S - 363

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Part - II) (Semester - III) Examination, May - 2015

APPLIED THERMODYNAMICS (Revised)

Sub. Code : 42661

Day and Date : Thursday, 21 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions:
1) **Solve any three questions from section-I and any three questions from section II.**
2) **Figures to right indicate full marks.**
3) **Use of calculator, steam table and mollier chart is allowed.**
4) **Assume suitable data if necessary.**

SECTION - I

Q1) a) Differentiate between availability and unavailability. [4]

b) Prove that entropy is a property of a system. [6]

c) 3kg of water at 80°c is mixed with 4kg of water at 15°c in a isolated system. Calculate the change of entropy due to mixing process. [6]

Q2) a) Derive an expression for Rankine efficiency of a vapour power cycle and represent the cycle on T-S plot. [8]

b) Rankine cycle operates between pressures of 80 bar and 0.1 bar the maximum cycle temperature is 600°c. If the steam turbine and condensate pump efficiencies are 0.9 and 0.8 respectively. Calculate specific work and thermal efficiency. [8]

Q3) a) Classification of condenser & explain the working of surface Condenser with neat sketch. [8]

P.T.O.

b) During a trial on a steam condenser, the following observations were recorded: [8]

Condenser vacuum	680 mm Hg
Barometer reading	764 mm Hg
Mean condenser temperature	36.2°c
Hot well temperature	30°c
Condensate formed per hour	1780Kg
Circulating cooling water inlet temp.	20°c
Circulating cooling water outlet temp.	32°c
Quantity of cooling water	1250Kg/min.

Determine:

i) Condenser vacuum corrected to standard barometer.

ii) Vacuum efficiency.

iii) Under cooling of condensate.

iv) Condenser efficiency.

v) Condition of steam as it enters the condenser.

$C_{pw} = 4.187$Kj/Kg-k, $R = 0.287$ Kj/Kg-k.

Q4) Write short notes any three of the following [18]

a) Third law of thermodynamics.

b) Increase of entropy principle.

c) Explain real gas equations of state.

d) Air extraction pumps.

SECTION - II

Q5) a) Define nozzle efficiency, velocity coefficient and coefficient of discharge List the factors on which nozzle efficiency depends. [8]

b) Dry saturated steam at a pressure of 11 bar enters a convergent — divergent nozzle and leaves at a pressure of 2 bar, if the flow is adiabatic and frictionless, Determine [8]

i) Exit velocity of steam

ii) Ratio of Area of exit to Throat area .

Q6) a) How steam turbines are classified? Difference between reaction & impulse turbine. [8]

b) The blade speed of single ring impulse blading is 250 m/s and nozzle angle is 20°. The heat drop is 550 KJ/Kg and nozzle efficiency is 85%. The blade discharge angle is 30° and machine develops 30KW, when consuming 360kg of steam per hr. Draw velocity dig. And calculate, [8]

- Axial thrust on blading
- Heat equivalent per kg of steam of friction of blading.

Q7) a) Define the term 'degree of reaction' and internal efficiency and that degree Of reaction [8]

$R = V_f/2V_b(\cot\beta_2 - \cot\beta_1)$

b) The outlet angle of the blade of Parson's turbine is 20° and the axial velocity of flow of steam is 0.5 times the mean blade velocity. Draw velocity dig. For a stage consisting of one fixed and one moving row of blades given that mean dia. is 71cm and speed 300 rpm find inlet angle of blade. [8]

Q8) Write note on following (any three). [18]

a) Reheat factor.

b) Throttle governing,.

c) Carbon ring gland & water sealed gland.

d) Turbine losses.

e) Turbine overhauling.

⊖⊖⊖

S - 369

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) Examination, May - 2015

APPLIED THERMODYNAMICS (Revised)

Sub. Code : 63352

Day and Date : Thursday, 21 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions:
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Assume suitable data if necessary.**
4) **Use of non - programmable calculator, steam table, Mollier chart are allowed.**

Q1) a) Explain equivalence of Kelvin - plank and Clausius statement. Give the statement of third law of thermodynamics. [8]

OR

Explain the principle of increase of entropy.

b) In an air turbine the air expands from 7 bar and 460° C to 1 bar & 160° C. The heat lost from the turbine can be assumed to be negligible. Show that the process is irreversible and calculate change in entropy per kg of air. [8]

Q2) a) Which are the different properties of steam? Explain the use of steam table and Mollier chart. [8]

b) In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Determine [9]

i) Turbine work

ii) Pump work

iii) The Rankine efficiency.

Assume flow rate of 9.5 kg/s.

P.T.O.

Q3) a) How is 'Boiler efficiency' defined? [8]

Give the construction and working of the Babcock and Wilcox boiler.

OR

How will you classify condensers? In what respect a jet condensor differs from a surface condenser?

b) The following data were obtained from the test of a surface condenser. [9]

i) Condenser vacuum = 711 mm of Hg

ii) Hot well temperature = 32° C

iii) Inlet temperature of cooling water = 12° C

iv) Outlet temperature of cooling water = 28° C

v) Barometric reading = 760 mm of Hg.

Calculate i) Vacuum efficiency

ii) Condenser efficiency

Q4) a) What is the effect of friction on the flow through a steam nozzle? Explain with the h - s plot. [8]

OR

Define nozzle efficiency, velocity coefficient and coefficient of discharge. List the factors on which nozzle efficiency depends.

b) In a convergent - divergent nozzle, the steam entres at 15 bar and 300° C and leaves at a pressure of 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit areas for mass flow rate If 1kg/s. Assume nozzle efficiency to be 90% and C_p = 2.4 kj/hg.k [10]

Q5) a) What is compounding? Explain any one compounding in detail. [8]

OR

Prove that maximum blade efficiency of a 50% single stage reaction turbine is given by $\eta_b = \frac{2\cos^2\alpha}{1+\cos^2\alpha}$ when α is nozzle angle or outlet angle of fixed blade.

b) The following data relate to a single stage impulse turbine.

Steam velocity = 600m/s

Blade speed = 250m/s

Nozzle angle = 20°

Blade outlet angle = 25°

Neglect the effect of friction, and calculate the work developed by the turbine for the steam flow rate of 20kg/s. Also calculate the axial thrust on the bearings. **[8]**

Q6) a) What are the methods of Governing of steam turbine? Explain any one in detail. **[8]**

OR

Write short notes (any two)

i) Reheating of steam turbine

ii) Effect of friction on combined velocity triangle

iii) Working of single stage impulse turbine.

b) In Parson's reaction turbine running at 400 rpm with 50% reaction develops 75 kw per kg per second of steam. The exit angle of the blades is 20° and the steam velocity is 1.4 times the blade velocity. Find **[8]**

i) Blade velocity

ii) Inlet angle of the blades

S - 372

Seat No.	

Total No. of Pages : 3

S.E.(Mechanical) (Semester-III) Examination, May - 2015

ELECTRICAL TECHNOLOGY (New)

Sub. Code : 63351

Day and Date : Thursday, 28 - 05 - 2015.

Time : 10.00 a.m. to 1.00 p.m. **Total Marks : 100**

Instructions : 1) All questions are compulsory.

2) Figures to the right indicate marks.

3) Draw neat figures wherever necessary.

4) Assume suitable data, if missing. State it clearly.

SECTION - I

Q1) a) Compare dc series motor and dc cumulative compound motor in terms of circuit, characteristics, advantages, disadvantages and applications. **[1 × 8]**

OR

In the working of dc motor, explain the role of-Stator field system, armature winding, commutator-brush system.

Answer any two of the following (b,c,d) **[2 × 6]**

b) Explain the role of following components in a 4 point starter: Variable resistance, NVC, OLC.

c) State the 4 advantages of electric braking. Explain plugging type electric braking for dc shunt motor and dc series motor.

d) A dc shunt motor has armature resistance and field resistance 1 ohm and 200 ohm respectively. When a rated voltage of 230V is applied, it runs at a rated speed of 1500 rpm at full load by taking 20A current. To reduce the speed to 1000 rpm how much resistance should be connected in series with the armature winding? The load torque remains constant.

Q2) Answer any two. **[2 × 8]**

a) Explain the working of 3 phase induction motor.

b) Draw the speed torque characteristics of 3 phase induction motor and explain the importance of stable operating region.

P.T.O.

c) The power input to a 6 pole, 50 Hz induction motor is 5 kW. Find the brake horse power and torque if slip = 0.05, Stator copper and iron loss = 200 W, Rotor copper and iron loss = 240 W, frictional loss = 100 W.

Q3) Answer any two. [2 × 8]

a) Draw the circuit and explain the working of a star delta starter.

b) Compare the voltage control and V/f control on the basis of range of speed, current drawn at constant torque load, speed regulation, maximum torque.

c) Explain the reversal of rotation of 3 phase induction motor.

SECTION - II

Q4) Answer any two. [2 × 8]

a) Explain the construction and working principle of D.C. Servo motor.

b) What are the types of stepper motor? Explain construction and working of permanent magnet stepper motor.

c) Explain the construction, working and applications of linear induction motor.

Q5) Answer any two. [2 × 8]

a) State four advantages of electrical drives. Differentiate between active load and passive load with examples.

b) Explain the starting requirements and running requirements, braking requirements and hence suggest a suitable motor for following applications.

i) Rolling mills

ii) Cranes, Hoists

iii) Conveyors

iv) Machine tools

c) Classify mechanical loads on the basis of load torque requirements. Explain variation of load torque with respect to speed for different mechanical load.

Q6) Answer any two. [2 × 8]

a) Explain construction, working and applications of salt bath electric furnace.

b) Explain the working and advantages of coreless Induction furnace.

c) Calculate the efficiency of a high frequency induction furnace which takes 10 minutes to melt 1.8 kg of aluminium. The input to the furnace being 4.8 kW and initial temperature 15°C, specific heat of aluminium = 0.88kJ/kg°C, melting point of aluminium = 660°C, latent heat of fusion of aluminium = 32kJ/kg,

XXXX

S-366

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Part -I) (Pre - Revised) Examination, May - 2015

ELECTRICAL TECHNOLOGY AND COMPUTER PROGRAMMING USING C++

Sub. Code : 42662

Day and Date : Thursday, 28 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions:

1) **Attempt Any Three Questions from each section.**
2) **Figures to the Right indicate full marks.**
3) **Use of non-programmable calculator is permissible.**
4) **Use separate answer sheet for each section.**

SECTION - I

*Q1)*a) Explain Three point starter & Limitations of three point starter. **[8]**

b) Explain speed control of DC series motor by armature & flux control Method. **[8]**

*Q2)*a) Explain the principle of operation & construction of Squirrel cage induction motor. State atleast Four applications of squirrel cage induction motor. **[8]**

b) Explain speed control Method of squirrel cage induction motor by stator side control. State limitations of each method. **[8]**

*Q3)*a) Explain Dynamic & Regenerative braking method of Three phase induction motor. **[8]**

b) Compare Group drive & individual drive with limitations & advantages. **[8]**

P.T.O.

Q4) Write short notes on Any Three: [18]

a) Selection factors of motors

b) Power factor correction methods

c) Electronic starter for DC shunt Motor

d) Auto transformer starter for Three phase induction Motor.

SECTION - II

*Q5)*a) Define a class to find volume and surface area of sphere. It should have following members:

Data members: Radius, volume and surf_area

Member functions: To get radius, To find volume and surface area and To display volume & surface area.

Write a program to find volume and surface area of 3 spheres. [12]

b) Name the following symbols and give the syntax for their use in C++ (any FOUR)

1. :: 2. && 3. || 4. << 5. # [4]

*Q6)*a) What is Inheritance? Explain Private and Public inheritance. [8]

b) Write code to explain the Constructor function. [8]

*Q7)*a) Enlist the types of expressions used in C++. Explain any two of them. [8]

b) Explain the effect of Protected inheritance on Private, Public and Protected member of base class. Write code to explain. [8]

Q8) Write short notes on the following. (Any THREE) [18]

a) Function and operator overloading

b) Basic concepts of OOP

c) Friend function

d) Abstract Base Class

Seat No.	

Total No. of Pages : 4

S.E. (Mechanical Engg.) (Semester - III) Examination, May - 2015

ENGINEERING MATHEMATICS - III (Revised)

Sub. Code : 63350

Day and Date : Tuesday, 19 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of non-programmable calculator is allowed.**
4) **Write both the Sections in one answer book.**

SECTION - I

Q1) Attempt any three questions from the following:

a) Solve $\frac{d^3y}{dx^3}+3\frac{d^2y}{dx^2}+3\frac{dy}{dx}+y=e^{-x}$. [6]

b) Solve $\frac{d^2y}{dx^2}-2\frac{dy}{dx}+2y=x+e^x\cos x$. [6]

c) Solve $(D^4+6D^2+9)\,y=96\sin 2x\cos x$. [6]

d) Solve $(D^2+3D+2)\,y=\sin e^x$. [6]

e) Solve $x^2\frac{d^2y}{dx^2}-2x\frac{dy}{dx}-4y=x^4$. [6]

P.T.O.

Q2) Attempt any one from the following:

a) The differential equation for the displacement y of a whirling shaft when the weight of the shaft is taken into account is $EI\frac{d^4y}{dx^4}-\frac{W\omega^2}{g}y=W$. Taking the shaft of length $2l$ with the origin at the centre and short bearings at both ends. Show that the maximum deflection of the shaft is $\frac{g}{2\omega^2}$ [sech al + sec al –2]. **[16]**

b) A body weighing 10 kg is hung from a spring. A pull of 20 kg wt. will stretch to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t sec., the maximum velocity and the period of oscillations. **[16]**

Q3) Attempt any four from the following:

a) Find $div\vec{F}$ and $Curl\vec{F}$ if $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$. **[4]**

b) Find the directional derivative of $\phi=x^4+y^4+z^4$ at the point A (1, –2, 1) in the direction AB, where B is (2, 6, –1). **[4]**

c) If $\vec{a}=a_1i+a_2j+a_3k$ is constant vector and $\vec{r}=xi+yj+zk$, then show that $\frac{\vec{a}\times\vec{r}}{r^n}$ is a solenoidal vector. **[4]**

d) Show that $\vec{F}=(6xy+z^3)i+(3x^2-z)j+(3xz^2-y)k$ is irrotational. **[4]**

e) Show that $\nabla\left(\frac{\vec{a}.\vec{r}}{r^n}\right)=\frac{\vec{a}}{r^n}-\frac{n(\vec{a}.\vec{r})\vec{r}}{r^{n+2}}$. **[4]**

SECTION - II

Q4) Attempt Any Three from the following:

a) Find the Laplace transform of $e^{-t}\int_0^t \frac{\sin t}{t}dt$. [6]

b) Use Laplace transform method to solve [6]

$\frac{d^2x}{dt^2}+4\frac{dx}{dt}+8x=1$ given that $x(0)=0, x'(0)=1$.

c) Find Inverse Laplace transform of $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$. [6]

d) Find $L\{f(t)\}$ and $L\{f'(t)\}$ for $\frac{t}{2a}$ sinhat. [6]

Q5) Attempt Any Two from the following:

a) Develop Fourier Series for the function $f(x)=\left(\frac{\pi-x}{2}\right)^2$ in $0\le x\le 2\pi$

and hence deduce that $\frac{\pi^2}{6}=\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots..$ [8]

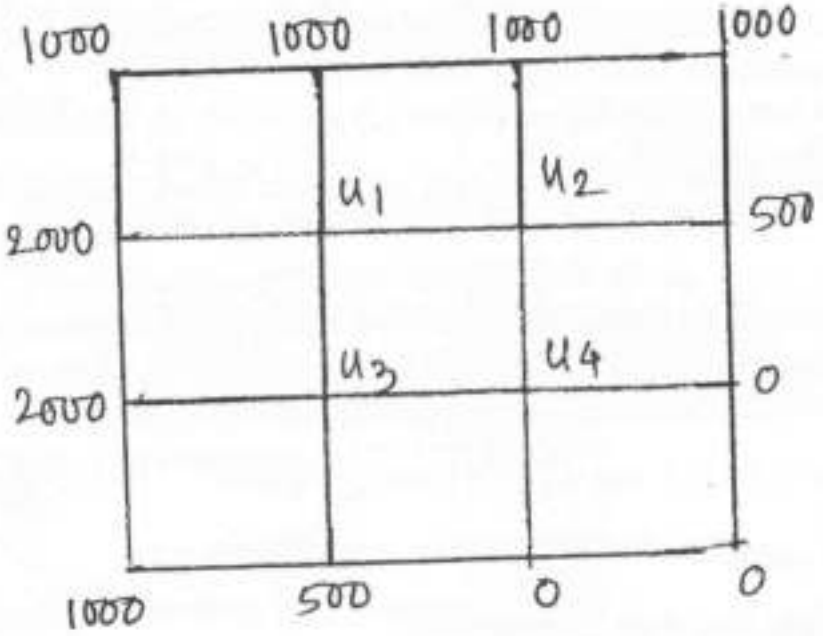
b) Find Half Range sine series and Half Range cosine series for $f(x)=\pi-x$ in $(0,\pi)$. [8]

c) Expand $f(x)=e^{-x}$ as Fourier series in the interval $(-l, l)$. [8]

Q6) A tightly stetched flexible string has its ends fixed at $x=0$ and $x=l$. At time $t=0$, the string is given a shape defined by $f(x)=\mu x(l-x)$ where μ is a constant and then released. Find the displacement of any point x of the string at any time $t>0$. [16]

OR

Given the values of $u(x, y)$ on the boundary of square in the figure, evaluate the function $u(x, y)$ satisfying Laplace eq^n. $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ By Gauss - Seidal iteration method.



(Find solution by four iterations)

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical Engg.) (Semester - III) Examination, May - 2015

ENGINEERING MATHEMATICS - III

Sub. Code : 42660

Day and Date : Tuesday, 19 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions : 1) Attempt Any Three questions from each section.
2) Figures to right indicate full marks.
3) Non-programmable calculator is allowed.

SECTION - I

Q1) a) Solve $\left(D^3-5D^2+8D-4\right)y=2e^x+3e^{-x}$. **[5]**

b) Solve $x^3\frac{d^3y}{dx^3}+2x^2\frac{d^2y}{dx^2}+2y=10\left(x+\frac{1}{x}\right)$. **[6]**

c) Solve $\left(D^2+4D+4\right)y=e^{-2x}\cos x$. **[5]**

Q2) a) An 8 lb weight is placed at one end of a spring suspended from the ceiling. The weight is raised to 5 inches above the equilibrium position and left free. Assuming spring constant 12 lb/ft, find the equation of motion, displacement $x(t)$ and amplitude. **[9]**

b) The motion of a particle is given by $\frac{d^2x}{dt^2}=-k^2x-2h\frac{dx}{dt}$ solve the equation when $h = 5$, $k = 4$, taking $x = 0$, $v = v_0$ at t = 0. Show that the time of maximum displacement is independent of the initial velocity. **[8]**

P.T.O.

Q3) Solve:

a) $p(y^2+z^2)-q(xy)=-xz$. [6]

b) $py-2xy=\log q$ [5]

c) $(x+y)(p+q)^2+(x-y)(p-q)^2=1$ [6]

(use $u=x+y$ & $v=x-y$).

Q4) Solve the wave equation [16]

$$\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$$

under the conditions $u=0$ when $x=0$ and $x=\pi$ and $\frac{\partial u}{\partial t}=0$ when t = 0 and

$u(x,0)=x, 0<x<\pi$.

SECTION - II

Q5) a) Find value of integral using Laplace transform $\int_0^\infty e^{-t}\cos^2 2t\,dt$. [5]

b) Find Laplace transform of $f(t)=t^2\sin 2t+\frac{1}{t}\int_0^t (u-2)\,du$. [6]

c) If, $f(t)=f(t+2)$, find Laplace transform of function

$f(t)=t,\ 0<t\le 1$

$=(2-t), 1<t<2$ [6]

Q6) a) Find Inverse Laplace transform of

$\phi(s)=\frac{1}{(s-1)(s^2+4s+8}$. [5]

b) Find inverse Laplace transform using convolution theorem.

$$\frac{1}{s^2(s+2)^2}.$$ [5]

c) Solve following L.D. equation using Laplace transform

$(D^3+3D+2)\,y=2t^2$ where $y(0)=2$ & $y'(0)=0$. [6]

Q7) a) Find the directional derivative of $\phi=x^2y-xy^2+xyz$ at the point $(1, 2, -1)$ in the direction of normal to surface $x^2+y^2+z=3$ at $(1, 1, 1)$. [5]

b) Find values of constants a & b such that

$\bar{f}=(axy^2+yz)i+(2x^2y+xz+yz^2)\,j+(2y^2z+bxy)k$ is irrotational. [5]

c) Find the angle between the tangents to the curve

$x=2\sin 3t, y=2\cos 3t, z=8t$ at $t=0$ and $t=\pi/2$. [6]

Q8) a) Find fourier series expansion for the function

$$\begin{aligned} f(x)&=\pi x \quad 0\le x\le 1\\ &=\pi(x-2) \quad 1\le x\le 2 \end{aligned}$$ [10]

b) Find half-range cosine series for the function

$$\begin{aligned} f(x)&=x \quad 0<x<\frac{\pi}{2}\\ &=(\pi-x) \quad \frac{\pi}{2}<x<\pi \end{aligned}$$ [7]

S - 365

Total No. of Pages :3

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised)

Examination, May - 2015

FLUID MECHANICS

Sub. Code : 42665

Day and Date : Tuesday, 26 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Solve any three questions from Section-I and three questions form Section-II.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Assume suitable data if necessary.**

SECTION - I

Q1) a) State and explain Newton's law of viscosity. **[5]**

b) Write a note on types of fluids. **[5]**

c) A U-tube is made up of two capillaries of bores 1.5 mm and 2 mm respectively. The tube is held vertical and partially filled with liquid whose $\sigma = 0.075$ N/m. Find out the mass density of the liquid if the difference in two menisci is 2mm. Assume angle of contact is zero. **[6]**

Q2) a) Explain the following: **[8]**

i) Path line ii) stream line

iii) Streak line iv) stream tube

b) Find the convective acceleration at middle of a pipe which converges uniformly form 0.4 m diameter to 0.2 m diameter over 2 m length. The rate of flow is 2 lit/sec. **[8]**

Q3) a) What is an orifice? How orifices are classified? **[5]**

b) State the Bernoulli's theorem. Also write the assumptions and limitations of bernoulli's theorem. **[5]**

P.T.O.

c) A large tank resting on the floor is filled to a depth of 6 m,. A sharp edged orifice of 10mm diameter is located 2.5 m above the floor level. For Cc = 0.6 Cv = 0.97, determine the discharge and horizontal distance from the tank, where the jet will strike the ground. Also determine Cd. [8]

Q4) a) Explain the following: [8]

i) Similitude and types of similarities

ii) Model laws

b) In a 45° a rectangular air duct of 1 m^2 cross sectional area is gradually reduced to 0.5 m^2 area. Find the magnitude and direction of force required to hold the duct in position if the velocity of flow at $1m^2$ section is 10 m/s and pressure is 2.943 N/cm^2. Take density of air as 1.16Kg/m^3. [8]

SECTION - II

Q5) a) Find the expression for average velocity for the viscous flow between two parallel plates. Find the ratio of maximum velocity to average velocity. [9]

b) A laminar flow is taking place in a pipe of diameter of 200 mm. the maximum velocity is 1.5 m/s. find the mean velocity and the radius at which it occurs. Also calculate the velocity at 4 cm from the wall of pipe. [8]

Q6) a) Derive an expression for equivalent pipe for parallel pipe. [8]

b) Two reservoirs, having a difference in elevation of 15 m, are connected by a 200 mm diameter siphon. The length of the siphon is 400 m and the summit is 3 m above the upper reservoir. The length of the pipe from upper reservoir to the summit is 120 m. if the coefficient is 0.005, determine; [9]

i) Discharge through the siphon

ii) Pressure at the summit.

Q7) a) Explain the development of boundary layer over a flat plate held parallel to the direction of flow. State the factors affecting the growth of boundary layer. [8]

b) A flat plate 1 m long and 0.5 m wide was held in the wind tunnel to such an angle that the coefficient of drag and lift are 0.15 and 0.75 respectively. If the wind speed is 48 km/hr and weight density of air is $12N/m^3$, calculate drag force, lift force, resultant force and power exerted by air on the plate. [8]

Q8) Write short notes on any four of the following: [16]

a) Minor losses

b) Magnus effect

c) Mach number and mach cone

d) methods of preventing the separation of boundary layer

e) Sonic, subsonic and supersonic flow

f) Stagnation point and its properties.

✔ ✔ ✔

S - 371

Total No. of Pages :3

Seat No.	

S.E. (Mechanical) (Semester - III) (Revised) Examination, May - 2015

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Tuesday, 26 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of Non programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) i) With the help of graphical representation explain briefly different types of fluids with examples. **[6]**

ii) Ten litres of a liquid of specific gravity 1.3 is mixed with eight Litres of a liquid of specific gravity 0.8 If the bulk of the liquid shrinks by one percent on mixing, calculate specific gravity, the volume and weight of the mixture. **[6]**

b) Define metacentre and metacentric height. **[4]**

Q2) a) Distinguish between Eulerian and lagrangian methods of representing fluid flow, steady and unsteady flow, pathline and streamline and convective and local acceleration . **[8]**

b) If $\phi = 3xy$ find x and y components of velocity at (1,3) and (3,3) Determine the discharge passing between stream lines passing through these points. **[8]**

OR

b) An aeroplane is flying at 1000 km/h through still air having a pressure of 78.5 kn/m^2 (abs) and temperature –8°c calculate on the stagnation point on the nose of the plane

i) Stagnation pressure

ii) Stagnation temperature

iii) Stagnation density. Assume for air R = 287J/kg k & $\gamma = 1.4$ **[8]**

P.T.O.

Q3) a) i) With a neat sketch explain pitot tube

ii) What are the applications of momentum equation [9]

b) Water at the rate of 30 lit/sec is flowing through 0.2 mt diameter pipe. A venturimeter of throat diameter 0.1mt is fitted in the pipeline A differential manometer in the pipeline has an manometric liquid M and the manometer reading is 1.16 mt. What is the specific gravity of the manometric liquid M? Assume $C_d = 0.96$ and density of water 998 kg/m^3 [9]

OR

b) In an experiment on determination of hydraulic co-efficients of sharp edged orifice 2.5cm of diameter, it was found that the jet issuing horizontally under a head of 1mt travelled a horizontal distance of 1.6 mt from venacontracta in a course of vertical drop of 0.7 mt from the same point. Further if a plate were held normal to the Jet at venacontracta, the force of 5.6 N would be exerted on the plate.

Determine C_c C_v for C_d for the orifice.

Q4) a) Derive an expression for force exerted by a fluid flow on bend, when the bend is in horizontal plane. [8]

b) A lubricating oil of viscosity 1 poise and specific gravity 0.9 is pumped through a 30mm diameter pipe. If the pressure drop per metre length of pipe is 20 kN/m^2 determine

i) The mass flow rate in Kg/min

ii) The shear stress at the pipe wall

iii) The Reynolds number of flow [8]

Q5) a) What are energy losses which occur when a fluid flows through pipe? Explain the concept of equivalent length in case of a pipe flow system. [9]

b) In a pipe of diameter 350mm and length 75mt water is flowing at a velocity of 2.8 m/s find the head lost due to friction using

i) Darcy's formula

ii) Chezy's formula for which c = 55 Take kinematic viscosity of water as 0.012 stokes the coefficient of friction is given by **[9]**

$$f = \frac{0.0791}{(\mathrm{Re})^{1/4}}$$

OR

b) Two pipes of 20cm and 30cm diameter are laid in parallel to pass a total discharge of 100 L.P.S. Each pipe is 250 mt long. Determine discharge through each pipe. Now these pipes are connected in series to connect two tanks 500mt a part to carry same total discharge. Determine water level difference between the tanks Neglect minor losses in both cases take f = 0.02 for both pipes in the relation

$$h_f = \frac{f\,\mathrm{LV}^2}{2gd}$$

Q6) a) Define any four non dimensional numbers and explain their significance in the study of fluid Mechanics. **[8]**

b) The velocity distribution in the boundary layer over a high spillway face was found to have the following term

$$\frac{u}{v} = \left(\frac{y}{\delta}\right)^{0.22}$$

prove that $\frac{\delta^*}{\delta} = 0.18,\ \frac{\theta}{\delta} = 0.125$ *and* $\frac{\delta^{**}}{\delta} = 0.217$

where δ^* = displacement thickness, θ = momentum thickness

δ^{**} = energy thickness **[8]**

OR

b) With usual notations derive the equation for velocity of sound wave in a fluid.

✔ ✔ ✔

S - 367

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, May - 2015

MACHINE DRAWING

Sub. Code : 42663

Day and Date : Saturday, 30 - 05 - 2015 **Total Marks : 100**

Time : 09.00 a.m. to 01.00 p.m.

Instructions : 1) **Question No. 1 and Question No. 4 are compulsory. Solve any one question out of remaining in each section.**

2) **Use first angle method of projection.**

3) **Figures to the right indicate full marks.**

4) **Make suitable assumptions if necessary and mention them clearly.**

SECTION - I

Q1) a) A vertical square pyramid of base 50 mm side and axis 80 mm has its base in HP with sides equally inclined to VP. It is penetrated by a square prism of base 30 mm side. The axis of prism is parallel to HP and VP and intersects the axis of pyramid at a point 25 mm from the base. The faces of prism are equally inclined to VP. Draw the projections showing the lines of intersection. **[15]**

b) Draw IS conventions for the following : **[10]**

i) Linoleum

ii) Back weld

iii) Straight knurling

iv) Aligned section

c) Draw free hand proportionate sketches for the following : **[10]**

i) Eye bolt

ii) Flat saddle key

P.T.O.

Q2) Draw IS conventions for the following : **[15]**

a) Rack and pinion

b) Cylindrical helical torsion spring

c) Repeated parts

Q3) Draw free hand proportionate sketches for the following : **[15]**

a) Knukle joint

b) Single riveted lap joint

c) Fast and loose pulleys

SECTION - II

Q4) Fig.II (a) shows the assembly drawing of 'steam engine connecting rod'. Draw the part drawing showing all dimensions. Two views of each part should be drawn. **[35]**

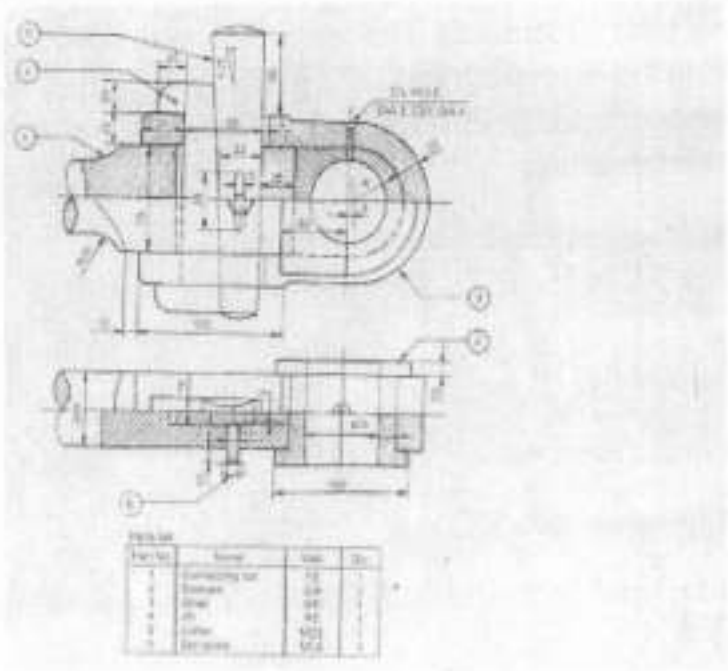


Fig.II (a)

Assembly of 'steam engine connecting rod'

Q5) Refer Fig. II (b) draw given views and show the following : **[15]**

a) Surface A and surface B are parallel within 0.1 mm.

b) Give tolerance to drilled hole $\phi 30H7$

c) Give bilateral tolerance, dimension 120 mm in 0.2 mm.

d) Show material removal by milling process for surface A within finish of two triangle.

e) Show $\phi 30$ hole is concentric to $\phi 50$ within 0.02 mm.

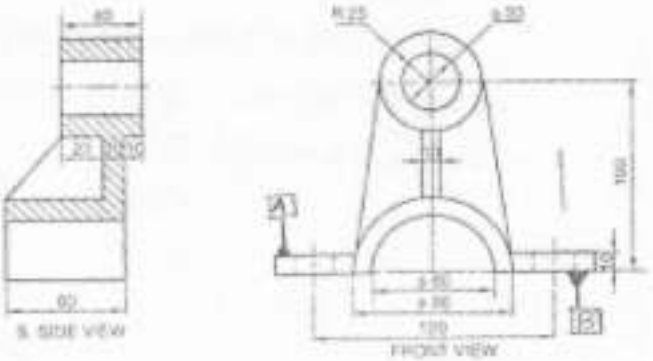


Fig II (b)

Q6) Fig.II (c) shows Front view, Auxillary view and incomplete side view. Redraw the given views and complete the incomplete side view. **[15]**

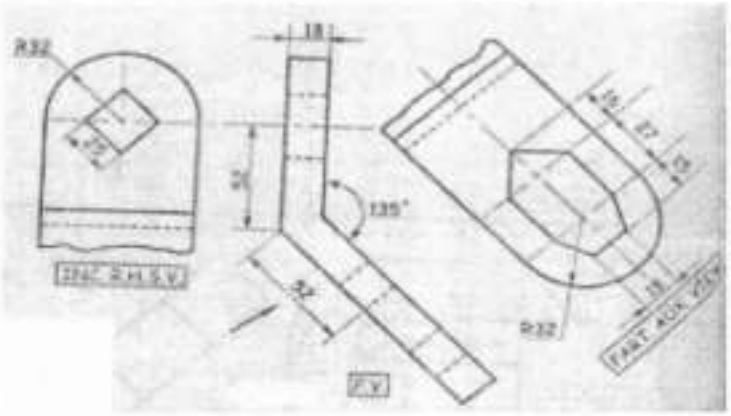


Fig.II (c)

S - 364

Total No. of Pages :3

Seat No.	

S.E. (Mechanical) (Semester - I) (Pre revised) Examination, May - 2015

MANUFACTURING PROCESSES

Sub. Code : 42664

Day and Date : Saturday, 23 - 05 - 2015 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) Answer any three questions from each section.
2) Draw neat sketches wherever necessary to support your answers.
3) Write our answers to the point and in order of preference.
4) Figures to the right indicate full marks.

SECTION - I

Q1) Explain the following terms fully and clearly (any six): [18]

a) Pattern
b) Mould
c) Core
d) Green sand
e) Sweep pattern
f) Gating ratio
g) Ram up core
h) Core print
i) Chaplet

Q2) a) Draw neat and labeled sketch for cupola and explain working and zones in cupola? [8]

b) Classify patterns? Write down composition, properties and applications of grey cast iron? [8]

Q3) a) What is foundry layout? Draw a typical layout for cast iron foundry using machine moulding, showing all sections in foundry? [8]

b) Compare and contrast any two of the following: [8]

i) Green sand and shell sand process
ii) Gravity die casting and pressure die casting
iii) Pattern and casting

P.T.O.

Q4) Write short notes on any four of the following: [16]

a) Tool steels
b) Composites
c) Continuous casting
d) Ceramics
e) Shrinkage allowance
f) Centrifugal casting

SECTION - II

Q5) a) Explain hot piercing? What you mean by mandrel, write its functions and properties required? [6]

b) Enlist various types of rolling mills? Explain any one with neat sketch? [6]

c) Compare with sketches open die and closed die forging and their applications? [6]

Q6) a) Classify different forming processes? Which are the desirable properties of material suitable for forming processes? [8]

b) Which are different structural shapes manufactured by rolling operations? Enlist different rolling defects which are occurring while cold rolling process? [8]

Q7) Differentiate clearly between any four of the following: [16]

a) Hot working and cold working.
b) Write drawing and tube drawing.
c) Direct and indirect extrusion.
d) Drop forging and press forging.
e) Soldering and brazing.
f) TIG and MIG welding.

Q8) Write short notes on any four of the following: **[16]**

a) Rotary swaging.

b) Cold heading.

c) Coining.

d) Impact extrusion.

e) Blow moulding.

f) Injection moulding.

✔ ✔ ✔

S - 370

Total No. of Pages :3

Seat No.	

S.E. (Mechanical) (Semester - I) (Revised) Examination, May - 2015

METALLURGY

Sub. Code : 63353

Day and Date : Saturday, 23 - 05 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Draw neat sketches wherever necessary to support your answers.**
3) **Write our answers to the point and in order of preference.**
4) **Figures to the right indicate full marks.**

Q1) a) Solve any one: **[6]**

i) Draw cooling curve for eutectic alloy and calculate degrees of freedom?

ii) Draw dendritic structure and explain coring in isomorphous alloys?

b) Write short notes on any three: **[12]**

i) Partial eutectic alloy.

ii) Nucleation and grain growth.

iii) Hume Rothery rules of solubility.

iv) Crystal imperfections.

v) BCC crystal structure.

Q2) a) Solve any Two: **[16]**

i) Draw steel portion of Fe–Fe_3 C diagram? Explain the cooling of eutectoid steel from melting to room temperature?

ii) Classify cast irons? Explain manufacturing of malleable cast iron?

iii) Explain precipitation hardening in Al- Cu alloy w.r.t. composition, aging temperature and time, hardness variations?

P.T.O.

b) Write short note on any three: [12]

i) Composition, properties & applications of austenitic stainless steels?

ii) Composition, properties & applications of high speed steel?

iii) AISI specifications for steels?

iv) Al-Si alloy modification.

v) Alpha beta brasses.

Q3) a) Solve any one: [6]

i) Draw stress strain diagram for mild steel; Define Y.S., B.S., U.T.S., ductility and Young's modulus?

ii) Write stages in Rockwell hardness testing; which indenter's and loads are used in Rockwell testing?

b) Write short note on any one: [4]

i) Magnetic particle testing.

ii) Dye penetrant testing.

Q4) a) Solve any one of the following: [6]

i) Draw TTT diagrams for hypo eutectoid and hyper eutectoid steels and explain why mild steels cannot be hardened.

ii) Draw self explanatory sketch for transformation of Pearlite to austenite and austenite to upper/feathery Bainite.

b) Solve any one of the following: [4]

i) Compare and contrast CCT diagram with TTT diagram.

ii) Compare and contrast Pearlitic transformation with Bainitic transformation.

Q5) a) Solve any two of the following: **[12]**

i) What is hardening? How is it carried out? With the help of neat sketches explain the different types of hardening.

ii) What is Flame Hardening and what are its advantages, limitations and applications? What are the various types of flame hardening?

iii) What is Nitriding? Write its advantages and limitations? What are Nitralloys and why they are used in Nitriding?

b) Solve any three of the following: **[12]**

i) Why hyper eutectoid steels are annealed from just above lower critical temperatures while hypo eutectoid steels are annealed from above upper critical temperatures?

ii) Explain the Mechanism of heat removal during quenching with neat sketch.

iii) With neat sketches explain structural transformations that occur during tempering.

iv) Why are medium carbon steels preferred for Induction and flame hardening.

v) Draw self explanatory sketches for a pit type batch furnace and conveyor type continuous furnace.

Q6) a) Solve any one of the following: **[6]**

i) Explain with neat sketch the process of compacting in powder metallurgy and write its purposes.

ii) Explain what is the purpose of mixing in Powder metallurgy and draw self explanatory sketch for any one type of mixer.

b) Solve any one of the following: **[4]**

i) Draw self explanatory flow chart of manufacturing Electrical contacts using powder metallurgical process.

ii) Explain the reason for why sizing is essential after the components are manufactured by powder metallurgical process.

✔ ✔ ✔

P-502

Seat No.	

Total No. of Pages : 4

S.E. (Mechanical Engg.) (Semester - III) (New) Examination, April - 2016

ENGINEERING MATHEMATICS - III

Sub. Code : 63350

Day and Date : Friday, 29-04-2016 Total Marks : 100

Time : 3.00 p.m. to 6.00p.m.

Instructions : 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is allowed.

SECTION - I

Q1) Attempt any three from the following:

a) Solve $(D^2 + 2D + 1)\, y = 4 \sin 2x$. [6]

b) Solve $(D^2 - 4D + 3)\, y = x^3 e^{2x}$. [6]

c) Solve $x^3 \frac{d^2y}{dx^2} + 3x^2 \frac{dy}{dx} + xy = \sin(\log x)$. [6]

d) Solve $(D^2 + 4D + 4)\ y = \frac{e^{-2x}}{x^5}$. [6]

Q2) Attempt any one from the following:

a) A body weighing 20 kg is hung from a spring. A pull of 40 kg wt. will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t sec., the maximum velocity and the period of oscillation. [16]

P.T.O.

b) The whirling speed of a shaft of length l is given by $\frac{d^4y}{dx^4} - a^4y = 0$

where $a^4 = \frac{W\omega^2}{gEI}$ and y is the displacement at distance x from one end

If the ends of the shft are constrained in long bearings so that the slope at each end is zero, show that the shift will whirl whencosal. cosh $al = 1$ [16]

Q3) Attempt any three from the following:

a) If $\phi = x^3 + y^3 + z^3 - 3xyz$ then find Div $\overline{F}$ and $Curl\,\overline{F}$ where $\overline{F} = \nabla\phi$. [6]

b) Find the directional derivative of $\phi = x^2 - y^2 - 2z^2$ at the point P(2,−1,3) in the direction $\overrightarrow{PQ}$ where Q is (5,6,4). [5]

c) Prove that $\nabla\left\{\nabla.\frac{\overline{r}}{r}\right\} = -\frac{2}{r^3}\overline{r}$. [5]

d) Find the constants m and n such that the surface $mx^2 - 2xyz = (m+4)x$ will orthogonal to the surface $4x^2y + z^3 = 4$ at the point $(1,-1,2)$. [5]

SECTION - II

Q4) Attempt any three from the following:

a) Find the Laplace transform of $\frac{1-\cos t}{t^2}$. [6]

b) Find $L\{t^2e^t \sin 4t\}$. [6]

c) Obtain the inverse Laplace transform of $\cot^{-1}\left(\frac{s+3}{2}\right)$. [6]

d) Find $L^{-1}\left\{\frac{1}{(s-2)(s^2+1)}\right\}$. [6]

e) Use transform method to solve $y''-4y'+4y=64\sin 2t$ with $y(0)=0$ and $y'(0)=1$. [6]

Q5) Attempt any two from the following:

a) Obtain Fourier series of the function $f(x)$ given by $f(x)=x+\frac{x^2}{4}, -\pi \le x \le \pi$ and hence show that $1-\frac{1}{4}+\frac{1}{9}-\frac{1}{16}+.....\infty=\frac{\pi^2}{12}$. [8]

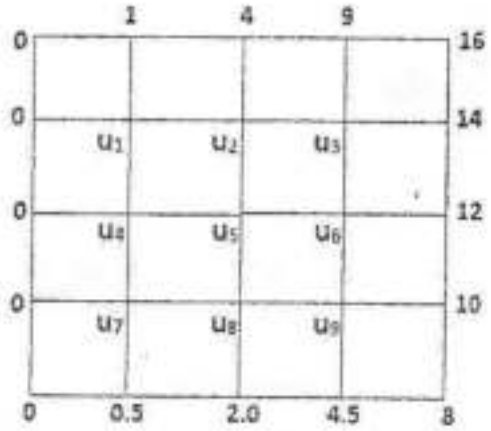
b) Find the Fourier series expansion of $f(x)=2x-x^2$ in $(0,3)$ and hence deduce that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+.....=\frac{\pi}{12}$. [8]

c) Express $f(x)=x\sin x$ as a half range cosine series in $0<x<\pi$ and hence obtain $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-.....=\frac{\pi-2}{4}$. [8]

Q6) Attempt any one from the following:

a) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y=A\sin\frac{\pi x}{l}$ from which it is released at time t = 0. Show that the displacement of any point at a distance x from one end at time t is given by $y(x,t)=A\sin\frac{\pi x}{l}.\cos\frac{\pi ct}{l}$. [16]

b) Solve the equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ for the following data by Gauss - Seidal method. (Carry out three iterations). [16]



P- 503

Total No. of Pages :3

Seat No.	

S.E.(Mechanical)(Semester -III)(New)
Examination, April - 2016
ELECTRICAL TECHNOLOGY
Sub. Code: 63351

Day and Date : Saturday, 30 - 04 - 2016 **Total Marks :100**
Time :03.00 p.m. to 06.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Draw neat figures wherever necessary.**
4) **Assume suitable data if missing state it clearly.**

SECTION-I

Q1) a) Compare dc shunt motor, dc series motor and dc cumulative compound motor in terms of circuit, characteristics, advantages, disadvantages and applications **[8]**

OR

Define electric braking. Explain Dynamic braking and plugging for dc shunt motor and dc series motor.

Answer any two of the following(b, c, d) **[2×6=12]**

b) Compare the armature voltage control method and field control method for a dc shunt motor.

c) Why does a dc motor draw high armature current at the time of starting? How is it reduced in a 3 point starter.

d) A dc series motor runs at 1500 rpm while taking 12 A from a 230V dc supply. The motor armature resistance is 1 ohm. Field resistance is 0.8 ohm. The load requires constant torque at all speeds. Now, the field winding is shunted by a 0.8 ohm resistance. Find the new speed.

P.T.O.

Q2) Answer any two: [2×8=16

a) Explain the construction of a 3 phase induction motor.

b) Write the expression for torque of 3 phase induction motor. State th slip and corresponding torque at

i) starting

ii) stalling

iii) no load(ideal case).

c) Explain the power satges in a 3 phase induction motor

Q3) Answer any two: [2×8=16]

a) Draw the circuit and explain the working of an autotransformer starter.

b) Explain the VFD control(constant V/f control) of 3 phase induction motor

c) Explain the reversal of rotation of 3 phase induction motor.

SECTION-II

Q4) Answer any two: [2×8=16]

a) What are the types of stepper motor? Explain construction,working and applications of variable reluctance stepper motor.

b) Explain the construction and working principle of a.c. Servo motor.

c) State the advantages of BLDC over conventional DC motor. State the applications of BLDC motor.

Q5) Answer any two: [2×8=16]

a) Discuss various electrical factors to be considered while selecting a motor for a particular machine.

b) State the advantages of individual drive. With a suitable example,explain the concept of multimotor drive

c) Determine power rating of electric motors to drive

i) Lift

ii) Pump

iii) Fan

iv) Metal shearing lathe

Q6) Answer any two: [2×8=1(

a) Describe indirect resistance heating method. State its advantages an applications.

b) State the principle of eddy current heat treatment. Discuss the choice (frequency.

c) Estimate the energy required to melt 500kg of brass in a single-phas Ajax-watt furnace. If the melt is to be carried out in3/4 hour,what shoul be the average

power input to the furnace?

Specific heat of brass=393.6J/kg °C,

Latent heat = 163 $\times 10^3$ J/kg,

Melting point of brass=920°C,

Assume furnace efficiency = 70%, initial temperature = 20 °C

P - 504

Total No. of Pages :3

Seat No.	

S.E. (Mechanical) (Part - I) (Semester - III) (Revised)

Examination, May - 2016

METALLURGY

Sub. Code: 63353

Day and Date :Tuesday, 03 - 05 - 2016 **Total Marks : 100**
Time :3.00 p.m. to 6.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Draw neat sketches wherever necessary to support your answers.**
3) **Write our answers to the point and in order preference.**
4) **Figures to the right indicate full marks.**

Q1) a) Solve any one: **[6]**

i) What you mean by solid solution? Differentiate substitutional and interstitial solid solution?

ii) Draw dendritic structure and explain coring in isomorphous alloys?

b) Differentiate clearly between following pairs (any three): **[12]**

i) Eutectoid and eutectic system.

ii) BCC and FCC structures.

iii) Nucleation and grain growth.

iv) Crystal imperfections.

v) Edge and Screw dislocation.

Q2) a) Solve any Two: **[16]**

i) Draw Fe-Fe_3C equilibrium diagram; indicate all temps, compositions and phases.

ii) Classify the steels? Write application & properties of medium C Steel.

iii) Classify Brasses and differentiate clearly between alpha and alpha-Beta brasses?

P.T.O.

b) Short note on any three: [12]

i) Classification and properties of superalloys.

ii) Classification and properties of stainless steels.

iii) Properties and applications of Ti6A14V alloy.

iv) Structure and Properties of Babbit alloy.

v) Composition and properties of heating element alloys.

Q3) a) Solve any one: [6]

i) True and engineering stress strain diagram.

ii) Working principle and Steps in Brinell hardness testing.

b) Solve any one: [4]

i) Magnetic particle testing

ii) Rockwell hardness test

Q4) a) Solve any one of the following: [6]

i) Draw TTT diagrams for hypo eutectoid and hyper eutectoid steels and explain why mild steels cannot be hardened.

ii) Explain with neat sketches the mechanism of transformation of pearlite to austenite and austenite into lower/acicular Bainite.

b) Solve any one of the following: [4]

i) What is the effect of alloying elements on location of TTT diagram, what is the significance of the same?

ii) What are CCT diagrams? How they differ from TTT diagrams?

Q5) a) Solve any two of the following: [12]

i) What is hardening? How is it carried out? With the help of neat sketches explain the different types of hardening.

ii) What is hardenability? What are the factors that influence hardenability? Explain the Jominy end quech test for determining hardenability.

iii) What are heat treatment furnaces? How are they classified? Write different types and explain any one with neat sketch.

b) Solve any three of the following: [12]

i) Explain with neat sketch the mechanism of precipitation hardening.

ii) Differentiate between Annealing and Normalizing.

iii) Explain with neat sketches different types of Flame hardening.

iv) Compare and contrast liquid carburizing with cyaniding.

v) Explain the Mechanism of heat removal during quenching with neat sketch.

Q6) a) Solve any one of the following: [6]

i) What are advantages and draw backs of components produced by powder metallurgy? Enlist different applications.

ii) Explain what is the purpose of mixing in powder metallurgy and draw self explanatory sketch for any one type of mixer.

b) Solve any one of the following: [4]

i) Draw self explanatory flow chart of manufacturing Electrical contacts using Powder metallurgical process.

ii) Explain the process of Isostatic compacting with neat sketch.

EEE

P-505

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) (Revised) Examination, May - 2016
FLUID MECHANICS
Sub. Code : 63354

Day and Date : Saturday, 07-05-2016 **Total Marks : 100**

Time : 3.00 p.m. to 6.00p.m.

Instructions :
1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of Non programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) i) Define Viscosity, specific gravity and Newtonian fluid. **[6]**

ii) One cubic metre of alcohol of relative density 0.788 and bulk modulus 1.32×10^6 N/m^2 is subjected to an increase of pressure of 45000 N/m^2. Find the change in volume and the value of final density of fluid. **[6]**

b) Define total pressure and centre of pressure. **[4]**

Q2) a) Is the continuity equation a conclusion of the principle of conservation of mass? And hence derive continuity equation in cartesian coordinates in three dimensional form. **[8]**

b) The fluid flow field is given by

$V = x^2yi + y^2zj - (2xyz + yz^2)k$ prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2,1,3). **[8]**

OR

b) A 120mm diameter pipe reduces to 60mm diameter through a sudden contraction. When it carries air at 25°C under isothermal condition, the absolute pressures observed in the two pipes just before and after the contraction are 480kN/m^2 and 384 kN/m^2 respectively. Determine

P.T.O.

i) Densities at two sections.

ii) Velocities at two sections and

iii) Mass flow rate through the pipe. Take R = 287 J/kgK. **[8]**

Q3) a) What is a Notch? How they are classified? Derive an expression for rate of flow for triangular Notch with usual notations. **[9]**

b) A pipe slopes downwards from 20cm diameter at upstream section1 (elevation 25mt) to 30cm diameter at downstream section 2 (elevation 20mt) A pressure gauge installed at section 1 reads 125 kPa. When the water flow rate is $0.25m^3/s$. If the kinetic energy correction factors for sections 1 and 2 are 1.1 and 1.3 respectively, workout the reading of the pressure gauge at section 2. The loss of head through the pipe may be assumed as $\frac{1.2(V_1-V_2)^2}{2g}$. Assume specific weight of water as $10kN/m^3$. **[9]**

OR

b) A 45° reducing bend is connected in a pipeline the diameters at inlet and outlet of bend being 60cm and 30cm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 N/cm^2 and rate of flow of water is 600 lit/sec. **[9]**

Q4) a) Explain the principle of venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it. **[8]**

b) Two reservoirs are connected by three pipes laid in parallel their diameters are d, 2d and 3d respectively and they are of the same length. Assuming coefficient of friction f to be same for all pipes determine the discharge through the larger pipes when smallest pipe is discharging one cubic metre per sec. **[8]**

Q5) a) Derive an expression for the velocity distribution for viscous flow between two parallel fixed plates and find the ratio of maximum velocity to average velocity. **[9]**

b) A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 20mt. The length of the syphon is 500mt. and the summit is 3mt above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 100mt. Determine the discharge through the syphon and also pressure at the summit. Neglect minor losses. Assume coefficient of friction f = 0.005. [9]

OR

b) Show that the loss of head due to sudden expansion in pipe line is a function of velocity head. [9]

Q6) a) Define Boundary layer thickness, Displacement thickness, Momentum thickness and Energy thickness. [8]

b) The resisting force F of a supersonic plane during flight can be considered as dependent upon the length of the air craft L, velocity V, air dynamic viscosity μ, air density ρ, and bulk modulus of air K using dimensional analysis show that $\frac{F}{\rho L^2 V^2} = f\left[\frac{\mu}{\rho VL}, \frac{K}{\rho V^2}\right]$. [8]

OR

b) Show by means of sketches, the nature of propagation of disturbance in compressible flow when Mach number is less than one, is equal to one and greater than one. [8]

P-795

Total No. of Pages : 4

Seat No.	

S.E. (Mech.) (Part - II) (Semester - III)
Examination, May - 2016
APPLIED THERMODYNAMICS
Sub. Code : 63352

Day and Date : Monday, 02-05-2016 Total Marks : 100

Time : 3.00 p.m. to 6.00p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable data if necessary.
4) Use of steam table, Mollier chart are allowed.
5) Use of non-programmable calculator is allowed.

Q1) a) Explain the equivalence of Kelvin-Plank and Clausius statement. [8]

OR

State and prove Clausius inequality and hence define entropy.

b) Show that the specific entropy change for a perfect gas in a process is given by $S_2 - S_1 = C_v \log\left(P_2/P_1\right) + C_p \log\left(V_2/V_1\right)$ [8]

Q2) a) Discuss how increase in pressure will effect the following: [8]

i) Lantent heat.

ii) Saturation temperature.

iii) Specific volume.

iv) Entropy.

b) In a Rankine cycle steam at inlet to turbine is saturated at pressure 30 bar and exhaust pressure is 0.24 bar. Determine

P.T.O.

i) Pump work

ii) Turbine power

iii) Rankine efficiency

iv) Condenser heat rejected

Assume steam flow rate = 10 kg/sec and specific volume of water at 0.24 bar $v_w = 0.001019 m^3/kg$. [9]

Q3) a) Classify the boiler. Explain any one boiler with neat sketch. [8]

OR

How the condensers are classified? Compare the jet condenser with surface condenser.

b) The observations recorded during the trial on steam condenser are given below. [9]

Condenser Vacuum = 685 mm of Hg

Barometer reading = 765 mm of Hg

Mean condenser temperature = 34°C

Hot well temperature = 28°C

Circulating cooling water inlet temp. = 18°C

Circulating cooling water outlet temperature = 30°C

Determine

i) Condenser Vacuum corrected to standard barometer.

ii) Vacuum efficiency.

iii) Condenser efficiency.

iv) Undercooling of condensate.

Q4) a) Derive the expression for maximum discharge through nozzle? [8

OR

b) Define [8

i) Nozzle efficiency

ii) Coefficient of discharge

iii) Velocity coefficient

iv) Degree of undercooling

c) Steam at the rate of 7.5 kg/s flows through a set of nozzles. The inle pressure is 14 bar and superheat is 55°C. The exit pressure is 6 bar Neglect the velocity of approach and assume the expansion of steam i isentropic. Find the number of nozzles used if the outlet area of eacl nozzle is approximately 2.3 cm^2. What should be the correct exit area?[9

Q5) a) What is compounding? Explain any one method with sketch in detail.[8

OR

b) With the help of h-s diagram explain reheat factor. [8

c) The velocity of steam exiting the nozzle of the impulse stage of turbine i 400m/s. The blades operate close to the maximum blading efficiency The nozzle angle is 20°. Considering equiangular blades and neglecting blade friction, calculate for steam flow of 0.6 kg/s, the diagram powe and the diagram efficiency. [8

Q6) a) Define the term degree of reaction for steam turbine. Show it is 50% fo Parson's reaction turbine. [8

OR

b) Explain the back pressure and Passout turbine. [8

c) The following particulars refer to stage of a Parson's reaction turbine comprising one ring of fixed blades and one ring of moving blades: mean diameter of blade ring = 70cm, RPM = 3000, steam velocity at exit from blade = 160 m/s, blade outlet angle = 20°, steam flow through blades = 7 kg/s,

Draw the velocity diagram and find the following:

i) blade inlet angle.

ii) Tangential force on the ring of moving blades.

iii) power developed in stage. [9]

S - 2069

Seat No.	

Total No. of Pages : 4

S.E.(Mechanical Engg.) (Semester - III) Examination, December - 2015

ENGINEERING MATHEMATICS - III (New)

Sub. Code : 63350

Day and Date : Monday, 7 - 12 - 2015.

Time : 10.00 a.m. to 1.00 p.m. **Total Marks : 100**

Instructions : 1) All questions are compulsory.
2) Figures to the right indicates full marks.
3) Use of non-programmable calculator is allowed.

SECTION - I

Q1) Attempt any three from the following

i) Solve $(D^2 - D + 1)y = x^3 - 2x^2 + 1$ [6]

ii) Solve $(D^3 - D^2 + 3D + 5)y = e^x \cos 3x$ [6]

iii) Solve $x^3\frac{d^3y}{dx^3} + x^2\frac{d^2y}{dx^2} - 2y = x + \frac{1}{x^3}$ [6]

iv) Solve $\frac{d^2y}{dx^2} + y = \sin x \sin 2x$ [6]

Q2) Attempt any one from the following

i) A spring fixed at the upper end supports a weight 980 gm at its lower end. The spring stretches $\frac{1}{2}cm$ under a load of 10 gm and resistance (in gm.wt.) to the motion of weight is numerically equal to $\frac{1}{10}$ of the speed of the weight in cm / sec. The weight is pulled down $\frac{1}{4}cm$ below its equilibrium position and then released. Find the expression for the distance of weight from its equilibrium position at time t during its first upward motion.

P.T.O.

Also find the time it takes the damping factor to drop $\frac{1}{10}$ of its initial value. [16]

ii) a) The differential equation of the motion of a body is $m\frac{d^2x}{dt^2} = -kx + mp\cos nt$ solve the equation completely [8]

b) A spring for which stiffness k = 700 N/m hangs in a vertical position with its upper end fixed. A mass of 7 kg is attached to the lower end. After coming to rest, the mass is pulled down to $0.05m$ and released. Find the displacement of mass from equilibrium position at any time t. [8]

Q3) Attempt any three from the following

i) Find the directional derivative of $\phi = xy^2 + yz^2$ at point $p(2,-1,1)$ in the direction $i + 2j + 2k$. [5]

ii) Show that the vector function $\bar{F} = \frac{xi + yj}{x^2 + y^2}$ is solenoidal as well as irrotational. [6]

iii) Show that the field of force given by $\bar{F} = \left(y^2\cos x + z^3\right)i + \left(2y\sin x - 4\right)j + \left(3xz^2 + 2\right)k$ is conservative and hence find its scalar function. [5]

iv) Find the unit normal vector to the surface $x^2 + y^2 + z^2 = 5$ at the point $p(0,1,2)$. [5]

SECTION-II

4) Attempt any three from the following.

i) Find the Laplace transform of $f(t)=\begin{cases} t^2 & \text{if } 0<t<2 \\ t-1 & \text{if } 2<t<3 \\ 7 & \text{if } t>3 \end{cases}$ [6]

ii) Evaluate $\int_0^\infty t^2 e^{3t}\sin^2 t\,dt$ [6]

iii) Find the inverse Laplace transform of $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$ [6]

iv) Find the inverse Laplace transform of $\tan^{-1}\left(\frac{2}{s^2}\right)$ [6]

v) Use transform method to solve $\frac{d^2y}{dx^2}+9y=6\cos 3t$ with $y(0)=2$ and $y'(0)=0$ [6]

5) Attempt any two from the following

i) Find a Fourier series to represent $f(x) = x^2$ in $(0,2\pi)$ and hence show that

$$\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\ldots=\frac{\pi^2}{12}$$ [8]

ii) Obtain the Fourier series of $f(x)=|x|$ in $(-l,l)$ and hence show that

$$\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots=\frac{\pi^2}{8}$$ [8]

iii) Express $f(x) = x$ as a half range sine and cosine series in $0\le x\le 2$ [8]

Q6) Attempt any one from the following

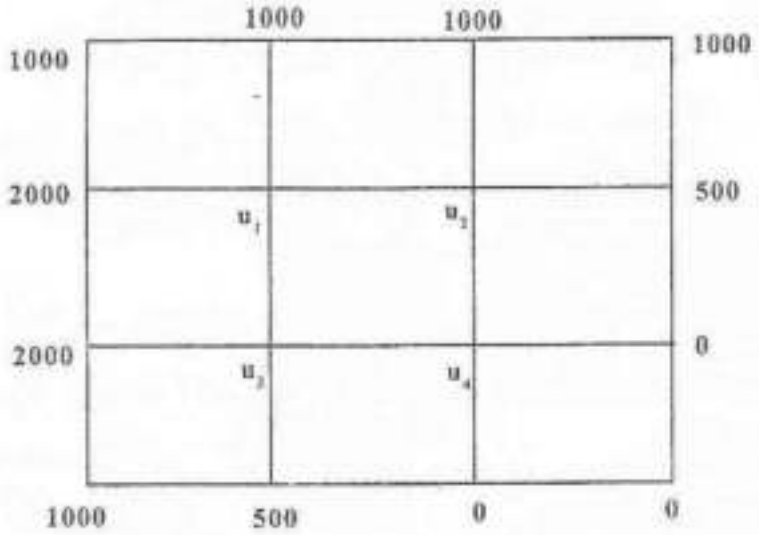
i) Solve the differential equation $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$ for the conduction of heat along a rod without radiation, subject to the following conditions **[16]**

a) u is not infinite for $t\to\infty$

b) $\frac{\partial u}{\partial x}=0$ *for* $x=0$ *and* $x=l$

c) $u = lx - x^2$ for $t = 0$, between $x = 0$ and $x = l$

ii) Solve the equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ for the following data by Gauss-Seidal method. (Carry out five iterations.) **[16]**



S -2070

Total No. of Pages :4

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) Examination, December - 2015

APPLIED THERMODYNAMICS (Revised)

Sub. Code : 63352

Day and Date :Wednesday, 09 - 12 - 2015 **Total Marks :100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) **All questions are compulsory**
2) **Figures to the Right indicates Full marks.**
3) **Assume suitable data if necessary.**
4) **Use of non-programmable calculator steam.**
5) **Table mollier chart are allowed.**

Q1) a) State and prove clausius inequality and hence define entropy. [8]

OR

Define the terms. [8]

i) Availabel energy

ii) Dead state

iii) Unavailable energy

iv) Exergy.

b) Show that the specific entropy change for perfect gas is given by [8]

$$S_2 - S_1 = mCv \log\left(\frac{T_2}{T_1}\right) + mR \log\left(\frac{V_2}{V_1}\right)$$

Q2) a) Sketch the carnot cycle on T-S & P-V diagram what are the limitations of carnot cycle. [8]

b) A simple rankine cycle works between pressure 28 bar and 0.06 bar, the initial condition of steam being dry saturated calculate. [9]

P.T.O.

i) Cycle efficiency

ii) Work ratio

iii) Sepcific steam consumption

Q3) a) Classify the steam boiler. Enplain any one fire tube boiler with neat sketch. [8]

OR

What is the function of condenser? Explain any one condenser with neat sketch. [8]

b) A surface condenser recieves 2000kg of steam /hr which is 0.9 dry. The condenser vacuum is 70 cm of Hg when barometer reads 75 cm of Hg. The Temperature of hot well is 27°C white the mean condenser temperature is 35°C. Cooling water gets heated from 17°C to 32°C. [9]

Determine :

i) Condenser efficiency

ii) Vacuum efficiency

iii) Quantity of cooling water per hour

Q4) a) What do you mean by super saturateel flow? Explain with H-5 diagram[8]

OR

Derive the expression for critical pressure ratio for maximum discharge through the nozzle.

b) A steam at a pressure of 10 bar and 0.9 dry discharges through nozzle having throat area of 450 mm^2. If the back pressure is 1 bar find

i) Final velocity of the steam.

ii) Cross - sectional area of the nozzle at exit for maximum discharge[8]

Q5) a) Explain the term reheat factor. Why its magnitude is always greater than using. [8]

OR

Draw a combined velocity triangle for a single stage impulse turbine and obtain expression for work done per stage, blade efficiency and axial thrust.

b) The main diameter of the blades of an impulse turbine wish a single, wheel is 105 cm and the speed is 3000 rpm. The nozzle angle is 18°, the ratio of blade speed to steam speed is 0.42 and the ratio of the relative velocity outlet from the blade to that at inlet is 0.84. The out let angles of the blade is to be made 3° less the in let angle. The steam flow rate is 8kg/sec. Draw velocity diagram for the blades and calculate.

i) Tangertial throust

ii) power developed by blade

iii) Blade efficiency [10]

Q6) a) Define the term 'Degree of Reaction' used in reaction turbine and prove that degree of reaction.

$$R = \frac{Cf}{2u}\left(\cot\beta_2 - \cot\beta_1\right)$$ [8]

OR

In a parson's reaction turbine of 50% degree of reaction at 25 rps the available enthalpy drop for an expansion is 62.8 kg/hg. If the mean diameter of the rotar is 1m find the no of rows of moving blade required. The blade out let angle is 20° & speed ratio is 0.7. Assume stage efficiency as 80%. [8]

b) Explain the following (any one) [4]

i) Internal losses in steam turbine

ii) Reheat factor

c) Write note on (any one) [4]

i) Throttle Governing

ii) Turbine Troubles

S – 2071

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) - I (Revised) Examination, December - 2015

METALLURGY

Sub. Code : 63353

Day and Date : Friday, 11 - 12 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Draw neat sketches wherever necessary to support your answers.**
3) **Write our answers to the point and in order of preference.**
4) **Figures to the right indicate full marks.**

Q1) a) Solve any one: [6]

i) Draw dendritic structure and explain coring in isomorphous alloys.

ii) Explain in short different imperfections in crystal structures.

b) Write short notes on any three: [12]

i) Substitutional and interstitial solid solution.

ii) BCC and FCC structures.

iii) Edge and Screw dislocation.

iv) Intermetallic compounds.

Q2) a) Solve any two: [16]

i) Draw Fe-Fe3C equilibrium diagram; indicate all temps, compositions and phases and reactions.

ii) Classify cast irons. Explain manufacturing of malleable cast iron.

iii) Draw Cu-Zn equilibrium diagram. Show variation of tensile strength and ductility with varying amount of Zn in brass.

P.T.O.

b) Write short note on any three: [12]

i) Structure and Properties of Babbit alloy.

ii) Properties and applications of Soldering alloy.

iii) AISI specifications for steels.

iv) Effect of Cr and Ni and C in stainless steel.

v) Effect of alloying element in tool steel.

Q3) a) Solve any one: [6]

i) Draw stress strain diagram for cast iron; Define Y.S., B.S., U.T.S., ductility and young's modulus.

ii) What is toughness? Explain the test for measuring toughness.

b) Write short note on any one: [4]

i) X-ray Radiography test.

ii) Stages in Dye Penetrant test.

Q4) a) Solve any one of the following: [6]

i) Explain step wise experimental procedure for drawing TTT diagram for eutectoid steel. Label the diagram and draw cooling curves to indicate the procedure of Annealing, Normalizing and Hardening on the diagram.

ii) Explain with neat sketches the mechanism of transformation of Pearlite to austenite and austenite to pearlite.

b) Solve any one of the following: [4]

i) Compare and contrast CCT diagram with TTT diagram.

ii) Compare and contrast transformation of Upper and Lower Bainite.

Q5) a) Solve any two of the following: **[12]**

i) What is Annealing? Write the different types of annealing and its purpose.

ii) What is surface hardening? What is the raw material used for surface hardening? Explain the process of Induction hardening with a neat sketch.

iii) What is precipitation hardening? What are the basic requirements of precipitation hardenable alloys? Explain.

b) Solve any three of the following: **[12]**

i) With neat sketches explain structural transformations that occur during tempering.

ii) Why are medium carbon steels preferred for Induction and flame hardening?

iii) Draw self explanatory sketches for a pit type batch furnace and conveyor type continuous furnace. What are the various types of hardening? Explain using TTT diagram.

iv) What are the essential properties of quenching media? Write the advantages and limitations of each type.

v) What are Nitralloys? Where and why they are used?

Q6) a) Solve any one of the following: **[6]**

i) What is powder metallurgy? Write its advantages, disadvantages and applications.

ii) What is sintering? What are the different types of sintering? What are the purposes of sintering?

b) Solve any one of the following: **[4]**

i) Explain the process of manufacturing carbide tipped tools with suitable flow chart.

ii) Draw self explanatory flow diagram of manufacturing self lubricated bearings by powder metallurgical process.

S–2072

Total No. of Pages : 3

Seat No.	14268

S.E. (Mechanical) (Semester - III) (Revised) Examination, December - 2015

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Monday, 14 - 12 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of non-programmable calculator is allowed.**
5) **Assume suitable data, if necessary.**

Q1) a) i) Define capillarity. Surface tension and vapour pressure. **[6]**

ii) Two capillary tubes of diameters 1.5 mm and 3 mm are dipped in an oil of surface tension 0.036 N/m and specific weight 9360 N/m^3. Find the difference of oil levels in the two tubes. Assume contact angle equal to 25°. **[6]**

b) Define Buoyancy. Centre of buoyance. **[4]**

Q2) a) Distinguish between Rotational and irrotational flow, one two and three dimensional flow, compressible and incompressible flow, velocity potential and stream function. **[8]**

b) For the following flows determine the components of rotation about the various axis. **[8]**

i) $u = xy^3z,\ v = -y^2z^2,\ w = yz^2 - \dfrac{y^3z^2}{2}$

ii) $u = 3xy,\ v = \dfrac{3}{2}x^2 - \dfrac{3}{2}y^2$

P.T.O.

OR

b) An aeroplane flies at an altitude where the pressure and density of air are 40 kN/m² (abs) and 0.6 kg/m³. If the stagnation pressure measured by pitot tube is 60 kN/m² (abs). Calculate the speed of aeroplane and stagnation temperature and density take R = 287 J/kg k γ = 1.4

Q3) a) State the assumptions made in Bernoulli's equation and write the Bernoulli's equation for Real fluids. Ideal fluids and when the velocity is not uniform across the flow section. [9]

b) During a test run in a Laboratory the water which has passed through 25 cm × 10 cm venturimeter flows over a right angled triangular notch whose discharge coefficient is 0.61 when a steady head of 18.5 cm is maintained over the notch, the difference of pressure head between the entrance and throat section of venturimeter is found to be 42.5 cm of water. Assuming that measurements at the notch are correct determine the discharge coefficient for the venturimeter. [9]

OR

b) A fireman holds a water house ending into nozzle that issues a 20 mm diameter jet of water. If the pressure of water in the 60 mm diameter house is 700 kPa. find the force experienced by the fireman.

Q4) a) Derive an expression for the velocity distribution for viscous flow in a circular pipe and find the ratio of maximum velocity to average velocity. [8]

b) A large tank resting on the floor is filled to a depth of 6 mt A sharp edged orifice of 10 mm diameter is located 2.5 m above the floor level. For Cc = 0.6 Cv = 0.97 determine the discharge and horizontal distance from the tank where the jet will strike the ground. Also determined Cd. [8]

Q5) a) i) What are the different losses taken into account in pipe flow problems and write expressions for calculating them. [5]

ii) What is an equivalent pipe. [4]

b) Determine the difference in elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 30 cm and length 400 mt. The rate of flow of water through the pipe is 300 lit/sec consider all losses and assume the value of coefficient of friction f = 0.008. [9]

OR

b) A pipe line of 0.6 mt diameter is 1.5 km long. In order to augment the discharge another pipe-line of same diameter is introduced parallel to the first in the second half of the length Neglecting minor losses, find the increase in discharge if the friction factor f = 0.04 and the head at inlet is 30 mt.

Q6) a) With the help of sketches discuss the methods used for controlling the seperation of boundary layer. [8]

b) Show by the method of dimensional analysis that the frictional torque T of a disc of diameter D, rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by [8]

$$T = D^5 N^2 \rho \phi \left(\frac{\mu}{D^2 N \rho} \right)$$

OR

b) A sphere of 4 cm diameter made of aluminium of specific gravity 2.8 is attached to a string and suspended from the roof of a wind tunnel test section. If an air stream of 30 m/s flows past the sphere, find the inclination of the string and tension in the string. Assume $\rho_a = 1.2$ kg/m^3 $C_D = 0.5$.

❄❄❄

S–2073

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, December - 2015

ELECTRICAL TECHNOLOGY (New)

Sub. Code : 63351

Day and Date : Wednesday, 16 - 12 - 2015 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions : 1) **All questions are compulsory.**

2) **Figures to the right indicate marks.**

3) **Draw neat figures wherever necessary.**

4) **Assume suitable data, if missing. State it clearly.**

SECTION - I

Q1) a) Explain the necessity of commutation in the working of a dc motor. List the drawbacks of commutation.

OR

What are the merits and drawbacks of dc series motor? How are these drawbacks overcome in a dc cumulative compound motor. **[1 × 8 = 8]**

Answer any two of the following (b, c, d). **[2 × 6 = 12]**

b) State the expression for speed of a dc motor. Hence explain the effect of each parameter in it on the speed.

c) Draw the circuit and explain the working of a 4 point starter.

d) A dc shunt motor has armature resistance and field resistance 1 ohm and 200 ohm respectively. When a rated voltage of 230V is applied, it runs at a rated speed of 1500 rpm at full load by taking 20A current. To increase the speed to 1800 rpm how much resistance should be connected in series with the field winding? The load torque is inversely proportional to the speed.

P.T.O.

Q2) Answer any two : **[2 × 8 = 16]**

a) Comment with the reasons on Ruggedness, Cost, controllability, applications of the cage motor and slip ring motor.

b) Draw and explain the torque slip characteristics of 3 phase induction motor.

c) Explain how unidirectional torque is produced in a 3 phase induction motor.

Q3) Answer any two. **[2 × 8 = 16]**

a) Why does an induction motor draw high stator current at the time of starting? How is it reduced in a rotor resistance starter?

b) Explain any one speed control method of 3 phase induction motor.

c) Explain the reversal of rotation of 3 phase induction motor.

SECTION - II

Q4) Answer any two. **[2 × 8 = 16]**

a) Differentiate between a servo motor and a drive motor on the basis of desirable properties, construction, speed torque characteristics and applications.

b) What are the types of stepper motor? Explain construction and working of any one type of the stepper motor.

c) Explain the construction and working BLDC motor.

Q5) Answer any two. **[2 × 8 = 16]**

a) Discuss various electrical factors to be considered while selecting a motor for a particular machine.

b) Explain the starting requirements and running requirements, braking requirements and hence suggest a suitable motor for following applications.

i) Paper mills ii) Blowers

iii) Lathe machines iv) Electric traction

c) Explain the 4 quadrant plane of operation of d.c. motors

Q6) Answer any two. **[2 × 8 = 16]**

a) Explain construction and working of vertical core type induction furnace.

b) Describe construction and working of 3 phase direct arc furnaces.

c) A resistance oven employing nichrome wire is to be operated from 220V single-phase supply and is to be rated at 16 kW. If the temperature of the element is to be limited to 1170 °C and average temperature of the charge is 500 °C; find the length and diameter of the element wire.

radiating efficiency = 0.57 , emissitivity = 0.9,

specific resistance of nichrome = 109×10^{-8} ohm - m

❄❄❄

S-2456

Total No. of Pages :3

Seat No.	

S.E.(Mechanical) (Semester -I) (Pre-Revised) Examination, December - 2015

NUMERICAL METHOD

Sub. Code: 43593

Day and Date : Tuesday, 01 - 12- 2015 **Total Marks : 100**

Time :10.00 a.m. to 1.00 p.m.

Instructions :
1) **Attempt any three questions from each section.**
2) **Make suitable assumptions /data if required and state clearly.**
3) **Draw neat sketches wherever necessary.**
4) **Use of calculator is allowed.**

SECTION - I

Q1) a) Find the root of the equation $x^3-5x+3=0$ correct to two decimal places by bisection method. [8]

b) Find a root of the equations [8]

$x = x^2 + y^2$,

$y = x^2 - y^2$

take $x_0 = 0.8$ and $y_0 = 0.4$

Q2) a) Apply Factorization method to solve the equation [9]

$$2x-6y+8z=24$$
$$5x+4y-3z=2$$
$$3x+y+2z=16$$

b) Solve the following equation by Gauss Jordan method [9]

$$5x_1+x_2+x_3+x_4=4$$
$$x_1+7x_2+x_3+x_4=12$$
$$x_1+x_2+6x_3+x_4=-5$$
$$x_1+x_2+x_3+4x_4=-6$$

P.T.O.

Q3) a) A simply supported beam carries a concentrated load P(lb) at its mid-point. Corresponding to various values of P, the maximum deflection Y(in) is measured. The data are given below. **[8]**

P	100	120	140	160	180	200
Y	0.45	0.55	0.60	0.70	0.80	0.85

and find the relation of the form $Y = a + bP$.

b) Using Newton's divided difference formula evaluate f(8) given **[8]**

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

Q4) a) Determine the probability distribution of the number of bad eggs in a box of 6 chosen at Random if 10% of eggs are bad, in a large consignment. **[8]**

b) The average number of phone calls/minute coming into a switch boards between 2 and 4 pm is 2.5 determine the probability that during one particular minute there will be **[8]**

i) 0 ii) 1 and iii) 2

SECTION - II

Q5) a) Calculate the value of $\int_0^1 dx/1+x^2$ by **[8]**

i) Trapezoidal rule take h = 1/4

ii) Simpsons 1/3rd rule take h = 1/4

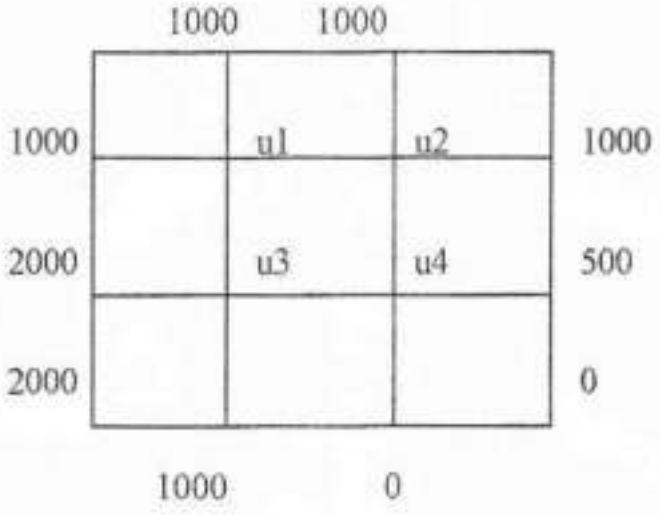
b) Use Romberg's method to compute $\int_0^1 dx/1+x$. Hence evaluate $\log_e 2$ correct to four decimal places. **[8]**

Q6) a) Using Runge-Kutta method solve $dy/dx = (y^2 - x^2)/(y^2 + x^2)$ with $y(0) = 1$ at $x = 0.4$ take $h = 0.2$. [9]

b) Determine the largest eigen-value and the corresponding eigen vector of matrix [9]

$$\begin{vmatrix} 10 & 7 & 8 & 7 \\ 7 & 5 & 6 & 5 \\ 8 & 6 & 10 & 9 \\ 7 & 5 & 9 & 10 \end{vmatrix} \quad \begin{vmatrix} 1 \\ 1 \\ 1 \\ 1 \end{vmatrix}$$

Q7) Given the values of u(x,y) on the boundary of the square in figure evaluate the function u(x, y) satisfying the Laplace equation at the pivotal points of the this figure by Gauss Seidal method. [16]



Q8) a) What is FEM? Explain the procedure to be followed for FEM. [8]

b) Explain the behaviour of linear element by using shape function and hence derive the expression $\phi = N_i \phi_i + N_j \phi_j$ [8]

EEE

S - 2523

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, December - 2015

MACHINE DRAWING

Sub. Code : 42663

Day and Date : Monday, 21 - 12 - 2015 **Total Marks : 100**

Time : 09.00 a.m. to 01.00 p.m.

Instructions:
1) **Questions 1 and 4 are compulsory solve any one from remaining two in each section.**
2) **Figures to right indicate full marks.**
3) **Make suitable assumptions whenever required and mention it clearly.**

SECTION- I

Q1) a) A vertical square prism with base sides 50 mm has a face inclined at 30° to VP. It has a hole of 65 mm diameter with axis parallel to HP and VP and 5 mm away from the axis of the prism. Complete the projections of the prism. **[15]**

b) Draw free hand proportionate dimensioned sketches of following **[10]**
   i) Universal coupling.
   ii) Double riveted Double strap joint

c) Draw neatly IS conventions of following **[10]**
   i) Ratchet and pinion.
   ii) Chain Dimensioning

Q2) Draw proportionate dimensioned free hand sketches for the following **[15]**
   a) Eye foundation bolt.
   b) Muff coupling.
   c) Union joint.

Q3) Draw neatly IS conventions for the following **[15]**
   a) Material symbol for marble
   b) Internal threads 2 views
   c) Leaf spring with eye
   d) Spot weld
   e) Removed Sections

P.T.O.

SECTION - II

Q4) Refer fig. 1 showing details of screw jack. Draw assembly showing sectional front view and top view. Prepare part list. [35]

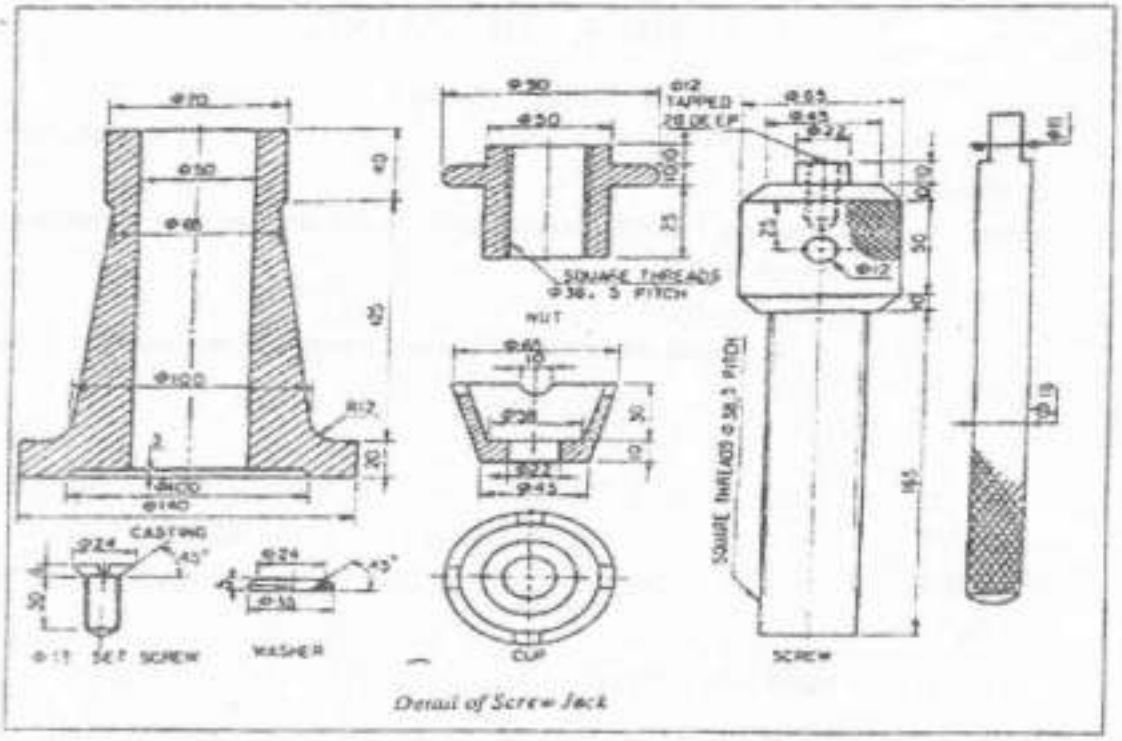


Fig.1

Q5) Refer fig.2 Redraw given view and draw partical auxiliary view. [15]

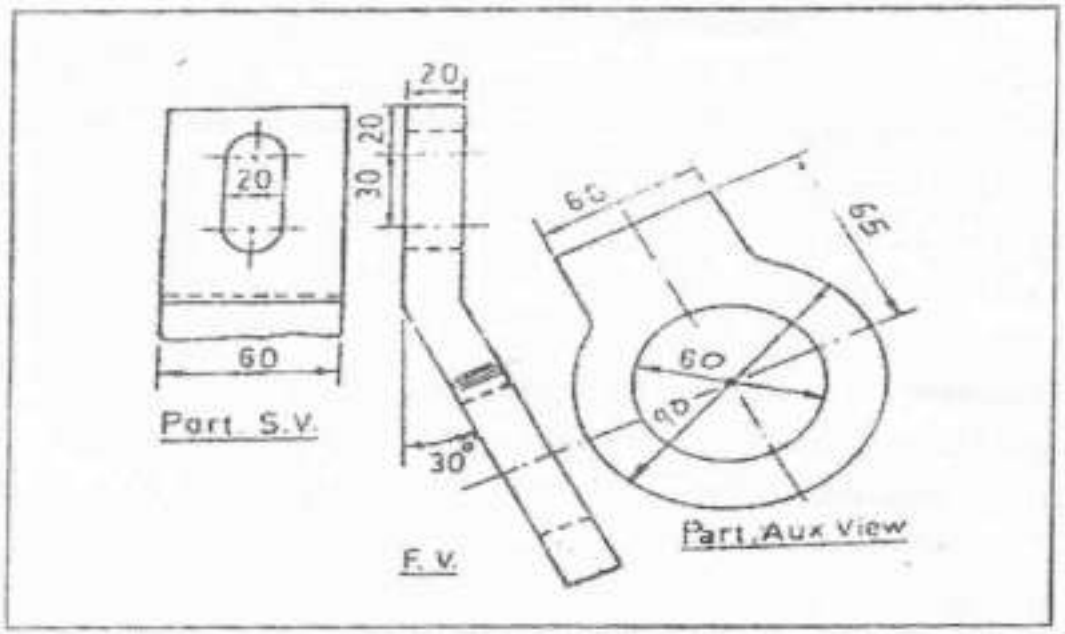


Fig.2

Q6) Redraw given view (fig.3) and show [15]

a) Center to center distance 80 mm is to be within 0.5 mm.

b) Surface A and B are to be parallel within 0.4 mm.

c) Surface A is to be milled to finish of N8.

d) Bilateral tolerance for dimension 45 is to be 0.4 mm. (total)

e) Tolerance on ϕ 30 hole is to be H8.

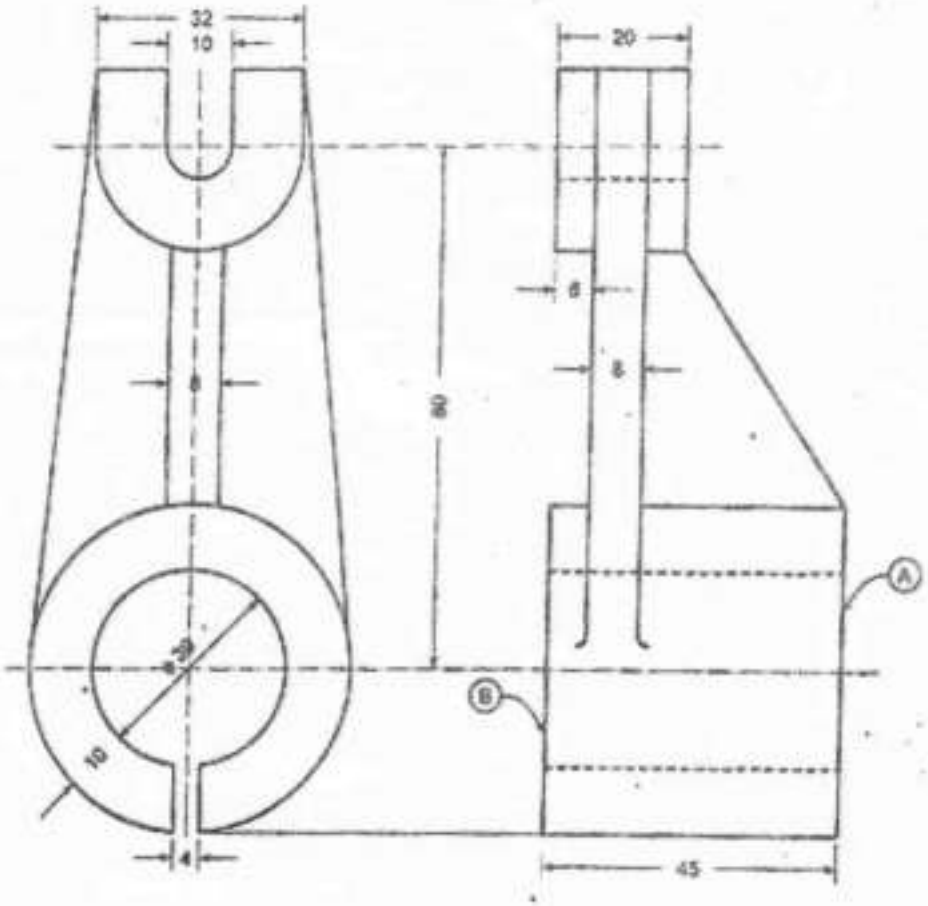


Fig.3

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical Engg.) (Semester - III) (Revised) Examination, November - 2019
ENGINEERING MATHEMATICS - III
Sub. Code : 63350

Day and Date : Saturday, 23- 11 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figure to the right indicates full marks.**
3) **Use of non-programmable calculator is allowed.**
4) **Assume suitable data if necessary.**

SECTION - I

Q1) Attempt Any Three of the following.

a) Solve $(D^2 - 6D + 9)\, y = 6e^{3x} + 7e^{-2x} - \log 2$. **[6]**

b) Solve $(D^3 - D^2 - 6D)\, y = x^2 + 1$. **[6]**

c) Solve $(D^2 + a^2)\, y = \sec ax$. **[6]**

d) Solve $x^2 \frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$. **[6]**

Q2) Attempt Any One of the following:

a) The differential equation for the displacement y of a whirling shaft when the weight of the shaft is taken into account is $EI\frac{d^4y}{dx^4} - \frac{W\omega^2}{g}y = W$.

Taking the shaft of length $2l$ with the origin at the centre and short bearings at both ends, show that the maximum deflection of the shaft is

$\frac{g}{2\omega^2}[\text{sech } al + \sec al - 2]$. **[16]**

b) A body weighing 10 kg is hung from a spring. A pull of 20 kg weight will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the deflection of the body from its equilibrium position at time t second, the maximum velocity and the period of oscillation. **[16]**

P.T.O.

Q3) Attempt Any Four of the following.

a) Find the directional derivative of $\phi = xy^2 + yz^2$ at point P(2, –1, 1) in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$. **[4]**

b) Find unit vector normal to the surface $2x^2 + 4yz - 5z^2 = -10$ at (3, –1, 2). **[4]**

c) Find the value of n for which the vector $r^n\vec{r}$ is solenoidal, where $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$. **[4]**

d) If $\vec{a} = a_1\vec{i} + a_2\vec{j} + a_3\vec{k}$ is constant vector and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$, prove that $\nabla.\left[\frac{\vec{a}\times\vec{r}}{r^n}\right] = 0$. **[4]**

e) If $\phi = x^2 + y^2 + z^2$ prove that the curl $(\nabla\phi) = 0$. **[4]**

SECTION - II

Q4) Attempt any Three from the following.

a) Find **[6]**

i) $L\{f(t)\}$, where $f(t) = \begin{cases} 4, & 0 \le t \le 1 \\ 3, & t > 1 \end{cases}$ and

ii) $L^{-1}\left\{\frac{3s+7}{s^2-2s-3}\right\}$

b) Find $L\left\{t\int_0^t \frac{e^{-t}\sin t}{t}dt\right\}$. **[6]**

c) Find inverse Laplace transform of $\frac{s}{(s-3)(s^2+4)}$. **[6]**

d) Find $L^{-1}\left\{\log\left(\frac{s+1}{s-1}\right)\right\}$. **[6]**

e) Using Laplace transform method, solve $y''(t) + y(t) = t$ given that $y(0) = 1$ and $y'(0) = 0$. **[6]**

Q5) Attempt any Two from the following.

a) Obtain Fourier series expansion of the function

$$f(x)=\begin{cases}\pi x, & 0\le x\le 1\\ \pi(2-x), & 1\le x\le 2\end{cases}$$ **[8]**

b) Find the fourier series expansion for $f(x)=x+\frac{x^2}{4}, -\pi\le x\le\pi$ and hence show that $\frac{\pi^2}{12}=1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+.....$ **[8]**

c) Expand $f(x)=e^x$ in a cosine series and sine series over (0, 1). **[8]**

Q6) Attempt any One from the following. **[16]**

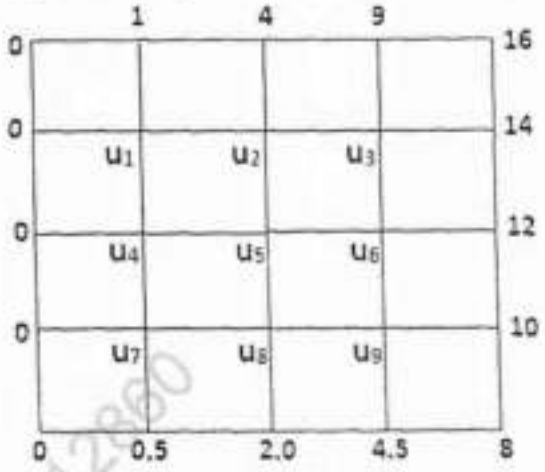
a) Solve the differential equation $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$ subject to the following conditions:

i) u is finite for all t

ii) $u=0$ for $x=0$ and $x=\pi$ for all t

iii) $u=\pi x-x^2$ for $t=0$ between $x=0$ and $x=\pi$.

b) Solve the Laplace equation $u_{xx}+u_{yy}=0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by performing three iterations.



Seat No.	

Total No. of Pages : 2

S.E. (Mechanical) (Semester - III) (Revised) Examination, November - 2019

ELECTRICAL TECHNOLOGY

Sub. Code : 63351

Day and Date : Tuesday, 26 - 11 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to right indicate full marks.**
3) **Draw neat labeled diagrams whenever necessary.**
4) **In case of missing data, assume suitable value. State it clearly.**

SECTION - I

Q1) a) Explain construction and working of DC Motor with a neat diagram. **[1×8]**

OR

Explain speed control methods for DC shunt motor.

Answer any two out of following sub questions b,c,d. **[2×6]**

b) Derive torque equation of DC motor.

c) Explain the concept of Back EMF for DC motor and state its importance.

d) A 500 V shunt motor runs at 1000 rpm, when armature current is 200 A. The resistance of armature is 0.12 Ω. Calculate speed when a resistance is inserted in the field to reduce the field of 70% of normal value & armature current is 100 A. The load requires constant torque at all speeds.

Q2) Answer any two. **[2×8]**

a) State & explain working principle of 3 phase Induction Motor. State the advantages of three phase induction motor.

b) Draw & explain Torque-Speed characteristics of 3 phase I.M. Explain the importance of stable operating region of T-N characteristics of 3 phase induction motor.

P.T.O.

c) The input power to a 500V, 50Hz, 6 pole, 3 phase induction motor running at 950 rpm is 25kW. The stator losses are 2kW and mechanical losses 3kW. Calculate

i) Slip
ii) Rotor copper losses
iii) Shaft Power
iv) Efficiency

Q3) Answer any two. **[2×8]**

a) Draw & explain Reversal of rotation of 3 phase I.M.
b) Draw the block diagram and explain VFD control to control speed of 3 phase I.M.
c) Why does induction motor takes large current at starting? How to reduce it from Star Delta starter.

SECTION - II

Q4) Answer any two. **[2×8]**

a) State the types of Servomotor. Explain construction, working and applications of AC servomotor.
b) Explain construction and working principle of PM type Stepper motor. State its applications.
c) Why BLDC motor is called as BLDC? Explain working principle and its applications.

Q5) Answer any two. **[2×8]**

a) Classify mechanical loads on the basis of torque speed variation. State two examples each.
b) Explain 4 quadrant operation of electric motor. Comment on power flow in each quadrant.
c) State and explain various factors to be considered to select a motor for a particular drive.

Q6) Answer any two. **[2×8]**

a) Explain the construction and working of coreless induction furnace.
b) Explain the construction and working of indirect resistance heating furnace.
c) Find the energy and power input required to melt 5 metric ton of steel in an 3 hour at an overall efficiency of 50%. of the furnace. If initial temperature is 30°C, melting point of steel is 1370°C, specific heat of steel is 278 J/kg/°C, and latent heat of steel is 37000 J/kg.

() () ()

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, November - 2019
APPLIED THERMODYNAMICS
Sub. Code : 63352

Day and Date : Thursday, 28- 11 - 2019 **Total Marks : 100**
Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Attempt all questions.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Make suitable assumptions if necessary and state it clearly.**
4) **Use of calculator, steam table and Mollier chart is allowed.**

Q1) a) Write a note on heat engine, refrigerator and heat pump. **[8]**

OR

Show that the specific entropy change for perfect gas in process is given by $s_2 - s_1 = c_p \log_e (v_2 / v_1) + c_v \log_e (p_2 / p_1)$. **[8]**

b) Water flows through a turbine in which friction causes the water temperature to rise from 35°C to 37°C. If there is no heat transfer, how much does the entropy of water change in passing through turbine? Water is incompressible and the process can be taken to be at constant volume.

Take c_v of water = 4.187 kJ/kg–K. Explain the process with the help of T-S diagram. **[8]**

Q2) a) Discuss the effect of steam supply pressure, temperature and condenser pressure on the performance of Rankine power cycle. **[9]**

b) A steam power plant uses steam at a pressure of 15 bar and temperature 350 °C and exhausted into a condenser where pressure of 0.06 bar is maintained. Determine thermal efficiency of Rankine cycle.' **[8]**

OR

In a steam turbine, steam at 20 bar, 360 °C is expanded to 0.08 bar. It then enters the condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assume ideal processes, find per kg of steam net work, the cycle efficiency, specific steam consumption and work ratio. **[8]**

Q3) a) Explain the following: **[8]**

i) Corrected vacuum
ii) Vacuum efficiency
iii) Condenser efficiency
iv) Capacity of air extraction pump

OR

Classify steam boiler. Explain any one water tube boiler with neat sketch. **[8]**

b) The following data were obtained from the test on the condenser: **[9]**
Condenser vacuum: 685 mm of Hg
Barometer reading = 765 mm of Hg
Mean condenser temp = 34°C
Hot well temp. = 28°C
Inlet temp. of circulated water = 18°C
Outlet temp. of circulated water = 30°C
Compute

i) Condenser vacuum corrected to standard barometer
ii) Vacuum efficiency
iii) Efficiency of the condenser
iv) Undercooling of condensate

Q4) a) Derive the expression for critical pressure ratio for maximum discharge through nozzle. **[8]**

OR

Explain with the help of h-s diagram, the term supersaturated flow and significance of Wilson's line. **[8]**

b) In a convergent-divergent nozzle the stream enters at 15 bar and 300°C and leaves at a pressure of 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit areas for mass-flow rate of 1 kg/s. Assume nozzle efficiency to be 93 percent. **[8]**

Q5) a) Draw combined velocity triangle for single stage impulse turbine and obtain work done per stage, blade efficiency and axial thrust. **[9]**

b) The nozzles of a de-laval turbine deliver 1.5 kg/s of stream at a speed of 800 m/s to a ring of moving blades having a speed of 200 m/s. The exit angle of the nozzle is 18°. If the blade velocity coefficient is 0.75 and the exit angle of the moving blades is 25°, calculate, **[8]**

i) Inlet angle of moving and fixed blades.

ii) Diagram efficiency.

iii) Power developed.

Q6) a) Derive the expression for gross stage efficiency for Parson's turbine. **[8]**

b) The outlet angle of blade of Parson's turbine is 20° and the axial velocity of flow of steam is 0.5 times the mean blade velocity. Draw the velocity diagram for stage consisting of one fixed and one moving row of blades given that mean diameter is 71 cm and the speed of rotation is 3000 rpm. Find the inlet angle of blades. **[9]**

OR

In a reaction turbine, the blade tips are inclined at 35° and 20° in the direction of motion. The guide blades are of the same shape as moving blades but reversed in direction. At a certain place in the turbine, the drum diameter is 1.1 m. and speed of rotation is 250 rpm. Find, power developed for the mass flow rate of 4 kg/s. **[9]**

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, November - 2019
METALLURGY
Sub. Code : 63353

Day and Date : Saturday, 30 - 11 - 2019 **Total Marks : 100**
Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Solve any three questions from each section.**
2) **Draw neat sketches wherever necessary to support your answer.**
3) **Write our answers to the point and in order of preference.**
4) **Figures to the right indicate full marks.**

SECTION - I

Q1) Solve the following

a) Draw Cu-Ni equilibrium diagram and show cooling of any one alloy, calculate proportion of phases in semi-solid state by using lever arm principle? Write Hume-Rothery rules of solubility? **[10]**

b) Draw Fe-Fe_3C equilibrium diagram; indicate all temps, compositions and phases. **[8]**

Q2) Differentiate clearly between following pairs (any four) **[16]**

a) Eutectoid and eutectic system
b) Short freezing and long freezing alloys
c) Substitutional and interestitial solid solution
d) BCC and FCC structures
e) Edge and Screw dislocation
f) Charpy and Izod test

Q3) Short note on any four **[16]**

a) Classify the Cast iron? Write microstructure & properties of grey iron.
b) Classification and properties of tool steels
c) Classification and properties of stainless steels
d) Properties and applications of super alloys
e) Structure and properties of Babbit alloy

P.T.O.

Q4) Solve any four **[16]**

a) True and engineering stress strain diagram
b) Pulse echo and through transmission method
c) Stapes in Dye Penetrant test
d) Draw Cu-Zn equilibrium diagram.
e) Properties and applications of Soldering alloy

SECTION - II

Q5) Solve the following

a) Draw TTT diagram for hypo eutectoid and hyper eutectoid steels and Explain why mild steel cannot be hardened by quenching? **[9]**
b) Classify precisely Heat treatment furnaces? Explain with neat sketch rotary health furnace? **[9]**

Q6) Solve the following

a) Classify different powder manufacturing methods and Explain with neat sketch automization process **[8]**
b) Write different quenching media used in heat treatments? Write advantages and limitations of each? **[8]**

Q7) Differentiate clearly between any four of the following **[16]**

a) Lower and upper bainite transformation
b) Pearlite and martensitic transformation
c) Flame and induction hardening
d) Nitriding and Carburizing
e) Annealing and Normalizing

Q8) Write short notes on any four of the following **[16]**

a) Sub-zero treatment
b) Heat treatment defects
c) Stages in Powder Metallurgy
d) Self-lubricating bearings
e) Precipitation hardening in Al- Cu alloy

■ ■ ■

SC - 91

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Semester - III) (Revised) Examination, December - 2019
FLUID MECHANICS
Sub. Code : 63354

Day and Date : Tuesday, 3 - 12 - 2019 **Total Marks : 100**
Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicates full marks.**
3) **Neat diagrams must be drawn wherever necessary.**
4) **Use of non - programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) Define viscosity and deduce the units of viscosity. Explain the effect of temperature on viscosity for liquids and gases. **[6]**

b) What is the bulk modulus of elasticity of a liquid which is compressed in a cylinder from a volume of 0.0125 m^3 at 80 N/cm^2 pressure to a volume of 0.0124 m^3 at 150 N/cm^2 pressure? Also find compressibility in m^2/N. **[6]**

c) Define total pressure and centre of pressure. **[4]**

Q2) a) Define steady and unsteady flow, state law of conservation of mass and hence derive the continuity equation in Cartesian coordinates in 3 dimensional flow when the flow is steady and incompresessible. **[8]**

b) Solve any one of the following: **[8]**

i) The velocity components in a two dimensional flow are, $u = 2xy$, $v = b^2 + x^2 - y^2$

1) Is the flow possible?
2) Is the flow rotational or irrotational?
3) If the flow is irrotational, determine potential function.
4) Determine corresponding stream function.

ii) Find the Mach number when an aeroplane is flying at 1100Km/hr through still air having a pressure of $7N/cm^2$ and temperature $-5°C$. Wind velocity may be taken as zero.

Take R = 287.14 J/Kg K. Calculate the pressure, temperature and density of air at stagnation pointing the nose of the plane. Take k = 1.4.

P.T.O.

Q3) a) List different forces existing in the fluid flow and derive Euler's equation of motion along streamline. **[9]**

b) Solve any one of the following: **[9]**

i) Find the discharge of water flowing through a pipe 30cm diameter placed in an inclined position where a Venturimeter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and the throat is measured by a liquid of specific gravity 0.6 in an inverted U–tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of pipe. Also find the value of Cd for Venturimeter.

ii) A tank containing water is provided with a sharp edged circular orifice of 7.5 mm diameter. The height of water in the tank is 1.44 m above the orifice. The jet strikes a wall 1.5 m away and 0.42 m vertically below the centre line of the contracted section of the jet. The actual discharge through the orifice is measured to be 35 litres in 4 minutes. Determine:

1) The orifice coefficients

2) The Loss coefficient and the power loss at the orifice.

Q4) a) Derive an expression for velocity distribution for viscous flow through circular pipe. Also find the ratio of Maximum velocity to Average Velocity. Draw velocity and shear stress distribution. **[8]**

b) A 300 mm diameter pipe carrier water under a head of 20 meters with a velocity of 3.5 m/s. If the axis of the pipe turns through 45°, find the magnitude and direction of the resultant force at the bend. **[8]**

Q5) a) i) Explain the terms Hydraulic gradient line and Total energy line. **[4]**

ii) What is Syphon? Where it is used and Explain its working with neat sketch. **[6]**

b) Solve any one of the following. **[8]**

i) Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300mm and length 400 meters. The rate of flow of water through the pipe is 300 litres/s. Consider all losses and take the value of $f = 0.008$.

ii) Two sharp ended pipes of diameters 50 mm and 100 mm with each of length 100 meters respectively are connected in parallel between two reservoirs which have a difference of level of 10 meters. If the friction factor for each pipe is 0.32, calculate

1) the rate of flow for each pipe
2) the diameter of the single pipe 100 meters long which would give the same discharge, if it were substitute for the original two pipes.

Q6) a) Define boundary layer and explain with neat sketch the effect of pressure gradient on a boundary layer separation. **[8]**

b) Solve any one of the following.

i) A flat plate 1.5m×1.5m moves at 50Km/hr in a stationary air of density 1.15Kg/m^3. If the coefficient of Lift and Drag are 0.75 and 0.15 respectively, determine **[8]**

1) The Lift force
2) The Drag force
3) The resultant force
4) The power required to keep the plate in motion

ii) The frictional torque 'T' of a disc of diameter 'D' rotating at a speed 'N' in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5N^2\rho\phi[\mu/D^2N\rho]$. Prove this by the method of dimensions.

✪ ✪ ✪

SE - 69

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical Engg.) (Semester - III) Examination, November - 2018
ENGINEERING MATHEMATICS - III (Revised)
Sub. Code : 63350

Day and Date : Tuesday, 20 - 11 - 2018 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non- programmable calculator is allowed
4) Assume suitable data if necessary.

SECTION - I

Q1) Attempt any three of the following:

a) Solve $(D^4 - 1)y = \cosh x \sinh x$ [6]

b) Solve $(D^2 - 4D + 4)y = x^2 + \cos 2x$ [6]

c) Solve $(D^2 + 5D + 6)y = e^{x}$ [6]

d) Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = 3x - 2$ [6]

Q2) Attempt any two of the following:

a) The whirling speed of a shaft of length l is given by $\frac{d^4y}{dx^4} - m^4 y = 0$, where $m^4 = \frac{W\omega^2}{gEI}$ and y is the displacement at distance x from one end. If the ends of the shafts are considered in long bearing so that the slope at each end is zero, show that the shaft will whirl when $\cos ml \cosh ml = 1$. [8]

b) A spring with a mass 2 kg has natural length 0.5 m. A force of 25.6 N is required to maintain it stretched to a length 0.7 m. If the string is stretched to a length of 0.7 m and then released with initial velocity zero, find the position of the mass at any time t. [8]

P.T.O.

c) The differential equation of the motion of a body is $\frac{d^2x}{dt^2}+k^2x=k^2a\sin nt$.

If $x=0$ and $\frac{dx}{dt}=0$ at $t=0$, then show that $x=\frac{ka}{n^2-k^2}(k\sin nt-n\sin kt)$. [8]

Q3) Attempt any Four of the following:

a) Find the angle between the tangents to the curve $\vec{r}=t^2\vec{i}+2t\vec{j}-t^3\vec{k}$ at the points $t=\pm1$. [4]

b) If $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$ and $r=|\vec{r}|$ then find $\text{div}\left(\frac{\vec{r}}{r^3}\right)$. [4]

c) Determine the constants a and b such that the curl of vector is zero, where $\vec{F}=(2xy+3yz)\vec{i}+(x^2+axz-4z^2)\vec{j}-(3xy+byz)\vec{k}$. [4]

d) If $\vec{a}$ is a constant vector and $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$ then prove that $\nabla\times[(\vec{a}.\vec{r})\vec{r}]=\vec{a}\times\vec{r}$. [4]

e) Find the directional derivative of $\phi=\frac{1}{(x^2+y^2+z^2)^{1/2}}$ at the point $P(1,-1,1)$ in the direction of the vector $\vec{a}=\vec{i}+\vec{j}+\vec{k}$. [4]

SECTION - II

Q4) Attempt any three from the following:

a) Find the Laplace transform of $\frac{d}{dt}\left(\frac{\sin t}{t}\right)$ [6]

b) Find Inverse Laplace transform of $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$ [6]

c) Given $L[J_0(t)]=\frac{1}{\sqrt{1+s^2}}$ then show that $\int_0^\infty te^{-3t}J_0(4t)\,dt=\frac{3}{125}$. [6]

d) Using convolution theorem find $L^{-1}\left[\frac{1}{(s-2)(s+2)^2}\right]$ [6]

Q5) Attempt any two from the following:

a) Obtain Fourier series of the function $f(x)$ given by. [8]

$$f(x)=\begin{cases} x & \text{if } -\pi<x<0 \\ -x & \text{if } 0<x<\pi \end{cases}.$$

Hence show that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\infty=\frac{\pi^2}{8}$

b) Find the Fourier series expansion of $f(x)=2x-x^2$ in $(0,3)$ [8]

c) Express $f(x)=\cos x$ as a half range sine series in $0<x<\pi$. [8]

Q6) Attempt any one of the following:

a) Solve $\frac{\partial u}{\partial t}=a^2\frac{\partial^2 u}{\partial x^2}$ if $u(x,t)$ satisfies the following conditions. [16]

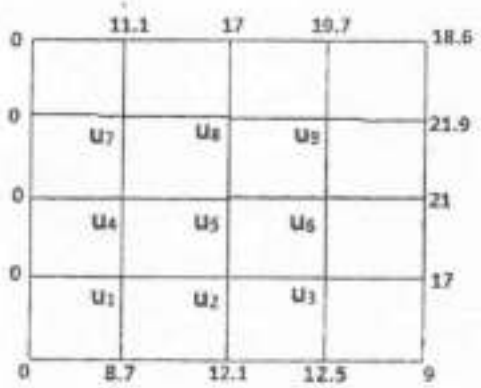
i) $u(0,t)=0$ for all t

ii) $u(l,t)=0$ for all t

iii) $u(x,0)=\begin{cases} x & \text{if } 0\le x\le l/2 \\ l-x & \text{if } l/2\le x\le l \end{cases}$

iv) $u(x,\infty)$ is finite.

b) Solve the Laplace equation $u_{xx}+u_{yy}=0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by performing four iterations. [16]



SE - 70

Seat No.	

Total No. of Pages : 2

S.E. (Mechanical) (Semester - III) (Revised) Examination, November - 2018

ELECTRICAL TECHNOLOGY

Sub. Code : 63351

Day and Date : Saturday, 24 - 11 - 2018 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicates full marks.**
3) **Draw neat labeled diagrams wherever necessary.**
4) **In case of missing data, assume suitable value. State it clearly.**

SECTION - I

Q1) a) State types of DC motor. Explain with circuit diagram & equations. **[1 × 8 = 8]**

OR

Draw a neat figure and explain the construction of dc motor.

Answer any two out of following sub questions b,c,d. **[2 × 6 = 12]**

b) Derive torque equation of DC motor.

c) Explain the speed control methods for d c shunt motor.

d) A 200V dc series motor runs at 500 r.p.m. taking a line current of 25 Amp. The resistance of armature is 0.3 ohm and that of field winding is 0.5 ohm. If the current taken remains constant, calculate the resistance necessary to reduce the speed to 350 r.p.m.

Q2) Answer any two. **[2 × 8 = 16]**

a) Explain working of three phase induction motor. In practice, why the slip cannot be zero?

b) Draw and explain the speed torque characteristics of 3 phase induction motor. What is the importance of stable operating region?

c) The power input to a 500V, 50Hz, 6 pole 3 phase induction motor running at 975 r.p.m. is 40 kW. The stator losses are 1 kw and friction and windage losses total 2 kW.
Calculate
i) The slip
ii) The rotor Cu loss
iii) Shaft power
iv) Efficiency

P.T.O.

Q3) Answer any two. [2 × 8 = 16]

a) Why does the induction motor draw a large starting current? How to reduce it from rotor side.

b) With a neat diagram explain the working of star delta starter for 3 phase induction motor.

c) Draw the block diagram and explain the VFD control in detail.

SECTION - II

Q4) Answer any two. [2 × 8 = 16]

a) State the types of Servomotor. Explain construction, working and applications of DC servomotor.

b) Explain construction and working principle of PM type Stepper motor. State its applications.

c) Explain working principle, construction and applications of Linear induction motor.

Q5) Answer any two. [2 × 8 = 16]

a) State and explain various factors to be considered to select a motor for a particular drive.

b) Explain 4 quadrant operation of electric motor. Comment on power flow in each quadrant.

c) Classify nature of different mechanical loads with respect to its duty period. Give example. Draw the graph of different mechanical loads with respect to speed.

Q6) Answer any two. [2 × 8 = 16]

a) Explain construction, working and applications of Direct Arc furnace.

b) Compare Core type and Coreless induction furnace in all aspects.

c) Determine the amount of energy required to melt 2000 kg of zinc in 1 hr, if it operates at an efficiency of 70%.

specific heat of zinc = 0.1 kcal/kg/ °C, The latent heat of zinc = 26.67 kcal/kg, melting point is 480°C, the initial temperature is 25°C.

▽▽▽▽

SE - 71

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Semester - III) Examination, November - 2018

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Tuesday, 27 - 11 - 2018 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Assume suitable data if necessary.**
4) **Use of steam table, Mollier-chart are allowed.**
5) **Use of non-programmable calculator is allowed.**

Q1) a) Explain the principle of increase of entropy. What is mean by available and unavailable energy. [9]

OR

Give the statements of zeroth law, first law, second law and third law of thermodynamics.

b) The air in the cylinder of an I.C. Engine at the beginning of the compression stroke occupies $0.013m^3$, the pressure is 100 kPa and temperature is 100°C. It is compressed to $0.001m^3$ according to law $PV^{1.3} = C$ and then pressure is 2800 kPa. Heat is now added at constant volume until pressure reaches to 5600 kPa. Find the entropy change in each operation and state whether increases or decreases. [8]

Take Cp = 1.0035kJ/kg.K Cr = 0.7165 kJ/kg. K.

Q2) a) Explain different properties of steam. What is use of steam table and Mollier chart? [9]

b) Dry saturated steam at a pressure 11 bar is supplied to a turbine and expanded isentropically to pressure 0.07 bar. Calculate following: [8]

i) Heat rejected in condenser.

ii) Thermal efficiency by neglecting pumping work.

P.T.O.

Q3) a) What is function of condenser? Which are the different elements of condensing plant? [8]

OR

Give the comparison between fire tube boilers and water tube boilers.

b) In a surface condenser the vacuum maintained is 700 mm of Hg. The barometer reads 754 mm. If the temperature of condenser is 18°C determine [8]

i) Mass of air per kg of steam.

ii) Vacuum efficiency.

Q4) a) Derive the expression for CPR for maximum discharge through the nozzle. [8]

OR

b) What are the effects of friction on the flow through a steam nozzle? Explain with the help of h-s diagram.

c) A De Lavel type impulse turbine is to develop 150 kW with a probable consumption of 7.5 kg of steam per kWh with initial pressure being 12 bar and exhaust 0.15 bar. Taking the diameter at the throat of each nozzle as 6 mm, find the number of nozzles required. Assuming that 10% of the total heat drop is lost in diverging part of the nozzle; find the diameter at the exit of the nozzle and the quality of steam which is to be fully expanded as it leaves the nozzle. (Assume steam to be initially dry saturated.) [9]

Q5) a) Explain difference between impulse and reaction turbine. [8]

OR

b) Define the following :

i) Diagram efficiency

ii) Blade velocity coefficient

iii) Speed ratio

iv) Stage efficiency

c) In a stage of an impulse turbine provided with a single row wheel, the mean diameter of the blade ring is 80 cm and the speed of rotation is 3000 rpm. The steam issues from the nozzle with velocity of 300 m/s and nozzle angle is 20°. The rotor blades are equiangular and due to friction in the blade channels the relative velocity of steam at outlet from blades is 0.86 times the relative velocity of steam entering the blades. What is the power developed in the blades when the axial thrust on the blades is 140 N? **[8]**

Q6) a) Explain the turbine troubles like erosion, corrosion, fouling and vibrations. **[8]**

OR

b) What are the different losses in steam turbine.

c) The steam consumption in Parson's reaction turbine running at 400 rpm is 5kg/s. The pressure of steam at a certain pair is 2 bar, its dryness is 0.96 and the power developed by the pair is 4.4 kW. The discharging blade tip angle is 20° for both fixed and moving blades. The axial velocity of flow is 0.72 of the blade velocity. Calculate drum diameter and the blade height, assuming the tip leakage as 5% and neglecting the blade thickness. **[9]**

▽▽▽▽

SE - 72

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical) (Semester-III) Examination, November - 2018
METALLURGY (Revised)
Sub. Code : 63353

Day and Date : Thursday, 29 - 11 - 2018 **Total Marks : 100**

Time : 10.00 a.m. to 01.00 p.m.

Instructions:
1) **All questions are compulsory.**
2) **Draw neat sketches wherever necessary to support your answers.**
3) **Write your answers to the point and in order of preference.**
4) **Figures to the right indicate full marks.**

Q1) a) Solve any one [6]

i) Explain in short Nucleation and grain growth mechanism.

ii) What you mean by solid solution? Differentiate substitutional and interstitial solid solution?

b) Write short note on any three [12]

i) Imperfections in Crystal structure

ii) Dendritic structure and coring

iii) Solidification of partial eutectic alloy

iv) Freezing range of alloys

Q2) a) Solve any Two [16]

i) Draw Cu -Zn equilibrium diagram. Show variation of tensile strength and ductility with varying amount of Zn in brass.

ii) Draw Fe-Fe_3C equilibrium diagram, indicate all temps, compositions and phases and reactions.

iii) Classify the Cast Iron. Write microstructure & properties of grey iron.

b) Write short note on any three [12]

i) Structure and Properties of Babbit alloy

ii) Effect of alloying element in tool steel

iii) Composition and properties of Al-4.5Cu alloy

iv) Properties and applications of Soldering alloy

v) AISI specifications for steels

P.T.O.

Q3) a) Solve any one [6]

i) Write stages in Rockwell hardness testing. Which indenter's and loads are used in Rockwell testing?

ii) Draw stress strain diagram for mild steel. Show the effect of C content on shape of stress strain diagram.

b) Draw self-explanatory sketches for any one [4]

i) Charpy and Izod test

ii) Dye penetrant testing

Q4) a) Solve any one of the following [6]

i) Explain the experimental procedure and draw TTT diagram for eutectoid steels. Label all the parts of the diagram. Show the CCR on the diagram and explain its significance.

ii) Draw self explanatory sketch for transformation of Pearlite to austenite and austenite to upper/feathery Bainite.

b) Solve any one of the following [4]

i) Explain the transformation process of austenite into martensite.

ii) Draw CCT diagram Overlapped on TTT diagram and explain its significance.

Q5) a) Solve any two of the following [12]

i) What is heat treatment? What is heat treatability and basic requirement of alloys that can be heat treated? Write the important types of heat treatments carried out on steels.

ii) What is Flame Hardening and what are its advantages, limitations and applications? What are the various types of flame hardening?

iii) What is Carburizing? What are its types? Explain liquid carburizing with neat sketch and write its advantages and limitations

b) Solve any three of the following [12]

i) Why hyper eutectoid steels are hardened from just above lower critical temperatures while hypo eutectoid steels are annealed from above upper critical temperatures?

ii) Explain with sketch the process of precipitation hardening in Al-4% Cu alloy.

iii) Carburized steels are required to be subjected to different post carburizing heat treatment processes? Explain.

iv) What is protective atmosphere? Enlist different types and explain any one.

v) Enlist important types of heat treatment defects and explain the causes and remedies of any two.

Q6) a) Solve any one of the following [6]

i) Explain with neat sketch the process of compacting in powder metallurgy and write its purposes.

ii) Write the classification and various types of powder manufacturing. Write the process of powder manufacturing for any two types.

b) Solve any one of the following [4]

i) What is Sintering and what are its purposes?

ii) Explain what oil impregnation is and why it is essential? Which are the components that are subjected to oil impregnation?

⊖⊖⊖

Seat No.	

SE - 73
Total No. of Pages : 3

S.E. (Mechanical) (Semester - III) (Revised) Examination, December- 2018

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Saturday, 01 - 12 - 2018 Total Marks : 100

Time : 10.00 a.m. to 01.00 p.m.

Instructions :
1) All questions are compulsory.
2) Neat diagrams must be drawn wherever necessary.
3) Figures to the right indicate full marks.
4) Use of non programmable calculator is allowed.
5) Assume suitable data if necessary.

Q1) a) What is a fluid? How does it differ from solid? Define density, specific volume, surface tension and capillarity. [6]

b) Determine the minimum size of glass tubing that can be used to measure water level, if the capillary rise in tube is not to exceed 0.3 mm Take surface tension of water in contact with air as 0.0735 N/m. [6]

c) Define Total pressure and centre of pressure. [4]

Q2) a) Explain the terms streamline, streakline, pathline. What does the smoke emitting from a lighted cigarette represent, streamline or streak line or path line why? [8]

b) Solve any one of the following [8]

i) A two dimensional velocity field is given by $u = 2xy$, $v = -x^2y$ compute the (A) Velocity (B) Local acceleration and (C) convective acceleration at (1,1)

ii) Air has velocity of 1000 Km/h at a pressure of 9.81 KN/m^2 vacuum and a temperature of 47°c Compute its stagnation properties and the local Mach number. Take atmospheric pressure 98.1 KN/m^2 R=287J/kgk.y=1.4

P.T.O.

Q3) a) i) Show that the first law of Thermodynamics (steady flow energy equation) for a stream line in a steady incompressible frictionless flow is same as Bernoulli's equation for such flow. [5]

ii) For what reasons the coefficient of discharge of an orifice meter is much smaller than that of venturimeter? [4]

b) Solve any one of the following [9]

i) A vertical venturimeter carries a liquid of relative density 0.8 and has inlet and throat diameters of 15 cm and 7.5 cm respectively. The pressure connection at the throat is 15 cm above that at the inlet. If the actual rate of flow is 40 lit/sec and C_d=0.96 calculate the pressure difference between inlet and throat in N/m^2.

ii) A pipe bend placed in horizontal plane tapers from 50 cm diameter at inlet to 25 cm diameter at outlet. An oil of density 850 Kg/m^3 enters the reducing bend horizontally and gets turned through 45° clockwise direction. Measurements indicate that when oil flows at the rate of 0.45 m^3/s the pressure of 40 KN/m^2 at the inlet section drops to 23 KN/m^2 at the outlet section due to frictional effects. Make calculations for the magnitude and direction of the resultant force on the bend.

Q4) a) Derive an expression for the velocity distribution for viscous flow in a circular pipe and find the ratio of maximum velocity to average velocity. [8]

b) The quantity of water flowing through a channel is measured by notch. The water head over the notch is thrice the width or length of the rectangular notch. If the rectangular notch is replaced by a V notch calculate the angle of V notch, other conditions remaining the same. The coefficient of discharge for rectangular notch is 0.66 and for V notch is 0.62. [8]

Q5) a) i) With a neat sketch explain what is syphon Where it is used. [4]

ii) Define the terms Major energy loss and Minor energy loss in pipes. What are the causes of these losses? Write the equations which are used to calculate them. [5]

b) Solve any one of the following [9]

i) A 50 cm diameter pipe of length 500 mt. is connected in series to a 30 cm diameter pipe of length 300 mt. to convey discharge. Assume that the friction factor remains same for both the pipes and the minor losses are negligible. Determine (A) an equivalent length of 40 cm diameter pipe and (B) an equivalent size of pipe of 800 mt length.

ii) An oil of viscosity 0.12 Ns/m^2 and density 900 Kg/m^3 flows between two large parallel plates which are kept at a distance of 20 mm apart. The maximum velocity of flow is 1.5 m/s. Determine (A) the velocity at 5 mm from the plates. (B) The discharge per mt width. (C) The velocity gradients at the plates. (D) The shear stresses at the plates.

Q6) a) What is meant by boundary layer thickness, displacement thickness, momentum thickness and energy thickness? [8]

b) Solve any one of the following. [8]

i) The size of droplets d produced by a liquid spray nozzle depends upon the nozzle diameter D, jet velocity V, liquid densityρ and viscosity μ and surface tension σ Using Buckingham's π theorem obtain the relation $d/D = \Phi[\mu/\rho VD, \sigma/\rho DV^2]$

ii) A jet plane having a wing area of $20m^2$ and weighing 25 KN flies at 950 Km/hr speed. The engine develops 8500 Kw and a mechanical efficiency of 60%. Determine the lift and drag coefficients for the wind. Assume specific weight of air 12 N/m^3

○○○

SF - 77

Total No. of Pages : 4

Seat No.	

S.E. (Mechanical Engg.) (Semester - III) (Revised) Examination, November - 2017

ENGINEERING MATHEMATICS - III

Sub. Code : 63350

Day and Date : Friday, 10 - 11 - 2017 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

SECTION - I

Q1) Attempt any Three of the following.

a) Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=3\sin x+4\cos x$ with $y(0)=1$ and $y'(0)=0$. **[6]**

b) Solve $(D^2+D+1)y=(1-e^x)^2$ **[6]**

c) Solve $(D^2+5D+4)y=3-2x$ **[6]**

d) Solve $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=e^x$. **[6]**

Q2) Attempt any one of the following.

a) The whirling speed of a shaft of length l is given by $\frac{d^4y}{dx^4}-a^4y=0$,

where $a^4=\frac{Ww^2}{gEI}$ and y is the displacement at distance x from one end. If the ends of the shafts are considered in long bearing so that the slope at each end is zero, show that the shaft will whirl when $\cos al \cosh al = 1$. **[16]**

P.T.O.

b) i) The motion of particle is given by $\frac{d^2s}{dt^2}+k^2\frac{ds}{dt}=0$. At $t = 0$, $s = s_0$ and $\frac{ds}{dt}=v_0$ show that as time $t\to\infty$, $s = s_0+\frac{v_0}{k^2}$ **[8]**

ii) A spring for which stiffness K = 700 Newton / m hangs in a vertical position with its upper end fixed. A mass of 7 kg is attached to the lower end. After coming to rest, the mass is pulled down to 0.05 m and released Discuss the resulting motion of the mass, neglecting air resistance. **[8]**

Q3) Attempt any two of the following.

a) If $\vec{a}$ is a constant vector, $\vec{r}=x\vec{i}+y\vec{j}+z\vec{k}$ and $r=\sqrt{x^2+y^2+z^2}$ then find

i) $\nabla.\left(\frac{\vec{a}\times\vec{r}}{r}\right)$ and show that ii) $\nabla r^n = nr^{n-2}\vec{r}$ **[8]**

b) Show that $\vec{F}=(z^2+2x+3y)\vec{i}+(3x+2y+z)\vec{j}+(y+2xz)\vec{k}$ is irrotational but not solenoidal and hence find scalar potential **[8]**

c) Find the directional derivative of $\phi = x^2+2y^2-3z^2$ at (1, 2, 1) in the direction **[8]**

i) Normal to $xy^2+yz^3=4$ at $(1,-1,1)$

ii) tangent to $x=t^2+t,\ y=2t, z=2-t$ at $t=1$

SECTION - II

Q4) Attempt any three from the following:

a) Find the Laplace transform of $\frac{d}{dt}\left(\frac{\sin t}{t}\right)$ **[6]**

b) Find $L\left\{\int_0^t x\cosh x dx\right\}$ **[6]**

c) Find inverse Laplace transform of $\log\left(1+\frac{a^2}{s^2}\right)$ **[6]**

d) A particle is moving along x-axis according to the law $\frac{d^2x}{dt^2}+6\frac{dx}{dt}+25x=0$. If the initial velocity is 12 meters per second to the left, determine x in terms of t using Laplace transform method. **[6]**

Q5) Attempt any Two of the following:

a) A function $f(x)$ is defined within the range $(0, 2\pi)$ as **[8]**

$$f(x)=\begin{cases} x & if\ 0<x<\pi \\ 2\pi-x & if\ \pi<x<2\pi \end{cases}$$

Express f(x) as a Fourier series in the range $(0, 2\pi)$

b) Find Fourier series with period 3 to represent $f(x) = 2x - x^2$ in the range $(0, 3)$ **[8]**

c) Find half range cosine series for $f(x) = \sin x$ in the range $(0, \pi)$ and hence deduce that $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots\ldots=\frac{\pi}{4}$. **[8]**

Q6) Attempt any one from the following.

a) Solve $\frac{\partial u}{\partial t}=a^2\frac{\partial^2 u}{\partial x^2}$ if $u(x, t)$satisfies the following conditions.**[16]**

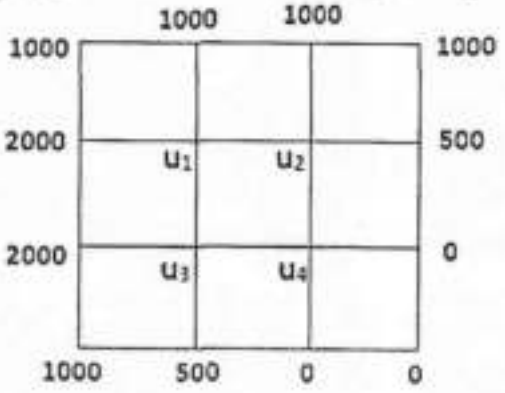
i) $u(0, t) = 0$ for all t

ii) $u(l, t) = 0$ for all t

iii) $u(x,0)=\begin{cases} x & if\ 0\le x\le l/2 \\ l-x & if\ l/2\le x\le l \end{cases}$

iv) $u(x, \infty)$ is finite

b) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by per [16]



SF-78

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, November - 2017
ELECTRICAL TECHNOLOGY
Sub. Code : 63351

Day and Date : Monday, 13-11-2017 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate marks.**
3) **Draw neat figures wherever necessary**
4) **Assume suitable data, if missing. State it clearly.**

SECTION - I

Q1) a) Derive the expression for speed and torque of dc motor. **[1 × 8]**

OR

Draw circuit diagrams and torque speed characteristics of dc shunt motor, dc series motor and dc cumulative compound motor.

Answer any two of the following (b, c, d). **[2 × 6]**

b) Draw the diagram and explain the working of 4 point starter.

c) Explain the basic methods of electric braking of dc motor.

d) A DC series motor runs at 1200 rpm driving a constant torque load by taking 10 A current from 200V supply. Now 5 ohm resistance is connected in series with the motor. Find the new armature current and new speed. The armature resistance is 0.6 ohm. Field resistance is 0.5 ohm.

Q2) Answer any TWO **[2 × 8]**

a) State three advantages of using 3 phase induction motor rather than dc motor. Describe the construction of cage type rotor.

P.T.O.

b) Torque of 3 phase induction motor is given by $\frac{120\, s\, E_2^2\, R_2}{2\pi N_s \left(R_2^2 + S^2 X_2^2\right)}$ where E_2, R_2, X_2, s, N_s are rotor induced emf per phase at standstill, Rotor resistance per phase, Rotor reactance per phase at standstill, slip and synchronous speed respectively. Write the value of slip and expression for torque at

i) Starting

ii) When the torque is maximum

iii) If rotor speed=Synchronus speed.

c) A 4 pole, 230V, 50Hz, 3 phase induction motor draws 10A at 0.8 pf while running at 1450rpm. The stator loss is 100W, frictional loss is 100W. Find the rotor Cu loss. Neglect the rotor iron loss and find efficiency of the motor.

Q3) Answer any TWO **[2 × 8]**

a) Why DOL starter should be used for small rating motors? Describe DOL starter for 3 phase induction motor.

b) Describe rotor side speed control methods of 3 phase induction motor.

c) Explain the 'constant v/f' speed control method. Why it is the most popular method these days?

SECTION - II

Q4) Answer any TWO **[2 × 8]**

a) What are the desirable properties of servo motor? Describe methods of controlling dc servo motor.

b) Describe a linear induction motor. State its applications.

c) State advantages of brushless dc motor over conventional de motor. How is commutation obtained in BLDC motor?

Q5) Answer any TWO **[2 × 8]**

a) Explain the factors to be considered for selecting a motor for a particular drive.

b) Explain with examples the terms- active load, passive load, multimotor drive.

c) Classify mechanical loads based on how the torque requirement changes with driving speed. Explain.

Q6) Answer any TWO **[2 × 8]**

a) Compare direct arc type furnace with indirect arc furnace in all aspects.

b) Describe the set up and operation for eddy current heat treatment of metallic parts.

c) A 200 kW resistance oven is to be operated in such a way that its maximum temperature is not to exceed 1700°C. The initial temperature of the charge is 420°C. If heating element is a wire of diameter 0.6 cm is used, find the length required. Also find resistance of heating element.

Radiating efficiency =0.5, Emissivity = 0.5, Specific resistance of heating element= 150×10^{-6} ohm-cm.

Seat No.	

S.E. (Mech.) (Part - II) (Semester - III) Examination, November - 2017
APPLIED THERMODYNAMICS
Sub. Code: 63352

Day and Date :Wednesday, 15 - 11- 2017 **Total Marks : 100**
Time :10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Assume suitable data if necessary.**
4) **Draw neat sketch wherever necessary.**
5) **Use of steam table, mollier chart and non-programmable calculator is allowed.**

Q1) a) State and prove Carnot Principle. **[8]**

OR

b) Prove that Entropy of an isolated system during a process always increases. **[8]**

c) An insulated cylinder of volume capacity 4 m^3 contains 20 kg of nitrogen. Paddle work is done on the gas by stirring it till the pressure in the vessel gets increased from 4 bar to 8 bar. Determine change in entropy. Take for nitrogen C_p = 1.04 kJ/kgK and C_v = 0.7432 kJ/kgK. **[8]**

Q2) a) Write a note on steam tables and Mollier chart. **[8]**

OR

b) Write a note on Reheat and Regenerative steam power cycles. **[8]**

P.T.O.

c) A steam turbine receives steam at a pressure of 20 bar and superheated to 87.6°C. The exhaust pressure is 0.07 bar and the expansion of steam takes place isentropically. Calculate following using steam table **[10]**

i) Heat supplied

ii) Heat rejected

iii) Net work done

iv) Thermal efficiency

v) SSC.

Q3) a) Classify boilers. Compare water tube boilers with fire tube boilers. **[8]**

OR

b) What is function of air pump in condenser? Explain with neat sketch working of Edward's air pump. **[8]**

c) A prime mover uses 15,000 kg of steam per hour develops 2450 kW. The steam is supplied at 30 bar and 350°C. The exhaust from the prime mover is condensed at 725 mm of Hg when barometer reads 755 mm of Hg. The condensate temperature from the condenser is 31°C and the rise in circulating water temperature is 10°C. Determine: **[8]**

i) The quality of steam entering the condenser.

ii) The quantity of circulating water required.

iii) Cooling ratio.

Assume that no air is present in the condenser.

Q4) a) What is the function of the nozzle? Describe different types of steam nozzles with suitable sketch. **[8]**

OR

b) Explain the terms, degree of under cooling and degree of super saturation. What are the effects of supersaturation? **[8]**

c) Steam at a pressure of 15 bar and dryness fraction 0.97 is discharged through a convergent- divergent nozzle to a back pressure of 0.2 bar. The mass flow rate is 9 kg/kwh. If the power developed is 220 kW. Determine **[8]**

i) Throat pressure.

ii) Number of nozzles required if each nozzle has a throat of rectangular cross section of 4 mm × 8 mm.

Q5) a) Classify the turbines and compare impulse turbine with reaction turbine. **[8]**

b) A impulse turbine has exit steam velocity from a nozzle equal to 900 m/s. The nozzle makes an angle of 20° to the tangent of the rotating wheel. The main blade speed is 300 m/s. The blades are equiangular. The mass of steam flowing through the turbine is 1200 kg/hr. Calculate **[9]**

i) The blade angles.

ii) The blade efficiency.

iii) The power developed.

Take blade velocity co-efficient = 0.85.

Q6) a) Define the following as related to steam turbine. **[8]**

i) Speed ratio

ii) Blade velocity coefficient

iii) Diagram efficiency

iv) Stage efficiency

OR

Explain the pressure compounding of impulse turbine showing pressure and velocity variations along the axis of the turbine.

b) The following particulars refer to a stage of a Parson's turbine comprising one ring of fixed blades and one ring of moving blades. **[9]**

Mean diam. of blade ring = 70 cm

Speed of turbine = 3000 rpm

Steam velocity at exit from blade = 160 m/s

Blade outlet angle = 20°

Steam flow rate = 7 kg/s

Draw velocity diagram & find

i) Blade inlet angle

ii) Tangential force

iii) Power developed

EEE

Seat No.	

Total No. of Pages : 3

S.E. (Mech) (Part - II) (Semester-III) (Revised) Examination, November - 2017

METALLURGY

Sub. Code : 63353

Day and Date : Tuesday, 21 - 11 - 2017 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Solve any three questions from each section.**
2) **Answers for both sections to be written in the same answer book.**
3) **Figures to the right indicate full marks.**
4) **Draw neat figures wherever necessary.**

SECTION-I

Q1) Answer any three of the following. Each question carries equal marks. **[18]**

a) With neat sketches. Explain the process of Solidification by nucleation, crystallization and growth.

b) Explain the phenomenon of coring using equilibrium diagram? How can be cored structures avoided or eliminated?

c) Draw a typical equilibrium diagram for impure/ partial eutectic systems and explain the cooling and solidification of any hypoeutectic alloy from above melting temperature to room temperature and draw the room temperature structure.

d) Draw the crystal structures of BCC and FCC and evaluate the number of atoms per unit cell for both.

Q2) a) Draw Fe-Fe_3C equilibrium diagram. Indicate all the phases. Temperatures and Compositions. **[8]**

b) What is SG Iron? Explain the process of manufacturing SG Iron. Draw the microstructure of SG iron and Gray Cast iron and compare their properties. **[8]**

P.T.O.

Q3) a) Draw typical equilibrium diagram of A1-Cu alloy system? Explain the process of precipitation hardening treatment and its effects. Write the applications. [7]

b) Draw self explanatory sketches of any three. [9]

i) Substitutional and interstitial type solid solution.

ii) Microstructure of white and malleable cast irons.

iii) Microstructure of 0.4 and 1.2% carbon steel .

iv) Microstructure of 70:30 brass as cast and annealed

v) X-ray Radiography.

vi) SN curve and Creep curve.

Q4) Write short notes on any four. [16]

a) Solid solutions.

b) Tool steels.

c) Ferritic Stainless steels.

d) Dye Penetrant Testing.

e) Impact Testing.

SECTION-II

Q5) a) Draw flowchart for carbide cutting tools manufactured by powder metallurgy techniques, why pre-sintering is necessary in such tools? [9]

b) Classify different types of heat treatment furnaces? Explain rotary hearth furnace with neat sketch? [9]

Q6) a) Explain precipitation in A1–Cu alloys with respect to composition, aging time and temperature, over-aging? [8]

b) Classify case carburizing methods? Explain pack carburizing with neat sketch. [8]

Q7) Differentiate clearly between any four of the following. **[16]**

a) Hardening and Tempering.

b) Flame and Induction hardening.

c) TTT and CCT curves.

d) Pearlite and ferrite.

e) Annealing and normalizing.

Q8) Write short notes on any four of the following. **[16]**

a) Liquid phase sintering.

b) Induction hardening.

c) heat treatment defects.

d) Bainitic transformation.

e) Self lubricating bearing.

✡ ✡ ✡

SF-81

Seat No.	

Total No. of Pages : 3

S.E. (Mechanical Engineering) (Semester - III) (Revised) Examination, November - 2017

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Thursday, 23 - 11 - 2017 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of non programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) Define viscosity, surface tension and capillarity and write their units in S.I. system. **[6]**

b) A thin square plate 1m × 1m is placed horizontally at the centre in a horizontal gap of height 2 cm filled with oil of viscosity 10 poise. The plate is pulled at a constant velocity of 0.1 m/s. Find the force on the plate.

If the gap is now filled with another oil. When the plate is placed at a distance of 0.5 cm from one of the surfaces of the gap and pulled with the same velocity, if the force on the plate remains same as before, find the viscosity of the new oil. **[6]**

c) Define Buoyancy and meta centre. **[4]**

Q2) a) Distinguish by giving examples, Laminar and Turbulent flow, Steady and Unsteady flow, Uniform and Non uniform flow and Compressible and Incompressible flow. **[8]**

b) Solve any one of the following : **[8]**

i) Find the value of a such that the flow field given by

$V = (axy - z^3)i + (a-2)x^2j + (1-a)xz^2k$ is irrotational.

ii) An air plane flies at an altitude where the pressure and density of air are 40 KN/m^2 and 0.58 Kg/m^3 respectively. If the stagnation pressure measured by a pitot tube is 57 KN/m^2, compute the speed of the aeroplane and the stagnation temperature and stagnation density. Take R = 287J/Kgk and ratio of specific heats is 1.4.

Q3) a) i) Bernoulli's theorem is based on which principle? Give its statement. Name three devices where Bernoulli's equation is applied. **[4]**

ii) Derive an expression for discharge over a triangular notch in terms of head of liquid over the crest of the notch and the included angle. **[5]**

b) Solve any one of the following : **[9]**

i) A venturimeter is used for the measurement of discharge of water in a horizontal pipeline. The pipe diameter is 20 cm and the throat diameter is 12 cm. When the flow of 130 lit/sec is flowing, the attached manometer shows a head difference of 50 cm if the coefficient of discharge of the venturimeter is 0.98 find the density of manometric fluid in the manometer.

ii) A circular tank of diameter 3 mt contains water up to a height of 4 mt. If the water is discharged through a 10 cm diameter orifice at the bottom of the tank, find the height of water above the orifice after 5 minutes. Assume coefficient of discharge of orifice is 0.63.

Q4) a) i) Discuss the applications of momentum equation. **[4]**

ii) Explain with a neat sketch how pitot tube is used to measure discharge through pipe. **[4]**

b) An oil of viscosity 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60 mm diameter. If the pressure drop in 100 mt. length of the pipe is 1800 KN/m^2 determine **[8]**

i) Wall shear stress and frictional drag for 100 mt. length.

ii) Power required to maintain the flow.

iii) The velocity gradient at the pipe wall.

iv) The velocity and shear stress at 8 mm from the wall.

Q5) a) i) Explain the concept of equivalent pipe. **[5]**

ii) Discuss the causes of minor energy losses in flow through pipes. **[4]**

b) Solve any one of the following : **[9]**

i) Three pipes of diameters 30 cm, 20 cm and 40 cm and lengths 450 mt, 255 mt and 315 mt respectively are connected in series. The difference in water surface levels in two tanks is 18 mt. Determine the rate of flow of water if coefficients of friction are 0.0075, 0.0078 and 0.0072 respectively considering

A) Minor losses also B) Neglecting minor losses.

ii) A horizontal pipe line 15 cm in diameter is joined by sudden enlargement to 25 cm diameter pipe. Measurements indicate that when flow is from smaller to larger cross section the head loss is 0.5 mt in excess of that when the flow takes place from larger to smaller section. Determine flow rate. Take coefficient of contraction $C_c = 0.63$.

Q6) a) What do you mean by boundary layer separation? Why does it occur? With neat sketches explain the methods used to control the separation of boundary layer. **[8]**

b) Solve any one of the following : **[8]**

i) A geometrically similar model of an air duct is built to 1 : 25 scale and tested with water which is 50 times more viscous and 800 times denser than air. When tested under dynamically similar conditions the pressure drop is 2 bar in the model. Find the corresponding pressure drop in the full scale prototype.

ii) Define pressure drag and skin drag or shear drag. A 2.5 mt long body having a projected area of 2.4 m^2 normal to the direction of motion is having a viscosity of 0.0012 Ns/m^2. Find the drag on the body if it has drag coefficient of 0.45 for Reynolds number of 7×10^6.

SJ-315

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical Engg.) (Semester-III) (Revised) Examination, November - 2016

ENGINEERING MATHEMATICS-III

Sub. Code :63350

Day and Date : Tuesday, 15 - 11 - 2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) All questions are compulsory
2) Figures to the right indicates full marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

SECTION-I

Q1) Attempt any three of the following.

a) Solve $(D^2 + 4D + 3)\, y = e^x \sin x$ [6]

b) Solve $r\frac{d^2y}{dr^2} + \frac{dy}{dr} - \frac{y}{r} = -ar^2$ [6]

c) Solve $(D^3 - 5D^2 + 8D - 4)y = 2e^x + 3e^{-x}$ [6]

d) Solve $(D^4 + 2D^2 + 1)\, y = x^2 \cos x$ [6]

Q2) Attempt any one of the following.

a) A body weighing 4.9 kg hung from spring. A pull of 10 kg will stretch to 5 cm. The body is pulled down to 6 cm below the state of equilibrium position and then released. Find the displacement of the body from its equlibrium position at time t seconds. Also find its maximum velocity and the period of oscillation. [16]

b) A spring stretches 1 cm under the tension of 2 N and has a negligible weight. It is fixed at one end and is attached to a weight W Newton at the other .If is found that resonance occurs when an axial periodic force 2 cos 2t N acts on the weight. Show that when the free vibrations have died out, the forced vibrations are given by $x = ct \sin 2t$ find the values of W and C. [16]

P.T.O.

Q3) Attempt any three of the following.

a) Find the directional derivative of $\phi = x^2 - y^2 - 2z^2$ at the point P(2, - 1 , 3) in the direction $\overrightarrow{PQ}$ where Q is (5, 6, 4). [6]

b) Show that the field of force given by $\bar{F} = (y^2 \cos x + z^3)\,i + (2y \sin x - 4)\,j + (3xz^2+2)\,k$ is irrotational and hence find scalar potential function ϕ. [5]

c) Find the divergence and curl of $\bar{F} = xyzi + 3x^2yj + (xz^2 - y^2 z)\,K$ at the point (2,1,1.) [5]

d) Show that $\nabla\left(\frac{\bar{a}\cdot\bar{r}}{r^n}\right) = \frac{\bar{a}}{r^n} - \frac{n(\bar{a}\cdot\bar{r})\bar{r}}{r^{n+2}}$ [5]

SECTION-II

Q4) Attempt any three questions from the following.

a) Find the Laplace transform of $\int_0^t e^{-2t} t\sin^2 t\, dt$ [6]

b) State Convolution theorem and use it to find inverse Laplace transform of $\frac{1}{(s+1)(s^2+1)}$ [6]

c) Find

i) $L\left\{e^{-2t}\sqrt{1+\sin 4t}\right\}$.

ii) $L^{-1}\left\{\frac{1}{s(s^2+4)}\right\}$ [6]

d) Solve $y'' - 3y' + 2y = 12e^{-2t}$ with $y(0) = 2$ and $y'(0) = 6$ by using Laplace transform method. [6]

Q5) Attempt any two from the following .

a) Find the Fourier series expansion for $f(x) = x \sin x$ in the inrerval $0 \leq x \leq 2\pi$ [8]

b) Obtain Fouricr series for the function $f(x)=\begin{cases} 2 \text{ if } -2 \leq x \leq 0 \\ x \text{ if } 0 < x < 2 \end{cases}$ [8]

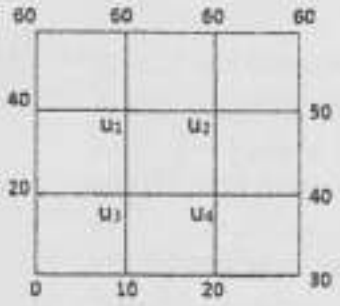
c) Expand $f(x) = lx - x^2$ in $0 < x < l$ in a half range sine and hence deduce that $\frac{\pi^3}{32} = \frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \ldots$ [8]

Q6) Attempt any one form the following.

a) The vibration of an elastic string is governed by the partial differential equation $\frac{\partial^2 y}{\partial t^2} = \frac{\partial^2 y}{\partial x^2}$ [16]

The length of the string is π and the end are fixed. The initial velocity is zero and the initial deflection $y(x,0) = 2 (\sin x + 2 \sin 3x)$. Find the deflection $y(x, t)$ of the vibration string for $t > 0$

b) Solve the equation $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial y^2} = 0$ for the following data by Gauss- Siedal iterative method up to the five iterations. [16]



❄ ❄ ❄

SJ-316

Total No. of Pages :3

Seat No.	

S.E.(Mechanical) (Semester - III) (New)
Examination, November - 2016
ELECTRICAL TECHNOLOGY
Sub. Code : 63351

Day and Date :Thursday, 17-11-2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate marks.
3) Draw neat figures wherever necessary.
4) Assume suitable data, if missing. State it clearly.

SECTION - I

Q1) a) With neat figure, explain the construction of dc motor. [8]

OR

Explain the working of dc motor. Explain why the commutator should reverse current in the armature conductor.

Answer any two of the following (b, c, d). [2×6]

b) Explain the basic methods of speed control of dc series motor.

c) Explain the basic methods of electric braking of dc shunt motor.

d) A DC series motor runs at 1000 rpm driving a constant torque load by taking 12 A current from 220V supply. Now 0.4 ohm resistance is connected in parallel with the field winding. Find the new armature current and new speed. The armature resistance is 0.8 ohm. Field resistance is 0.4 ohm.

P.T.O.

Q2) Answer any TWO: [2×8]

a) Differentiate between squirrel cage induction motor and slip ring induction motor.

b) Write the expression for Torque of the induction motor. Hence explain how does the torque vary with slip for

i) Large values of slip

ii) Small values of slip.

State the condition for maximum torque.

c) State the relation between rotor copper loss, rotor input and slip. Find the rotor cu loss and efficiency of a 3 phase induction motor if stator input is 3500W, stator loss is 200 W, mechanical loss is 150 W. Motor runs with 4% slip.

Q3) Answer any TWO [2×8]

a) Draw a figure and explain how starting current of 3 phase induction motor is reduced using a star-delta starter.

b) Explain the rotor resistance speed control of slip ring induction motor.

c) State one main advantage and one main drawback of following speed control methods-

i) Voltage control.

ii) Frequency control.

iii) V/f control.

iv) Rotor resistance control.

SECTION - II

Q4) Answer any TWO [2×8]

a) Explain construction and working of dc servo motor.

b) Explain construction and working any one type of stepper motor.

c) Write a note on brushless DC motor and state its applications.

)5) Answer any TWO [2×8]

a) State various reasons for using individual drive after the invention of electric motor.

b) Classify mechanical loads on the basis of torque speed variation. State two examples each.

c) Determine the power rating for following continuous duty constant loads:

i) Pump

ii) Lathe

iii) Fan

iv) Metal shearing machine

)6) Answer any TWO [2×8]

a) Explain the construction and working of indirect resistance heating furnace.

b) Describe the construction and working of indirect arc furnace.

c) A three phase arc furnace operates on 440V taking 10000 W power. In 4 hours, it melts 200kg scrap steel which was preheated upto 200 deg. C. Find efficiency of the furnace.

Take melting point of the steel as 1370 deg. C Latent heat of fusion of steel = 270 J/kg, Specific heat of steel = 450 J/kg degC.

SJ-317

Total No. of Pages : 3

Seat No.	

S.E. (Mech.) (Part - II) (Semester - III)
Examination, November - 2016
APPLIED THERMODYNAMICS
Sub. Code : 63352

Day and Date : Monday, 21 - 11 - 2016 **Total Marks : 100**

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Assume suitable data if necessary.**
4) **Draw neat sketch wherever necessary.**
5) **Use of steam table, Mollier chart and non programmable calculator is allowed.**

Q1) a) Write a note on heat engine, refrigerator and heat pump. [8]

OR

b) State and prove Clausius inequality. [8]

c) Water flows through a turbine in which friction causes the water temperature to rise from 35°C to 37°C. If there is no heat transfer, how much does the entropy of water change in passing through turbine? Water is incompressible and the process can be taken to be at constant volume. C_v of water = 4.187 kJ/kgK. [8]

Q2) a) What is effect of increasing pressure. [8]

i) Entropy.

ii) Specific volume.

iii) Latent heat.

iv) Saturation temperature.

OR

P.T.O.

b) Discuss the effects of various operating parameters on performance of Rankine cycle. [8]

c) A steam power plant operates on Rankine cycle. The condition of steam at inlet to turbine is 40 bar, 400°C and condenser pressure is 0.08. If the turbine and pump work with 80% mechanical efficiency each, calculate: [10]

i) Cycle efficiency

ii) Work ratio

iii) SSC

Q3) a) What are different parameters for selection of boilers? Discuss the essentials of good boilers. [8]

OR

b) Classify steam condensers. What are functions of condenser in steam power plant? [8]

c) The following observations were recorded during a test on a steam condenser. [8]

i) Vacuum = 71 cm of Hg

ii) Barometer reading = 76.5 cm of Hg

iii) Mean condenser temperature = 34°C

iv) Condensate collected = 1800 kg/hr

v) Mass of cooling water = 57500 kg/hr

vi) Cooling water temp. rise = 17.5°C

Calculate:

1) Corrected vacuum to standard barometer of 76 cm of Hg

2) Vacuum efficiency

3) Condenser efficiency

4) State of steam entering the condenser

Assume inlet temperature of cooling water as 8.5°C.

Q4) a) Derive the expression for critical pressure ratio for maximum discharge through nozzle. [8]

OR

What do you mean by a supersaturated flow? Explain with the help of h-s diagram.

b) Superheated steam enters a nozzle at a pressure of 25 bar and temperature 300°C and expands adiabatically to an exit pressure of 2 bar. Calculate: [8]

i) exit speed of steam neglecting initial speed of steam at inlet of nozzle.

ii) exit area of nozzle for a mass flow rate of steam 1.25 kg/s.

Q5) a) Explain the reasons of compounding of steam turbines. What are the kinds of compounding. Describe one of them by drawing stages and distribution of pressure and velocity along axis of the turbine. [9]

OR

What is the fundamental difference between the operation of impusle turbine and reaction turbine? Explain the same with sketch of the arrangement of blades and change in pressure and velocity.

b) In a single stage impulse turbine steam flows from the nozzle at velocity 500m/s. The nozzle angle is 18°. The steam comes out at the moving blades with an velocity 120m/s. in the direction at 170° with the direction of blade motion. The blades are equiangular and steam flow rate is 4kg/s. Calculate power developed. [8]

Q6) a) What are the different sources of losses in steam turbine? [8]

b) A stage of Parson's reaction turbine has a following data: [9]

i) mean diameter of the moving blade ring = 100 cm

ii) Speed of turbine = 3000 rpm

iii) The inlet absolute velocity = 350 m/s

iv) Fixed blade outlet angle = 20°

Calculate the blade inlet angle, the power developed and tangential force.

SJ-318

Total No. of Pages :3

Seat No.	

S.E. (Mechanical) (Part - I) (Semester - III) (Revised) Examination, November - 2016

METALLURGY

Sub. Code : 63353

Day and Date : Wednesday, 23 - 11 - 2016 Total Marks : 100

Time : 10.30 a.m. to 1.30 p.m.

Instructions :
1) Solve any three questions from each section.
2) Answers for both sections to be written in the same answer book.
3) Figures to the right indicate full marks.
4) Draw neat figures wherever necessary.

SECTION - I

Q1) Answer any three of the following. Each question carries equal marks. **[18]**

a) What are Intermediate phases? What are the various types of Intermediate phases? Explain each in short.

b) What is Gibbs phase rule? Evaluate Degree of freedom (F) for a Solid solution alloy and a Eutectic alloy using cooling curves.

c) Draw a typical equilibrium diagram for impure/ partial eutectic systems and explain the cooling and solidification of any hypoeutectic alloy from above melting temperature to room temperature and draw the room temperature structure.

d) Draw the crystal structures of FCC and HCP and evaluate the number of atoms per unit Cell for both.

Q2) a) Draw Fe-Fe_3C equilibrium diagram. Indicate all the phases, Temperatures and Compositions. **[8]**

b) What are steels? How steels are classified based on the basis of composition, structure, properties and applications? Draw typical microstructure and write the applications of each type. **[8]**

P.T.O.

Q3) a) Draw typical equilibrium diagram of Al-Si alloy system? Explain the process of modification treatment and its effects. What are the applications of AL-Si alloys. [7]

b) Draw self explanatory sketches of any three: [9]

i) Magnetic Particle Inspection

ii) Y-ray Radiography

iii) Creep Test set up

iv) Stress vs. strain diagram of mild steel and Cast Iron

v) Coring and Dendritic Structure

vi) FCC and BCC crystal structures

Q4) Write short notes on any four: [16]

a) Solid solutions

b) Berrilium Bronzes

c) Solders

d) Dye Penetrant Testing

e) Impact Testing

SECTION - II

Q5) a) Draw flowchart for carbide cutting tools manufactured by powder metallurgy techniques, why pre-sintering is necessary in such tools? [9]

b) Explain different types of annealing with respect to its temperature range, purposes and applications? [9]

Q6) a) Explain precipitation in Al-Cu alloys with respect to composition, aging time and temperature, over-aging? [8]

b) Classify surface and case hardening methods? Explain cyaniding with neat sketch. [8]

Q7) Differentiate clearly between any four of the following: **[16]**

a) Hardening and Tempering
b) Pack carburizing and liquid carburizing
c) TTT and CCT curves
d) Pearlite and bainite
e) Annealing and Tempering process

Q8) Write short notes on any four of the following: **[16]**

a) Liquid phase sintering
b) Induction hardening
c) Heat treatment defects
d) Martensitic transformation
e) Sub zero treatment.

Seat No.	

S.E. (Mechanical) (Semester-III) (Revised) Examination, November - 2016
FLUID MECHANICS
Sub. Code : 63354

Day and Date : Friday, 25 - 11 - 2016 **Total Marks : 100**
Time : 10.30 a.m.to 1.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of non-programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

SECTION-I

Q1) a) What is continuum? Under what conditions might the continuum idealizations be invalid? **[4]**

b) Two large fixed parallel planes are 12mm apart. The space between the surface is filled with oil of viscosity 0.972Ns/m^2 .A flat thin plate 0.25m^2 area moves through the oil as a velocity of 0.3m/s. Calculate the drag force **[8]**

i) When the plate is equidistant from both the planes and

ii) When the thin plate is at a distance of 4mm from one of the plane surface.

c) Define total pressure and centre of pressure. **[4]**

Q2) a) Define steady and unsteady flow and hence derive the continuity equation in Cartesian coordinates in three dimensional flow when the flow is steady and incompressible. **[8]**

b) Solve any one of the following **[8]**

i) The velocity along the centreline of nozzle of length I is given by $V=2t\,[1-(x/2I)]^2$ where Vis velocity in m/s, t is time in seconds from the commencement of flow; x is the distance from inlet of nozzle. Calculate the convective acceleration, local acceleration and total acceleration when t=6sec.,x=1mt and I=1.6mts.

P.T.O.

ii) A 120mm diameter pipe reduces to 60mm diameter through a sudden contraction. When it carries air at 25c° under isothermal condition the absolute pressures observed in the two pipes just before and after the contraction are 480KN/m² and 384KN/m² respectively Determine.

a) Densities at two sections

b) Velocities at two sections

c) Mass flow rate through the pipe. Assume R=287J/KgK.

Q3) a) List the different forces existing in the fluid flow and derive euler's equation of motion along streamline. **[9]**

b) Solve any one of the following **[9]**

i) A venturimeter is to be fitted in a pipe of 20cm diameter where pressure head is 7.6mts of flowing fluid and the maximum flow is 8100lit/min. Find the least diameter of the throat to ensure that the pressure head does not become negative Assume C_d=0.96. What is the quantity of liquid flowing through it when a differential manometer shows a steady deflection of 20cms of mercury? Assume relative density of mercury is 13.6.

ii) A 3mts high tank standing on the ground is kept full of water. There is a small orifice in its vertical side with its centre at depth h meters below the free surface of liquid in the tank. Find the value of h so that the liquid strikes the ground at the maximum distance from the tank. Assuming C_v=0.97 Calculate the maximum value of the horizontal distance.

Q4) a) Derive an expression for the velocity distribution for viscous flow between two fixed parallel plates and Find the ratio of maximum velocity to average velocity. **[8]**

b) In a 45°bend a rectangular fluid duct of 1m² cross sectional area is gradually reduced to 0.5m² area. Find the magnitude and direction of force required to hold the duct in position if the velocity of flow at 1m² section is 10m/s and pressure is 30KN/m². Assume specific weight of fluid as 0.0116KN/m³. **[8]**

Q5) a) Explain when the pipes are connected in series and parallel and what the loss of head is in the system when the pipes are in series and parallel. [9]

b) Solve any one of the following [9]

i) Two reservoirs whose surface levels differ by 30mts are connected by a pipe 600mm diameter and 3000metres long. The pipe line crosses a ridge whose summit is 9metres above the level of, and 300metres distant from the higher reservoir. Find the minimum depth below the ridge at which the pipe must be laid if the absolute pressure head in the pipe is not to fall below 2.5metres of water and calculate the discharge. Take atmospheric pressure head=10.3metres of water and f=0.0075

ii) Pipe carrying water increased in diameter from 40cms to 100cms suddenly. The pressure difference in small and bigger sections is measured by using mercury U-tube manometer which is connected to upstream and downstream of the enlarged section immediately. The difference in pressure is equal to 6cms of mercury. Find out discharge through the pipe.

Q6) a) Explain with a neat sketch the effect of pressure gradient on boundary layer separation. [8]

b) Solve any one of the following [8]

i) The pressure rise ΔP generated by a pump is a function of the impeller diameter D,the rotational speed N, the fluid density ρ and viscosity μ and the discharge Q show that $\Delta P = D^2N^2\rho\,\Phi$

$[(Q/D^3N),(D^2N\rho/\mu)]$

ii) Explain with neat sketches the propagation of pressure waves during the motion of a projectile with a steady velocity when Mach number is equal to one, less than one, and greater than one.

✓ ✓ ✓

Seat No.	

S.E. (Mechanical Engg.) (Semester-III) (Revised) Examination, May - 2017
ENGINEERING MATHEMATICS-III
Sub. Code : 63350

Day and Date : Friday, 12-05-2017 **Total Marks : 100**
Time : 02.00 p.m. to 5.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figure to the right indicates full marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

SECTION-I

Q1) Attempt any three of the following.
Solve.

a) $(D^3+3D^2+2D)\,y = x^2$ [6]

b) $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=2\sinh x$ [6]

c) $x^2\frac{d^2y}{dx^2}+4x\frac{dy}{dx}+2y=e^x$ [6]

d) $(D^4-3D^2-4)y = 48 \sin x \cos x - 40c^{-2x}$ [6]

Q2) Attempt any one of the following.

a) The whirling speed of a shaft of length l is given by $\frac{d^4y}{dx^4}-a^4y=0$,

where $a^4=\frac{W\omega^2}{gEI}$ and y is the displacement at distance x from one end.

If the ends of the shafts are considered in long bearing so that the slope at each end is zero, show that the shaft will whirl when cos al cosh al=1. [16]

b) A mass of 200 gm is tied at the end of a spring which extends to 4cm under a force 196000 dynes. The spring is pulled 5cm and released. Find the displacement t seconds after release, if there be a damped force of 2000 dynes per cm per sec. [16]

P.T.O.

Q3) Attempt any three of the following.

a) Find the constants 'a' and 'b' so that the surface $ax^2-byz=(a+2)x$ will be orthogonal to the surface $4x^2y+z^3=4$ at the point $(1,-1,2)$. **[6]**

b) Show that the $\vec{F}=(y\sin z-\sin x)\,i+(x\sin z+2yz)\,j+(xy\cos z+y^2)k$ is irrotational and hence find scalar potential function ϕ. **[5]**

c) Evaluate div $(3x^2i+5xy^2j+xyz^3k)$ at the point $(1,2,2)$. **[5]**

d) Find the directional derivative of $\phi=4e^{2x-y+z}$ at the point A$(1,1,-1)$ in the direction towards B$(-3,5,6)$. **[5]**

SECTION-II

Q4) Attempt any three questions from the following.

a) Show that $\int_0^\infty e^{-\sqrt{2}t}\left(\frac{\sinh t\sin t}{t}\right)=\frac{\pi}{8}$ **[6]**

b) Obtain the inverse Laplace transform of $L^{-1}\left\{\frac{5s^2-15s-11}{(s+1)(s-2)^2}\right\}$ **[6]**

c) Find (i) $L\{\cosh^3 2t\}$ (ii) $L^{-1}\left\{\frac{2s+3}{s^2+2s+17}\right\}$ **[6]**

d) Solve $y''+y'-2y=2(1+t-t^2)$ with $y(0)=0$ and $y'(0)=3$ by using transform method. **[6]**

Q5) Attempt any two from the following.

a) Obtain the Fourier series expansion for the function

$$f(x)=\begin{cases}x & if\ 0<x<\pi\\ 2\pi-x & if\ \pi<x<2\pi.\end{cases}$$ **[8]**

b) Find the Fourier series expansion for the function $f(x)=x-x^2$ in the interval $-1<x<1$. **[8]**

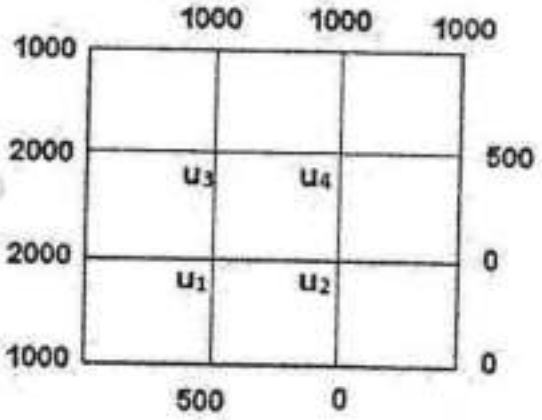
c) Find the Fourier half-range cosine series of the function $f(x)=\sin x$, $0<x<\pi$ and hence show that $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\ldots=\frac{\pi}{4}$ **[8]**

Q6) Attempt any one from the following.

a) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y = 4\sin^3\frac{\pi x}{l}$ from which it is released at time t =0. Show that the displacement of any point at a distance x from one end at time t is given by

$$y(x,t) = 3\sin\frac{\pi x}{l}.\cos\frac{\pi ct}{l} - \sin\frac{3\pi x}{l}.\cos\frac{3\pi ct}{l}$$ **[16]**

b) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ for the following data by Gauss-Seidal iterative method by performing five iterations. **[16]**



Seat No.	

S.E. (Mechanical) (Semester-III) (Revised) Examination, May - 2017
ELECTRICAL TECHNOLOGY
Sub. Code : 63351

Day and Date : Monday, 15-05-2017 **Total Marks : 100**
Time : 2.00 p.m. to 5.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Draw neat labeled diagrams whenever necessary.**
4) **In case of missing data, assume suitable value. State it clearly.**

SECTION-I

Q1) a) Explain the electric braking methods for dc shunt motor. **[1×8]**

OR

a) Draw speed torque characteristics of shunt motor, series motor. From these, explain the important feature of that motor deciding its application.

Answer any two out of following sub questions b.c.d **[2×6]**

b) Draw circuit diagrams for different the types of dc motor and give applications of each.

c) With a neat figure explain the working of 4 point starter.

d) A 200V dc shunt motor takes 15A armature current and runs at 1200 rpm driving a constant torque load. The speed is increased by connecting a 100 ohm resistance in series with the field winding. Find the new speed. Armature resistance = 0.5 ohm. Field resistance = 200 ohm.

Q2) Answer any two. **[2×8]**

a) Explain the terms (i) synchronous speed (ii) slip (iii) stable operating region of speed torque characteristics.

b) Derive the expression for torque of 3 phase induction motor. Hence explain how the torque varies with slip.

c) A 3 phase 4 pole induction motor draws 20A at 0.8 pf lagging from 415V, 50Hz supply. Find the efficiency and slip if stator loss = 500W, rotor loss = 400W, frictional loss = 300W.

P.T.O.

Q3) Answer any two. **[2×8]**

a) With a block diagram, Describe the V/f speed control of 3 phase induction motor. What are the advantages of V/f speed control over Voltage control?

b) With a neat diagram explain the working of star delta starter for 3 phase induction motor.

c) State and justify the effect of increasing rotor resistance on (i) starting torque (ii) starting current (iii) speed at full load. (iv) Speed regulation for 3 phase induction motor.

SECTION-II

Q4) Answer any two. **[2×8]**

a) Explain construction and working of Variable reluctance stepper motor with its applications.

b) Differentiate between 2 phase servo motor and 1 phase induction motor with respect to its construction and characterstics.

c) State the advantages of BLDC over conventional DC motor. State the applications of BLDC motor.

Q5) Answer any two. **[2×8]**

a) Explain the 4 quadrant plane of operation of electric motors.

b) Explain the starting requirements, running requirements, braking requirements and hence suggest a suitable motor for following applications.

i) Paper Mills ii) Conveyors

iii) Cranes, Hoists iv) Blowers

c) State classification of load torques. Explain variation of load torque with respect to speed for different mechanical load.

Q6) Answer any two. **[2×8]**

a) Describe construction and working of direct arc furnaces.

b) Explain the features of core type Induction heating.

c) A 20 kW single phase, 220 V resistance oven has circular nickel chrome wire for its heating element. If the wire temperature is not to exceed 1170°C and the temperature of the charge is to be 500°C. Calculate the length and diameter of wire required. Assume a radiating efficiency of 0.6, and specific resistance of the nickel chrome 101.6×10^{-6} ohm cm.

✈ ✈ ✈

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, May - 2017

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Tuesday, 16 - 05 - 2017 **Total Marks : 100**

Time : 2.00 p.m. to 5.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Assume suitable data if necessary.**
4) **Use of steam table and Mollier chart are allowed.**
5) **Use of non-programmable calculator is allowed.**

Q1) a) Define entropy & hence prove that entropy is a property of a system. **[8]**

OR

Explain the terms:

i) Pure substance.

ii) Dead state.

iii) Available energy.

iv) Energy.

b) 0.25 kg of perfect gas is heated from 100°C to 325°C at a constant pressure of 300 kN/m^2. It is then cooled at constant volume to the initial temperature find the average change in entropy.

Take C_p = 1.005 kg/kg.K C_v = 0.718 kJ/kg.K **[8]**

Q2) a) What is effect of supply pressure of temperature and condenser pressure on the performance of cycle. **[9]**

OR

What is meant by Reheat and Regeneration steam power cycle? Explain with T-S diagram.

b) A steam turbine receives steam at 15 bar and 350°C and exhausts to the condenser pressure at 0.06 bar. Determine the thermal efficiency of Rankine cycle.

Assume C_p of steam 2.0 kJ/kg. K. Neglect pumping work. **[8]**

P.T.O.

Q3) a) Define the thermal efficiency of boiler. Explain with neat sketch any one fire tube boiler. **[8]**

OR

Explain the following terms:

i) Condenser efficiency

ii) Vacuum efficiency

iii) Corrected vacuum

iv) Capacity of air extraction pump

b) A surface condenser receives 2000 kg of steam per hour which is 0.9 dry. The condenser vacuum is 700 mm of Hg when barometer reads 750 mm of Hg. Tempt of hot well is 27°C. While mean condenser temperature is 35°C. Cooling water gets heated from 17°C to 32°C. Determine: **[9]**

i) Condenser efficiency

ii) Vacuum efficiency

iii) Quantity of cooling water per hour

Q4) a) Explain with the help of h-s diagram the term supersaturated flow and significance of Wilson's line. **[8]**

b) The nozzle of a certain turbine have a throat diameter of 0.6cm each. The power developed by the turbine is 150 kW and steam consumption is about 9.5 kWh. The upstream pressure is 14 bar and temperture is 300°C. The back pressure is 0.05 bar. Assuming the flow is isentropic between entrance and exit; find the number of nozzles and the steam consumption based on these coniditions. Neglect the velocity of approach. If 12% of isentropic heat drop is wasted between throat and exit find the exit diameter and final condition of steam. What will be the overall efficiency of nozzle? **[9]**

OR

c) Steam at an initial pressure of 7 bar and in dry saturated condition flows through a convergent divergent nozzle having a throat area 3.5 cm^2. The pressure at exit plane is 1.4 bar and the exit velocity is 700 m/s. The flow from nozzle entrance to throat is reversible and adiabatic. Determine the exit area of nozzle, and the overall nozzle efficiency. **[9]**

Q5) a) Draw a combined velocity triangle for a single stage impulse turbine and derive expression for work done per stage, blade efficiency and axial thrust. **[8]**

OR

b) Explain effect of friction on combined velocity triangle of impulse turbine. **[8]**

c) Steam with absolute velocity 360 m/s enters the stage of an impulse turbine provided with single row of wheel. The nozzles are inclined at 20° to the plane of wheel. The blade rotor with diameter 95.5 cm rotates with speed of 3000 rpm. **[8]**

Find:

i) Suitable inlet and outlet angles for moving blades so that there is no axial thrust on the blades. Velocity coefficient for blades can be taken as 0.90.

ii) Power developed in blading for a steam flow of 1 kg/s.

Q6) a) In a Parson's turbine, the blade angles at inlet and outlet are 75° and 20° respectively. The mean blade ring diameter is 90 cm and the rotor speed is 2000 rpm. If the steam enters the stage at 8 bar dry and saturated and 8% is lost in leakage, calculate the blade height for 160 kW to be developed in the stage. Assuming a stage efficiency of 0.75, determine the isentropic heat drop in the ring. **[9]**

b) Write short note (any two): **[8]**

i) Governing of turbine

ii) Function of diaphragm and glands

iii) Internal losses in a steam turbine.

Seat No.	

S.E. (Mechanical) (Part-I) (Semester-III) (Revised) Examination, May - 2017
METALLURGY
Sub. Code : 63353

Day and Date : Wednesday, 17-05-2017 **Total Marks : 100**
Time : 2.00 p.m. to 5.00 p.m.

Instructions :
1) **Solve any three questions from each section.**
2) **Answers for both sections to be written in the same answer book.**
3) **Figures to the right indicate full marks.**
4) **Draw neat figures wherever necessary.**

SECTION-I

Q1) Answer any three of the following. Each question carries equal marks. **[18]**

a) What are Hume Ruthery Rules for Substitutional Solid Solutions? Explain.

b) What is Coring and Dendritic structure? Explain with neat sketches.

c) Explain what Lever Rule is and derive the same.

d) Explain what are Eutectic, Eutectoid and Peritectic transformations?

Q2) a) Draw Fe-Fe_3C equilibrium diagram. Indicate all the phases, Temperatures and Compositions. **[8]**

b) Suggest suitable materials for any four of the following and justify the same. **[8]**

i) Window grill
ii) Hack saw blade
iii) Lathe bed
iv) Non sparking tool
v) Surgery equipment
vi) Solder material

P.T.O.

Q3) a) What are SG Irons? How are they manufactured? Draw typical microstructure and write the applications? [7]

b) Draw self explanatory sketches of any three. [9]

i) Microstructures of mild steel and eutectoid steel

ii) Microstructures of White and gray cast irons

iii) Microstructures of α and $\alpha + \beta$ brasses.

iv) Pb-Sn equilibrium diagram

v) Substitutional and Interstitial solid solutions

vi) Standard specimen for Charpy and Izod impact testing

Q4) Write short notes on any four. [16]

a) Tool steels

b) Stainless steels

c) Brinnel hardness testing

d) Malleable cast iron

e) Ultra sonic Testing

SECTION-II

Q5) a) Draw Flowchart for manufacturing of self lubricating bearings? Explain why oil impreganation is must in this process? [9]

b) What you mean by quenching in heat treatment process, why it is needed? Mechanism of heat removal during quenching? [9]

Q6) a) Explain precipitation hardening in Al-Cu alloy w.r.t. composition, aging temperature and time, hardness variations. [8]

b) Explain carburizing process? Why carburizing is followed by hardening? [8]

Q7) Differentiate clearly between any four of the following. **[16]**

a) Diffusion and shear transformation

b) Compacting and sintering

c) Upper and lower bainite

d) Surface and case hardening

e) CCT and TTT diagram

Q8) Write short notes on any four of the following. **[16]**

a) Heat treatment defects

b) Sub-zero treatment

c) Austenite to Pearlite transformation

d) Different Powder manufacturing methods

e) Heat treatment furnaces

✈ ✈ ✈

SL-307

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester-III) (Revised) Examination, May - 2017

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Thursday, 18-05-2017 **Total Marks : 100**

Time : 2.00 p.m. to 5.00 p.m.

Instructions :

1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the right indicate full marks.**
4) **Use of non programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) Define viscosity and deduce the units of viscosity. Explain the effect of temperature on viscosity for liquids and gases. **[6]**

b) A thin plate of very large area is placed in a gap of height h with oils of viscosities μ_1 and μ_2 on two sides of the plate. The plate is pulled at a constant velocity V. Calculate the position of the plate so that (i) The shear force on the two sides of the plate is equal. (ii) The force required to drag the plate is minimum. Assume viscous flow and neglect all end effects. **[6]**

c) Explain in brief the different types of equilibrium of floating bodies. **[4]**

Q2) a) The velocity components in a two dimensional flow field for an incompressible fluid are expressed as $u=(y^3/3)+2x-x^2y$, $v=xy^2-2y-(x^3/3)$. **[8]**

i) Show that these functions represent a possible case of an irrotational flow.

ii) Obtain an expression for stream function and velocity potential function.

b) Solve any one of the following. **[8]**

i) Define path line, streak line and streamline. For what type of flow these lines are identical.

ii) Derive Bernoulli's equation for compressible flow when the compression is isothermal and adiabatic.

P.T.O.

Q3) a) Derive an expression for the discharge passing through an inclined venturimeter. For a given flow show that the reading of differential manometer remains unchanged irrespective of the inclination of venturimeter. **[9]**

b) Solve any one of the following. **[9]**

i) A pipe slopes downwards from 20cm diameter at upstream section 1(elevation 25mt) to 30cm diameter at downstream section 2(elevation 20mt). A pressure gauge installed at section 1 reads 125Kpa when the water flow rate is $0.25m^3/s$. If the kinetic energy correction factor for sections 1 and 2 are 1.1 and 1.3 respectively, workout the reading of the pressure gauge at section 2. The loss of head through the pipe may be assumed as $1.2(V_1-V_2)^2/2g$. Assume specific weight of water $10KN/m^3$.

ii) The velocity distribution in a pipe is given by the equation $u=U_{max}(y/R)^{1/7}$ where R is the radius of pipe and u is the velocity at any distance y from the pipe wall, U_{max} is the maximum velocity occuring at the centre of the pipe. Find the average velocity and momentum correction factor.

Q4) a) Derive an expression for time of emptying a tank through an orifice at its bottom. **[8]**

b) When a sudden contraction is introduced in a horizontal pipeline from 50cm diameter to 25cm diameter, the pressure changes from $105KN/M^2$ to $69KN/m^2$. If the coefficient of contraction is assumed to be 0.65 calculate water flow rate. Following this if there is sudden enlargement from 25cm to 50cm and if the pressure at the 25cm section is $69KN/m^2$. What is the pressure at the 50cm enlarged section. **[8]**

Q5) a) i) Explain the terms Hydraulic gradient line and Total energy line. **[6]**

ii) What is syphon? Where it is used and Explain its working. **[4]**

b) Solve any one of the following. **[8]**

i) A pipe of diameter 20cm and length 10000mt is laid at a slope of 1 in 200. An oil of specific gravity 0.9 and viscosity 1.5 poise is pumped up at the rate of 20lit/sec. Check whether the flow is laminar or turbulent. If it is laminar find the head lost in friction. Also calculate the power required to pump the oil.

ii) Two pipe of diameters D and d of equal length I are considered. If the pipes are arranged in parallel, the loss of head for either pipe when a total quantity of water flows through them is h. If the pipes are arranged in series and the same quatity Q flows through them, the loss of head is H. If d-0.5D, find the percentage of total flow through each pipe when palced in parallel and the ratio of H to h. Neglect minor losses and assume coefficient of friction to be constant.

Q6) a) Define boundary layer and explain the fundamental causes of its existence. Also discuss the various methods of controlling the seperation of boundary layer. **[8]**

b) Solve any one of the following. **[8]**

i) A spherical balloon 1.5mt in diameter is filled with hydrogen and held stationary in air by anchoring it to the ground with the help of a string of negligible weight. The balloon is subjected to an upward force of 20N. Determine the inclination of the string with the ground if the wind is flowing with a velocity of 18Km/hr. Take the mass density of air as 1.2Kg/m^3 and the drag coefficient as 0.5. Also find the tension in the string.

ii) A supersonic aeroplane is flying at the Mach number of 2 at a height of 1.5Km above the observer. The temperature of air is 20°C. Find the time after which the observer hears the sonic boom after the plane is directly overhead of observer. How far will be the plane from the observer at the instant of boom reaching the observer? Assume R=287J/Kgk and γ=1.4

✈ ✈ ✈

SL - 1057

Total No. of Pages : 5

Seat No.	

S.E (Mechanical) (Part - I) (Semester - III) Examination, May - 2017

MACHINE DRAWING

Sub. Code : 42663

Day and Date : Friday, 12 - 05 - 2017 **Total Marks : 100**

Time : 02.00 p.m. to 06.00 p.m.

Instructions :
1) **Question No. 1 and Question No. 4 are compulsory. Solve any one. Question out of remaining in each section.**
2) **Use first angle method of projection.**
3) **Figure to the right indicate full marks.**
4) **Make suitable allumptions if necessary.**

SECTION - I

Q1) a) A vertical cone of diameter 100 mm and slant height 100mm is resting on its base in HP. It is completely penetrated by a square prism of 35mm side the fales of which are equally inclined to vp. The axis of prism is parallel to HP and VP and interescts axis of the cone of at 30mm from the base. Draw projections of solids showing curves of penetration. **[15]**

b) Draw IS conventions for the following : **[10]**
   i) Copper
   ii) Plug weld
   iii) Cup spring
   iv) Half section

c) Draw free hand proportionate sketches for the following : **[10]**
   i) Capstan nut
   ii) Flat belt pulley

Q2) Draw IS conventions for the following. **[15]**
   a) Bevel gears
   b) Helical compression spring
   c) Combined dimensioning.

P.T.O.

Q3) Draw free hand proportionate sketches for the following : [15]

a) Knuckle joint

b) Flexible coupling

c) Single riveted chain lap joint

SECTION - II

Q4) Fig II (a) shows the assembly of Tool Post. Draw the following part drawings showing all the dimensions with one view in section. [35]

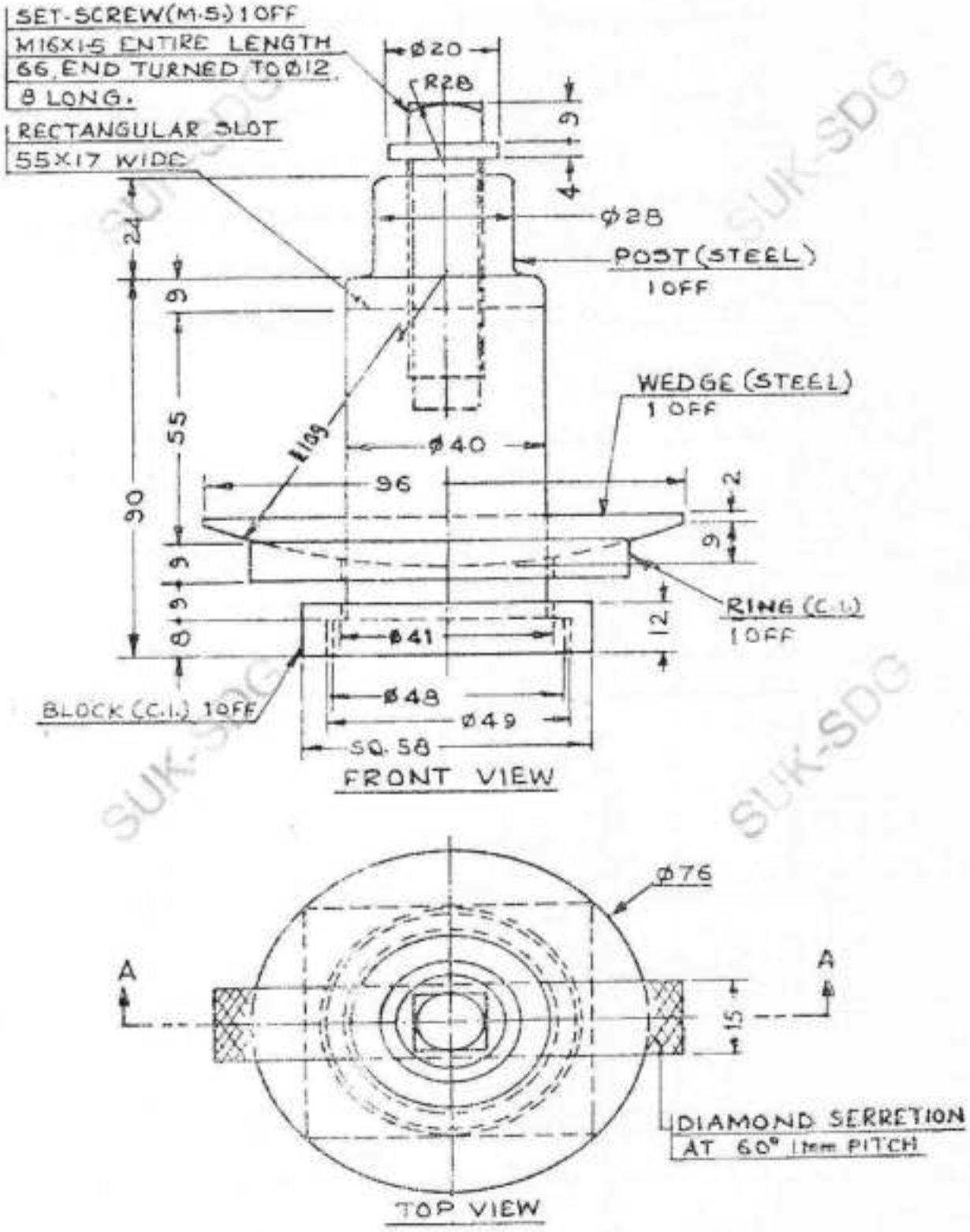
a) Post

b) Wedge

c) Ring

d) Block

e) Set screw



ASSEMBLY OF TOOL-POST

Fig. II (a)

NOTE:- ALL DIMENSIONS ARE IN mm.
ALL FILLETS AND ROUNDS TO 3R.

Q5) Fig II (b) shows two views of an object. Draw the given views and show the following. **[15]**

a) Tolerance grade of H7 on hole ϕ 20.

b) Bilateral tolerance ±15 minutes for angle 30°.

c) Unilateral tolerance of +50 microns for length 60mm.

d) Surface B is perpendicular to surface a within 40 microns.

e) Flatnell of surface c is 20 microns.

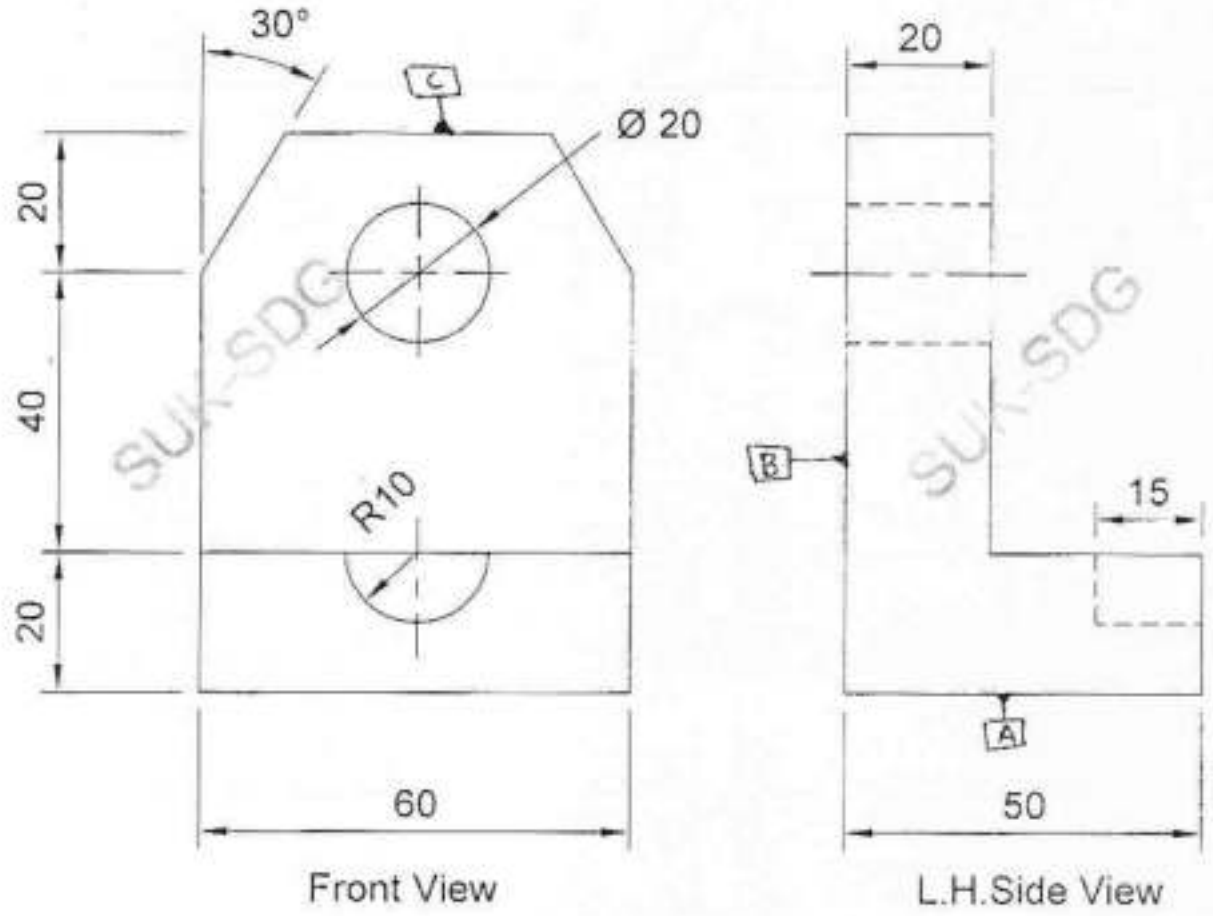


Fig. II (b)

f) Refer Fig II (c) and Redraw the given views and complete the incomplete top view. **[15]**

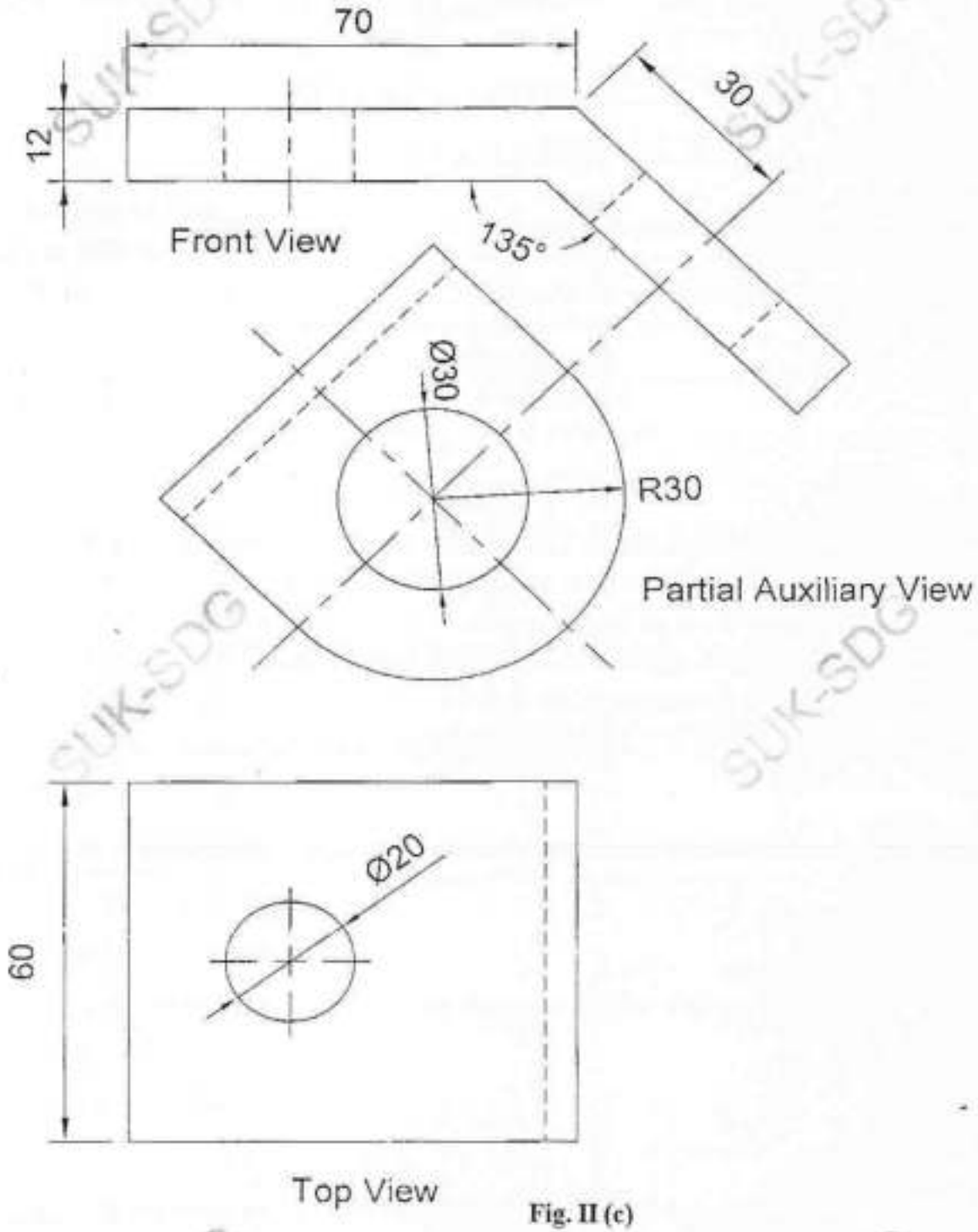


Fig. II (c)

Seat No.	

S.E. (Mechanical Engg.) (Semester - III) (Revised) Examination, April -2019

ENGINEERING MATHEMATICS-III

Sub. Code : 63350

Day and Date : Friday, 26 - 04 - 2019 **Total Marks : 100**
Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicates full marks.
3) Use of non programmable calculator is allowed.
4) Assume suitable data if necessary.

SECTION - I

Q1) Attempt any Three of the following.

a) Solve $(D^3 - 2D^2 - 5D + 6)y = \cosh 2x$. [6]

b) Solve $(D^2 - D + 1)y = x^3 - 3x^2 + 1$. [6]

c) Solve $(D^3 - D^2 + 3D + 5)y = e^x \cos 3x$. [6]

d) Solve $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^2 + 2\log x$. [6]

Q2) Attempt Any one of the following.

a) The differential equation of a shaft which is whirling with the line bearings horizontal is given by $EI\frac{d^4y}{dx^4} - \frac{W\omega^2}{g}y = W$, where W is the weight of the shaft and ω is the whirling speed. Taking the shaft of length $2l$ with the origin as is centre and short bearing at both ends, show that

$$y = \frac{g}{2\omega^2}\left[\frac{\cos mx}{\cos ml} + \frac{\cosh mx}{\cosh ml} - 2\right], \text{where} \quad m^4 = \frac{W\omega^2}{EIg}.$$ [16]

P.T.O.

b) i) A body falling vertically under gravity encounters resistance of atmosphere and satisfies equation of motion $\frac{d^2x}{dt^2} + k\frac{dx}{dt} = g$, where g being gravitational constant. Solve the differential equation and show that as time increases to infinity velocity approaches to $\frac{g}{k}$ and distance fallen by body from rest in time t is $x = \frac{gt}{k} - \frac{g}{k^2}\left(1 - e^{-kt}\right)$. [8]

ii) The differential equation of the motion of a body is $\frac{d^2x}{dt^2} + \omega_0^2 x = f_0 \sin nt$, where $n \neq \omega_0$. If initially $x = 0$ and $\frac{dx}{dt} = 0$ when t = 0, determine the motion. [8]

Q3) Attempt Any Two of the following.

a) Find the directional derivative of $\phi = x^2 + 2y^2 - 3z^2$ at point $P(1,2,1)$ in the direction [8]

i) Normal to the surface $xy^2 + yz^3 = 4$ at (1,1,1).

ii) Tangent to the curve $x = t^2 + t, y = 2t, z = 2 - t$ at t = 1.

b) i) Find the angle between the tangent to the curve $\vec{r} = t^2\vec{i} - 2t\vec{j} + t^3\vec{k}$ at the points $t = 1$ and $t = 2$. [4]

ii) Prove that $curl\left(\vec{a} \times \vec{r}\right) = 2\vec{a}$, where $\vec{a}$ is constant vector and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ is position vector of a particle. [4]

c) Show that the vector field $\vec{F} = \left(z^2 + 2x + 3y\right)\vec{i} + \left(3x + 2y + z\right)\vec{j} + \left(y + 2zx\right)\vec{k}$ is irrotational but not solenoidal and hence find the scalar potential function. [8]

SECTION - II

Q4) Attempt Any Three from the following.

a) Find $L\{t^3 \sin t\}$ and hence find the value of the integral $\int_0^\infty e^{-t} t^3 \sin t \ dt$. [6]

b) Find $L\left\{e^{2t}\int_0^t \frac{e^{-4t}\sin 3t}{t}dt\right\}$. [6]

c) Find $L^{-1}\left\{\frac{4s+5}{(s-1)^2(s+2)}\right\}$. [6]

d) Using convolution theorem find inverse Laplace transform of $\frac{1}{s^2(s^2+a^2)}$ [6]

e) Solve $y''(x) - y(x) = a \cosh x$, $y(0) = y'0 = 0$ using Laplace transform method. [6]

Q5) Attempt Any Two from the following.

a) Find the Fourier series to represent the function $f(x)$ given by

$$f(x) = \begin{cases} -k, & -\pi < x < 0 \\ k, & 0 < x < \pi \end{cases}$$

. Hence show that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots = \frac{\pi}{4}$. [8]

b) Obtain the Fourier series for the function $f(x) = 2x - x^2$ in $0 \le x \le 2$.

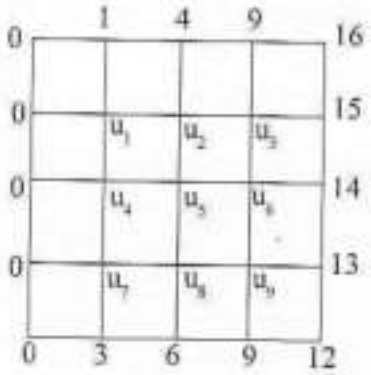
Hence show that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \ldots$ [8]

c) Find half range sine and cosine series for $f(x) = x(l - x)$, $0 \le x \le l$. [8]

Q6) Attempt any one of the following.

a) A tightly stretched string with fixed end points $x = 0$ and $x = \pi$ is initially at rest in its equilibrium position. If it is set vibrating by giving to each of its points an initial velocity $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0.05 \sin x - 0.06 \sin 2x$. Then find the displacement $y(x, t)$ at any point of string at any time. **[16]**

b) Solve the Laplace equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by performing three iterations. **[16]**



* * *

SV-75

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, May - 2019

ELECTRICAL TECHNOLOGY

Sub. Code : 63351

Day and Date : Thursday, 02 - 05 - 2019. **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to right indicate full marks.**
3) **Draw neat labeled diagram wherever necessary.**
4) **In case of missing data, assume suitable value. State it clearly.**

SECTION-I

Q1) a) Explain working principle of DC Motor. And state their applications. [8]

OR

Draw & explain characteristics of -

i) DC shunt motor

ii) DC series motor

iii) Cumulative compound motor.

Answer any two out of following sub questions b,c,d. [2×6]

b) Explain the flux control methods for DC series motor.

c) With a neat figure explain the working of 3 point Starter for dc shunt motor.

d) A 250v dc shunt motor with armature resistance of 0.5 ohm runs at 600 r.p.m. on full load and takes an armature current of 20A. If resistance of 1 ohm is placed in the armature circuit, find the speed at half full load.

[2×8]

Q2) Answer any two.

a) Compare squirrel cage induction motor with slip ring induction motor.

b) Derive the expression for running torque of 3 phase induction motor. Hence explain how the torque varies with slip.

P.T.O.

c) A three phase induction motor has stator loss of 2 kw, rotor copper loss of 1kw and mechanical loss of 0.5 kw at a slip of 0.04 find.

i) Rotor input
ii) Stator input
iii) Rotor output
iv) Motor output.

Q3) Answer any two. [2×8]

a) Draw diagram and explain autotransformer starter.

b) Describe the stator side speed control methods of 3 phase induction motor.

c) With circuit diagram state the method of reversing rotation of 3 phase induction motor. Explain the reason behind the method.

SECTION-II

Q4) Answer any two. [2×8]

a) State the types of stepper motor. Explain VR type stepper motor with its applications.

b) Explain construction and working principle of AC servomotor. State its applications.

c) Why BLDC motor is called as BLDC? Explain working principle and its applications.

Q5) Answer any two [2×8]

a) What factors to be considered for motor selection from electrical, mechanical and economical aspects?

b) State and explain types of mechanical loads. Give suitable example.

c) Suggest suitable motor for following applications. Also state their starting and running requirements.

i) Lift
ii) Lathe machine
iii) Electric traction
iv) Pumps

Q6) Answer any two. [2×8]

a) Explain construction, working and applications of core type induction furnace.

b) Compare direct and indirect Arc furnace in each aspect.

c) A high frequency induction furnace takes 20 min to melt 1.9 kg of aluminum, the input to the furnace being 3 kw and the initial temperature is 25°C, and then determines the efficiency of the furnace.

Melting point of aluminum = 660°C,

Specific heat = 0.212 kcal / kg °C,

Latent heat of 1 fusion of aluminum = 76.8 kcal/kg,

SV-76

Total No. of Pages : 4

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, May -2019

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Saturday, 4 - 05 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Attempt all questions.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Make suitable assumptions if necessary and state it clearly.**
4) **Use of calculator, steam table and Mollier chart is allowed.**

Q1) a) State and prove Clausius inequality and hence define entropy. **[8]**

OR

Define and explain **[8]**

i) Energy

ii) Anergy

iii) Exergy

iv) Dead sate

b) 0.5 kg of perfect gas is heated from 100°C to 300°C at a constant pressure of 300 kN/m^2. It is then cooled at constant volume to initial temperature find the average change in entropy.

(Take c_p = 1.005 kJ/kg-K, c_v = 0.718 kJ/kg-K) **[8]**

Q2) a) What is meant by Reheat and regeneration steam power cycle? Explain with T-s diagram. **[8]**

OR

Which are the different properties of steam? Explain use of steam table and Mollier Chart. **[8]**

P.T.O.

b) In a Rankine cycle steam at inlet to turbine is saturated at a pressure 30 bar and exhaust pressure is 0.24 bar. Determine. [8]

i) Pump work

ii) Turbine power

iii) Rankine efficiency

iv) Condenser heat rejected.

Assume steam flow rate = 10 kg/sec and specific volume of water at 0.24 bar $v_w = 0.001019\ m^3/kg$.

Q3) a) Define thermal efficiency of steam boiler. Explain any one fire tube boiler with neat sketch. [8]

OR

What is function of condenser? Explain any one condenser with neat sketch.

b) In a condenser test, the following observations were made [10]

Vacuum = 71 cm of Hg

Barometer reading = 76.5 cm of Hg

Mean Temperature of condensation = 35°C

Temperature of hot well = 28°C,

Mass of cooling water = 60000 kg/hr.

Cooling water temperature temp. = 24°C

Mass of condensate collected = 2000 kg/hr

Find:

i) Corrected vacuum of standard barometer of 76 cm of Hg

ii) The quality of steam entering the condenser.

iii) Vacuum efficiency.

iv) Condenser efficiency.

v) Undercooling of the condenser.

Assume inlet temp of cooling water = 8°C.

Q4) a) What is the function of the nozzle? Describe types of steam nozzles with neat sketch. [8]

b) Stream enters a convergent-divergent nozzle of 2 MPa and 400°C with negligible velocity and mass-flow of 2.5 kg/s and it exits at a pressure of 300 kPa. The flow is isentropic between the nozzle entrance and throat and overall nozzle efficiency is 93 percent. [9]

Determine

i) Throat and

ii) Exit areas.

OR

Calculate the throat and exit diameters of a convergent-divergent nozzle, which will discharge 820 kg of steam per hour at a pressure of 8 bar and superheated to 220°C, into a chamber having a pressure of 1.5 bar. The friction loss in the divergent portion of the nozzle may be taken as 0.15 of the isentropic enthalpy drop in the divergent portion of the nozzle.[9]

Q5) a) How the steam turbines are classified? Differentiate between impulse and reaction turbine. [9]

OR

Explain the term reheat factor. Why its magnitude is always greater than unity? [9]

b) In an impulse turbine (with a single row wheel), the mean diameter of the blade is 1.05 m and speed is 3000 rpm. The nozzle angle is 18°. The ratio of blade speed to steam speed is 0.42 and ratio of relative velocity at outlet from the blades to that at inlet is 0.84. The outer angle of the blade is to be made 3° less than the inlet angle. The steam-flow rate is 10kg/s. Draw the velocity diagram for blades and derive the following. [8]

i) Tangential thrust on the blades.

ii) Power developed in the blades.

iii) Blanding efficiency.

Q6) a) Define the term degree of reaction for steam turbine. Show it is 50% for parson's reaction turbine. [8]

b) The following data refers to a particular stage of Parson's reaction turbine. Find the isentropic enthalpy drop in the stage. [8]

Speed - 1500 rpm. Mean diameter of rotor - 1m.

Stage efficiency - 80% Speed ratio - 0.7 Blade outlet angle - 20°

♦ ♦ ♦

SV-77

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - I) (Semester - III) (Revised) Examination, May -2019

METALLURGY

Sub. Code : 63353

Day and Date : Tuesday, 07 - 05 - 2019 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) **Solve any three questions from each section.**
2) **Draw neat sketches wherever necessary to support your answers.**
3) **Write our answers to the point and in order of preference.**
4) **Figures to the right indicate full marks.**

SECTION - I

Q1) Solve the following.

a) Classify Brasses and differentiate clearly between alpha and alpha-Beta brasses? [9]

b) Classify the steels ? Write down composition, properties and Applications of plain 'C' steels. [9]

Q2) Solve any four. [16]

a) Effect of Cr and Ni and C in stainless steel.

b) Effect of alloying element in tool steel.

c) Composition and properties of A1-4.5Cu alloy.

d) Properties and applications of Ti6A14V alloy.

e) Composition and properties of heating element alloys.

f) Explain in short different imperfections in crystal structures?

P.T.O.

Q3) Solve any four. [16]

a) Differentiate substitutional and interstitial solid solution?

b) Working principle and Steps in Brinell hardness testing.

c) Draw stress strain diagram for mild steel;

d) Dye penetrant method.

e) Pulse echo Ultrasonic method.

Q4) Write short notes on any four of the following. [16]

a) Nucleation and grain growth.

b) Lever arm principle.

c) Eutectic system with example.

d) Intermetallic compounds.

e) Dendritic structure and coring.

SECTION - II

Q5) Solve the following.

a) Draw Flowchart for manufacturing of self lubricating bearings? Explain why oil impreganation is must in this process? [9]

b) What you mean by quenching in heat treatment process, why it is needed? Mechanism of heat removal during quenching? [9]

Q6) Solve the following.

a) Explain precipitation hardening in Al- Cu alloy w.r.t. composition, aging temperature and time, hardness variations. [8]

b) Explain carburizing process? Why carburizing is followed by hardening? [8]

Q7) Differentiate clearly between any four of the following. **[16]**

a) Diffusion and shear transformation.

b) Compacting and sintering.

c) Upper and lower bainite

d) CCT and TTT diagram.

e) Flame and induction hardening.

f) Annealing and Normalizing.

Q8) Write short notes on any four of the following. **[16]**

a) Heat treatment defects

b) Sub-zero treatment

c) Austenite to Pearlite transformation

d) Different Powder manufacturing methods

e) Heat treatment furnaces

* * *

Seat No.	

SV-78

Total No. of Pages : 3

S.E. (Mechanical) (Semester - III) (Revised) Examination, May -2019

FLUID MECHANICS

Sub. Code : 63354

Day and Date : Thursday, 09 - 05 - 2019

Time : 10.00 a.m. to 1.00 p.m.

Total Marks : 100

Instructions :
1) All question are compulsory.
2) Neat diagrams must be drawn wherever necessary.
3) Figures to the right indicate full marks.
4) Use of non programmable calculator is allowed.
5) Assume suitable data if necessary.

Q1) a) State the characteristics of an ideal fluid. The general relation between shear stress and velocity gradient of a fluid can be written as $T = A[du/dy]^n + B$ where A, B and n are constants that depend upon the type of fluid and conditions imposed on the flow comment on the values of these constants so that the fluid may behave as [6]

i) An ideal fluid

ii) Newtonian fluid and

iii) Non Newtonian fluid

b) Five litres of oil weighs 61.8N Calculate [6]

i) Specific weight

ii) Specific mass

iii) Specific volume

iv) Relative density

c) Define Pascal's law and Hydrostatic law of pressure. [4]

Q2) a) In a two dimensional incompressible flow, the fluid velocity components are given by u=x-4y and v=-y-4x show that velocity potential exists and determine its form as well as stream function. [8]

P.T.O.

b) Solve any one of the following. [8]

i) Distinguish between Eulerian and Lagrangian methods of representing fluid flow, Steady and Unsteady flow, Pathline and Streamline and Convective and Local acceleration.

ii) With usual notations derive the equation for velocity of sound wave in fluid.

Q3) a) Explain why [9]

i) Coefficient of discharge for orifice meter is less than venturimeter.

ii) Length of divergent cone is greater than convergent cone in venturimeter.

iii) The convergent angle of venturimeter is around 21° and divergent angle around 5° to 7°.

b) Solve any one of the following [9]

i) Water is flowing vertically upwards through a pipeline having diameter 1 mt. and 0.5mt at the base and top respectively. The pressure at the lower end is 45cms of Hg. While the pressure at the upper end is 20KN/m^2 If the loss of head is 20% of difference in velocity head, calculate the discharge. The difference in elevation is 4mts.

ii) The drainage pump has tapered suction pipe. The pipe is running full of water. The pipe diameters at inlet and at the upper end are 1mt. and 0.5mt. respectively. The free water surface is 2mt. above the centre of the inlet and centre of upper end is 3mt. above the top of free water surface. The pressure at the tip end of the pipe is 25cms of mercury and it is known that loss of head by friction between top and bottom section is one tenth of the velocity head at the top section. Compute the discharge. Neglect loss of head at the entrance of the tapered pipe. Assume pressure head at the inlet is 76cms of mercury.

Q4) a) Derive an expression for the velocity distribution for viscous flow in a circular pipe and find the ratio of maximum velocity to average velocity. [8]

b) Water enters a reducing pipe horizontally and comes out vertically in the downward direction if the inlet velocity is 5m/s and pressure is 80Kpa and the diameters. at the entrance and exit sections are 30 cm and 20cm respectively. Calculate the components of the reaction acting on the pipe. [8]

Q5) a) i) Differentiate between major energy losses and minor energy losses in pipes. [4]

ii) With a neat sketch explain what is syphon Where it is used. [5]

b) Solve any one of the following [9]

i) Two pipes of diameters 40cm and 20cm are each 300mt. long. When the pipes are connected in series the discharge through the pipeline is $0.1m^3/s$ find the loss of head incurred. What would be the loss of head in the system to pass the same total discharge when the pipes are connected in parallel? Take friction factor as 0.0075 for each pipe and head loss coefficient of contraction as 0.33.

ii) An oil of viscosity 0.096 Ns/m^2 and density 900 Kg/m^3 is flowing through a horizontal pipe of 20cm. diameter and of length 20mt. If 90 Kg of oil is collected in a tank in one minute, check whether the flow is laminar or turbulent. If it is laminar find the difference of pressure at the two ends of the pipe.

Q6) a) Define Boundary layer thickness, displacement thickness, Momentum thickness and Energy thickness and write expressions of each. [8]

b) Solve any one of the following. [8]

i) The lift force F_L of an airfoil is found to depend on Mass density (ϱ), velocity of flow (V), characteristic depth d, angle of incidence (α) and coefficient of viscosity (μ) show by dimensional analysis $F_L = \varrho V^2 d^2 \phi[(\varrho Vd/\mu), \alpha]$

ii) In a fluid mechanics laboratory it was asked to conduct an experiment on a flat plate of 2mt long and 1.2mt wide in a wind tunnel with a wind velocity of 40 Km/hr when the plate is at 6° angle of attack the coefficients of lift and drag are computed as 0.7 and 0.18 respectively. Find the

1) Lift force
2) Drag force
3) Magnitude and direction of resultant force and
4) Power exerted by air on the plate. Assume density of air as 1.2 kg/m^3.

* * *

SV-72

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical Engg.) (Semester - III) (Revised) Examination, April - 2018

ENGINEERING MATHEMATICS -III

Sub. Code :63350

Day and Date : Tuesday, 24- 04 - 2018 Total Marks : 100

Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of non-programmable calculator is allowed.
4) Assume suitable data if necessary.

SECTION - I

Q1) Attempt any Three of the following.

a) Solve $\left(D^2-4D+4\right)y=x^3+\cos 2x$ [6]

b) Solve $\left(D^3-7D^2+10D\right)y=e^{2x}\sin x$ [6]

c) Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=\sin e^x$ [6]

d) Solve $x^2\frac{d^3y}{dx^3}+3x\frac{d^2y}{dx^2}+\frac{dy}{dx}+\frac{y}{x}=x^2\log x$ [6]

Q2) Attempt any one of the following.

a) The differential equation of a shaft which is whirling with the line bearings horizontal is given by $EI\frac{d^4y}{dx^4}-\frac{W\omega^2}{g}y=W$, where W is the weight of the shaft and ω is the whirling speed. Taking the shaft of length $2l$ with the origin as its centre and short bearing at both ends i.e. for $x=\pm l, y=\frac{d^2y}{dx^2}=0$ show that $y=\frac{g}{2\omega^2}\left[\frac{\cos mx}{\cos ml}+\frac{\cosh mx}{\cosh ml}-2\right]$, where $m^4=\frac{W\omega^2}{EIg}$ [16]

P.T.O.

b) A spring at the upper end supports a weight of 980 gm at its lower end. The spring stretches ½ cm under a load of 10 gm and the resistance (in gm wt.) to the motion of the weight is numerically equal to the 1/10 of the speed of weight in cm/sec. The weight is pulled down ¼ cm below its equilibrium position and then released. Find the expression for the distance of weight from its equilibrium position at time t during its first upward motion. [16]

Q3) Attempt any four of the following.

a) Show that $\vec{V} = 2xyz\vec{i} + (x^2z + 2y)\vec{j} + x^2y\vec{k}$ is irrotational and hence find a scalar potential function $u(x, y, z)$ such that $\vec{V} = \text{grad } u$ [4]

b) Find angle between surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at a point (2, –1, 2) [4]

c) If $\vec{a}$ is a constant vector and $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ then prove that

i) $div(\vec{a} \times \vec{r}) = 0$

ii) $curl(\vec{a} \times \vec{r}) = 2\vec{a}$ [4]

d) If $\vec{F} = (x + y + 1)\vec{i} + \vec{j} - (x + y)k$, find the value of $\vec{F}$. curl $\vec{F}$ [4]

e) If $\vec{r} = x\vec{i} + y\vec{j} + z\vec{k}$ and $r = \sqrt{x^2 + y^2 + z^2}$ then prove that $\nabla(r^2e^r) = (r + 2)e^r\vec{r}$ [4]

SECTION - II

Q4) Attempt any three questions from the following.

a) Find Laplace transform of $\frac{1}{t}(\cos 6t - \sin 4t)$ [6]

b) Find Inverse Laplace transform of $\frac{3s + 1}{(s - 1)(s^2 + 1)}$ [6]

c) Solve using Laplace transform method $\frac{dy}{dt} + 3y + 2\int_0^t y\,dt = t$, given that $y(0) = 0$ [6]

d) Find the Laplace transform of $\frac{te^{3t}\sin t \cos t}{2}$ [6]

Q5) Attempt any two from the following.

a) Obtain Fourier series for $f(x)=\begin{cases}1+\frac{2x}{\pi}, & -\pi\le x\le 0\\ 1-\frac{2x}{\pi}, & 0<x\le\pi\end{cases}$ and hence deduce that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots=\frac{\pi^2}{8}$ [8]

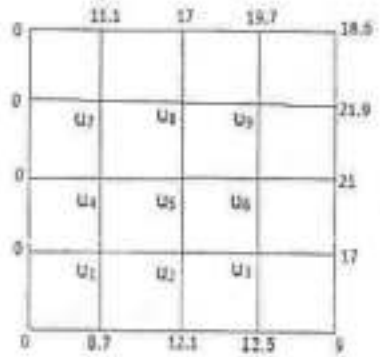
b) Obtain the Fourier series expansion for the function $f(x)=x+x^2$ in $(-1, 1)$. [8]

c) Find half range sine series for $f(x)=\begin{cases}x, & 0<x<\pi/2\\ \frac{\pi}{2}, & \pi/2<x<\pi\end{cases}$. [8]

Q6) Attempt any one from the following.

a) An elastic string stretched between two fixed points at a distance 'l' apart. One end is taken at origin and at a distance $\frac{2l}{3}$ from this end the string is displaced a distance k transversely and is released from rest when in this position. Find $y(x, t)$ the vertical displacement, if y satisfies the equation $\frac{\partial^2 y}{\partial t^2}=c^2\frac{\partial^2 y}{\partial x^2}$ [16]

b) Solve the Laplace equation $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ for the following square mesh with boundary values as shown in figure by Gauss-Siedal iterative method by performing four iterations. [16]



SV-73

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) Examination, April - 2018

ELECTRICAL TECHNOLOGY

Sub. Code : 63351

Day and Date : Wednesday, 25 - 4 - 2018 **Total Marks : 100**

Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Draw neat figures wherever necessary.**
4) **Assume suitable data, if missing. State it clearly.**

Q1) a) Explain the function of **[1×8]**

i) Field winding
ii) Armature winding
iii) Commutator
iv) Interpoles in a dc motor

OR

Differentiate between dc shunt motor and dc series motor about

i) Field winding design
ii) Torque speed characteristics
iii) Starting torque
iv) Applications

Answer any two of the following (b, c, d): **[2×6]**

b) Explain the principle of reversing rotation of dc motor. Draw appropriate circuit diagrams.

c) Explain the basic methods of speed control of dc series motor.

d) A DC shunt motor runs at 1200 rpm driving a constant torque load by taking 10 A armature current from 200 V supply. Now 5 ohm resistance is series with the armature winding. Find the new armature current and new speed. The armature resistance is 0.6 ohm.

P.T.O.

Q2) Answer any TWO: [2×8]

a) Explain the working of 3 phase induction motor.

b) Compare two types of 3 phase induction motor with different rotor constructions.

c) Torque of 3 phase induction motor is given by $\frac{120 s E_2^2 R_2}{2\pi N_s \left(R_2^2 + s^2 X_2^2\right)}$ where

E_2, R_2, X_2, s, N_s are rotor induced emf per phase at standstill, Rotor resistance per phase, Rotor reactance per phase at standstill, slip and synchronous speed respectively. Write the value of slip and expression for torque

i) At starting

ii) When the torque is maximum

iii) If rotor speed = Synchronus speed

Q3) Answer any TWO: [2×8]

a) Why does induction motor draw large current at large slip? Explain basic methods of reducing starting current of induction motor.

b) Compare different methods of speed control of induction motor on the basis of

i) Effect on starting torque

ii) Suitability to different types of rotor

iii) Effect on current drawn while driving constant torque load

c) Explain the principle of rotation reversal of 3 phase induction motor. Draw necessary circuit diagrams.

Q4) Answer any TWO: [2×8]

a) What is the difference between drive motor and servo motor? Describe methods of controlling dc servo motor.

b) Describe the construction and working of any one type of stepper motor.

c) Describe a linear induction motor. State its applications.

Q5) Answer any TWO: [2×8]

a) State starting and braking requirements of following load and state one suitable motor for each.

i) Paper mill
ii) Drilling machine
iii) Rolling mill
iv) Conveyor

b) Explain with examples the terms - active load, passive load, multimotor drive.

c) Classify mechanical loads based on how the torque requirement changes with driving speed. Explain.

Q6) Answer any TWO: [2×8]

a) Compare core type induction furnace with coreless induction furnace.

b) State basic principle of producing large heat for industrial use by using electric power. How is this principle adapted in resistance furnace, induction furnace, arc furnace.

c) Find the input power to a furnace required to melt 500 kg metal scrap per hour. The scrap is preheated to 100 deg. C. Efficiency of furnace 60%, latent heat constant of metal 270 J/kg, specific heat constant of metal 450 J/kg, melting point = 1500 deg. C.

Seat No.	

S.E. (Mechanical) (Part-II) (Semester - III) (Revised) Examination, April - 2018

APPLIED THERMODYNAMICS

Sub. Code : 63352

Day and Date : Thursday, 26 - 4 - 2018 **Total Marks : 100**

Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Figures to the right indicates full marks.**
3) **Assume suitable data if necessary.**
4) **Use of steam table & Mollier chart are allowed.**
5) **Use of non-programmable calculator is allowed.**

Q1) a) Explain equivalence of Kelvin-Planck and Clausius statement of second law. **[8]**

OR

b) Explain Available energy, Unavailable energy and Dead state. **[8]**

c) State and prove Clausius Inequility. **[8]**

Q2) a) Draw P - V, T - V and P - T diagram for water - steam pure substance. **[8]**

OR

b) Write note on Reheat and Regenerative steam power cycles. **[8]**

c) A simple Rankine cycle steam power plant operates between temperatures of 260°C to 95°C. The steam is supplied to the turbine at a dry saturated condition. In the turbine, it expands in isentropic manner. Determine the efficiency of Rankine cycle, net work done and SSC. **[8]**

Q3) a) Classify boilers and compare between water tube and fire tube boilers. **[8]**

OR

b) Classify steam condensers and compare between surface and jet condensers. **[8]**

P.T.O.

c) During a trial on a steam condenser, the following observations were made [10]

Condenser Vacuum	680 mm of Hg
Barometer reading	764 mm of Hg
Mean condenser temperature	36.2°C
Hot well temperature	30°C
Condensate formed per hour	1780 kg
Circulating cooling water inlet temperature	20°C
Circulating cooling water outlet temperature	32°C
Quabtity of cooling water	1250 kg/min

Determine:

i) Condenser Vacuum corrected to standard barometer
ii) Vacuum Efficiency
iii) Under cooling of condensate
iv) Condenser efficiency
v) Condition as steam as it enters the condenser

Take the specific heat of water as 4.186 kJ/kgK

Q4) a) What is the effect of friction on the flow through a steam nozzle? Explain with the help of h - S diagram. [8]

OR

Derive an expression for mass of steam discharged through nozzle.

b) A convergent divergent nozzle is to be designed when pressure of entering steam is of 15 bar with dryness fraction of 0.97. The exit pressure is 0.2 bar. The mass flow rate is 9 kg/kw. hr. If the power developed is 220 kw determine: [9]

i) Throat pressure
ii) The number of nozzles required if each nozzle has a throat of rectangular C/S of 4 mm × 8 mm.

Take frictional heating as 78.96 kJ/kg.

Q5) a) Explain with the help neat sketch a single stage impulse turbine. Also explain the pressure and velocity variations along the axial direction. Draw combined velocity triangle of impulse turbine. **[9]**

b) A simple impulse turbine has one ring of moving blades running at 150 m/s. The absolute velocity of steam at exit from the stage is 85 m/s at an angle of 80° from the tangential direction. Blade velocity ci-efficient is 0182 and the rate of steam flowing through the stage is 2.5 kg/s. If the blades are equiangular, determine **[8]**

i) Blade angles

ii) Nozzle angle

iii) Axial thrust

iv) Absolute velocity of steam at inlet

Q6) a) Explain the term reheat factor why it's magnitude is always greater then unity? **[8]**

OR

Which are the different governing methods of steam turbine. Explain any one of them.

b) In a Parson's reaction turbine of 50% degree of reaction running at 1500 rpm, the available enthalpy drop for an expansion is 62.8 kJ/kg. If the mean diameter of the rotor is 1 m. Find number of rows of moving blades required. The blade outlet angle is 20° and speed ratio is 0.7. Assume stage efficiency as 80%. **[8]**

SV-75

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Part - II) (Semester - III) (Revised) Examination, April -2018

METALLURGY

Sub. Code : 63353

Day and Date :Friday, 27 - 04 - 2018 **Total Marks : 100**

Time : 2.30 p.m to 5.30 p.m.

Instructions :
1) **Solve any three questions from each section.**
2) **Answer for both sections to be written in the same answer book.**
3) **Figures to the right indicate full marks.**
4) **Draw neat figures wherever necessary.**

SECTION - I

Q1) Answer any three of the following. Each question carries equal marks. **[18]**

a) What is Coring and Dendritic structure? Explain with neat sketches.

b) Explain what cooling curves are. Draw different types of cooling curves and evalute degree of freedom (DOF) of anyone using Gibbs phase rule.

c) What are Hume Ruthery rules for Substitutional Solid Solutions? Explain.

d) Explain what are Eutectic, Eutectoid and Peritectic transformations?

Q2) a) Draw Fe-Fe_3C equilibrium diagram. Indicate all the phases, Temperatures and Compositions. **[8]**

b) Suggest suitable materials for any four of the following and justify the same. **[8]**

i) Steel used in RCC

ii) Gears

iii) Machine tool Column

iv) Tools used in

v) Restaurant pots and pans

vi) Bearing material

P.T.O.

Q3) a) What are Malleable cast Irons? Explain the manufacturing process? Draw typical microstructure of Malleable and Gray cast iron and compare their properties. [7]

b) Draw self explanatory sketches of any three. [9]

i) Typical Microstructures of medium carbon steel and high carbon steels.

ii) Microstructures of White and gray cast irons.

iii) Microstructures of α & $\alpha + \beta$ brasses.

iv) Sn-Sb equilibrium diagram.

v) Substitutional and Interstitial solid solutions.

vi) Standard specimen for Charpy and Izod impact testing.

Q4) Write short notes on any four. [16]

a) Water hardenables Tool steels.

b) Stainless steels.

c) Rockwell hardness testing.

d) Cast iron.

e) Ultra sonic Testing.

SECTION - II

Q5) a) Draw Flowchart for manufacturing of self lubricating bearings? Explain why oil impreganation is must in this process? [9]

b) Draw TTT diagram for hypo eutectoid and hyper eutectoid steels and explain why mild steel cannot be hardened by quenching? [9]

Q6) a) Explain precipitation hardening in Al-Cu alloy w.r.t. composition, aging temperature and time, hardness variations. [8]

b) Elaborate case hardening processes, which steels are carburized and what is the significance of case depth? How it is measured? [8]

Q7) Differentiate clearly between any four of the following. **[16]**

a) Hardening and softening processes.

b) Compacting and sintering.

c) Austempering and martempering.

d) Flame and induction hardening.

e) CCT and TTT diagram.

Q8) Write short notes on any four of the following. **[16]**

a) Oxidation and decarburization defects.

b) Austenitic grain size.

c) Austenite to Pearlite transformation.

d) Different Powder manufacturing methods.

e) Heat treatment furnaces.

♦ ♦ ♦

SV-76

Total No. of Pages : 3

Seat No.	

S.E. (Mechanical) (Semester - III) (Revised) Examination, April - 2018

FLUID MECHANICS

Sub. Code: 63354

Day and Date : Saturday, 28 - 04 - 2018 **Total Marks : 100**

Time : 2.30 p.m. to 5.30 p.m.

Instructions :
1) **All questions are compulsory.**
2) **Neat diagrams must be drawn wherever necessary.**
3) **Figures to the Right indicate full marks.**
4) **Use of non programmable calculator is allowed.**
5) **Assume suitable data if necessary.**

Q1) a) Define surface tension and show that the gauge pressure within a liquid droplet varies inversely with the diameter of the droplet. **[6]**

b) A U tube containing water has two limbs of internal diameters 3 mm and 8 mm respectively. The free surfaces of water are observed to be having approximately zero contact angles with the U tube surface. What is the approximate difference of water level between the two limbs? Surface tension coefficient and density of water are 0.073 N/m and 1000 Kg/m^3 respectively. **[6]**

c) Explain the terms stable, unstable and neutral equilibrium with reference to the floating bodies. **[4]**

Q2) a) The velocity field in a fluid flow is given by $V = x^2ti + 2xytj + 2yztk$ where x, y and z are given in metre and time t in seconds. Determine the velocity vector at a point (2, –1, 1) at time $t = 1$ second. Also determine the magnitude of velocity and acceleration of the flow for the given location and time. **[8]**

b) Solve any one of the following : **[8]**

i) Define stream function and velocity potential. Show that the lines of constant stream function and velocity potential must intersect orthogonally.

P.T.O.

ii) Explain briefly the phenomenon of propagation of elastic waves in a compressible fluid and hence define zone of action and zone of silence.

Q3) a) i) Starting from steady flow energy equation show how Bernoulli's equation for an inviscid incompressible fluid can be obtained. **[4]**

ii) State the momentum equation. How will you apply momentum equation for determining the force exerted by a flowing fluid on a pipe bend? **[5]**

b) Solve any one of the following : **[9]**

i) Gasoline of specific gravity 0.8 is flowing upwards in a vertical pipeline which tapers from 30 cm to 15 cm diameter. A gasoline mercury differential manometer is connected between 30 cm and 15 cm pipe section to measure the rate of flow. The distance between the manometer tappings is 1 metre and gauge reading is 0.5 metre of mercury find

1) Differential gauge reading in terms of gasoline head.

2) Rate of flow. Neglect friction and other losses between tappings.

ii) A 300 mm × 150 mm venturimeter is to be replaced by an orificemeter both the meters are to give the same differential mercury manometer reading for a discharge of 100 lit/sec and the inlet diameter to remain as 300 mm. What should be the diameter of orifice? The coefficient of discharges of the venturimeter and orificemeter are 0.98 and 0.6 respectively. Assume the working fluid as water.

Q4) a) i) Explain why there is a need of defining correction factors for kinetic energy and momentum? And hence define kinetic energy correction factor and momentum correction factor. **[4]**

ii) Explain the concept of Total Energy Line and Hydraulic gradient Line. **[4]**

b) An oil of dynamic viscosity 20 centipoise and density 1200 Kg/m^3 flows through a 2.5 cm diameter pipe 250 metre long. What is the maximum flow in m^3/s that will ensure laminar flow? What would be the pressure drop for this flow? **[8]**

Q5) a) Show that the loss of head due to friction in a circular pipe can be expressed as $h_f = fLV^2/2gD$ where f is friction factor, L is length of pipe, V is average velocity and D is diameter of pipe. **[9]**

b) Solve any one of the following : **[9]**

i) Two pipelines of equal length and with diameters of 20 cm and 30 cm are in parallel and connect two reservoirs. The difference in water levels in the reservoirs is 4 metres. If the friction factors are assumed to be equal, find the ratio of the discharges due to the large diameter pipe to that of the smaller diameter pipe. Neglect all minor losses.

ii) Water is flowing through a horizontal pipe when the diameter of the pipe is suddenly enlarged from 20 cm to 40 cm, the hydraulic gradient line rises by 15 mm. Find the rate of flow of water.

Q6) a) Explain the effect of pressure gradient on boundary layer separation. **[8]**

b) Solve any one of the following : **[8]**

i) The power P required to run a centrifugal pump depends on the impeller diameter D, the rotational speed N, the rate of discharge Q, density ρ and viscosity μ. Using Buckingham's π theorem obtain an expression for power of the form $P=\rho N^3D^5\Phi\left[\left(Q/ND^3\right),\left(\mu/\rho ND^2\right)\right]$.

ii) A truck having a projected area of 6.5 m^2 travelling at 70 Km/hr has a total resistance of 2000 N of this 20 percent is due to rolling friction and 10 percent due to surface friction. The rest is due to form drag. Make calculations for the coefficient of form drag. Take density of air as 1.22 Kg/m^3.