Total No. of Printed Pages:02

SUBJECT CODE NO:- H-133
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech/Prod)
Thermodynamics -II
(REVISED)

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

Please check whether you have got the right question paper.

N.B
1) Solve any three questions from each section.
2) Use of steam table, molliers diagram allowed.
3) Assume suitable data, if required.

Section A

Q.1 a) Discuss construction & working of Lancashire Boiler. 05

b) A Lancashire Boiler fitted with a super heater generates 1800 ka of steam per hour at a pressure of 10 bar and 250ºC form feed water at 90ºC. The calorific value of coal is 26,000 Kj/Kg. Calculate if coal burnt= 200 Kg/hr. 08
i) Equivalent evaporation from and at 100ºC.
ii) The thermal efficiency of the Boiler.

Q.2 a) Explain with neat sketch, working of Velox Boiler. 07

b) Determine the quantity of air required per kg of coal burnt in boiler fitted with 32 metres high stack draught produced is 18.5 mm of water when the temp. Of the flue gases is 370ºC and ambient temperature is 30ºC. Also calculate draught produced in term of column of hot flue gases. 06

Q.3 a) Derive the equation for height and diameter of Chimney. 07

b) Derive the condition for maximum discharge through nozzle. 06

Q.4 Steam enters a convergent-divergent nozzle at 2mPa and 400ºC with negligible velocity and mass flow rate of 2.5 Ka/s. It exits at a pressure of 300 KPa. The flow is isentropic between nozzle entrance & throat. Overall efficiency of nozzle is 93%. Determine throat and exit areas. 13

Q.5 Write short note on (any two) 14

a) Steam generation controls
b) Effect of back pressure on nozzle characteristics
c) Distinguish between Induced draught and forced draught.

Section B

Q.6 a) Derive equation for mass of circulating water in condensers. 05

b) Describe evaporative condenser with neat sketch. 08

Q.7 An Ideal regenerative steam cycle operates with the steam entering the turbine at 30 bar and 500ºC and is exhausted at 0.1 bar. A feed water is used, which operates at 5 bar. Calculate 13

i) Thermal efficiency
ii) Steam rate of cycle
iii) Mean temperature of heat addition

Q.8 a) Discuss classification of air compressors. 05

b) Discuss the Rankine cycle with T-S and h-S diagram. 08

Q.9 a) A single stage reciprocating air compressor take in 1.4 kg of air per minute at 1 bar and 17ºC and delivers it at 6 bar. Assuming compression follows law $PV^{1.35} = constant$. Calculate Indicated power input to – compressor. 06

b) Explain construction and working of axial flow compressor. 07

Q.10 Write short note on (any two) 14

i) Edward's air extraction pump
ii) Effect of inlet pressure and back pressure on performance of Rankine cycle
iii) Air motor

Total No. of Printed Pages:04

SUBJECT CODE NO:- H-111
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All Branches)
Engineering Mathematics - IV
(REVISED)

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

Please check whether you have got the right question paper.

N.B
1. Q. No. 1 and 6 are compulsory
2. Solve any two questions from the remaining questions of each section
3. Figures to the right indicate full marks
4. Assume suitable data, if necessary

Section: A

Q.1 Attempt any five 10

1. If $L\{J_0(t)\} = \frac{1}{\sqrt{s^2+1}}$ then find $L\{J_0(3t)\}$

2. Find Laplace transform of $cost\ logt\ \delta(t-\pi)$

3. Find inverse Laplace transform of $\frac{e^{-3s}}{s^2-1}$

4. Find inverse Laplace transform of $\frac{1}{s^2-2s+17}$

5. Find inverse z-transform of $\frac{z}{(z-1)(z-2)}$ by residue method

OR

Solve by direct integration method $\frac{\partial^2 u}{\partial x \partial t} = e^{-t}cosx$

6. Find z-transform of $sinh\frac{\pi}{2}k, k \geq 0$

OR

Form a partial differential equation by eliminating a and b from the equation $z = (x+a)(y+b)$

7. Find z-transform of $f(k) = 3^k k, k \geq 0$

OR

Solve $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = u,\ u(o,y) = 3e^{-3y}$

8. Find z- transform of $f(k) = cos2k, k \geq 0$

OR

Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial y}$, where $u(x,0) = 6e^{-3x}$

Q.2 a. Find Z- transform of $3^k \sin(2k+5)$ 05

OR

Solve $y^2zp + x^2zq = y^2x\ by$ Lagrange's method of linear partial differential equations

b. Find Laplace transform of $e^{-3t}\int_0^t t\ \ sin3t\ \ dt$ 05

c. Find inverse Laplace transform of $log\ (\frac{s+a}{s+b})$ 05

Q.3 a. Find z-transform of $k^2 f(k)$ if $f(k) = 3^k,\ k \geq 1$ 05

OR

Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x,0) = 6\ e^{-3x}$

b. Find Laplace transform of $f(t)$ $\begin{cases} t, 0 < t < 1 \\ 2-t, 1 < t < 2\ and \\ f(t) = f(t+2) \end{cases}$ 05

c. Find inverse Laplace transform of $\frac{1}{(s^2+1)\,(s^2+4)}$ by using convolution theorem 05

Q.4 a. Find inverse z- transform of $\frac{z}{(z-2)(z-3)}$ by partial fraction 05

OR

Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions
$u(x,o) = 3\sin n\pi x,\ u(o,t) = 0$
$and\ \ u(1,t) = o, where\ 0 < x < 1, t > 0$

b. Evaluate $\int_0^\infty e^{-2t}\sin^3 t\ dt$ 05

c. Solve $y'' - 4y' + 3y = 6t - 8, y(o) = 0$
$y'(0) = 0\ by\ Laplace\ transform$ 05

Q.5 a. Solve the difference equation by z-transform 05

$y(k+2) - 4y(k) = o, given$

That $y(0) = 0, y(1) = 2$

OR

Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to conditions

$u(o, y) = 0\,, \quad u(\pi, y) = 0,$

$u(x, 0) = 100 \quad and \quad u(x, \infty) = 0$

b. Express the given function into Heaviside unit step function and hence find its Laplace transform 05

$f(t) = t^2, \quad 0 < t < 1$

$= 4t, \quad t > 1$

c. Find inverse Laplace transform of $\frac{s\,e^{-3s}}{s^2+8s+25}$ 05

Section: B

Q.6 Attempt <u>any five</u> 10

a. Find f(2) for the data

x:	0	1	4
f(x)	4	3	24

b. Find the first approximate value of the root (i.e. x_1) by Newton raphson method for $logx = cosx$

c. Find the values of x, y, z in the first iteration by Gauss seidal method

$10x + 2y + z = 69$

$x + 8y + 2z = -3$

$2x - y + 20z = 76$

d. Find the values of $k_1\ and\ k_2$ while solving the D.E.

$\frac{\partial y}{\partial x} = 3e^x + 2y,\ y(0) = 0,\ \ Take\ \ h = 0.1$ by runge-kutta fourth order method

e. Verify whether $f(z) = sinz$ is analytic

f. Find the image of $|z| = 2$ under $w = \frac{1}{z}$

g. Evaluate $\int_c (x+y)dx + (2y-x)dy$ where c is the straight line y=x joining the points (0,0) to (3,3)

h. Find the residues of $\frac{z}{(z+3)(z-2)}$ at each of its poles

Q.7 a. Fit a second degree parabola to the following data 05

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

b. Apply the Runge-Kutta fourth order method to find y(1.1) given that, 05

$$\frac{dy}{dx} = 3x + y^2, \quad Y(1) = 1.2, \quad h = 0.1$$

c. If $f(z) = u + iv$ is analytic then find $f(z)$ if $u + v = e^x(cos\, y + siny)$ 05

Q.8 a. Using Lagrange's formula find f(2) from the data 05

x	0	1	4	5
f(x)	4	3	24	39

b. Evaluate $\int_c \frac{e^{-z}}{(z+2)^3} dz$, where c is the circle $|z| = 3$, by cauchy's integral formula 05

c. Show that $u = log\sqrt{x^2 + y^2}$ is harmonic hence find harmonic conjugate 05

Q.9 a. Find the root of the equation $2(x - 3) = \log_{10} x$ by Newton Raphson method 05

b. Evaluate $\int_c \frac{dz}{sinhz}$, where c is $|z| = 4$ by cauchy's residue theorem 05

c. Find the bilinear transformation which maps the points z=1, i, -1 into the points w=i, 0, -i 05

Q.10 a. Expand $f(z) = \frac{1}{z^2-4z+3}$ by Laurent series for $1 < |z| < 3$ 05

b. Solve by using gauss seidal method 05

$$10x + 2y + z = 9$$
$$2x + 20y - 2z = -44$$
$$-2x + 3y + 10z = 22$$

c. Evaluate $\int_{(0,0)}^{(1,1)} (3x^2 + 4xy + ix^2)dz$ along y=x 05

Total No. of Printed Pages:04

SUBJECT CODE NO:- H-112
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All Branches)
Engineering Mathematics –IV
(OLD)

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

Please check whether you have got the right question paper.

N.B
i. Q.No.1 and 6 are compulsory.
ii. Solve any two questions from remaining of each section.
iii. Figures to the right indicate full marks.
iv. Assume suitable data, if necessary.

SECTION-A

Q.1 Solve any five from the following 10

a) Determine the analytic function whose real part is $2x(1-y)$.
b) Show that $u = r^n \cos n\theta$ is harmonic.
c) Show that the image of the line $x = 0$ under the transformation $w = e^z$ is a circle.
d) Evaluate $\int_0^{1+i} z^2\, dz$ along the line $y = x$.
e) Evaluate $\int_c \frac{e^z}{(z-1)^2}\, dz \; where \; c : |z| = 2.$
f) State Cauchy's residue theorem.
g) Solve $\frac{\partial z}{\partial x} + 4z = \frac{\partial z}{\partial t}, where\ z(x,0) = 4e^{-3x}$

OR

Find Z-transform of $f(k) = a^k$.

h) Solve $\frac{\partial u}{\partial t} = 4\frac{\partial^2 u}{\partial x^2}$

OR

Find Z-transform of $f(k) = \cos 2k$.

Q.2 a) Determine analytic function $f(z) = u + iv$ whose imaginary part is $e^{-x}(x \sin y - y \cos y)$. 05

b) Show that $w = \frac{i-z}{i+z}$ maps the real axis of z-plane into the circle $|w| = 1$ and the half plane $y > 0$ into the interior of the unit circle $|w| = 1$ in the w-plane. 05

c) Solve $\frac{\partial u}{\partial t} = \beta^2 \frac{\partial^2 u}{\partial x^2}$ subject to the conditions 05

i. $u(0,t) = u(l,t) = 0\ for\ all\ t$
ii. $u(x,0) = x\ in\ 0 < x < l$
iii. $u(x,\infty)$ is finite.

OR

Find Z-transform of $3^k \sin(3k-2)$.

Q.3 a) Show that $v = r^2 \sin 2\theta + r \sin\theta$ is harmonic. Find its harmonic conjugate and hence find corresponding analytic function. 05

b) Evaluate $\int_{1-i}^{2+i}(2x+iy+1)\,dz$ along $x = t+1; y = 2t^2-1$ 05

c) Solve $\frac{\partial^2 u}{\partial t^2} = C^2\frac{\partial^2 u}{\partial x^2}$ 05

subject to the conditions

i. $u(0,t) = u(l,t) = 0\ for\ all\ t.$

ii. $\frac{\partial u}{\partial t} = 0\ when\ t = 0$

iii. $u(x,0) = a\ \sin\frac{\pi x}{l}$

OR

Find inverse z-transform of $\frac{z}{(z^2+7z+10)}$

Q.4 a) Expand $f(z) = \frac{1}{(z^2-3z+2)}\ for\ 1 < |z| < 2$ 05

b) Evaluate $\oint_c \frac{\cos z}{(z-\pi)^3}dz$ where c is $|z-1| = 3$ 05

c) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ 05

Subject to the conditions

i. $u = 0\ when\ y \to \infty$ for all x

ii. $u = 0$ when $x = 0$ for all y

iii. $u = 0\ when\ x = 1\ for\ all\ y$

iv. $u = x(1-x)$ when $y = 0\ for\ 0 < x < 1$

OR

Solve the difference equation by z-transform

$$u_{k+2} + 4u_{k+1} + 3u_k = 3^k\ with\ u_0 = 0, u_1 = 1$$

Q.5 a) Find the bilinear transformation which maps the point $z = 1, i, -1$ into the points $w = i, 0, -i$. 05

b) Evaluate $\oint_c \frac{z\sec z}{(1-z)^2}dz$ where c is the circle $|z| = 2$ by residue theorem 05

c) Evaluate $\int_0^{2\pi}\frac{d\theta}{1-2a\sin\theta+a^2}, 0 < a < 1.$ 05

SECTION B

Q.6 Solve any five from the following. 10

a) Define Laplace Transform and find $L\{e^t\}$.

b) Find Laplace Transform of $\sin^2 2t$.

c) Find Laplace Transform of

$f(t) = e^{t-2}, \quad t > 2$

$= 0, t < 2$

d) Find inverse Laplace transform of $\frac{2s+1}{s(s+1)}$

e) Find inverse Laplace transform of $\frac{e^{-\pi s}}{s^2+4}$

f) Find inverse Laplace transform of $\frac{s}{(s-3)^5}$

g) Find the Fourier sine transform of $\frac{1}{x}$

h) Find the Fourier sine transform of

$f(x) = 1, \quad |x| < a$

$= 0, \quad |x| > a$

Q.7 a) Find Laplace Transform of $e^{3t}\int_0^t t\cosh 3t\, dt$ 05

b) Find inverse Laplace transform of $\log\left[\frac{s+3}{s+2}\right]$ 05

c) Solve $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}, -\infty < x < \infty$ 05

Subject to the conditions

i. $u \text{ and } \frac{\partial u}{\partial x} \to 0 \text{ as } x \to \pm\infty$

ii. $u(x,0) = \begin{cases} u_0 & |x| \le a \\ 0 & |x| \ge a \end{cases}$

Q.8 a) Evaluate $\int_0^\infty e^{-3t}\sin^3 t\, dt$ 05

b) Find inverse Laplace transform of $\frac{s}{(s^2+a^2)^2}$ by convolution theorem. 05

c) Solve the integral equation $\int_0^\infty f(x)\cos px\, dx = \begin{cases} 1-p; & 0 < p < 1 \\ 0; & p > 1 \end{cases}$ 05

Q.9

a) Find the Laplace Transform of $f(t) = \begin{matrix} 1 & ; & 0 \le t \le 2 \\ -1 & ; & 2 \le t \le 4 \end{matrix}$ $where\ f(t+4) = f(t)$ 05

b) Solve $\frac{dy}{dt} + 3y + 2\int_0^t y\,dt = t, y(0) = 0$ by Laplace Transform. 05

c) Find Fourier sine transform of $f(x) = e^{-x}$ and evaluate $\int_0^\infty \frac{x \sin kx}{1+x^2} dx$ 05

Q.10

a) Express the following function in term of Heaviside unit step function and hence find Laplace Transform $f(t) = \begin{matrix} t^2 & ; & 0 < t < 1 \\ 4t & ; & t > 1 \end{matrix}$ 05

b) Solve by Laplace Transform 05

$$\frac{dx}{dt} - y = e^t;\ \frac{dy}{dt} + x = \sin t\ , subject\ to\ x(0) = 1; y(0) = 0.$$

c) Find Fourier sine Transform of $f(x) = \frac{e^{-ax}}{x}$ 05

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-203
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech/Prod)
Electrical Machines
(REVISED)

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

Please check whether you have got the right question paper.

N.B
i) Q.No.1 and Q.No.6 are compulsory.
ii) Solve any two questions from Q.2 to Q.5.
iii) Solve any two questions from Q.7 to Q.10.
iv) Assume suitable data wherever necessary.

Section A

Q.1 Attempt the following(any five) 10
a) Enlist the different types of D.C. generator.
b) Give the function of yoke and pole shoes in D.C. generator.
c) Why D.C series motor never started on no load?
d) What is the purpose of starter in D.C. motor?
e) How is unidirectional torque produced in case of D.C. motor?
f) Write applications of stepper motor.
g) Give two comparisons of lap and wave winding.
h) Write applications of Brush less D.C. motor.

Q.2 a) Explain with neat diagram construction of D.C. machine. 07
b) Derive EMF equation of D.C. generator. 08

Q.3 a) Explain principle and operation of D.C. generator. 07
b) Explain the characteristics of D.C. Motor. 08

Q.4 a) Explain speed control methods of D.C. series motor. 08
b) Explain the working of three point starter with neat diagram. 07

Q.5 Write short notes (Any three) 15
a) Brushless D.C. motor
b) Swinburne test
c) Solid state starters
d) Stepper Motor

Section B

Q.6 Attempt the following(any five) 10

a) A 4 pole, 50HZ Induction Motor running at 1450 rpm then what is its rotor frequency?
b) Write applications of capacitor start capacitor run single phase induction motor.
c) A 4 pole synchronous generator operating at 60 HZ then find its synchronous speed.
d) Write applications of Hysteresis motor?
e) Define synchronous speed and write its formula.
f) What is hunting in synchronous motor?
g) In synchronous machine which winding is called as rotor?
h) Write applications of shaded pole motor.

Q.7
a) Explain procedure of blocked rotor test for induction motor. 07
b) Explain the construction and details of slip ring induction motor. Why rotor resistance is added in slip ring induction motor. 08

Q.8
a) Explain the concept of double revolving theory in single phase induction motor. 08
b) Explain capacitor start capacitor run single phase induction motor. 07

Q.9
a) Derive EMF equation of synchronous generator. 08
b) Explain construction details of cylindrical type rotor. 07

Q.10 Write short notes (any three) 15

a) Principle and operation of synchronous generator.
b) Shaded pole single phase induction motor.
c) Starting methods of synchronous motor
d) Hysteresis motor

Total No. of Printed Pages:04

SUBJECT CODE NO: H-301
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All Branches)
Engineering Mathematics - III
(OLD)

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

Please check whether you have got the right question paper.

N.B i) Questions number 1 and 6 are compulsory.
ii) Attempt any two questions from the remaining each section.
iii) Figures to the right indicate full marks.
iv) Assume suitable data if necessary.

SECTION – A

Q.1 Solve any five from the following: 10

a) Solve $(D^2 - 6D + 25)y = 0$

b) Solve $(D^2 - 4D + 5)y = 0$

c) Find the particular integral of $(D^2 - 4)y = x^2$

d) Solve $(x^2D^2 + xD - 1)y = 0$

e) If 2lb weight is pulled 6 inches below its equilibrium position and then released. Assuming a spring constant $k = 16lb/ft$, damping force $2\frac{dx}{dt}$ Set- up the equation of motion.

f) A circuit consists of an inductance od 0.05 henry, a resistance of 5 ohms and a Condenser of capacitance 4×10^{-4} farad, with constant EMF of 110 volts. Set-up the differential equation.

g) In a certain manufacturing process 5% of the tools produced turn out to be defective. Find the probability that in a sample of 40 tools, at most 2 will be defective.

h) The marks of 1000 students in a university are found to be normally distributed with mean 70 and standard deviation 5. Find the number of students whose marks will be less than 68.

Q.2 a) Solve $(D^2 - 6D + 13)y = 8e^{3x} \sin 4x$ 05

b) If a weight 6lb hangs from a spring with constant k =12 and no damping force exists. Find the motion of weight when an external force $3cos18t$ acts. Initially $x = 0, \frac{dx}{dt} = 0$ at $t = 0$. Determine whether the resonance occurs. 05

c) Calculate the mean deviation from mean of the following data: 05

x	0-6	6-12	12-18	18-24	24-30
f	8	10	12	9	5

Q.3 a) Solve $(D^3 - 2D + 4)y = 3x^2 - 5x + 2$ 05

b) A one henry inductance, a 4 microfarad capacitor and EMF of $180 \cos 40t$ are connected in series. Find the charge Q and the current i, if $i = Q = 0$ at $t = 0$. 05

c) Suppose that life of a gas cylinder is normally distributed with mean of 40 days and a standard deviation of 5 days. If at a time 10,000 cylinders are issued to customer's, how many will need replacement after 35 days? 05

Q.4 a) Solve $(D^2 + 5D + 6)y = e^{e^x}$ by using general method. 05

b) A long column of length l fixed at one end is completely free at other. If the load P is axially applied at the free end. Its deflection is given by 05

$$EI\frac{d^2y}{dx^2} = P(a - y)$$

Where the origin is taken at the fixed end and 'a' is the lateral displacement of the free end. Show that the deflection curve is given by

$$y = a\left[1 - \cos\left(\sqrt{\frac{P}{EI}}\right)x\right].$$

c) Compute mean, variance, β_1 and β_2 if the first four moments about a value 5 of a variable are given as 2, 20, 38 and 52. 05

Q.5 a) Solve $(D^2 + 4)y = \frac{1}{1+\cos 2x}$ by using method of variation of parameter. 05

b) Solve $(x-1)^3 \frac{d^3y}{dx^3} + 2(x-1)^2 \frac{d^2y}{dx^2} - 4(x-1)\frac{dy}{dx} + y = 4\log(x-1)$ 05

c) Fit a straight line to the following data: 05

x	1	2	3	4
y	3	7	13	21

SECTION – B

Q.6 Solve any five from the following: 10

a) If $\bar{F} = x\cos zi + y\log xj - z^2k$ find curl $\bar{F}$

b) Find the unit vector normal to the surface $xy^3z^2 = 4$ at the point $(-1,-1,2)$

c) Find the constant 'a' if $\bar{F} = (x + 3y^2)i + (2y + 2z^2)j + (x^2 + az)k$ is solenoidal.

d) Evaluate $\int_C \bar{F}.\overline{dr},\ where\ \bar{F} = \cos yi - x\sin yj$ and C is the curve $y = \sqrt{1 - x^2}$ in xy-plane from$(1,0) to\ (0,1)$

e) State Stoke's theorem.

f) Find the first approximate root of the equation $xe^x - cosx = 0$ using Newton Raphson method.

g) Find the first approximate solution of the equation
$8x - 3y + 2z = 20,$
$4x + 11y - z = 33,$
$2x + y + 4z = 12$
by Gauss Seidal method.

h) Find the missing term in the following:

x	0	1	3	4
f(x)	5	6	--	105

Q.7 a) Find the directional derivative of $\frac{1}{r}$ in the direction of $\bar{r}$, where $\bar{r} = xi + yj + zk$ 05

b) Find the work done in moving a particle in the force field 05
$\bar{F} = 3x^2i + (2xz - y)j + zk$
along the straight line joining the points $(0,0,0)\ and\ (2,1,3)$

c) Find the real root of the equation $x + logx = 2$ by Newton – Raphson method correct to three decimal places. 05

Q.8 a) Prove that $\nabla^4 e^r = \left(1 + \frac{4}{r}\right) e^r$ 05

b) Evaluate Green's theorem for $\int_C (3x + 4y)dx + (2x - 3y)dy \ with \ C: x^2 + y^2 = 4$ 05

c) Given $\frac{dy}{dx} = x^2 - y, y(0) = 1, find \ y(0.1) and \ y(0.2)$ using Runge – Kutta fourth order method. 05

Q.9 a) Prove that the vector field $\bar{F} = (6xy + z^3)i + (3x^2 - z)j + (3xz^2 - y)k$ is irrotational. Find the scalar potential ϕsuch that $\bar{F} = \nabla\phi$. 05

b) Evaluate $\iint_S \bar{F} . \overline{ds}$ using Gauss divergence theorem, where $\bar{F} = 2xyi + yz^2j + zxk \ and \ S$ is surface of the region bounded by $x = 0, y = 0, z = 0, y = 3, x + 2z = 6$. 05

c) Solve the equations $83x + 11y - 4z = 95, 7x + 52y + 13z = 104, 3x + 8y + 29z = 71$ by Gauss Seidal method. 05

Q.10 a) Verify Stoke's theorem for $\bar{F} = 4xzi - y^2j + yzk$ over the area in the plane $z = 0$, bounded by $x = 0, y = 0, x^2 + y^2 = 1$ 05

b) From the following table, Obtain the first and second derivative at the point $x = 0.96$ 05

x	0.96	0.98	1.00	1.02	1.04
y	0.7825	0.7739	0.7651	0.7563	0.7473

c) Taking $h = 0.05$, determine the value of y at $x = 0.1$ by Euler's modified method, given that $\frac{dy}{dx} = x^2 + y, y(0) = 1$ 05

Total No. of Printed Pages:02

SUBJECT CODE NO: H-275
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech/Prod)
Machine Tools
(Revised)

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

Please check whether you have got the right question paper.

N.B
i. Solve any three questions from each section.
ii. Figures to the right indicate full marks.
iii. Add suitable sketches, wherever necessary.

Section A

Q.1 a) List various types of chips produced during metal cutting. What are the reasons for these type of chips? 07

b) What do you understand by economics of machining? How do you evaluate machining cost? 06

Q.2 a) Sketch, label and explain tool angles on single point cutting tool. 07

b) Why chucks are used? List & discuss various types of chucks used in lathes. 06

Q.3 a) State the operations which may performed on a lathe. 06

b) Compare between plain and universal milling machine. 07

Q.4 a) Describe whit worth quick return mechanism. (Add suitable sketch). 07

b) List & describe in brief the main parts of a planer. 06

Q.5 a) Describe various slotting tools and slotter operations. 07

b) Explain gear Hobbing process with neat sketch. 07

Section B

Q.6 a) What are various work holding devices of drilling machine? Describe one with sketch. 06

b) Explain spindle drive and feed mechanism of drilling machine. 07

Q.7	a)	Describe the different operations that can be performed on a horizontal boring machine.	08
	b)	Outline the nature & characteristics of abrasive used in grinding wheels.	05
Q.8	a)	Sketch different elements of a broach and describe them briefly.	07
	b)	With the help of neat sketch describe twist drill nomenclature.	06
Q.9	a)	Explain laser beam machining.	07
	b)	With neat sketch discuss electron beam machining.	07
Q.10	a)	What are the various maintenance practices? State their appropriate strategies in use.	07
	b)	Discuss the general lubrication practice. How lubricants are selected for various conditions of machine tools?	06

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-394
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mechanical)
Production Processes
(REVISED)

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

Please check whether you have got the right question paper.

N.B
1.Q. No.01 and 06 are compulsory.
2. Attempt any two remaining questions from Section A and B.
3. Draw neat labeled sketch whenever necessary and assume suitable data whenever necessary.

Section A

Q.1 Solve "any five" from the following. 10

a) What are the main constituents of moulding sand?
b) Define hot working and cold working process.
c) What are the common allowances provided to pattern?
d) List the operations carried out in sheet metal working.
e) Write the different types of cores.
f) Explain in short punching and blanking operation
g) Write the various rolling mills used for rolling.
h) What are the different types of Patterns.

Q.2 (a) Explain cupola furnace in detail with neat sketch. 08
(b) Explain various casting defects. 07

Q.3 A) Explain hydraulic power press in detail with neat sketch. Also write the advantages of hydraulic press. 08
B) What are different types of moulding sand? Discuss in detail different type of moulding sand and their properties. 07

Q.4 A) With a neat sketch explain centrifugal casting. State its applications. 08
B) Explain the process of production of seamless pipes. 07

Q.5 Write short note on any three 15

A) Rotary Swaging
B) Drop Forging
C) Gating system
D) Press brake
E) Bending operation.

Section B

Q.6 Solve "any five" from the following. 10

(a) Name the different defects in welding.
(b) Define electroplating and galvanizing.
(c) What is the purpose of Surface treatment?
(d) Define thermoplastic and thermosetting plastic
(e) Name different types of weld testing methods.
(f) List different types of coatings.
(g) What are laminated plastics?
(h) Why filler materials are used in welding process.

Q.7 A) Describe with neat sketch blow moulding, stating their advantages and application s. 07

B) With a neat sketch explain the working principle of plastic injection moulding process. 08

Q.8 A) Define electric arc welding. Discuss with the help of neat sketch the principles of arc welding. 08

B) Explain the following welding defects with causes and remedies. 07

(i) Porosity
(j) Spatter.

Q.9 (a) What are various cleaning processes? Explain chemical cleaning process. 08

(b) What is powder coating? List down the advantages and limitations of powder coating. 07

Q.10 Write short notes on any three 15

(a) Application of Plastic in industry
(b) Thermit Welding Process
(c) MIG Welding
(d) Metal Spraying
(e) Callendaring.

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-302
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (All)
Engineering Mathematics – III
(Revised)

[Time: ThreeHours] **[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B
1) Q. No. 1 and Q. No. 6 are compulsory.
2) Solve any two questions from remaining questions of each section.
3) Figures to the right indicate full marks.
4) Assume suitable data, if necessary.

Section – A

Q.1 Solve any five from the following. 10

a) Solve $(D^2 - 13D + 36)y = 0$
b) Solve $(D^3 - 7D - 6)y = 0$
c) Find particular integral (P.I.) of $(D^3 + 1)y = 2^x$
d) Find Particular integral (P.I.) of $(D^2 + 4)y = \sin 3x$
e) Write Kirchhoff's voltage law to electrical ckt.
f) Set – up the equation of motion of a body of weight 10kg attached to a spring given that 20 kg weight will stretch the spring to 10cm.
g) Find the Fourier cosine transform of $f(x) = e^{-2x}$
h) Find the Fourier transform of $f(x) = 1; \quad 0 < x < a$
$= 0 \quad otherwise$

Q.2 a) Solve $(D^2 + 6D + 10)y = 50x$ 05

b) An emf of 200v is in series with a 10 ohm resistance, a 1 henry inductor and 0.02 farad capacitor. At t=0 the charge Q and current I are zero. Find Q & I at any time t. 05

c) Solve$(D^2 + 9)y = x \cos x$. 05

Q.3 a) Solve $(D^2 - 1)y = xe^x \sin x$ 05

b) A body executive damped forced vibrations given by the equation 05

$$\frac{d^2x}{dt^2} + 2k\frac{dx}{dt} + b^2x = e^{-kt} \sin wt$$

Solve the equation for both the cases when $w^2 \neq b^2 - k^2$and $w^2 = b^2 - k^2$.

c) Find $f(x)$ if $Fs(\lambda) = \frac{e^{-a\lambda}}{\lambda}$ 05

Q.4

a) $(x+1)^2\frac{d^2y}{dx^2}+(x+1)\frac{dy}{dx}+y=2\sin\log(x+1)$ 05

b) The differential equation satisfied by beam uniformly loaded with one end fixed & second subjected to a compressive force is given by $EI\frac{d^2y}{dt^2}=py-\frac{1}{2}wx^2$ show that the elastic curve for the beam With condition $y=0,\frac{dy}{dx}=0$ at $x=0$ given by$y=\frac{w}{pn^2}(1-\cos nx)+\frac{wx^2}{2p}$, where $n^2=\frac{p}{EI}$ 05

c) Express $f(x)=1 \quad ,0\le x\le\pi$
$=0 \quad , \quad x>\pi$
As a Fourier sine integral and hence evaluate$\int_0^\infty\frac{(1-cos\pi\lambda)\sin\lambda x}{\lambda}\,d\lambda$. 05

Q.5

a) Solve by using the method of variation of parameters. $(D^2+4)y=\sec 2x$ 05

b) Solve the integral equation$\int_0^\infty f(x)\cos\lambda x\,dx=e^{-\lambda}$. 05

c) Solve $x^2\frac{d^2y}{dx^2}-2x\,\frac{dy}{dx}-4y=x+2logx$ 05

Section – B

Q.6 Solve any five from the following. 10

a) Find the mean of the following data

Class	0-10	10-20	20-30	30-40	40-50
Frequency	14	17	22	26	23

b) $\nabla.\bar{r}\text{if}\bar{r}=xi+yj+zk$

c) State Green's Theorem.

d) Find $\nabla\emptyset$ at (1,1,1)if $\emptyset=x^2+y^2+z^2$.

e) Find the area under the normal curve between $z=0$to $z=2$.

f) Find the Karl Pearson's coefficient of skewness if mean =3, mode = 5.2 and Standard Deviation = 2.5

g) Show that $\bar{A}=3y^4z^2i+4x^3z^2j-3x^2y^2k$ is solenoidal.

h) The probability of certain college students will pass is 0.8 Determine the probability that out of 10 students exactly 6 will pass.

Q.7

a) Evaluate $\int_C [(x^2 + 2y)dx + (4x + y^2)dy]$ by Green's theorem, where c is the boundary of the region bounded by $y = 0$, $y = 2x$ and $x + y = 3$. 05

b) Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)i + (3xz + 2xy)j + (3xy - 2xz + 2z)k$ is both solenoidal and irrotational. 05

c) Find the Karl Pearson's coefficient of skewness for the following data. 05

Marks	0-5	5-10	10-15	15-20	20-25	25-30
No. of Students	4	6	8	12	7	2

Q.8

a) Find the directional derivative of $\emptyset = xy^2 + yz^2$ at the point $(2, -1, 1)$ in the direction of the vector i +2j +2k. 05

b) Determine the equation for the regression line of the force on time for the following data 05

Force	11.4	18.7	11.7	12.3	14.7	18.8	19.6
Time	0.56	0.35	0.55	0.52	0.43	0.34	0.31

c) Evaluate by Stokes theorem $\iint_S \nabla \times \bar{F}\hat{n}\, ds$ for the vector field $\bar{F} = 4yi - 4xj + 3k$, where S is a disk of radius one lying on the plane z = 1. 05

Q.9

a) The mean I.Q. of large number of children of age 14 is 100 with standard deviation 16. Assuming the distribution of I.Q. is normal, find the percentage of children having I.Q. between70 to 120. 05

b) Evaluate $div(\bar{r} \times \bar{a})$, where $\bar{a}$ is a constant vector and $\bar{r} = xi + yj + zk$. 05

c) Find the work done in moving a particle in the force field given by $\bar{F} = yi + zj + xk$ along the parabola $y^2 = x$ from the origin to the point$4i + 2j$. 05

Q.10

a) Find the standard deviation of the following data 05

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Frequency	10	15	25	25	10	10	5

b) Express $\iint \left(y^2z^2i + z^2x^{2j} + z^2y^2k\right)\overline{ds}$ as a volume integral. Evaluate it by Gauss divergence theorem over the upper part of the sphere $x^2 + y^2 + z^2 = 1$ above the XY plane. 05

c) Show that vector field $\bar{A}$ is irrotational. Find scalar potential function $\emptyset$ such that $\bar{A} = \nabla\emptyset$if $\bar{A} = y^2i + 2xyj - z^2k$. 05

Total No. of Printed Pages: 04

SUBJECT CODE NO:- H-325
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mechanical)
Machine Drawing
(Revised)

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

Please check whether you have got the right question paper.

N. B
i) Q-1 and Q-4 are compulsory.
ii) Assume suitable data, if necessary.
iii) All dimensions are in mm.

Section A

Q.1 A vertical square prism, base 50mm side has its faces equally inclined to V.P. It is completely penetrated by another square prism base 30mm side, the axis of which is parallel to both the planes and 6 mm away. From the axis of vertical prism. The faces of horizontal prism are also equally inclined to V.P. Draw the projections of the solid showing lines of intersections. Assume suitable length of axis. 14

Q.2 A cylinder, base diameter 50 mm and height 70mm is resting on its base in H.P. It is cut by a cutting plane 50^o to H.P. passing through a point on axis 10mm from its top face. Draw its sectional top view and devleope the lateral surface of cylinder. 13

OR

A right circular cone having diameter of base 40mm, axis length 50 mm resting on its base on H.P. it is cut by a cutting plane perpendicular to V.P. and 45^o inclined to H.P. and bisecting the axis. Develop the lateral surface of the remaining portion of pyramid.

Q.3 Figure 1 shows Front view and auxiliary view of an "Angle plate" draw i) Front view ii) Top view 13

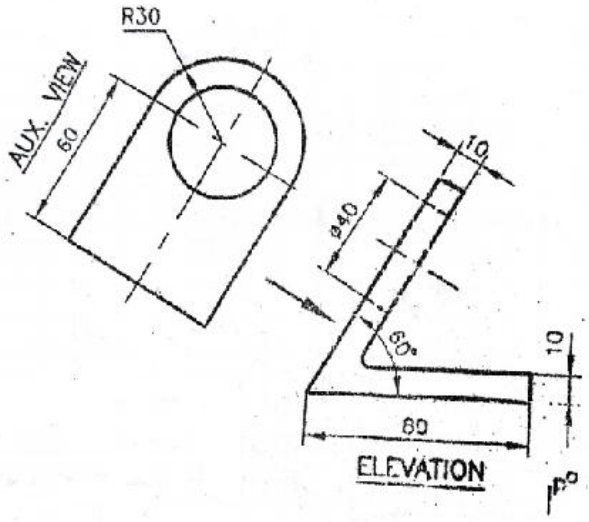


Figure 1

OR

Figure 2 shows Front view, incomplete top view and partial auxiliary view. Draw front view and top view.

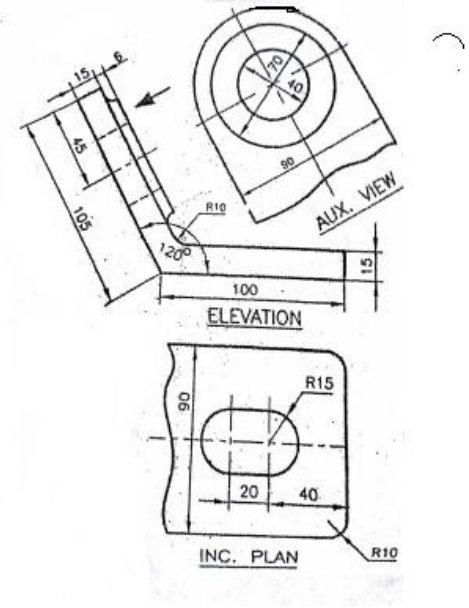


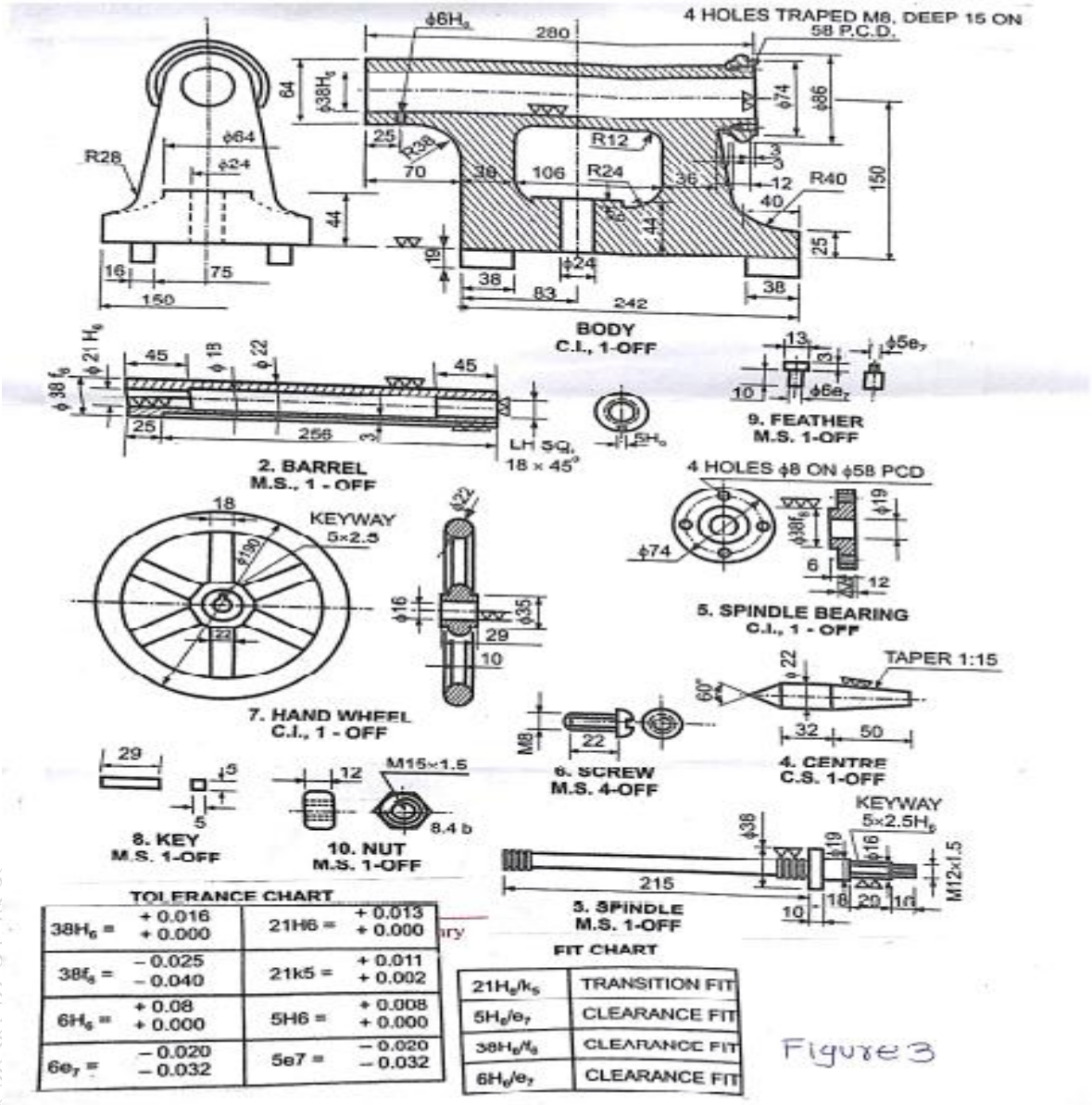
Figure 2

Section B

Q.4 Solve any five questions from the following. 15

a) Draw the material conventions of
   i. Concrete
   ii. Glass
   iii. Rubber
b) Rag Foundation bolt
c) Union pipe joint
d) Single riveted single strap butt joint
e) Give the symbols of following welded joints
   i. Fillet weld
   ii. Single 'V' butt
   iii. Double 'U' butt
f) Given surface roughness values and symbols for
   i. N4
   ii. N10
   iii. N2

Q.5 Figure 3 shows details of tailstock. Assemble all the parts, tabulate the bill of material and draw 25
i) Sectional front view ii) side view



TOLERANCE CHART

$38H_6$ =	$^{+0.016}_{+0.000}$	21H6 =	$^{+0.013}_{+0.000}$
$38f_6$ =	$^{-0.025}_{-0.040}$	21k5 =	$^{+0.011}_{+0.002}$
$6H_6$ =	$^{+0.08}_{+0.000}$	5H6 =	$^{+0.008}_{+0.000}$
$6e_7$ =	$^{-0.020}_{-0.032}$	5e7 =	$^{-0.020}_{-0.032}$

FIT CHART

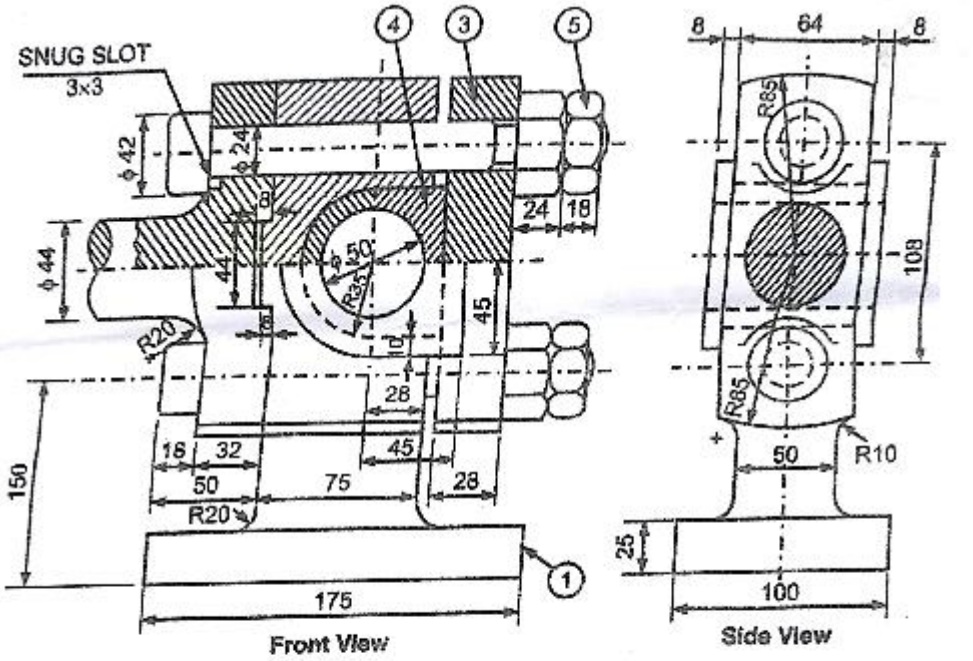
$21H_6/k_5$	TRANSITION FIT
$5H_6/e_7$	CLEARANCE FIT
$38H_6/f_6$	CLEARANCE FIT
$6H_6/e_7$	CLEARANCE FIT

Figure 3

OR

Figure 4 shows assembly of corss head. Draw two views of the following parts. 25

i) Cross body ii) Piston rod end iii) CAP iv) Brass



PART LIST

PART NO.	PART NAME	MATERIAL	QUANTITY
1.	CROSS BODY	C.I.	1
2.	PISTON ROD END	C.I.	1
3.	CAP	C.I.	1
4.	BRASS (TWO HALVES)	G.M.	1
5.	ROUND HEAD NUT AND BOLT	M.S.	2

Figure 4

Total No. of Printed Pages:4

SUBJECT CODE NO:- H-324
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech/Prod)
Machine Drawing
(Old)

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

Please check whether you have got the right question paper.

N.B
1) All the questions are compulsory.
2) Figure to the right indicates full marks.
3) Assume suitable data, if and wherever necessary.

SECTION – A

Q.1 a) A fountain jet discharges water from ground level at an inclination of 55° to the ground. The jet travels a horizontal distance of 10 m from the point of discharge and falls on the ground. Trace the path of the jet and name the curve. 08

b) A circular disc of diameter 40 mm rolls on a circular surface of 150 mm diameter. Trace the locus of point of contact P for one complete revolution of the disc. Name the curve and also draw tangent and normal to the curve at any point. 08

Q.2 Figure 1 shows the elevation, partial top view and partial auxiliary view of an object. Redraw the given views, complete the top view. Add the complete right hand side view. 12

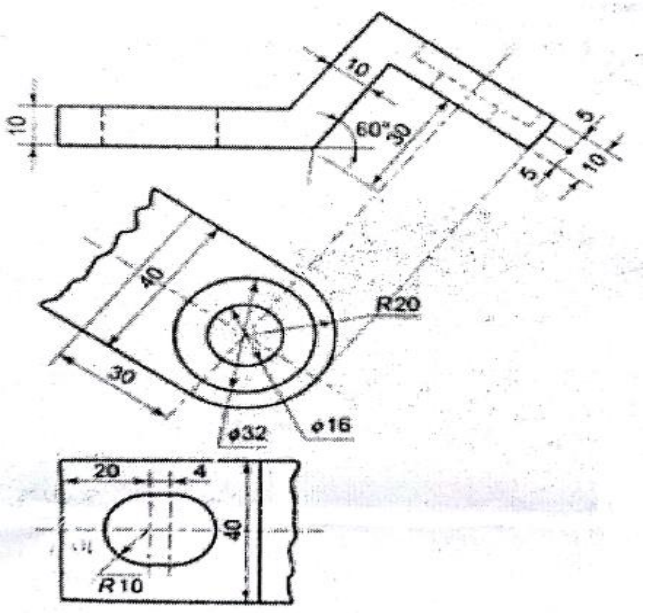


Figure.1

OR

Figure 2 shows front view and top view of an object, draw the isometric projection. 12

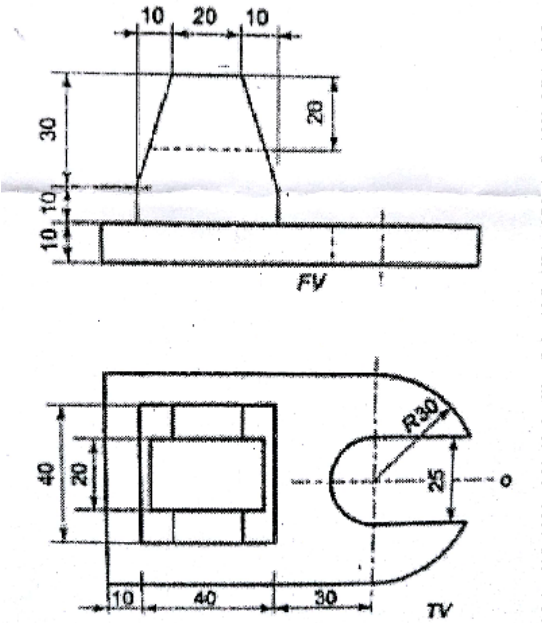


Figure 2

Q.3 A square prism with 50 mm base sides and axis 90 mm long is resting on its base with an edge of the base inclined at 30 of intersection° to the VP. It is completely penetrated by a horizontal cylinder 50 mm in diameter and 90 mm in length. The axes of both the solids are parallel to VP and bisect each other. Draw the projections showing curves of intersection. 12

OR

A cone with 60 mm diameter at its base and axis length 70 mm resting 0 its base in penetrated by vertical cylinder of 60 mm diameter. The axes of two solids are 10 mm apart and are contained by a vertical plane inclined at 45° to the V.P. Draw the projections and show curve of intersection. 12

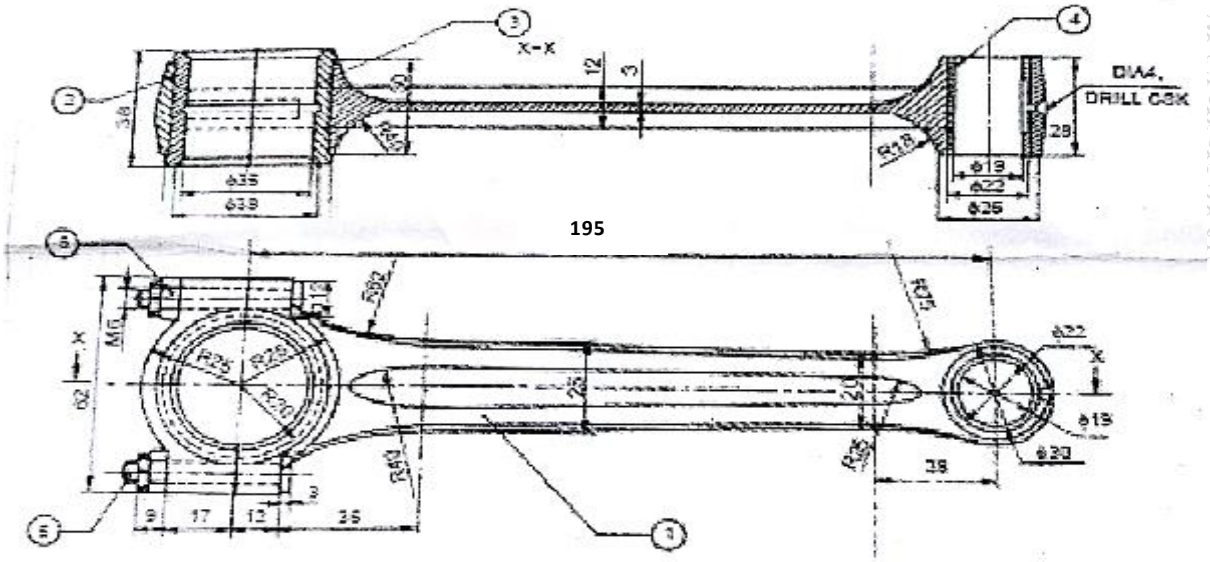
SECTION – B

Q.4 Draw the conventional representation of the following. 15

1) Wood material
2) Glass material
3) Spur gear
4) Leaf spring
5) Draw a figure showing aligned dimensioning
6) Interference fit
7) Geometric tolerance
8) Fillet weld
9) Square butt weld
10) Surface roughness symbol for N5
11) Machining symbol
12) Define sampling length
13) define allowance

14) upper and lower limit
15) direction of lay

Q.5 Figure 3 shows assembly of petrol engine connecting rod along with its part list. Draw the detailed drawings of all the parts in front and top views. 25



Parts list

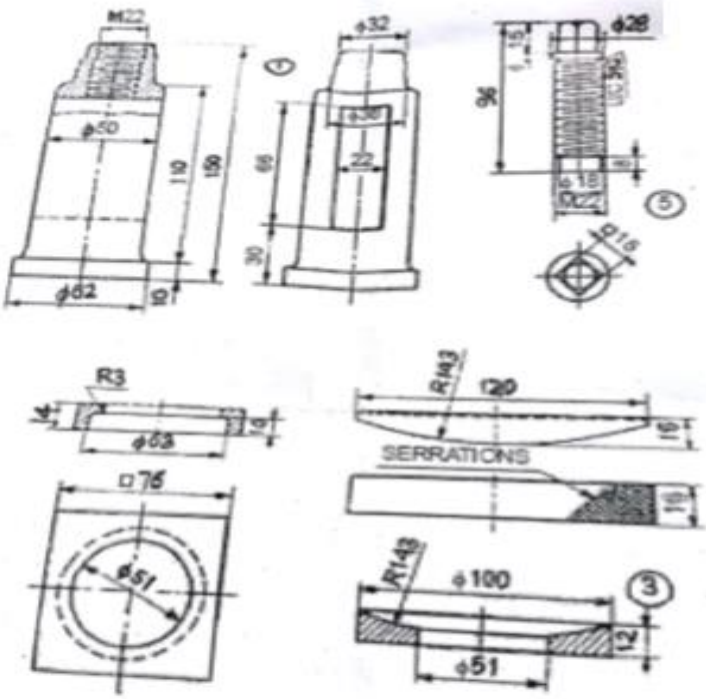
Part No.	Name	Matl.	Qty.
1	Rod	FS	1
2	Cap	FS	1
3	Bearing brass	GM	2
4	Bearing bush	P Bronze	1
5	Bolt	MCS	2
6	Nut	MCS	2

Figure 3

OR

Q.5 Figure 4 shows details of single tool post along with its part list. Prepare the following views 25
a) sectional front view
b) left hand side view
c) top view

a) Top view



Parts list

No.	Name	Matl	Qty
1	Piller	MCS	1
2	Block	MCS	1
3	Ring	MS	1
4	Wedge	MCS	1
5	Screw	TS	1

Figure 4

Total No. of Printed Pages:4

SUBJECT CODE NO:- H-168

FACULTY OF SCINECE AND TECHNOLOGY

S.E. (Mech/Prod)

Theory of Machines - I

(REV)

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

Please check whether you have got the right question paper.

N.B
1. Q.no.1 and Q.no.6 are compulsory
2. Attempt any two questions out of remaining from each section.
3. Figures to the right indicate full marks
4. Draw neat sketches wherever necessary
5. Assume suitable data wherever necessary.

Section -A

Q.1 Attempt any five 10

a) Define mechanism with example
b) What is Gruebler's criterion
c) Classify kinematic links with example
d) What is superstructure
e) Define rigid and resistant bodies
f) State third inversion of single slider crank chain with example.
g) Compare space and body centrode
h) Define tangential component of acceleration
i) How to decide direction of coriolios component of acceleration
j) State Three line theorem.

Q.2 The dimensions of the mechanism as shown in figure 1 are as follows 15

AB= 0.45m, BD=1.5m , BC =CE=0.9m

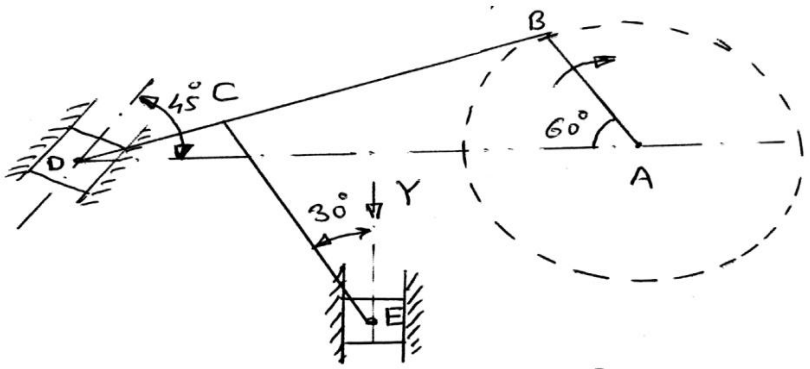


Figure 1

The crank AB turns uniformly at 180rpm in the clockwise direction and the blocks at D and E are working in frictionless guides Draw the velocity diagram and find the velocities of the sliders D and E in their guides.

Q.3 In the mechanism shown is figure 2 the crank OA rotates at 60rpm Determine 15

i) The linear acceleration of the slider at B

ii) The angular acceleration of the links AC, CQD and BD

Given BD=500mm, CD=125 mm, CQ=145mm, AC= 600mm OA=150mm, OQ=625mm DQ=145mm.

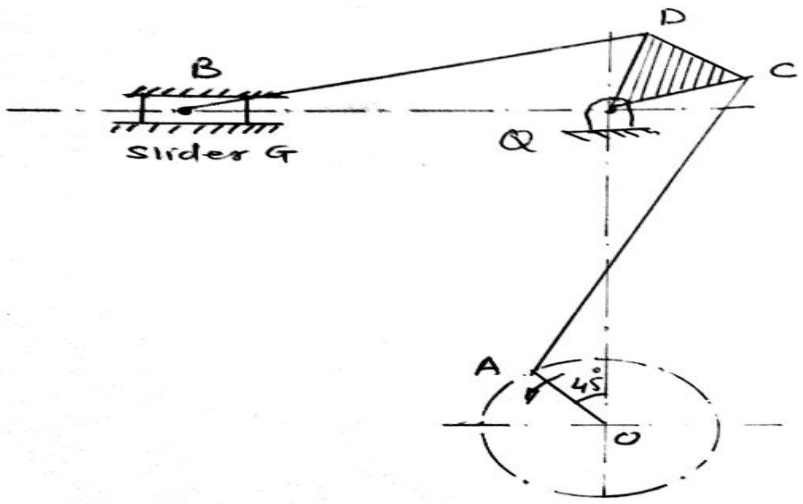


Figure 2

Q.4 a) The length of various links of mechanism as shown in figure 3 are OA = 0.3m AB=1m CD= 0.8 m and AC=CB Determine 15

i) Velocity of slider B
ii) Velocity of slider D
iii) Angular velocity of CD

If OA rotates at 60rpm clockwise use instantaneous center method

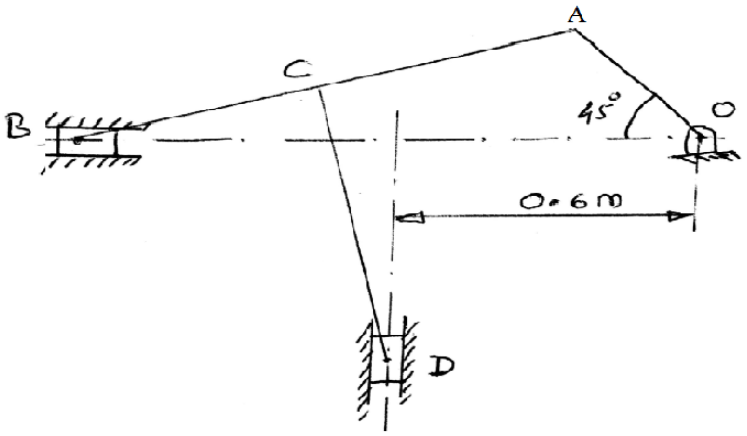


Figure 3

Q.5 a) In slider crank mechanism the length and connecting rod are 100mm and 400mm respectively the crank rotates uniformly at 600 rpm clockwise when the crank has furned through 45° from the inner dead center, find by kleris construction method. 10

I) velocity and acceleration of the slider
II) Angular velocity and angular acceleration of connecting rod

b) Explain with neat sketch whit worth Quick Return mechanism. 05

Section – B

Q.6 Attempt any five 10

a) What are characteristics of brake lining
b) Give classification of Dynamometer
c) Sketch and label the geometric elements of camprofile
d) Enlist types of cams
e) What is necessity of balancing
f) What is Direct and reverse crank method
g) Compare inside and outside cylinder locomotive
h) State equation of swaying couple
i) Draw neat sketch of unbalanced forces in engine
j) What is effect of unbalance forces in engine

Q.7 Draw the profile of cam that gives lift of 50mm to the rod carrying a 20mm chameter roller the axis of roller passes through the center of cam the least radius of cam is 50mm the rod is to be lifted with SHM in 90^o rotation of cam and suddenly returns to its original position during 180^o revolution with SHM remaining is dwell 15

Q.8 For differential band brake following data given drum diameter is 1000mm, 15
Two ends of the band are fixed to the pins on the opposite sides of the fulcrum of the level at a distance of 40mm & 200mm from the fulcrum the angle of contact is 270^o and coefficient of friction is 0.2 determine the brake torque when a force of 600N is applied to the lever at a distance of 800mm from the fulcrum .

Q.9 Four masses A, B C and D are completely balanced masses C and D make angles of 90^o and 120^o respectively with B in the same sense the planes containing B and C are 300 mm apart Masses A, B C andD can be assumed to be concentrated at radii 360 , 480 , 240 and 300mm respectively the masses B , C and D are 15 kg, 25kg and 20 kg respectively 15
Determine the

i. Mass A and its angular position
ii. Positions of planes A and D

Q.10 In an in – line six cylinder engine working on two stroke cycle the cylinder centre lines are spaced at 600mm In the end view, the cranks are 60^o apart and in the order 1-4-5-2-3-6.the stroke of each piston is 400mm and the connecting rod length is 1 m The mass of the reciprocating parts is 200kg per cylinder and that of rotating parts 100kg per crank. The engine rotates at 300 rpm Examine the engine for the balance of primary and secondary forces and couples. find the maximum unbalanced forces and couples. 15

Total No. of Printed Pages:2

SUBJECT CODE NO:- H-204
FACULTY OF SCIENCE AND TECHNOLOGY
S.E (Mech./Prod)
Electrical Machine and Applied Electronics
(Old)

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

Please check whether you have got the right question paper.

N.B
1. Q.No.1 from section A and Q.No.6 from section B are compulsory.
2. Solve any two questions from remaining each section.
3. Assume suitable data, if required.

Section A

Q.1 Attempt any five of the following: 10
a) Give the classification of Electrical Drives.
b) Define back EMF & state its significance.
c) Enlist the braking methods of DC motor.
d) Draw circuit diagram of Universal Motor.
e) Enlist types of Single Phase Induction Motor.
f) Enlist the speed control methods of 3-phase induction motor.
g) Define Synchronous speed, Slip
h) Explain the concept of plugging.

Q.2 a) Give the comparison between electric drive and mechanical drive. 07
b) What are types of drives? Explain Multi motor drive with suitable example. 08

Q.3 a) What is working principle of DC motors? Explain DC shunt motor. 07
b) What is necessity of starter in DC Motor? Draw and Explain Three Point Starter. 08

Q.4 a) Draw and explain the construction of squirrel cage motor. 08
b) Explain V/F control of Three Phase Induction Motor. 07

Q.5 Write a short note: (any three) 15
a) Regenerative Braking
b) Chopper Fed DC Drive
c) Autotransformer Starter
d) AC Servo Motor

Section B

Q.6 Attempt any five of the following: 10

a) Give the detail classification of sensors.
b) Give the selection criteria for sensors.
c) What is MOSFET?
d) Enlist various types of Actuators.
e) Draw & explain 7-segments display.
f) Explain the working principle of light dimmer
g) Draw V-I characteristics of TRIAC.
h) What is Hall Effect?

Q.7 a) State Piezoelectric effect. Explain with neat schematic piezoelectric sensor. 08
b) Give the detailed classification of actuators. 07

Q.8 a) Explain construction and working of transistor in detail. 07
b) What is See back effect? Explain Thermocouple in detail. 08

Q.9 a) Explain shaft encoder-decoder sensor. 08
b) What is Heat Sink? Explain causes and effects of Heat Sink. 07

Q.10 Write a short note: (any three) 15

(i) Air flow sensor
(ii) LCD Display
(iii) Flash Circuit
(iv) TRIAC

Total No. of Printed Pages:3

SUBJECT CODE NO:- H-428
FACULTY OF SCIENCE & TECHNOLOGY
S.E. (Mech/Prod)
Strength of Material
(Old)

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

Please check whether you have got the right question paper.

N.B
1) Q.No.1 and Q.No.6 are compulsory.
2) Attempt any two questions from the remaining.
3) Assume suitable data if necessary.

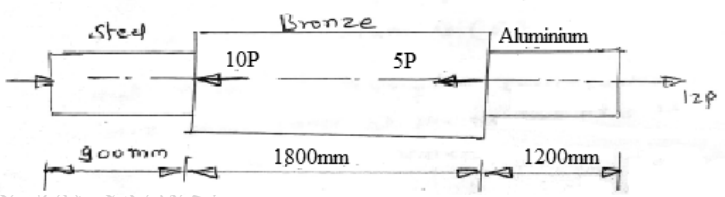
Section – A

Q.1 Attempt any five 10

1. Define shear strain with example.
2. Compare linear and lateral strain
3. What is shear modulus
4. Define Poisson's ratio
5. What is shear modulus
6. State principal of superposition
7. What is flitched beam
8. Draw shear stress distribution for circular section.
9. Explain shear force
10. State two assumption during bending analysis.

Q.2 a) A bronze bar is fastened between a steel bar and an aluminium bar as shown in figure 1. Axial loads are applied at the position as shown Find the largest value of P that will not exceed an overall deformation of 4mm or following stresses. 08

$\sigma_{st} = 140$ MPa, $\sigma_b = 120$MPa $\sigma_{a1} = 80$ Mpa $E_{st} = 200$ GPa
$E_b = 83$ GPa $E_{a1} = 70$ GP$_a$ $A_{st} = 560$ mm^2
$A_b = 750$ mm^2 $A_{a1} = 360$ mm^2



b) A composite rod, 1200mm long consists of a steel tube of 50mm external diameter and 40mm internal diameter. A copper rod of 30mm diameter is placed coaxially into the steel tube. The assembly is held between two rigidly plates and is subjected to an axial compressive force of 200 KN. Find the stress induced in each material and the contraction produced. Take E_s=200 GPa E_c=100GPa. 07

Q.3 Draw SFD and BMD for simply supported beam as shown in figure 2. 15

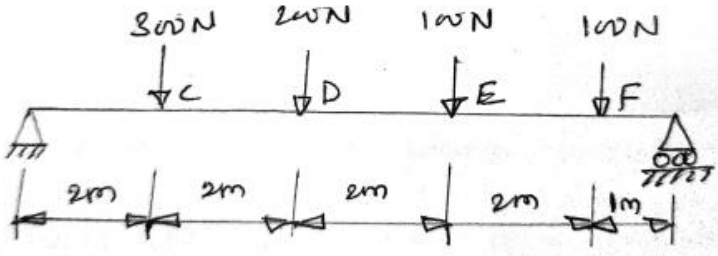


Figure 2

Q.4 a) Derive shear stress equation for beam. 07

b) A beam of rectangular section carry load 20KN of span 4m if depth (d) is twice breath (b) and allowable stress is 60 N/mm^2 find c/s area. How would you modify the cross section of beam if it were a concentrated load placed at the centre with the same ratio of breadth to depth. 08

Q.5 Derive with usual notation that shear stress at layer in the section of beam is $(\sigma_s) = \frac{SA\bar{Y}}{BI}$ also show that in case of rectangular cross-section, the maximum shear stress at the Neutral axis is 50% more than the mean value. 15

Section B

Q.6 Attempt any five 10

1) What is neutral axis
2) What is polar MI
3) Define polar section modulus
4) What is importance Mohr's circle
5) State different type of loading
6) What is load factor
7) What is principal shear stress
8) Define principal stresses
9) State deflection equation
10) Define boundary condition for simple support beam

Q.7 a) A short hollow cylindrical cast iron column having outside diameter 400mm and inside diameter 300mm was cast in a factory on inspection it was found that the base is eccentric in such a way that the thickness varies from 30mm at an end to 70mm at the other. Calculate the extreme intensities of stress induced in the section of the column carries a load of 2000 KN along the axis of the box. 10

b) State assumptions while analyzing torque in shaft. 05

Q.8 a) A piece of material is subjected to two perpendicular tensile stresses of 100 MPa and 60 MPa. Determine the plane on which the resultant stress has maximum obliquity with the normal. Also find the resultant stress on this plane. 08

b) Explain Graphical representation of principal stresses. 07

Q.9 a) A spherical shell of 1.2 m internal diameter and 6mm thickness is filled with water under pressure until the volume is increased by $400 \times 10^3 \text{mm}^3$. Find the pressure exerted by water on the shell E=204 GPa and $v = 0.3$ 08

b) A vertical steel rod of uniform diameter 30mm and 2.5 m long is subjected to a load of 2KN dropping from 20mm on a collar at a lower end of bar. If top end of bar is fixed. Calculate 07
(1) Instantaneous stress produced
(2) Strain energy $E = 2 \times 10^5 N/\text{mm}^2$

Q.10 a) A Beam 4m long , simply supported at its ends carries load 'w' at the centre. If the slope at the ends of beam is not to exceed 1°. Find Deflection at the center of Beam. 10

b) Explain deflection by double integration method. 05

Total No. of Printed Pages:4

SUBJECT CODE NO:- H-429
FACULTY OF SCIENCE & TECHNOLOGY
S.E. (Mechanical)
Strength of Material
(Revised)

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

Please check whether you have got the right question paper.

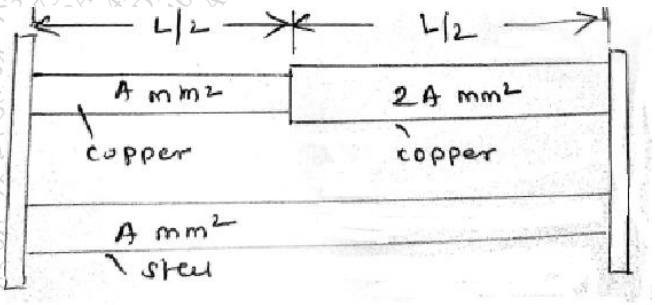
N.B
i) Q.1 and Q.6 are compulsory. Attempt any two from remaining from each section.
ii) Figures to right indicate full marks.
iii) Assume suitable data if necessary.

Section – A

Q.1 Attempt any Five 10

a) Define Hook's Law
b) Define Factor of Safety
c) Define Linear and Lateral Strains
d) Define Poisson's ratio
e) Define UDL
f) Define bending stress
g) Define Neutral Axis
h) Define shear stresses in Beams

Q.2 a) A composite bar is made up of connecting a steel member and a copper member rigidly fixed at their ends as shown in figure 1. The cross sectional area & steel member is A mm^2 while that of the copper member is 2A mm^2 for half the length and A mm^2 for the other half of length $\propto_s = \propto$ and $\sigma_{cu} = 1.25 \propto$ which Es=E and $E_{cu} = 0.5$ E. Estimate stresses induced in the members due to a temperature rise of t degrees. 10



b) Explain principal of superposition with example. 05

Q.3 a) Determine the force P necessary for the equilibrium of steel bar as shown in figure 2. The diameters of the first, middle and last segments of the bar are 30mm, 25mm and 30mm respectively. Also, find the elongation of the bar E=200 GPa. 08

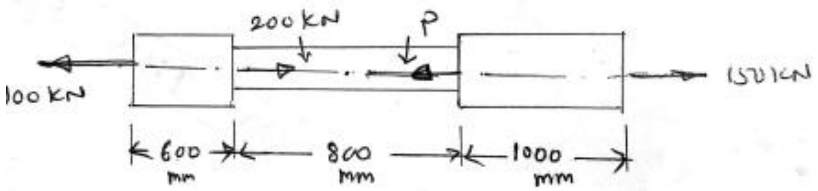


Figure 2

b) Explain Thermal stresses and strain with example. 07

Q.4 Construct shear force and bending moment diagram for a beam loaded as shown in figure 3 and locate point of contraflexture. 15

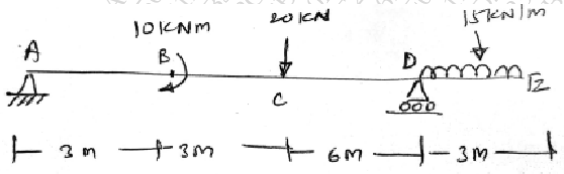


Figure 3

Q.5 a) Derive with usual notations that shear stress at a layer in the section of Beam is given by $= \frac{SA\bar{Y}}{BI}$ 07

b) The cross section of a beam is shown figure 4. The beam is made of a material with permissible stress in compression and tension equal to 100 N/mm^2 and 140 N/mm^2 respectively. Calculate the moment of resistance of the cross-section , when subjected to a moment causing compression at the top and tension at the bottom. 08

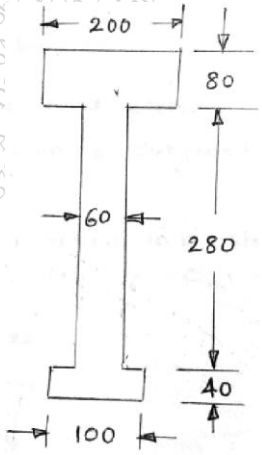


Figure 4

Section B

Q.6 Attempt any five 10

a) Define core sections

b) Define Direct and Bending stress

c) State equation of normal and tangential stress

d) Explain Mohr's circle of stresses.

e) Define Thin cylinder

f) Explain strain energy

g) Define Proof Resilience

h) Define circumferential stress

Q.7 a) A stepped shaft fixed at the two ends as shown in figure 5 is subjected to a torque of 300 Nm at Section C. The larger section is of aluminium and the small one is of steel. Determine the maximum stresses in the two material. 10

$G_s = 82$ GPa $G_{a1} = 27$GPa

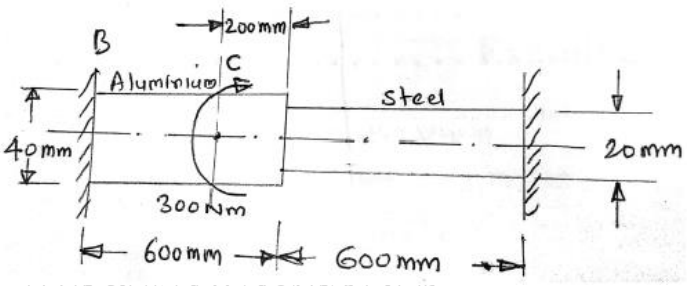


Figure 5

b) How to calculate total stress (Direct and bending stress) When column is subjected to eccentric loading. 05

Q.8 The state of stresses in a strained material is as shown in figure 6. Find analytically 15

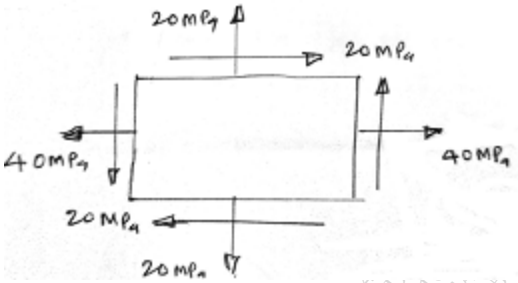
(1) Principal planes

(2) Principal stresses

(3) Normal stress on the planes of maximum and minimum shear stress.

(4) Maximum and minimum shear stress and their planes.

(5) Normal stress, shear stress and the resultant stresses on the planes the normal of which are inclined at +30° with X axis.



Q.9 a) Show that stress due to sudden load is twice the stress due to gradually applied load with neat sketch or graph. 08

b) A seamless spherical shell is of 0.8 m internal diameter and 4 mm thickness. It is filled with under pressure units its volume increases by 50 cm^3. Determine the fluid pressure $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio = 0.3 07

Q.10 For a beam as shown in Figure 6 Calculate the slope at support C and deflection under point load $E = 2 \times 10^5$ N/mm^2 $I = 5 \times 10^8$ mm^4 using Macaulay's Method 15

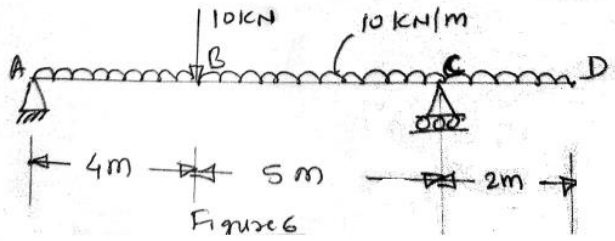


Figure 6

Total No. of Printed Pages:4

SUBJECT CODE NO:- H-134
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech./Prod)
Theory of Machines – I
(OLD)

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

Please check whether you have got the right question paper.

N.B
1) Q.1 and Q.6 are compulsory
2) Attempt any two questions remaining from each section
3) Assume suitable data if required

Section A

Q.1 Attempt any five 10

1. Enlist all kinematic pairs
2. What is mechanism
3. Compare machine and mechanism
4. Draw mechanism having two degree of freedom
5. When coriolis component of acceleration is considered in acceleration analysis
6. Define space and Body centrode
7. What is relative velocity method
8. Draw neat sketch of oldham's coupling and scotch yoke mechanism
9. How to get inversions of single slider crank chain
10. Compare kinetics and kinematics

Q.2 The mechanism of a warping machine as shown in figure 1 has the dimensions as follows 15
QA=100mm, AC=700mm, BC=200mm, BD=150mm,
O_2D=200mm, O_2E=400mm, O_3C=200mm
The crank O_1A rotates at a uniform speed of 100 rad/s For the given configuration determine the linear velocity of Point E

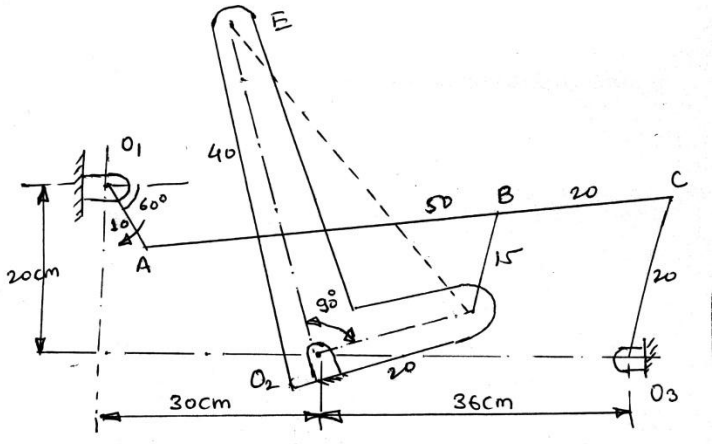


Fig.1

Q.3 Figure 2 shows a 'toggle mechanism' in which the length of various links are as follows OP=15cm, PQ=30cm, QR=22.5cm and QS=50cm S is a slider which is constrained to move in a horizontal direction. For the given configuration find the velocity of slider 'S' and angular velocity of links QR and QS when the crank OP is rotating uniformly with a speed of 240rpm in counter clockwise direction by instantaneous centre method 15

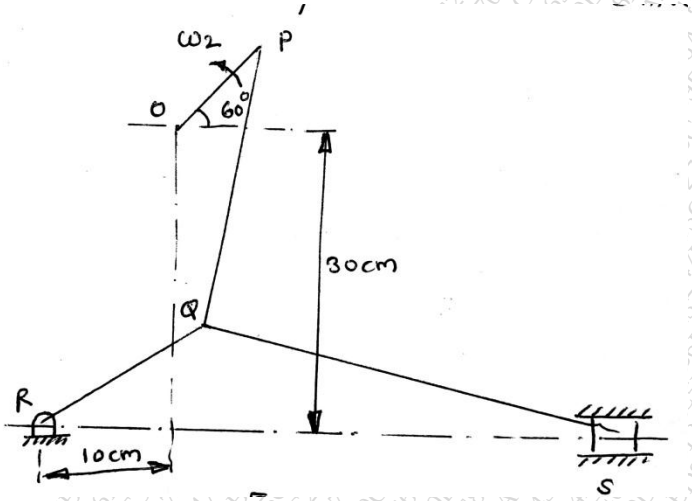


Fig.2

Q.4 In a whitworth quick return motion as shown in figure 3, OA is a crank rotating of 30rpm in a clockwise direction. The dimensions of various links are OA=150mm, OC=100mm, CD=125mm and DR=500mm Determine the acceleration of the sliding block R and the angular acceleration of the slotted lever CA 15

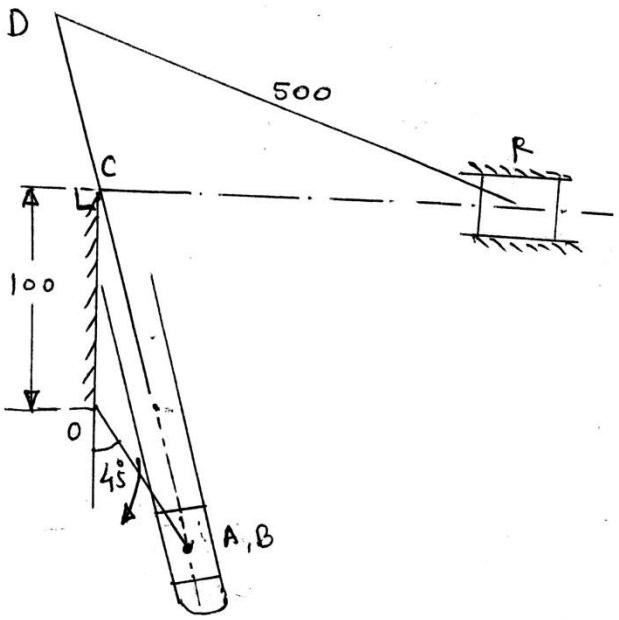


Fig. 3

Q.5 a) Derive an essential condition of placing the two masses, so that the system becomes dynamically equivalent 07

b) What is difference between piston effect, crank effort and crank pin effort 08

Section B

Q.6 Attempt any five 10

1. Draw neat sketch of epicyclic train dynamometer
2. Compare absorption and Transmission dynamometer
3. What are characteristics for material of brakes
4. What are functions of dynamometer
5. Classify cam based on motion of follower with neat sketch
6. What is pitch curve of cam
7. What do you mean by balancing of rotating masses
8. What are condition for dynamic balancing
9. What is displacement diagram in cam
10. What is hammer low

Q.7 A cam operates a roller in line reciprocating follower, while rotating at 300rpm the further specifications are minimum radius of cam=25mm 15
Lift of follower = 30mm
Diameter of roller = 15mm
Angle of lift = 120^0 (Nature of lift is SHM)
Outer dwell angle = 30^0
Angle of return = 150^0 Nature of return is uniform acceleration and retardation where acceleration is equal to retardation in magnitude.
Draw the cam profile find the maximum velocity and acceleration of the follower during lift as well as return

Q.8 a) A simple band brake is applied to a shaft carrying a flywheels of mass 250kg and radius of gyration 300mm. The shaft speed is 200 rpm. The drum diameter is 200mm and coefficient of fraction is 0.25. The free end of band is attached at 100mm from fulcrum and effort of 120N is applied on lever at 280mm from fulcrum. The angle embraced by belt is 225^0. Determine for counter clockwise rotation of drum 08

i) Braking Torque
ii) The no. of turns of flywheel before it come to rest
iii) The time taken by flywheel to come to rest

b) Write short note on Torsion Dynamometer 07

Q.9 P, Q, R and S are masses carried by a shaft at radii 200mm, 200mm, 150mm and 250mm respectively the planes in which masses rotates are spaced at 300mm apart and the magnitude of masses Q, R and S are 9kg, 5kg and 4kg respectively. Find the required mass A and there relative angular settings of the four masses so that shaft shall be complete balance 15

Q.10 The firing order in a 6 cylinder vertical four stroke in line engine is 1-4-2-6-3-5. The Piston stroke is 100mm and the length of each connecting rod is 200mm. The pitch distances between the cylinder centre lines are 100mm, 100mm, 150mm, 100mm and 100mm respectively. The reciprocating mass par cylinder is 1kg and the engine runs at 3000rpm. Determine the out of balance primary and secondary forces and couples on this engine, taking a plane midway between the cylinder 3 and 4 as the reference plane 15

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-276
FACULTY OF SCIENCE AND TECHNOLOGY
S.E.(Mech/Prod)
Production Processes -II
(Old)

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

Please check whether you have got the right question paper.

N.B
i. Q.1 and Q.6 are compulsory.
ii. Solve any two questions from remaining questions from each section.
iii. Figures to the right indicate full marks
iv. Assume suitable data, if necessary.

Section A

Q.1 Solve any five 10
a. Define tool life. How it is expressed?
b. Give significance of chip breakers.
c. What are the various materials used for cutting tools?
d. What is oblique cutting?
e. Explain working principle of lathe.
f. Define machine tool. Give its classification.
g. Explain straddle milling.
h. Explain economics of machining.

Q.2 a. What is orthogonal and oblique cutting? 08
b. Explain nomenclature of single point cutting tool. 07

Q.3 a. Explain principal parts of lathe. 08
b. Explain any four lathe operations with neat sketch. 07

Q.4 a. Explain gear cutting procedure on milling machine. 08
b. Differentiate between UP milling & down milling. 07

Q.5 a. Write a short note on cutting fluid. 08
b. Explain the heat sources doing machining. 07

Section B

Q.6 Solve any five 10
a. What is grade and structure of grinding wheel?
b. Define abrasive. State its types.
c. Enlist types of grinding wheels.
d. What are the limitations of broaches?
e. State advantages of plasma arc machining.
f. Enlist boring defects.
g. Give applications of ultrasonic machining.
h. Enlist tool holding devices for shaper machine.

Q.7	a.	Explain the principle & working of slotter machine.	08
	b.	Explain various operations performed on shaper.	07
Q.8	a.	What is the classification of boring machine? Explain any one.	08
	b.	Explain tool holding & working holding devices of drilling machine.	07
Q.9	a.	Explain electro discharge machining. Also state its applications.	08
	b.	Explain plasma are machining. Give its merits & demerits.	07
Q.10	a.	With neat sketch explain Electro chemical machining.	08
	b.	Explain jig boring machine.	07

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-359
FACULTY OF SCIENCE AND TECHNOLOGY
S.E (Mech/Prod)
Thermodynamics-I
(Old)

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

Please check whether you have got the right question paper.

N.B
1) Q.1 and Q.6 are compulsory.
2) Solve any two questions from remaining questions from each section.
3) Use of Steam table/ mollier diagram is allowed.
4) Figures to the right indicate full marks.
5) Assume suitable data, if necessary.

Section A

Q.1 Solve any five 10
a. State assumption of steady flow process.
b. Derive equation for nozzle from SFEE.
c. What do you mean by unavailable energy?
d. Explain perpetual motion machine of first kind.
e. State Carnot theorem.
f. Define flow work.
g. Draw isobaric process on PV and TS diagram.
h. Define heat engine.

Q.2 a. In steam power station steam flows steadily through 0.2m diameter pipe line from a boiler to the turbine. At the boiler end, the steam conditions are found to be, pressure 4 MPa, temperature 400°C, enthalpy 3213 6.6 kJ/kg and specific volume $0.073 m^3/kg$. At the turbine end conditions are found to be pressure 3.5 MPa, temperature 392°C, enthalpy 3202.6 kJ/kg and specific volume $0.084 m^3/kg$. There is heat loss of 8.5 kJ/kg from pipeline. Calculate steam flow rate. 08
b. Discuss limitations of first law of thermodynamics. 07

Q.3 a. A reversible refrigerator is used to maintain a space at a temperature of 0°C, when it's rejects heat to the surrounding at 30°C. If the heat removal rate from refrigerator is 100 MJ/hour. Determine COP of system. 08
b. A heat pump is used to maintain an auditorium Hall at 25°C when atmospheric temperature is 12°C. The heat load of the hall is 1550 kJ/minute. Calculate the power required to run actual heat pump if the COP of the actual heat pump is 32% of Carnot heat pump working between same temperature limits. 07

Q.4 a. Explain entropy and irreversibility. 07
b. Explain principle of increase in entropy of universe. 08

Q.5 Solve any three of the following. 15

a. Availability in steady flow and non – flow process
b. Control volume
c. Clausius theorem
d. Difference between heat pump and refrigerator

Section B

Q.6 Solve any five questions from the following. 10

a. Write limitations of Carnot cycle.
b. Define calorific value.
c. Define critical point.
d. Define dryness fraction of steam.
e. Draw dual cycle on PV and TS diagram.
f. Draw Carnot cycle on PV and TS diagram.
g. Define fuel what are its importance.
h. Write assumptions made in a standard cycles.

Q.7 a. Explain phase change diagram for pure substance. 07

b. The minimum pressure and temperature in an auto cycle are 100KPa and 27°C, the amount of heat added is 15000 kJ/kg. Calculate pressure and temperature at all point assuming compression ratio of 8. 08

Q.8 Percentage composition of liquid fuel is C=85% and $H_2 = 15\%$ by mass calculate 15

i) Mass of air required per kg of fuel
ii) Product of combustion by volume if 15% excess air is supplied.

Q.9 a. Derive an expression for enthalpy of wet steam. 04

b. Steam at 8 bar and 250°C is flowing at rate of 1.5 kg/s passes through a pipe carrying wet steam at 8 bar and 0.98 dry. After adiabatic mixing the flow rate is 2.8 kg/s. Determine condition of steam after mixing. The mixture is further expanded in nozzle isentropically to a pressure of 4 bar. Determine velocity of steam leaving nozzle. 11

Q.10 Write note on any three 15

a. Bomb calorimeter
b. Triple point
c. Comparison of otto, diesel and dual cycle on basis of same compression ratio.
d. Steam table.

Total No. of Printed Pages: 02

SUBJECT CODE NO:- H-360
FACULTY OF SCIENCE AND TECHNOLOGY
S.E.(Mechanical)
Thermodynamics –I
(Revised)

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

Please check whether you have got the right question paper.

N. B
i. Q. 1 and Q. 6 are compulsory.
ii. Solve any two questions from remaining questions from each section.
iii. Use of Steam table/ mollier diagram is allowed.
iv. Figures to the right indicate full marks.
v. Assume suitable data, if necessary.

Section A

Q. 1 Solve any five of the following 10
a. What is PMM-1? Explain.
b. Define heat pump.
c. Draw constant entropy process on PV and TS diagram.
d. Explain working of nozzle.
e. Explain flow work.
f. What do you mean by available energy?
g. State Kelvin planck statement.
h. What is principle of increase in entropy?

Q. 2
a. Derive an expression Clausius inequality. 07
b. A blower handles 1 kg/s of air at 18^0C and consumes power of 16 KW. The inlet and outlet velocities of air are 110 m/s and 160 m/s respectively. Find exit air temperature assuming adiabatic condition. Take Cp of air 1.005 KJ/kgK. 08

Q. 3
a. Prove the equivalence of Kelvin plank and clausius statement of second law of thermodynamics. 07
b. A reversible heat engine supplied with heat from two constant temperature source at 800 K and 500 K and reject heat too low temperature reservoir at 300 K. assuming the engine to execute number of complete cycles, while developing 70 kW and rejecting 50 kW. Calculate heat supplied by each source and efficiency of the engine. 08

Q. 4
a. Discuss entropy and disorder. 07
b. Show that entropy is property of system. 08

Q. 5 Write short note on any three 15
a. Difference between steady flow and non-flow process
b. Refrigerator
c. Entropy and irreversibility
d. PMM-II

Section B

Q. 6 Solve any five 10

a. What do you mean by higher calorific value lower calorific value?
b. What is HCV and LCV?
c. Write assumptions in power cycle.
d. Explain triple point.
e. Draw PV and TS diagram of otto cycle.
f. State devices used for determining dryness fraction.
g. Define wet steam and superheated steam.
h. What is fuel what are its types.

Q. 7

a. Derive expression for mean effective pressure of diesel cycle. 07
b. A gas turbine plant operates on Brayton cycle between Tmin= 290k and Tmax 1000k. Find maximum work done per kg of air and corresponding cycle efficiency. How does this efficiency compare with the carnot efficiency operating between same to temperatures? 08

Q. 8

a. Draw a neat sketch of Orsat apparatus and explain its working. 07
b. A vessel of volume $0.04m^3$ contains a mixture of saturated water and saturated steam at a temperature of 250^0C. The mass of liquid present is 9 kg. Find the pressure, the mass, the specific volume, the enthalpy, the entropy and internal energy. 08

Q. 9

a. Methane is burnt with atmospheric air. The analysis of products on a dry basis is as follows 08
$CO_2 11\%, O_2\ 2.37\%, CO\ 0.53\%, N_2 = 86.10\%$
Calculate the air fuel ratio and percentage of theoretical air and determine combustion equation.

b. Discuss dryness fraction and how it is measured? 07

Q. 10 Write note on any three 15

a. Pure substance
b. Otto cycle
c. Atkinson cycle
d. Bomb calorimeter

Total No. of Printed Pages: 2

SUBJECT CODE NO:- H-393
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech./Prod.)
Production Processes –I
(OLD)

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

Please check whether you have got the right question paper.

N.B
1. Questions No.1 from section A and Q.no.6 from section B are compulsory.
2. Attempt any two questions from Q.no.2 toQ.no.5 in section A and any two questions from Q.no.7 to Q.no.10 in section B
3. Figures to the right indicate full marks
4. Assume suitable data whenever necessary

Section - A

Q. 1 Attempt any five questions from the following 10
a) State two types of pattern with sketch
b) Why core box used in foundry
c) What is function of Gate
d) State any two advantages of centrifugal casting
e) Draw neat sketch of rolling operation.
f) What is press brake where it is used
g) What is lancing sheet metal operation?
h) Compare punching & blanking with sketch.
i) Draw two defect in die casting.
j) State advantages of extrusion.

Q. 2 a) Explain cupola furnace in detail with neat sketch 07
b) State various casting defect with neat sketches 08

Q. 3 a) Discuss in detail continuous casting with example 08
b) Explain shell moulding, when it is used. 07

Q. 4 a) Define extrusion, compare forward and backward extrusion 07
b) State advantages & disadvantages of cold rolling 08

Q.5 Write short note on any three 15
a) Testing of moulding sand
b) Induction furnace
c) Moulding boxes
d) Rotary swaging

Section –B

Q.6 Solve any five 10

a) What is poymer.
b) Why additives are added in plastics.
c) What is high pressure of low pressure laminating plastics?
d) What is gas cutting
e) State application projection welding.
f) What is LASER?
g) Define weldability.
h) Define polishing.
i) State steps in chemical cleaning.
j) What is anodizing.

Q.7 a) Write short note on rotational moulling. 08
b) With neat sketch explain plastic moulding dies. 07

Q.8 a) Explain working principles of plasma arc welding 07
b) Compare arc welding and resistance welding. 08

Q.9 a) Explain working principle of shielded metal arc welding process. 09
b) State advantages and disadvantages of welding process. 06

Q.10 a) How mechanical cleaning for metal arc done. 07
b) Explain in detail process of power coating stating its application. 08

Total No. of Printed Pages:02

SUBJECT CODE NO:- H-169
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (Mech/Prod)
Thermodynamics-II
(OLD)

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

Please check whether you have got the right question paper.

N.B
1. Assume suitable data, if necessary.
2. Question No.1 and Question No. 6 are compulsory from section And B.
3. Solve any TWO questions from remaining in each section A and B.
4. Use steam Table, Mollier diagram is permitted.

Section A

Q.1 Attempt any FIVE of the following. 10
a. Define Equivalent evaporation?
b. Define evaporative capacity and boiler efficiency?
c. Define draught and classify it?
d. Write down the advantages of natural draught over artificial draught?
e. What is the equation of continuity of nozzle?
f. Define coefficient of discharge of nozzle?

Q.2 a. With suitable neat sketch explain construction and working principle of Benson boiler? 07
b. The following particulars were recorded during a trial of steam boiler: 08
Pressure of steam = 11 bar, mass of feed water =4600 kg/ hr, temperature of feed water= 75°C, dryness fraction of steam = 0.96, coal used = 490 kg/hr, calorific value of coal = 35700 kj/ kg, moisture in coal = 4% by mass, mass of dry flue gases =18.57 kg/kg of coal, temperature of flue gases= 300°C, boiler house temperature = 16°C, specific heat of flue gases = 0.97 kJ/ kg K. draw heat balance sheet of the boiler per kg of coal.

Q.3 a. Derive an equation for condition for maximum discharge through the chimney? 07
b. In a chimney of height 50m, temperature of flue gases with natural draught is 367°C. The temperature of waste gases by using artificial draught is 127°C. The temperature of outside air is 27°C. If the air supplied is 19 kg / kg of fuel burnt, determine the efficiency of chimney. Assume $C_P = 1.005$ kj/kgK for flue gases. 08

Q.4 a. Obtain an expression for discharge through nozzle. 07
b. Air at a pressure of 20 bar and at a temperature of 18°C is supplied to a convergent divergent nozzle having a throat diameter of 1.25 cm and discharge to atmosphere. The adiabatic index for air is 1.4 and characteristic gas constant is 287. Find the weight of air discharged per minute. 08

Q.5 Write short notes on (Any three) 15
a. IBR Laws?
b. Difference between Forced and induced Draught?

c. Effect of back pressure on nozzle characteristics?
d. Supersaturated flow through nozzle?

Section B

Q.6 Attempt any FIVE of the following. 10

a. Define condenser and classify it?
b. Define vacuum efficiency?
c. Draw P –V and T- S diagram for regenerative cycle?
d. Define specific steam consumption?
e. Difference between reciprocating and rotary compressor?
f. Write the engineering applications of compressed air?

Q.7 a. What do you understand by cooling towers? Explain their utility. 07

b. Find the weight of cooling water required in the surface condenser of a 3000kW steam power plant from the following data: 08
Steam used = 10 kg/ kWh
Exhaust steam condition = 0.9 dry
Pressure in the condenser = 0.1bar
Hot well temperature = 32℃
Cooling water inlet temperature = 25℃
Cooling water outlet temperature = 32℃
Temperature of steam at entrance = 40℃
What will be the vacuum efficiency?

Q.8 a. Explain in detail Reheat cycle? 07

b. A steam turbine supplied with steam at a pressure of 85 bar and 450℃. The steam is reached to its original temperature in a reheater at 10 bar. The expansion then takes place at condenser pressure of 0.08 bar. Find the efficiency of the reheat cycle and the work output if the flow of steam is 1 kg/s. consider the pump work and assume that the expansion in the turbine is isentropic. 08

Q.9 a. Explain with suitable neat sketch two stage reciprocating air compressor with intercooler and draw P-V and T-S diagram for perfect and imperfect intercooling? 07

b. A single stage reciprocating air compressor is required to compress 1 kg of air from 100 kPa to 400 kPa. The initial temperature is 27℃, compare the work requirement in the following cases: Isothermal compression, compression with $PV^{1.2} = C$, isentropic compression. 08

Q.10 Write short notes on (any THREE) 15

a. Describe the factors affecting the efficiency of condensing plant.
b. Compare jet condenser and surface condenser?
c. Effect of back pressure on the performance of Rankine cycle?
d. Air motors?