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5E6201

Roll No. _____ Total No of Pages: 4

5E6201

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME1A Heat Transfer
Common with AE

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) Write the rate equations for the three modes of heat transfer. Define the symbols used and give the units for each. [8]

(b) Define and distinguish.

(i) Steady state.

(ii) Unsteady state and.

(iii) Transit state of heat transfer. [8]

OR

Q.1 Explain the concept of thermal contact resistance. A furnace wall consists of an inside layer of silica brick 10cm thick (k=1.5 kcal/m-hr°C) followed by a 20 cm layer of magnesite brick (k=5 kcal/m hr°C) on the outside. The inside surface of the silica brick wall is maintained at 750°C whilst the outside surface of magnesite is at 125°C. The contact thermal resistance between the two walls at the interface is 0.003 hr°C /kcal per unit wall area. What is the rate of heat loss per unit area of the wall? Also calculate the temperature drop at the interface. [16]

UNIT – II

Q.2 (a) Define fin efficiency. In which medium (gas or liquid) will the use of fins be more effective and why? [8]

(b) A long aluminum cylinder of radius 10 cm which is initially at a uniform temperature of 350°C is suddenly exposed to an environment at 30°C. The convection heat transfer coefficient between the cylinder's surface and the environment is 1000 W/m^2k. Determine the time required for the axis of the cylinder to attain a temperature of 126^0C. [8]

OR

Q.2 Derive the energy equation for the laminar boundary layer on a flat plate. Explain its importance in heat transfer. [16]

UNIT – III

Q.3 A plate heater 0.4 x 0.4 m using electrical elements, has a constant heat flux of 1.2 kW/m^2. It is placed in room air at 20^0C with the hot side facing up. Determine the value of h and average plate temperature. [16]

OR

Q.3 (a) With a sketch of boiling curve explain the type of flow regimes. [8]

(b) Steam at 65^0C condenses on vertical tube of diameter of 0.3m at 55^0C. Determine the location at which the film will become turbulent. [8]

UNIT – IV

Q.4 (a) Discuss the importance of heat exchangers for industrial use. Classify it with neat sketches. [8]

(b) Differentiate the parallel and counter flow type heat exchangers. [8]

OR

Q.4 A shell and tube oil to water heat exchanger has tubes of internal diameter 12mm and length 2m in a single shell. Cold water (C_{pc} =4180 Jkg°C) enters the tubes at 33°C with a flow rate of 5 kg/s and leaves at 55°C. Oil (C_{ph} =2150 Jkg°C flows through the shell and is cooled from 120°C to 75°C. The overall heat transfer coefficient is U_i = 885 $W/m^2\,^0C$ based on the internal area of the tubes. Determine the number of tubes required in this heat exchanger. [16]

UNIT – V

Q.5 Two large parallel planar surfaces are maintained at 400 and 800k, respectively. The surfaces are non-gray and have the emissivity variation given below:-

Surface 1:

$T_1 = 800k$, $E_{1,1} = 0.6$ for $0 < \lambda < 3\ \mu m$; $E_{1,2} = 0.2$ for $\lambda > 3\mu m$.

Surface 2:

$T_2 = 400k$, $E_{2,1} = 0.2$ for $0 < \lambda < 3\mu m$; $E_{2,2} = 0.6$ for $\lambda > 3\ \mu m$.

Determine the heat transfer between the two planes per unit area using a non-gray analysis. Compare this with a gray analysis based on the equivalent gray emissivities of the two surfaces at their respective temperatures. [16]

OR

Q.5 Write short note on: [16]

(a) Plank distribution law.

(b) Krichoff's law.

(c) Radiation intensity.

(d) Shape factor.

5E6202

Roll No. _____ Total No of Pages: 4

5E6202

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME2A Dynamics of Machines
Common with AE

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks Main: 26

Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) What do you mean by effort and power of a governor? Find expression for same in a porter governor. [8]

(b) In a spring loaded Hartnell type governor, the extreme radii of rotation of the balls are 80mm and 120mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2kg. If the speeds at the two extreme positions are 400 and 420 r. p .m., find - [8]

(i) The Initial compression of the central spring

(ii) The spring constant.

OR

Q.1 (a) What is the function of a governor? How does it differ from that of a flywheel? [4]

(b) Derive an expression for height of governor of watt governor with considering mass of arm. [12]

UNIT – II

Q.2 (a) Explain, in what way the gyroscopic couple effects the motion of an aircraft while taking a turn. [8]

(b) The turbine rotor of a ship has a mass of 3500kg. It has a radius of gyration of 0.45m and a speed of 3000 r.p.m. clockwise when looking from stern. Determine the gyroscopic couple and its effect upon the ship - [8]

(i) when the ship is steering to the left on a curve of 100m radius at a speed of 36km/h.

(ii) when the ship is pitching in a simple harmonic motion the bow falling with its maximum velocity. The period of pitching is 40 seconds and the total angular displacement between the two extreme positions of pitching is 12 degree.

OR

Q.2 A rear engine automobile is travelling along a track of 100 meters mean radius. Each of the four road wheels has a moment of inertia of 2.5 kg – m^2 and an effective diameter of 0.6m. The rotating parts of the engine have a moment of inertia of 1.2 kg – m^2. The engine axis is parallel to the rear axle and the crankshaft rotates in the same sense as the road wheels. The ratio of engine speed to back axle speed is 3:1. The automobile has a mass of 1600 kg and has its centre of graving 0.5m above road level. The width of the track of the vehicle is 1.5m.

Determine the limiting speed of the vehicle around the curve for all four wheels to maintain contact with the road surface. Assume that the road surface is not cambered and centre of gravity of the automobile lie centrally with respect to the four wheels. [16]

UNIT – III

Q.3 (a) Derive a relation for a minimum number of teeth for rack and pinion arrangement to avoid interference. [8]

(b) What do you mean by undercutting of gears? [4]

(c) Make a comparison of Cycloidal and Involute tooth forms. [4]

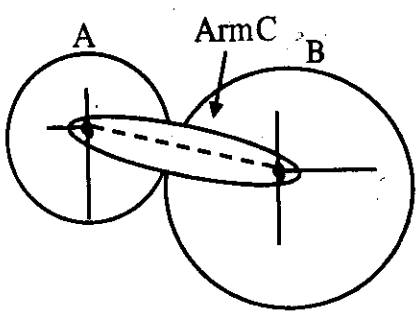
OR

Q.3 (a) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12mm module and 10mm addendum. Find the length of path of contact, arc of contact and the contact ratio. [8]

(b) Derive an expression for efficiency of spiral gear drive. [8]

UNIT – IV

Q.4 (a) In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anti-clockwise direction about the centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? [12]



(b) Define velocity ratio and transmission ratio. [4]

OR

Q.4 (a) Give the procedure to analyze Sun and Planet gear box. [8]

(b) Explain the working of constant mesh gear box. [8]

UNIT – V

Q.5 (a) A, B, C and D are four masses carried by a rotating shaft of radii 100, 125, 200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the mass of B, C and D are 10kg, 5kg and 4 kg respectively. Find the required mass A and the relative angular settings of the four masses so that the shaft shall be in complete balance. [12]

(b) Why is balancing necessary for rotors of high speed engines? [4]

OR

Q.5 (a) Explain the method of balancing of different masses revolving in the same plane. [8]

(b) Four masses m_1, m_2, m_3 and m_4 are 200kg, 300kg, 240kg and 260kg respectively. The corresponding radii of rotation are 0.2m, 0.15m, 0.25m and 0.3m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2m. [8]

5E6203

Roll No. _____ Total No of Pages: 3

5E6203

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016

Mechanical Engineering

5ME3A Measurement & Metrology

Common with EI

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks Main: 26

Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) Draw the block diagram of generalized measurement system and explain different stages with examples. [8]

(b) Distinguish between Repeatability and Reproducibility & Systematic and Random Errors. [8]

OR

Q.1 Define the following terms: - [16]

(a) Measurand, (b) Metrology,

(c) True size, (d) Actual size,

(e) Hysteresis, (f) Span,

(g) Resolution, (h) Standards

UNIT – II

Q.2 (a) Explain the working principle of mechanical comparator and briefly explain its applications. [8]

(b) State and explain the Tyler's principle of gauge design. [8]

OR

Q.2 (a) What is sine bar? Write its use, limitations and applications. [8]

(b) Describe the principle and construction details of Vernier Caliper & Bevel Protractor. [8]

UNIT – III

Q.3 (a) What is surface metrology? Why surface finish is important in engineering applications? Define surface roughness. [8]

(b) Calculate the CLA (Ra) value of a surface for which the sampling length was 0.8 mm. The graph was drawn to a vertical magnification of 10,000 and a horizontal magnification of 100 and the area above and below the datum line were: [8]

Above (mm^2):	150	80	170	40
Below (mm^2):	80	60	150	120

OR

Q.3 (a) Define gear terminology with sketch. Discuss and explain the gear errors. [8]

(b) Explain the working principle of gear tooth caliper and Parkinson gear tester. [8]

UNIT – IV

Q.4 (a) How laser interferometry can be utilized for measurement? Discuss its applications and limitations. [8]

(b) Explain the working metrology of laser scanning gouge with neat sketch, and limitations. [8]

OR

Q.4 (a) Write the name of equipments for alignment test. Discuss the working principle, advantages and applications of pillar type drilling machine. [8]

(b) Explain the coordinate measuring machine with respect to its types, features and advanced technologies. [8]

UNIT – V

Q.5 (a) Differentiate the direct methods and indirect methods for measurement. Explain the working principle of load cell with neat sketch. [8]

(b) Differentiate the Orifice meter and Venturimeter with respect to neat sketch, use and limitations. [8]

OR

Q.5 (a) What is flow? How hot wire anemometer can be utilized for flow measurement? [8]

(b) Explain the thermoelectric effect? Compare the working principle for thermocouples and thermistors. [8]

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5E6204

Roll No. _____ Total No of Pages: 3

5E6204

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME4A Quality Assurance and Reliability

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions**, selecting **one question** from **each unit**. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) Discuss the importance of Quality Control in the success of an organization. Explain factors affecting quality. [8]

(b) Define quality policy. Differentiate between Quality Control and Inspection. [8]

OR

Q.1 (a) Explain normal and exponential probability distributions along with their applications. [8]

(b) A process is known to produce 5% nonconforming items. A sample of 40 items is selected from the process. Determine the distribution of nonconforming item in the sample. Also find the probability of obtaining no more than 3 nonconforming items in the sample. [8]

UNIT – II

Q.2 (a) What are the benefits of using control charts? Discuss the causes of variation in control charts. [8]

(b) The following data shows the number of defective items discovered in 10 items taken on 10 consecutive days of a month. Construct control chart for number of defects per units. [8]

Data	1	2	3	4	5	6	7	8	9	10
Defects/unit	1	2	4	16	4	3	5	20	16	4

OR

Q.2 (a) What do you mean by process capability? Explain the objectives of an analysis of process capability. [8]

(b) Explain the difference in interpretation of an observation on an $\overline{X}$ chart and on an R chart. [8]

UNIT – III

Q.3 (a) What ate the advantages and disadvantages of Control Charts for Attributes. [8]

(b) Discuss the different types of Quality Audits. What is the role of ISO-9000. [8]

OR

Q.3 The number of nonconforming cables is found for 20 samples of size 100 as given. Construct a control chart for the proportion of nonconforming cables. Revise the control limits, assuming special causes for points outside the control limits. [16]

Sample	No. of nonconforming Cables	Sample	No. of nonconforming Cables	Sample	No. of nonconforming Cables
1	2	9	4	17	3
2	5	10	11	18	2
3	4	11	5	19	5
4	3	12	4	20	2
5	4	13	2		
6	2	14	5		
7	3	15	3		
8	2	16	12		

UNIT – IV

Q.4 (a) What is the importance of the OC curve in the selection of sampling plans? Describe the impact of the sample size and the acceptance number on the OC curve. [8]

(b) A sampling plan is desired to have a producer's risk of 0.05 at AQL = 0.9% and a consumer's risk of 0.10 at LQL = 6.5% of nonconforming. Find the single sampling plan that meets the consumer's stipulation. [8]

OR

Q.4 (a) What do you understand by acceptance sampling? Describe briefly double sampling plan. [8]

(b) Find a double sampling plan for lot size 3000 where it is desired to reject lots that are 2% nonconforming no more than 10% of the time. Assume that the size of the second sample is twice that of the first sample and that the consumer's stipulation is to be satisfied exactly. [8]

UNIT – V

Q.5 (a) Discuss the role of reliability in quality control and improvement. What are the ways of improving reliability of a system? [8]

(b) Explain the items in concept with reliability:- [8]

(i) Failure Rate.

(ii) MTBF.

(iii) Weibull distribution.

OR

Q.5 A sample of 12 electronic components is tested for 1000 h, with no replacement of failed components. The time to failure is exponentially distributed. Three components failed within the prescribed test time, the failure times being 650, 680 and 720 hr. Estimate the mean time to failure and the failure rate. Find a 90% confidence interval for the mean time to failure. [16]

5E6205

Roll No. _____ Total No of Pages: 2

5E6205

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Production & Industrial Engineering
5PI5A Sociology and Economics for Engineers
Common with ME and AE

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks Main: 26

Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 Write down the comments on the following -

(a) The Universalistic – Achievement pattern [8]

or

The Universalistic – Ascription pattern

(b) The Particularistic – Achievement pattern [8]

or

The Particularistic – Ascription pattern

OR

Q.1 Write down the elements by which individual & groups are ranked in a more or less enduring hierarchy of status in the society. [16]

UNIT – II

Q.2 **Write** short notes on -

(a) Elements of Village Community [8]

(b) Elements of Urban Community [8]

OR

Q.2 Discuss the structure of Agrarian society. [16]

UNIT – III

Q.3 Briefly discuss the price elasticity of demand. [16]

OR

Q.3 Discuss different types of direct & indirect taxes. [16]

UNIT – IV

Q.4 Write short note on capital market. [16]

OR

Q.4 Define inflation, what are the various types & causes of inflation? [16]

UNIT – V

Q.5 Discuss the role of urbanization in economic development. [16]

OR

Q.5 Give a critical evaluation of the challenges and policy issues of internal sector in India. [16]

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5E6207

Roll No. _____ Total No of Pages: 2

5E6207

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME6.2A Automobile Engineering

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) Explain the vehicle body terminologies. [8]

(b) Explain the Frame construction & their types. [8]

OR

Q.1 (a) Derive mathematical expressions for the torque transmitted clutch with 'n' Plates. [8]

(b) Explain the construction and working of hydraulic clutch. [8]

UNIT – II

Q.2 (a) Explain the construction and working of synchromesh devices used in synchromesh gear box. [8]

(b) What is Epicyclic gear box? Describe its principle of operation with the help of neat sketch. [8]

OR

Q.2 (a) Derive expression for the following in a Hooke's joint: [10]
- (i) Velocity
- (ii) Angular acceleration of the drive shaft

(b) What is constant velocity joint? [3]

(c) What is the function of shackle with a leaf spring? [3]

UNIT – III

Q.3 Write short notes on: [16]
- (a) Cadmium test
- (b) Voltage drop test
- (c) Specific gravity test
- (d) Battery rating

OR

Q.3 (a) Explain the battery construction in details with neat sketch. [8]

(b) Describe the working principle of alternator with neat sketch. [8]

UNIT – IV

Q.4 (a) Draw a simplified wiring circuit for the lighting system of car and discuss the same. [8]

(b) Discuss working of coil ignition system with neat sketch. [8]

OR

Q.4 (a) Draw the layout of the air conditioning system for a car and explain its working. [8]

(b) What do you mean by refrigerants? Explain the type of refrigerants and their nomenclature. [8]

UNIT – V

Q.5 (a) Write short notes on the safety considerations for an automotive vehicle. [6]

(b) Write short note on following: [10]
- (i) Night vision system
- (ii) Global positioning system

OR

Q.5 (a) Discuss operational principle of air bags. [6]

(b) Explain the requirements of safety devices with their working principle. [10]

5E3175

Roll No. _____ Total No of Pages: 3

5E3175

B. Tech. V Sem. (Old Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME1 (O) Advanced Mechanics of Solids

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting one **question** from **each** unit. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No. 205)

1. NIL 2. NIL

UNIT – I

Q.1 (a) At a point P, the rectangular stress components are (in KPa)

$\sigma_x = 1, \quad \sigma_y = -2, \quad \sigma_z = 4$

$\tau_{xy} = 2, \quad \tau_{yz} = -3, \quad \tau_{xz} = 1$

Find the principal stresses and check for invariance. [12]

(b) What do you mean by Octahedral Stresses? [4]

OR

Q.1 (a) Define stress at a point. And derive differential equations of equilibrium. [2+6=8]

(b) The state of stress at a point is σ_x = 100MPa, σ_y = – 40MPa, σ_z = 80MPa. And all other stress components are zero. Determine the extreme value of shear stresses, their associated normal stresses, the octahedral shear stress and its associated normal stress. [2+2+2+2=8]

UNIT – II

Q.2 The displacement field is given by –

$$u = (x^2 + y)\hat{i} + (3+z)\hat{J} + (x^2 + 2y)\hat{k}.$$

Determine the principal strains at (3, 1, –2) and the direction of the minimum principal strain. [8+8=16]

OR

Q.2 Explain following -

(a) Strain deviator and its invariants. [8]

(b) Plane state of strain [4]

(c) State of strain at a point [4]

UNIT – III

Q.3 (a) A rubber cube is inserted in a cavity of the same form and size in a steel block and the top of the cube is pressed by a steel block with a pressure of p pascals. Considering the steel to be absolutely hard and assuming that there is no friction between steel and rubber, find. [10]

(i) The pressure of rubber against the box walls.

(ii) The extreme shear stresses in rubber.

(b) Explain generalized Hooke's law. [6]

OR

Q.3 A cubical element is subjected to the following state of stress - [16]

$\sigma_x = 100\text{MPa}$, $\sigma_y = -20\text{MPa}$, $\sigma_z = -40\text{MPa}$.

$\tau_{xy} = \tau_{yz} = \tau_{zx} = 0$.

Calculate (i) Principal shear strains

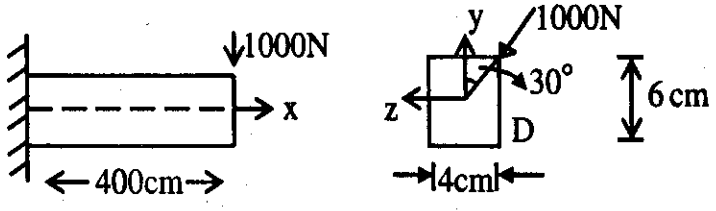
(ii) Octahedral shear strain

$E = 2 \times 10^5 \text{MPa}$, $V = 0.25$.

Material is assumed to be homogeneous and isotropic.

UNIT – IV

Q.4 (a) What is the stress due to bending at point D near the built – in end? [12]



(b) What do you mean by unsymmetrical bending? [4]

OR

Q.4 (a) Explain shear centre. [6]

(b) Derive and explain Winkler – Bach formula. [10]

UNIT – V

Q.5 Derive general expression for stresses of rotating disk having uniform thickness. Also show the stress distribution. [16]

OR

Q.5 Derive an expression for contact pressure between two shrink fits cylinders. Assume suitable dimensions and constants. [16]

5E3177

Roll No. _____ Total No of Pages: 4

5E3177

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME3 Fundamentals of Aerodynamics

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question from each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. Gas Table 2. NIL

UNIT – I

Q.1 (a) Explain the concept of lift and drag. How the lift and the drag varies with their dependent variables. [4+4=8]

(b) Consider the lifting flow over a circular cylinder with a diameter of 0.5m. The freestream velocity is 25 mk and the maximum velocity on the surface of the cylinder is 75 mk. The freestream conditions are those for a standard altitude of 3km. Calculate the lift per unit span on the cylinder. (ρ at 3 km is 0.90926 kg/m^3). [8]

OR

Q.1 (a) Explain the Kelvin's circulation theorem. Calculate the lift over an airfoil. [4+4=8]

(b) An airplane is cruising at a velocity of 219.94 m/s at an altitude of 10058.4m, where the ambient air density is 0.4105 kg/m^3. The weight and wing plan form areas of the airplane are 66723.33 N and 31.83m^2, respectively. The drag coefficient at cruise is 0.015. Calculate the lift coefficient and the lift – to – drag at cruise. [8]

UNIT – II

Q.2 (a) Explain the blade theory relative to it's design and applications. What is turbine cascade nomenclature? [4+2=6]

(b) Calculate the energy transfer in terms of lift and drag. [10]

OR

Q.2 (a) Define the cascade lift and drag coefficients. What are the losses in the cascade? [4+2=6]

(b) A compressor cascade is working with air of 1.25 kg/m3 density and100 m/s velocity at the entry. The air is making angles of 50° and 25° at entry and exit, respectively. The pitch to cord ratio of the compressor cascade is 1.5. If the stagnation pressure loss is 15mm, determine the pressure loss coefficient, lift coefficient and drag coefficient. [10]

UNIT – III

Q.3 (a) With the help of the relation for velocity change in terms of area change in a divergent duct, explain how the flow velocity charges in the duct when - [6]

(i) The entry Mach number is subsonic, and

(ii) The entry Mach number is supersonic.

(b) Air enters in a variable area duct at pressure of 350 kN/m2, a temperature of 27°C and a velocity of 150m/s. The area of cross – section at entry is 500 cm^2 and the exit area is 350 cm^2. If the flow is isentropic, determine: [10]

(i) The mass flow rate through the duct.

(ii) The pressure, temperature and velocity at exit from the duct, and

(iii) The change in impales function.

OR

Q.3 (a) Explain the phenomenon of choking in isentropic flow. [6]

(b) Air is discharged from a reservoir at 1MB and 500k through a nozzle to an exit pressure of 0.09 MPa. If the flow rate through the nozzle is 3600 kg/h, determine following for isentropic flow: [10]

(i) Throat area, pressure and velocity

(ii) Exit area and Mach number.

UNIT – IV

Q.4 (a) What is Fanno flow? What are the assumptions made in deriving equations for Fanno flow? Write the basic equations governing Fanno flow in a constant area duct. [6]

(b) A 3.5m long well – insulated duct of diameter 50mm and average friction coefficient 0.005 is connected to a frictionless bell mouth entrance. Air at 110 kpa and 300 K is drawn through the entrance and flows into the duct. Find the maximum mass flow rate, the flow parameters at exit and the range of back pressures that will produce the flow. [10]

OR

Q.4 (a) Differentiate between Fanno flow and Rayleigh flow. [4]

(b) Drive expressions for: [12]

(i) Pressure Ratio,

(ii) Stagnation Pressure Ratio,

(iii) Temperature Ratio,

(iv) Stagnation Temperature Ratio,

(v) Density Ratio and

(vi) Velocity Ratio

Assume finite control volume in Rayleigh flow.

UNIT – V

Q.5 (a) Explain the phenomena of normal shock with the help of Fanno line and Rayleigh line on the same h- s plot. [6]

(b) An aircraft engine employs a subsonic inlet diffuser of area ratio 4. Free stream air at a total pressure and temperature of 1×10^5 N/m2 and 570K approaches the diffuser with a Mach number 2.2 A shock wave stands just outside the diffuser inlet. Determine the Mach number, pressure and temperature of the air at the exit of the diffuser. Also, find the loss in stagnation pressure of air. [10]

OR

Q.5 (a) Show that the entropy increase across a normal shock is a function of the ratio of specific heat capacities and the Mach number on the upstream side of the shock. [6]

(b) The exit to entry area of a divergent duct is 14:1. The Mach number at inlet and exit are 1.7 and 0.5 respectively. A normal shock occurs in the duct.

Assuming isentropic flow of air before and after the shock, determine - [10]

(i) Location of the normal shock in the duct.

(ii) Percentage loss in stagnation pressure, and

(iii) Change in entropy.

5E3178

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5E3178

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME4 Industrial Engineering - I

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. NIL 2. NIL

UNIT – I

Q.1 (a) State and describe Fayol's principle of management. [8]

(b) Name the various functions of management. Describe any two of them in brief.[8]

OR

Q.1 (a) What do you understand by "scientific management"? Describe the principles of scientific management in brief. [8]

(b) Discuss about decision making, type of decisions and process of decision making. [8]

UNIT – II

Q.2 What is meant by "Joint Stock Company"? Describe briefly the procedure for forming "Joint Stock Company". Also compare Joint Stock Company with partnership. [16]

OR

Q.2 (a) Explain line and staff type of organization. State its advantages and disadvantages. [12]

(b) Discuss what do you mean by span of control. [4]

UNIT – III

Q.3 (a) Explain operating cycle concept of working capital. List sources of working optical. [8]

(b) Explain – [8]

(i) Preference share

(ii) Equity share

(iii) Deferred share

Also distinguish between shares and debenture.

OR

Q.3 (a) Explain components of a "Balance Sheet" with suitable example. [8]

(b) Define following – [8]

(i) Liquidity ratio

(ii) Debt equity ratio

(iii) Inventory turnover ratio, and

(iv) Gross Profit ratio

UNIT – IV

Q.4 (a) Show that present value of an Annuity can be expressed as- [8]

$$P = A\left[\frac{(1+i)^n - 1}{i(1+1)^n}\right]$$

Where A = Constant periodic flow of cash

i = rate of interest per year

n = no. of years

(b) Explain nominal and effective rate of interest. Show that effective rate (i) can be expressed as –

$$i = \left(1 + \frac{i^{(m)}}{m}\right)^m - 1$$

Where $i^{(m)}$ = nominal rate of interest p.a. convertible m times a year. [8]

OR

Q.4 (a) Define "Depreciation". Discuss about objectives of depreciation provision and causes of depreciation. [8]

(b) An engine lathe was purchased for Rs. 2,00,000. Its useful life was estimatied as ten years and the value as Rs. 20,000. Using the diminishing balance method, calculate the depreciation ratio (%). Also estimate the depreciation fund at the end of two years. [8]

UNIT. – V

Q.5 (a) Explain - [8]

(i) Collective bargaining

(ii) Conciliation

(iii) Mediation, and

(iv) Arbitration

(b) Discuss about recent industrial dispute of Maruti company. [8]

OR

Q.5 (a) Describe the welfare provisions under Factories Act. Explain how it will affect productivity. [8]

(b) Describe briefly the main provisions of Workmen's Compensation Act. [8]

5E3180

Roll No. _____ Total No of Pages: 4

5E3180

B. Tech. V Sem. (Main/Back) Exam., Nov.-Dec.-2016
Mechanical Engineering
5ME6 Principles of Turbo machines

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks Main: 26
Min. Passing Marks Back: 24

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

1. NIL 2. NIL

UNIT – I

Q.1 (a) How is the efficiency (η_p) of an infinitesimal compression stage defined? Prove that the overall efficiency of compressor is (symbols have their usual meaning) [8]

$$\eta_{is} = \frac{\left(\frac{P_{ps}}{P_s}\right)^{\frac{\gamma-1}{\gamma}} - 1}{\left(\frac{P_p}{P_s}\right)^{\frac{\gamma-1}{\gamma^{np}}} - 1}$$

(b) What is meant by dimensional analysis? Derive the dimensional parameters for a rotating machine. [8]

OR

Q.1 A small compressor has the following data: [16]

Air flow rate = 1.5778 kg / s, Pressure ratio = 1.6

Speed = 60000 rpm , Efficiency = 85%

State of air at entry: P_{01} = 1.008 bar, T_{01} = 300k. Cp = 1.009 KJ /Kg. K.

(i) Determine the power required to drive this compressor.

(ii) A geometrically similar compressor of three times this size is constructed. Determine for this compressor -

(a) Speed

(b) Mass flow rate

(c) Pressure ratio

(d) Power required

Assure same entry conditions and efficiency for the two compressors.

UNIT – II

Q.2 (a) A centrifugal pump delivers saltwater agonist a net head of 15m. at a speed of 1000 rpm. The vanes are curved backward at 30° with the periphery. Obtain the discharge for an impeller diameter of 30 cm and outlet width of 5 cm at a manometric efficiency of 90%. [8]

(b) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1200 rpm. works against a total head of 75 m. The velocity of flow through the impeller is constant and equals 3 m/s. The vanes are set back at angle of 30° at outlet. It the outlet diameter of the impeller is 60 cm, width at outlet is 5 cm, determine - [8]

(i) Vane angle at inlet

(ii) Work done per sec by impeller

OR

Q.2 (a) Explain with neat sketch the main parts and the functioning of a centrifugal pump. What is priming? [8]

(b) During a test on the centrifugal pump, the following readings were obtained, Vacuum gauge reading = 25 cm of Hg, Pressure gauge reading = 1.5kg / cm^2, Effective height = 0.5m, S. H. P of electric motor = 30, Discharge of pump = 100 liters/sec, Dia. of suction pipe = 15 cm, Dia. of delivery pipe = 15 cm. Determine manometric head and overall efficiency. [8]

UNIT – III

Q.3 (a) An axial flow pump has an impeller of outlet dia. 1m. The dia. of loss is 0.5m. If specific speed of pump is 1200 and velocity of flow is 2 m/s. Suggest a suitable speed of the pump to give a head of 6m. Also determine vane angle at the entry of pump. [8]

(b) An axial flow pump is to be designed for $1.75 m^3/S$ and 7.5 head while running at 750 rpm. Assuming hub to runner diameter ratio as 0.45 and through velocity as 0.35 times of the periphery of the velocity, what will be the diameter, minimum speed ratio and pressure co-efficient? [8]

OR

Q.3 (a) Explain work done on fluid and energy transfer in axial flow pump. [8]

(b) A propeller pump designed for Jaipur lift irrigation scheme is required to deliver $1 m^3/s$ at 7m. head while running at 960rpm. Its outer diameter is 50 cm and hub dia. is 25 cm. Find - [8]

(i) Flow ratio

(ii) Speed ratio

(iii) Power required

UNIT – IV

Q.4 (a) How is the degree of reaction of a centrifugal compressor stage defined? [8]

(b) A centrifugal compressor running at 16000 rpm takes in air at 17°C and compresses it through a pressure ratio of 4 with an isentropic efficiency of 82%. The blades are radically inclined and slip factor is 0.85. Guide blades at inlet give air an angle of pre-whirl of 20° to axial direction. The mean diameter of the impeller eye is 200 mm. and the absolute air velocity at inlet is 120m/s. calculate impeller tip diameter. [8]

OR

Q.4 (a) Air at a temp of 300k. flows into a centrifugal compressor running at 18000 rpm. The other data are as follows – [10]

Isentropic total head eff. = 0.76.

Outer dia. of blade tip = 550mm

slip factor = 0.82

Calculate -

(i) Work done per kg of air.

(ii) The temp rise of air passing through the compressor.

(iii) Static pressure ratio.

Assume absolute velocities of air at inlet and exit of the compressor are same.

(b) Explain surging and choking in centrifugal compressor. [6]

UNIT – V

Q.5 (a) vortex flow and what are the advantages of designing axial flow stage for free vortex condition? Show for free vortex flow, the radial equilibrium condition leads to constant axial vetoing with radius. Assume C_m co. from hub to tip. [8]

(b) Draw a sketch of an axial flow compressor with inlet guide vanes and explain the working principle of the compressor. [8]

OR

Q.5 (a) Explain briefly.(Any two) [8]

(i) Free vortex blade.

(ii) Radial equilibrium theory.

(iii) Compressor stall and surge.

(b) Show that the velocity triangles at the entry and exit of the rotor of a 50% reaction stage are symmetrical. [8]
