a four bar mechanism to guide a rod AB through three consecutive positions A_1B_1, A_2B_2 and A_3B_3 as shown in figure :



15. Explain the various engine indicator mechanisms.

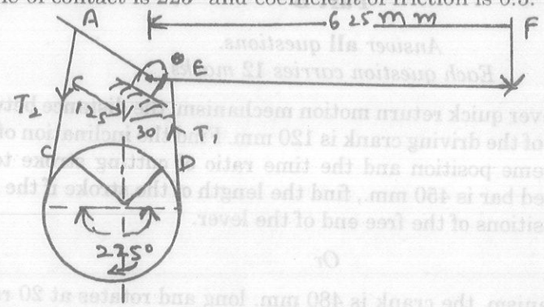
Or

16. Explain with neat sketches :

(i) Davis steering gear.

(ii) Ackerman steering gear.

17. Figure shows the layout of a band brake applied to the brake drum of a hoist, where the braking force F is applied at one end of the lever which is pivoted on a fixed fulcrum O. The drum diameter is 1 m., the angle of contact is 225° and coefficient of friction is 0.3.



Calculate the effort F to give a braking torque of 4000 Nm if the drum is rotating (a) in clockwise direction ; (b) in counter clockwise direction. Also give your comment on the answer.

Or

18. A band brake acts on the 3/4th of the circumference of a drum of 450 mm. diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm. from the fulcrum. If the operating force is applied at 500 mm. from the fulcrum and the coefficient of friction is 0.25, find the operating force when the drum rotates in the (a) clockwise direction and (ii) anticlockwise direction.

19. A pair of gears having 20° involute teeth is required to transmit motion at a velocity ratio of 1 : 4. If the module of both pinion and gear is 5 mm. and centre distance is 250 mm., determine the number of teeth and base circle radius of pinion and gear.

Or

20. A pair of spur gear having 20 and 40 teeth are in mesh. The pinion being driving element rotates at 2000 r.p.m. Find the sliding velocity between teeth faces (i) At the point of engagement ; (ii) At the pitch point ; and (iii) At the point of disengagement. Assume the gear teeth are of 20° involute form. Addendum is 5 mm. and module is 5 mm. Find also the angle through which pinion turns while one pair of teeth is in contact.

(5 × 12 = 60 marks)